EXHIBIT C

City of Keene, New Hampshire Wastewater Treatment Plant: NPDES Permit No. NH0100790 Draft Permit Comments, dated July 17, 2020 (“Keene Draft Comments”)

City of Keene
New Hampshire

July 17, 2020

Michael Cobb, Acting Chief
Municipal Permits Section
Water Division
United States Environmental Protection Agency
Region 1
Office of Environmental Stewardship
5 Post Office Square, Suite 100
Boston, MA 02109-3912
VIA EMAIL Cobb.Michael@epa.gov

George Papadopoulos
United States Environmental Protection Agency
Region 1
Office of Environmental Stewardship
5 Post Office Square, Suite 100
Boston, MA 02109-3912
VIA EMAIL papadopuoulos.george@epa.gov

RE: City of Keene, New Hampshire Wastewater Treatment Plant: NPDES Permit No. NH0100790 Draft Permit Comments

Dear Mr. Cobb and Mr. Papadopoulos:

On May 20, 2020, Region 1 of the United States Environmental Protection Agency (EPA) issued draft National Pollutant Discharge Elimination System (NPDES) Permit No. NH0100790 (the Draft Permit) to the City of Keene, New Hampshire (the City) in electronic form. In conjunction with the issuance of the Draft Permit, EPA regulations require a comment period of at least 30 days after issuance of a draft permit per 40 C.F.R § 124.10(b). During this time, the public may submit comments associated with the permit and the permit fact sheet and/or may request a public hearing pursuant to 40 C.F.R § 124.11.

The City submitted a formal request to extend the comment period an additional 90 calendar days beyond the stated 30-day comment period noted in the Draft Permit. The City received a formal response from EPA that an additional 30-day extension was granted. The modified deadline to submit comments to the draft permit was therefore extended to July 20, 2020. The City utilized the additional time to evaluate the proposed limits and to confirm that each proposed limit is achievable without causing adverse effects to remaining compliant with any other limit. This analysis has led the City to develop comments and questions in response to the requirements set forth in the draft permit.

The highest priority comments of concern are related to the following parameters:

- Total Nitrogen Rolling Annual Average Effluent Limit: The overall scientific basis and methodology used to develop the numerical effluent limitation are nonexistent and any generalized approach used to establish a numerical effluent limitation is without merit. Without any sound scientific study or rationale, the proposed permit limitations are impermissibly arbitrary and capricious. Further commentary regarding Total Nitrogen may be found in the following Draft Permit Comments report.

- Winter Ammonia Chronic Effluent Limit: The Draft Permit proposes a new winter chronic effluent limitation. The pH used to develop this limitation is based on data specific to the City's performance at the point of discharge rather than accounting for receiving water conditions and site-specific characteristics. Chronic criteria calculated utilizing low pH values which are representative of the receiving water yield less stringent effluent limits. Site-specific characteristics should be considered as data is available. Further commentary regarding Winter Ammonia may be found in the following Draft Permit Comments report.

- 7Q10: The Draft Permit proposes a conservative upstream 7Q10 low flow as the basis for determining the available dilution and effluent limits for multiple constituents. Alternative low flow approaches have been evaluated by many state organizations, including NHDES, such as utilizing an August median flow. Further detail on this approach applied to the City's dilution factor and to other permit parameters may be found in the following Draft Permit Comments report.

- pH Range: Since 1997, the City has implemented pH adjustment by way of chemical addition to remain compliant with the required pH effluent limitation range of 6.5 to 8.0 S.U. The Draft Permit and associated regulations allow the City the ability to modify the pH range dependent on if it can be demonstrated that the change should be made due to naturally occurring conditions in the receiving water or the receiving water would not be significantly impacted by the discharge. Data collected by both the City and volunteer watershed stakeholder organizations confirm the relatively low pH of the receiving water. The City seeks approval to investigate site-specific conditions; further commentary may be found in the following Draft Permit Comments report.

- Total Recoverable Aluminum: The Draft Permit establishes effluent limitations for this parameter using the obsolete 1988 criteria. This has been superseded with a more appropriate methodology, which was finalized by EPA in 2018. To impose a new stringent numerical effluent limitation using superseded and since-updated science during the intermediate period between adoption of a new EPA-authored criteria and adoption by NHDES as a new Water Quality Standard does not reflect a collaborative environment and can be interpreted as operating in bad faith; at a minimum, it is the result of an erroneous approach that causes undue hardship to the City. The City has sampled for DOC, pH and hardness and the calculations have confirmed that the proposed 108 μg/L effluent limitation is inappropriate, given that the new criteria does not accurately account for the bioavailability of aluminum. Further commentary regarding Total Recoverable Aluminum may be found in the following Draft Permit Comments report.

- Total Recoverable Copper: The proposed Draft Permit effluent limitations for Total Recoverable Copper are more stringent than the limits that the City currently operates under, which were carried forward from the 1994 NPDES Permit. The current EPA approach to developing copper limitations is hardness dependent. However, the Draft Permit fails to consider the latest data and development of a new downstream hardness concentration when determining the proposed copper effluent limits. Further, site-specific approaches that are not hardness dependent also warrant consideration. Detailed commentary on Total Recoverable Copper may be found in the following Draft Permit Comments report.

- Total Phosphorus: The Draft Permit proposes a more stringent effluent limitation for Total Phosphorus. Existing treatment operations have been proved successful to meet current effluent limits given that there are no violations and data collected by volunteer watershed stakeholder organizations on the receiving water have shown that concentrations consistently meet water quality standards. Site-specific approaches to determining effluent limitations have also warrant consideration. Further commentary on Total Phosphorus may be found in the following Draft Permit Comments report.

The prepared comments are enclosed in the following report, which expand on the listed contentions in greater detail as well as addressing multiple additional issues. The City will also be submitting a letter under separate cover outlining a request and rationale for a public hearing to the Draft Permit. All of these documents have been submitted in a timely manner, in advance of the July 20, 2020 close of the comment period.

Since the City was only provided limited time to prepare comments in response to the Draft Permit, the City requests that, should there be a need for additional details or to address any unintended omissions, we will be contacted and provided an opportunity to provide clarity in the form of a subsequent formal response.

The City is confident that EPA will consider each comment in its entirety and fully recognizes that Keene has long striven to be a steward of our environment and approaches our day-to-day responsibility to protect our water resources for the benefit of today's residents and future generations with the utmost seriousness and diligence. Thank you for your attention to this matter.

Very truly yours,

Elizabeth A. Dragon

Elizabeth A. Dragon
City Manager

cc: Stergios Spanos, NHDES
Kürt Blomquist, City of Keene
Tom Moran, City of Keene
Aaron Costa, City of Keene
Mary Ley, City of Keene
Tom Mullins, Esq., City of Keene
Joanna Tourangeau, Esq., Drummond Woodsum
Chris Perkins, Weston & Sampson
John Sykora, Weston & Sampson

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INTRODUCTION

On May 20, 2020, Region 1 of the United States Environmental Protection Agency (EPA) issued draft National Pollutant Discharge Elimination System (NPDES) Permit No. NH0100790 and Fact Sheet (the Draft Permit) to the City of Keene, New Hampshire (Keene) and co-permittees the Town of Marlborough, New Hampshire and the Swanzey Sewer Commission. In conjunction with the issuance of the Draft Permit, EPA regulations require a comment period of at least 30 days after issuance of a Draft Permit per 40 C.F.R § 124.10(b). During this time, the public may submit comments associated with the permit and the permit fact sheet and/or may request a public hearing pursuant to 40 C.F.R § 124.11.

The City submitted a formal request of a 90-day extension of the public comment period to the Environmental Protection Agency (EPA) on May 29, 2020. In response, EPA granted the City an additional 30-day extension to the public comment period, extending the submission of public comments deadline to July 20, 2020.

Keene, New Hampshire (NH) owns and operates a wastewater treatment facility (WWTF) that discharges treated effluent to Assessment Unit ID NHRIV802010301-38 of the Ashuelot River, a Class B classified warm water. The Ashuelot River flows to the Connecticut River and ultimately Long Island Sound. The City of Keene WWTF collects and treats domestic, commercial, and industrial wastewater throughout the City, the Town of Marlborough and the Town of Swanzey. The system is a separate system as there are no combined sewer stormwater structures. Marlborough and Swanzey are considered co-permittees to the NPDES Permit and are bound to the requirements specific to proper operation and maintenance of their collection systems. The WWTF receives millions of gallons of septage and holding tank waste annually from communities throughout NH, and communities located in Massachusetts (MA) and Vermont (VT).

The WWTF has a design flow of 6.0 million gallons per day (MGD) to treat collected wastewater via an activated sludge aeration treatment process. Process flow begins with a main pumping station where influent is injected with liquid oxygen, then passes through an aerated grit chamber and on to two primary clarifier tanks. Wastewater is conveyed to two aeration basins and then flows to one of the two secondary clarifiers. Treated effluent is conveyed through the UV disinfection building to its discharge point at the Ashuelot River.

The WWTF has undergone multiple operational improvements since the issuance of the 2007 NPDES Permit. These improvements were divided into three Phases; Phase 1 equates to approximately $8.9 million, Phase 2 equates to approximately $2.7 million, and Phase 3 equates to approximately $1.8 million capital cost. A brochure outlining the list of improvements is provided in Appendix A. Keene is committed to operate while using sound and reliable infrastructure in order to remain compliant with permit effluent limitations.

The State of NH outlines requirements specific to surface water discharges to a Class B warm water fishery. The water quality standards (WQS) required by the State are considered in the development of the effluent restrictions and provide the basis to EPA's methodology in establishing numerical effluent limits.

The City has reviewed the Draft Permit and has developed multiple comments and questions regarding the constituents and requirements outlined in the Draft Permit and the Draft Permit's Fact Sheet. This report presents the City's comments specific to each permit parameter.

1.0 TOTAL NITROGEN

Keene has evaluated the requirements set forth in the Draft Permit for Total Nitrogen and has developed the following comments.

I. Limitations Unsupported by Federal or State Law Are Impermissible because they are Arbitrary and Capricious

1.1 Rolling Annual Average Total Nitrogen and Special Condition I.G.3

The proposed Rolling Average Total Nitrogen limitation and Special Condition I.G.3 in the Draft Permit. are not based on water quality standards, or site-specific data. The conclusion that a uniform 10 mg/L Total Nitrogen concentration for Keene and other NH permittees in the Connecticut, Housatonic, and Thames rivers watersheds is not based on sound and peer-reviewed science.

The assessment of a design flow-based Total Nitrogen concentration for NH WWTFs within the LISW is not linked to any study, research, or available data. The 10 mg/L concentration imposed upon Keene in the writing of their Draft Permit does not indicate how their discharge is similar or differs from that of the other five (5) WWTFs with design flows between 1.5 mgd and 6 mgd, how each specific discharge location and characteristics within the LISW. There is no published data indicating a specific Total Nitrogen concentration manifests itself into a particular outcome of benefit to the LISW. In short, there is no rationale for the imposition of this limitation.

EPA's inclusion of total nitrogen rolling annual average mass-based loading limits does not adhere to any of the available methods for establishing effluent limits. Though EPA acknowledges that the Total Maximum Daily Load (TMDL) target of a 25% reduction from 1998 baseline loading is currently being met – and that the overall loading from WWTF discharges in to the Connecticut River is actually 15% below the TMDL Waste Load Allocation (WLA) – EPA expresses concern that future hypothetical growth of cities and towns in NH may reverse the current reductions. Moreover, though Waste Load Allocations resulted in these reductions, EPA posits that these are not enough, in and of themselves, to protect the waters of the Connecticut River (as they have continually done) if cities and towns grow. Despite EPA's stated goal, the EPA must still comply with the requirements for setting effluent limits as required in 40 CFR § 122.44(d)(vi). This provision requires effluent limits to be established using: (1) the use of a calculated numeric water quality criterion, which is derived using a proposed state criterion or an explicit state policy or regulation interpreting its narrative water quality criterion; (2) using EPA's water quality criteria developed pursuant to Section 304(a) of the CWA on a case-by-case basis; or (3) an indicator parameter for the pollutant, provided certain requirements are met. EPA's proposed total nitrogen limit of 10 mg/L was developed using proposed future population growth as a critical criterion; this is not a listed basis for developing the effluent limitations, and therefore, is not a permitted approach under 40 CFR § 122.44(d)(vi).

Without such a foundation, these proposed permit limits are impermissibly arbitrary and capricious.

These issues are described in further detail below and therefore, Keene respectfully requests removal of the Rolling Average Total Nitrogen limit from the Final Permit.

1.1.1 Total Nitrogen Numerical Limit is not based on Water Quality Standards

The Draft Permit indicates that the TMDL and associated WLA related to the Long Island Sound watershed (LISW) requires an aggregate 25% reduction from the baseline total nitrogen loading estimated in the TMDL. However, the data provided in the Draft Permit indicates that the 25% reduction is "currently being met", with overall discharges from MA, NH, and VT WWTFs being 11% below the WLA.

EPA utilized a 10 mg/L Total Nitrogen concentration to implement a Rolling Average Total Nitrogen mass-based limit in the Draft Permit based solely on its receipt of LISW stakeholder input expressing concern regarding theoretical, possible future loading increases.[1]. EPA further indicates its intent to apply these limitations to all permittees within the above watersheds based on the design flow of the respective WWTFs.

This approach does not meet the standard set forth in 40 CFR § 122.44(d)(vi)(A) which specifies that effluent limits are to be established "using a calculated numeric water quality criterion for the pollutant". Thus, in order to properly impose a Total Nitrogen effluent limit, EPA must first establish a numeric WQS criterion. The 10 mg/L Total Nitrogen concentration included in the Draft Permit for the assessment of the Rolling Average Total Nitrogen limitation, and Special Condition I.G.3.a., are thus not founded on a proper basis. Permit effluent limits should be imposed to be protective of receiving water conditions with consideration for water quality characteristics in establishing criteria, not based on performance of permittee discharge. There has been no implementation plan developed based on the TMDL to allocate each discharger a portion of the allowable Total Nitrogen load, and therefore attempting to develop a WLA through individual permits is inappropriate.

1.1.2 Total Nitrogen Numerical Limit is not based on Site-Specific Data

EPA determined that permittees in the LISW which experience population growth or new industrial discharges shall be subject to the 10 mg/L Total Nitrogen concentration. EPA further specifies in the Draft Permit that any WWTF within the LISW that has a design flow equal to or greater than 1.5 mgd and up to 6 mgd is subject to the 10 mg/L Total Nitrogen concentration. However, the Draft Permit contains no information linking design flow to either increased population or new industrial discharges in Keene.

Imposition of effluent limitations without site specific supporting data is impermissibly arbitrary and capricious. Further, Keene's data does not support EPA's underlying assumptions as described below:

- Assumption: only communities served by larger WWTFs can experience population growth or be the site of new industrial dischargers.

  Response: There is no indication that this is accurate. Such projections are the result of numerous, individual demographic decisions and long-term societal shifts. These types of projections are further complicated by the availability of developable and redevelopable property

[1] The documents cited in footnote 13 on page 26 of the Fact Sheet: Connecticut Department of Energy and Environmental Protection letters to EPA dated February 7, 2018 and April 27, 2018; Connecticut Fund for the Environment letter to EPA dated February 7, 2018; and Connecticut River Conservancy letter to EPA dated February 18, 2018 are not readily available for review by Keene. The propriety of reliance on these letters in developing the total nitrogen rolling annual average mass-based loading limits in the Draft Permit cannot properly be commented upon without provision of full and accurate copies of each.

in many communities in the region, including many not served by any centralized wastewater infrastructure. This is borne out by data derived from the U.S Census Bureau, Population Division which indicates that from 2010 to 2019, Keene's population dropped from 23,515 to 22,786.

- Assumption: Permittees and associated WWTFs that experience an increase in industrial dischargers will result in increased nitrogen loadings.

  Response: A number of industrial users in Keene and elsewhere across the U.S. do not discharge greater concentrations of various forms of nitrogen. There is no documentation indicating that the mere presence of industrial users translates to increased nitrogen loading. In fact, the data indicates that increased residential and CSO discharge are more likely to increase nitrogen loading. The City is aware that the main contributors to the collection system are residential, with a total of 98% of users as residential. Further, data shows that the number of industrial users classified in the City have not greatly increased from 2015 to 2020. This period of societal disruption and comprehensive state-wide executive orders due to the COVID-19 pandemic can also be expected to negatively impact the number of industrial users. It is anticipated that there will be no increase in industrial users at this time due to the implications of this pandemic. The implications have already led to the discontinuation of one of the largest industrial users in Keene, and Keene State College has temporarily closed normal operations and seasonal activities.

- Assumption: The Draft Permit optimization requirements for nitrogen removal are insufficient to address increased nitrogen load from industrial dischargers to the WWTF.

  Response: The Draft Permit requires documentation of nitrogen removal optimization efficiencies per Special Condition I.G.3.b. The annual report required under this condition documents actual nitrogen loadings to the WWTF and Total Nitrogen discharged from the WWTF. Keene implements an Industrial Pretreatment Program which requires industrial dischargers to obtain authorization for discharge to the WWTF. Significant Industrial Users from 2015 to 2020 have increased by one.

- Assumption: Increased nitrogen loadings to a specific WWTF will cause an exceedance of the 25% reduction required by the WLA.

  Response: There is no evidence that an increased WWTF Total Nitrogen load will cause an exceedance of the LISW WLA. Facilities are designed to remove pollutant loadings to reach enforced criteria. The Draft Permit and the 2007 Permit outline requirements specific to industrial users to monitor the loadings received at the WWTF, of which the type of treatment can remove. Quantifying the relationship between influent loadings and removal success is specific to each permittee's type of treatment methods and should not be based on assumptions.

1.1.3 The Rolling Annual Average of Total Nitrogen limitation does not utilize sound and peer-reviewed science in the application of a WWTF design flow threshold 10 mg/L. Total Nitrogen concentration to this and other NH permittees within the LISW.

Table 3 of the Fact Sheet of the Draft Permit presents the methodology used to assess Annual Average Total Nitrogen limitations for NH WWTFs in the LISW. This methodology appears without science-based support. Specifically:

- There is no background data provided within the Draft Permit indicating why a Total Nitrogen concentration was selected or why a specific concentration or alternate optimization or monitor-only requirement is imposed.
- There is no indication that a specific Total Nitrogen concentration will provide a specific outcome to the LISW. The LISW TMDL and associated WLA do not indicate that such numeric Total Nitrogen concentrations from NH WWTFs are required, nor that the baseline loadings and associated 25% aggregate reduction is impacted by this numerical permit limitation.
- There is no WLA provision stating that further reductions in Total Nitrogen loadings are required at present.
- A review of available Long Island Sound Study (LISS) documents does not identify additional requirements or recommendations for numeric Total Nitrogen limitations to be imposed upon NH point source discharges. In fact, LISS published material indicates that the 2017 goal to reduce nitrogen loads into LISW from WWTFs has been met. (Graphic source: https://longislandsoundstudy.net/ecosystem-target-indicators/nitrogen-loading/)

Subsequent goals are focused on nonpoint sources and are therefore irrelevant to Keene's Draft Permit.

- The Rolling Average methodology is an average of averages, which does not account for the variability from month to month, the number of weeks per month, and actual flow on a sample day versus other non-sampling days. All of this causes inaccuracies.

1.1.4 Special Condition I.G.3 requirements are Unsupported by the CWA

The one year requirement to conduct "an evaluation of alternative methods of operating the existing waste water treatment facility to optimize the removal of nitrogen in order to minimize the annual average discharge of total nitrogen and submit a report to EPA and NHDES documenting this evaluation and presenting a description of recommended operational changes" is not consistent with the goals of the CWA. It is also unclear by whom and to whom the recommendations are to be made, and what subsequent actions are expected in response to the recommendations.

As previously indicated, the basis of the Rolling Average Total Nitrogen limitation is arbitrary, and the further mandate to evaluate how to "minimize" the annual average mass discharge of total nitrogen is highly subjective. This condition is open to broad interpretation and therefore represents real financial risk to Keene and its users.

Given there is no WQS rationale for further reductions in nitrogen discharge loadings, the requirement for this evaluation, and more specifically the requirement to provide "recommendations", Keene respectfully requests Special Condition G.3. be removed in its entirety from the Final Permit.

1.1.5 Reporting Requirements is Inappropriate for a WWTF in New England

Nitrogen removal during cold weather months is well understood to be a challenge. Operational modes vary greatly from summer months to winter months. **All reporting requirements associated with all nitrogen effluent characteristics, with the exception of Rolling Average Total Nitrogen, which is addressed elsewhere in this section, and Ammonia Nitrogen as N, are respectfully requested to be modified to "Report Only" seasonal rolling averages bracketed for the periods May 1 through October 31 and November 1 through April 30.**

II. Technical or Factual Errors Underlying Proposed Limits

1.1.6 Winter Ammonia Chronic Effluent Limit

The Draft Permit proposes a winter ammonia effluent limit of 9.9 mg/L, based on the criteria calculated using an assumed pH of 6.5 for both winter and summer, as well as a winter temperature of 5°C and a summer temperature of 25°C. The assumed pH of 6.5 represents the median value of the effluent monitoring data reported in Appendix A of the Draft Permit. pH has an indirect relationship with chronic ammonia based on the NHDES 2016 criteria calculation; a lower pH yields a higher ammonia criteria value. The development of criteria for each constituent, based on state and federal approved standards, should consider the receiving water characteristics in order to fully evaluate the amount of a specific parameter that the receiving water can take and maintain protective of the environment and its existing conditions. The assumed pH based on the effluent of the discharge fails to account for the receiving water conditions.

Keene collected ambient pH data in the receiving water upstream of the discharge in 2018 and is included as part of Appendix B of this report. The following table represents the median of the summer and winter months; this was a substantial commitment that resulted in a robust dataset, as indicated by the number of samples collected.

Table 1.1 Upstream pH Data from 2018 Sampling

Months	Number of Samples	Median pH (S.U.)
Summer (June 1- Oct. 31)	73	6.0
Winter (Nov. 1- May 31)	63	5.8

In addition to the data collected by the City, other Ashuelot River data is available as part of the Volunteer River Assessment Program (VRAP). The intention of this program, as referenced in the 2007 VRAP report, is ***"to assist NHDES in evaluating water quality throughout the state"***. NHDES provides reports and available data collected through VRAP for public viewing. The samples collected as part of VRAP are collected in the summer months (June 1- October 31). The annual reports published between 2007 and 2010 utilize collected data which is interpreted as they relate to the surface WQS; available data is also collected by VRAP and published through NHDES for the years 2011 through 2019. Sampling station locations are arranged by VRAP staff annually. In 2007, data was collected at a total of 13 sampling stations in the Ashuelot River Watershed.

The data presented in Table 1.1 was collected upstream of Keene's discharge at the Martell Court Bridge. Based on the description of VRAP sampling locations identified on the NHDES website, VRAP's sampling station 17-ASH is located at the Martell Court, similar to the location of Keene's 2018 data collection. However, there is no available data in the past 10 years collected at 17-ASH. Therefore, the data collected at sampling station 18-ASH, located at Route 101, was analyzed. A comprehensive review of the data collected through VRAP may be found in Table 3.1 of Section 3.0. Data collected over the past 5 years at sampling station 18-ASH may be found below in Table 1.2. The data collected as part of VRAP confirm the low pH range values found as part of Keene's data collection.

Table 1.2 VRAP Receiving Water pH Data at 18-ASH, 2015-2019

Sampling Station	Year	Samples Collected	pH Data Range
18-ASH	2019	5	5.94-6.15
18-ASH	2018	5	5.97-6.35
18-ASH	2017	5	5.08-5.99
18-ASH	2016	5	6.30-6.57
18-ASH	2015	4	6.36-6.68

Of the dataset shown in Table 1.2, 21 out of the 24 samples collected had a pH below the water quality standard of 6.5. There is a notable amount of variability in this dataset, likely due to the limited number of samples collected annually. Based on Keene's robust and comprehensive dataset throughout 2018, Keene is satisfied that the dataset presented in Table 1.1 most appropriately depicts receiving water conditions upstream of the discharge and therefore Keene evaluated the winter ammonia criteria based on the median of the pH values collected by the City.

Since the winter chronic ammonia was the only parameter determined to require a more stringent limit based on the new criteria calculated with 6.5 pH, the criteria was recalculated using a site-specific pH of 5.8 representing seasonal receiving water conditions. The calculation for chronic winter ammonia criteria may be found below:

$$\text{Criteria} = 0.8876 * \left[\left(\frac{0.0278}{1 + 10^{7.688-5.8}}\right) + \left(\frac{1.1994}{1 + 10^{5.8-7.688}}\right)\right] * \left[2.126 * 10^{0.028*(20-7)}\right]$$

The criteria for chronic winter ammonia using the above equation yields a value of 5.2 mg/L. If a new limit were to be calculated based on the revised criteria, the chronic winter ammonia limit would be 11.5 mg/L. The 2007 permit established a chronic winter ammonia effluent limit of 12 mg/L. **Keene respectfully requests that EPA review the site-specific calculations and considerations depicted in**

Section 1.1.7 below and that the effluent limits be re-evaluated considering the seasonal receiving water pH data.[2]

1.1.7 Alternative Low Flow on Ammonia Limit Development

Section 2.0 of this report outlines comments requesting the use of an alternative low flow in place of the 7Q10. The 7Q10 calculated for the facility and identified in the Fact Sheet of the Draft Permit is used to establish the reasonable potential for a constituent to cause or contribute to an exceedance of WQS, as well as to developing permit effluent limits for constituents. **If the request for the use of an alternative low flow is granted through the Final Permit, Keene respectfully requests that the Reasonable Potential Analysis Table in Appendix B of the Draft Permit reflect this modification, and that the pollutant effluent limits be adjusted.**

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[2] The new information available to complete these calculations justifies this revised limit as does good cause. 40 CFR 122.44(l)(2)(i)(B)(1); *Great Basin Mine Watch v. State of Nevada*, No. 43943, 2006 WL 1668890, at *3 (Nev. Apr. 19, 2006).

2.0 7Q10 LOW FLOW

The City has assessed EPA's approach to developing the 7Q10 upstream flow conditions used to establish the permit limits and has included the following comments.

2.1 Alternative Low Flow

The permit includes a calculation for $WWTF_{ACTUAL}$ of 4.22 cfs. The correct value, based on a 2.65 mgd value, is 4.10 cfs. **The value of 4.10 cfs should be used for $WWTF_{ACTUAL}$ through-out the calculations.** This is noted in full recognition that the change in value does not drastically change the resultant calculations.

State of NH law supports use of August median stream flows in lieu of 7Q10 calculations to establish nutrient discharge limits for aquatic life and human health criteria. NH RSA 485-A:8(II). The NH. Department of Environmental Services (NHDES) published a presentation by the NH Water Quality Standards Advisory Committee, dated October 11, 2018, entitled "Alternatives to 7Q10 for Nutrient Permitting." This presentation (which discusses total phosphorus) includes extensive discussion of appropriate alternatives to 7Q10 to establish nutrient discharge limits. For instance, Vermont uses the Summer low median monthly flow (generally August) for an index flow. NHDES concludes:

> August median flow may be appropriate for NH nutrient permitting because it:
> - Is similar to VT and ME (and other states);
> - Addresses duration concern with the 7Q10; and
> - Flow is less than or equal to the August median flow ~17% of the year (62 days) and ~ 0.5% (2 days) for the 7Q10 flow. 62 days is sufficient time for a river to respond to nutrients."
>
> https://www.des.nh.gov/organization/divisions/water/wmb/wqs/meetings/2018/documents/20181011-7q10-alternatives.pdf

Based on August data at for the Ashuelot River at West Swanzey, USGS gage 01160350 for the years 1994 through 2019, and USGS gage 01158000 for the Ashuelot River below the Surry Mt Dam August data for 1946 through 2019, the dilution factor calculations would be modified as follows:

Permit unadjusted downstream = 26.3 cfs.

August 1994-2019 mean of monthly discharge, USGS gage 01160350 downstream = 255 cfs

Permit unadjusted upstream = 2.65 cfs.

August 1946-2019 median flow, USGS gage 01158000 upstream = 56 cfs

$$Q_{DSG,adj} = Q_{DSG} + (0.28)(Q_{WWTF,actual}) - (Q_{WWTF,actual})$$

$$Q_{DSG,adj} = 255 + (0.28 * 4.10) - 4.10 = 252.02 \text{ cfs}$$

$$7Q10_{unadj} = ((Q_{DSG,adj} - Q_{USG})\left(\frac{Q_{D1}}{Q_{D2}}\right) + Q_{USG} = 166.57 \text{ cfs}$$

$$7Q10_{\text{unadj}} = ((252.05 - 56)\left(\frac{10.6}{18.8}\right) + 56 = 166.57 \text{ cfs}$$

$$7Q10_{\text{final}} = 7Q10_{\text{unadj}} - (0.28)(Q_{\text{WWTF,design}})$$

$$7Q10_{\text{final}} = 166.57 - (0.28)(9.28) = 163.97 \text{ cfs}$$

$$\text{Dilution Factor} = (0.9) * (Q_s + Q_{\text{WWTF,design}})/Q_{\text{WWTF,design}}$$

$$\text{Dilution Factor} = (0.9) * \frac{163.97 + 9.28}{9.28} = \mathbf{16.88}$$

There are significant impacts from this calculation; namely, all WQBEL will need to be revised as a result of this change in methodology. **Keene respectfully requests approval of this modified Dilution Factor calculation and further asked that it be incorporated into the Final Permit, with reasonable potential analyses and WQBEL modified and adjusted accordingly and in accordance with the CWA.**

Further, Appendix B outlines the Reasonable Potential Analysis Table, which identifies permit effluent limits for pollutants if a reasonable potential is found to cause or contribute to an exceedance to WQS. The upstream 7Q10 flow listed in the Reasonable Potential Analysis Table is listed as 11.4 cfs. **Keene respectfully requests that the Reasonable Potential Analysis Table in Appendix B be modified in the Final Permit to represent 11.7 cfs to remain consistent with the 7Q10 set forth in the Draft Permit.**

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3.0 PH RANGE

The Draft Permit includes an effluent pH range of 6.5 - 8.0 S.U. Keene has been operating since 1997 with an additional chemical feed system that adjusts effluent pH to achieve compliance with the low-level 6.5 S.U. effluent limitation. The receiving water pH has consistently been measured to have a pH well below that of the effluent, based on data collected in the upstream receiving water. See Appendix B. The implications of the varying pH levels may be causing an adverse effect by producing a pH "curtain wall" in the vicinity of Outfall Serial Number 001. Due to the drastic changes in water conditions, migration routes of native fish may be adversely impacted. In addition, the injection of caustic soda to the discharge pipe from Secondary Clarifier #1 for pH adjustment requires additional operational efforts by WWTF staff and approximately $140,000 annually (in FY20 dollars) in additional operational costs to meet the pH range.

The Draft Permit states in Part I.I.5 (page. 22 of the Draft Permit) that a change to the pH Range may be implemented if either of the following two cases are applicable and can be demonstrated to NHDES that the range should be modified: (1) due to naturally occurring conditions in the receiving water or (2) the naturally occurring receiving water pH would not be significantly changed by the Permittee's discharge. To determine whether Keene's discharge affects the naturally occurring pH in the receiving water, the City would need to conduct a pH demonstration study. This would entail developing proposed study parameters and NHDES approval prior to the initiation of the project. **Accordingly, Keene respectfully requests the Final Permit include language indicating that the development of a site-specific study to evaluate if either of the written conditions apply to the City's discharge is an accepted approach. If the study determines either of the conditions apply, it is further requested that the Final Permit language include confirmation that EPA shall accept the results of the study.**

Keene has collected data simulating the results of an unadjusted pH to the effluent. In 2018, Keene collected and performed Whole Effluent Toxicity (WET) tests on an unadjusted Secondary Clarifier #2 in parallel and concurrent with their typical testing requirements. There were no violations or failures in toxicity evaluated under the unadjusted pH. Refer to Appendix C for these parallel WET test results. The pH values recorded in the WET testing are notably high given the unadjusted condition, however, still did not fail a toxicity test. The pH analysis of the unadjusted data was conducted at a contract lab and therefore exceeds the 15-minute hold time of the samples given the currier travel time. The process that the lab takes to conduct the WET testing for pH includes warming the sample to test temperature and aerating to bring the dissolved oxygen (DO) into equilibrium. The process of warming and aerating a sample has major effects to a sample's pH level. Therefore, this lab analysis is not a representative indication of the level of pH at the time of collection. Keene requests that the receiving water pH data collected during 2018, attached to this document as Appendix B and mentioned in the winter ammonia comment, be considered.

NHDES provides reports for public viewing on the data collected in the Ashuelot River Watershed as part of VRAP. The intention of this program, as referenced in the 2007 VRAP report is ***"to assist NHDES in evaluating water quality throughout the state"***. The annual reports published between 2007 and 2010 utilize collected data which is interpreted as they relate to the surface WQS; available data is also collected by VRAP and published through NHDES for the years 2011 through 2019. Sampling station locations are arranged by VRAP staff annually. In 2007, data was collected at a total of 13 sampling stations in the Ashuelot River Watershed. These stations are located both upstream and downstream of the Keene WWTF discharge point. It is notable that the majority of pH samples collected are below the

NH surface WQS. As stated in the 2007 VRAP report, ***"lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area"***; further, the report stated, ***"it is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life."*** These statements are repeated verbatim in the 2008, 2009 and 2010 reports.

Data collected over the past 5 years through this program are presented in Table 3.1. Available data over the past 5 years is based on characteristics at 15 sampling stations. Data collected at sampling stations 16D-ASH and 16A-ASH are representative of conditions 40 feet upstream of the Keene WWTF and at the mouth of the South Branch, downstream of the Keene WWTF. VRAP reports and data from 2007-2010 are included as part of Appendix D.

A review of the available data from 2011 through 2019 confirmed that the majority of the data has consistently been below the surface WQS. Moreover, as partially depicted in Table 3.1, the sampling stations upstream of the Keene WWTF have lower pH measurements than those of the sampling stations downstream of the Keene WWTF.

Table 3.1: VRAP Receiving Water pH Data, 2015-2019

Sampling Station	Year	Samples Collected	pH Range	Acceptable Samples Not Meeting WQS
28-ASH	2015	4	5.56-6.18	4 (100%)
27-ASH	2015	4	5.74-6.14	4 (100%)
24A-ASH	2015	4	5.87-6.43	4 (100%)
23-ASH	2015	4	6.01-6.73	0 (0%)
20A-ASH	2015	4	6.38-6.55	3 (75%)
18-ASH	2015	4	6.36-6.68	1 (25%)
16D-ASH	2015	5	6.34-6.72	3 (60%)
16A-ASH	2015	5	6.26-6.56	3 (60%)
16-ASH	2015	5	6.41-6.65	2 (40%)
02B-SBA	2015	4	6.08-6.56	3 (75%)
02-SBA	2015	4	6.38-6.56	2 (50%)
15A-ASH	2015	5	6.44-6.72	1 (20%)
07-ASH	2015	5	6.63-6.72	0 (0%)
02-ASH	2015	4	5.69-7.38	1 (25%)
01-ASH	2015	5	6.78-7.23	0 (0%)
28-ASH	2016	5	5.67-6.04	5 (100%)
27-ASH	2016	5	4.90-6.14	5 (100%)
24A-ASH	2016	5	5.09-6.22	5 (100%)
23-ASH	2016	5	6.04-6.59	3 (60%)
20A-ASH	2016	5	6.20-6.46	5 (100%)
18-ASH	2016	5	6.30-6.57	5 (100%)
16D-ASH	2016	5	6.40-6.75	1 (20%)
16A-ASH	2016	5	6.30-6.90	1 (20%)
16-ASH	2016	5	6.39-6.74	1 (20%)

Table 3.1: VRAP Receiving Water pH Data, 2015-2019				
Sampling Station	Year	Samples Collected	pH Range	Acceptable Samples Not Meeting WQS
02B-SBA	2016	5	6.31-6.61	3 (60%)
02-SBA	2016	5	6.21-6.73	3 (60%)
15A-ASH	2016	5	6.23-6.99	3 (60%)
07-ASH	2016	5	6.32-6.79	2 (40%)
02-ASH	2016	4	7.01-7.51	0 (0%)
01-ASH	2016	5	6.32-7.19	1 (20%)
28-ASH	2017	5	4.90-5.56	5 (100%)
27-ASH	2017	4	4.98-5.64	4 (100%)
24A-ASH	2017	5	5.10-6.01	5 (100%)
23-ASH	2017	5	5.11-5.85	5 (100%)
20A-ASH	2017	5	5.12-5.78	5 (100%)
18-ASH	2017	5	5.08-5.99	5 (100%)
16D-ASH	2017	5	6.28-6.51	3 (60%)
16A-ASH	2017	5	6.35-6.61	3 (60%)
16-ASH	2017	5	6.37-6.64	3 (60%)
02B-SBA	2017	5	5.17-6.07	5 (100%)
02-SBA	2017	5	5.01-6.04	5 (100%)
15A-ASH	2017	5	6.11-6.55	4 (80%)
07-ASH	2017	5	5.22-6.43	5 (100%)
02-ASH	2017	4	6.27-7.01	2 (50%)
01-ASH	2017	5	5.93-6.71	3 (60%)
28-ASH	2018	5	5.26-5.71	5 (100%)
27-ASH	2018	5	5.48-5.82	5 (100%)
24A-ASH	2018	5	5.53-5.92	5 (100%)
23-ASH	2018	5	5.88-6.44	5 (100%)
20A-ASH	2018	5	6.12-6.56	4 (80%)
18-ASH	2018	5	5.97-6.35	5 (100%)
16D-ASH	2018	8	6.05-6.66	4 (50%)
16C-ASH	2018	3	6.41-6.85	1 (33%)
16A-ASH	2018	5	5.78-6.62	3 (60%)
16-ASH	2018	5	6.12-6.50	4 (80%)
02B-SBA	2018	5	5.73-6.48	5 (100%)
07U-SBA	2018	3	5.85-6.59	2 (67%)
08-SBA	2018	3	5.84-6.52	2 (67%)
02-SHK	2018	3	5.55-6.48	3 (100%)
02-SBA	2018	5	5.64-6.37	5 (100%)
15A-ASH	2018	5	5.79-6.71	4 (80%)
07-ASH	2018	5	5.68-6.46	5 (100%)
02-ASH	2018	4	6.58-7.44	0 (0%)
01-ASH	2018	5	6.04-7.04	1 (20%)

Table 3.1: VRAP Receiving Water pH Data, 2015-2019				
Sampling Station	Year	Samples Collected	pH Range	Acceptable Samples Not Meeting WQS
28-ASH	2019	5	5.65-5.71	5 (100%)
27-ASH	2019	5	5.56-5.81	5 (100%)
24A-ASH	2019	5	5.57-6.05	5 (100%)
23-ASH	2019	5	5.93-6.35	5 (100%)
20A-ASH	2019	5	5.83-6.12	5 (100%)
18-ASH	2019	5	5.94-6.15	5 (100%)
16D-ASH	2019	5	5.95-6.71	2 (40%)
16A-ASH	2019	5	6.01-6.75	1 (20%)
16-ASH	2019	5	6.00-6.71	1 (20%)
02B-SBA	2019	5	6.04-6.24	5 (100%)
02-SBA	2019	5	6.04-6.21	5 (100%)
15A-ASH	2019	5	6.14-6.35	5 (100%)
07-ASH	2019	5	6.12-6.33	5 (100%)
02-ASH	2019	4	6.78-7.28	0 (0%)
01-ASH	2019	5	6.31-6.71	2 (40%)

The percentages in the righthand column of Table 3.1 depict the percent of samples that did not meet the surface WQS of 6.5 to 8.0 S.U. Over the 5 years of data, the majority of the sampling stations yielded pH data below the surface WQS as representative by these percentages. **Keene respectfully requests that this data collected through this program and in collaboration with the State be considered as part of this request.**

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4.0 TOTAL RECOVERABLE ALUMINUM

The City has evaluated the proposed effluent limit and associated compliance schedule outlined in the Draft Permit and has developed the following comments.

4.1 Numerical Limit and Compliance Schedule

The Draft Permit includes an Average Monthly (chronic) numerical effluent limitation of 108 μg/L for Total Recoverable Aluminum and a reporting requirement for the maximum day (acute) condition. The Draft Permit also includes a schedule of compliance for this limitation subject to modification depending on the status of NH's adoption of the revised aluminum criteria as well as EPA's approval of said criteria, along with several other considerations and mandated reporting requirements. The current permit does not include an effluent limitation for Total Recoverable Aluminum.

The compliance schedule set forth in the Draft Permit proposes a 3-year period to achieve the 108 μg/L. Once the scheduled period is commenced, the 108 μg/L limit will be enforced. There is limited understanding behind the effectiveness of the 108 μg/L permit limit and the benefits that the threshold imposes to the receiving water. There is longstanding and significant regulatory controversy on the validity of the aluminum chronic criterion of 87 μg/L. This criterion was published in 1988; Page 22 of the 1988 document states that the chronic criterion would have been 748 μg/L but was reduced to 87 μg /L to protect brook trout and striped bass. However, page 6 of the 1988 document states that 87.2 μg/L "did not kill any of the exposed organisms" (striped bass), and similar irregularities for the brook trout results.

Although the Draft Permit grants Keene the opportunity to modify the proposed limit if NHDES adopts the new criteria, the inclusion of the following language depicted below causes Keene immense concern:

"If new criteria are approved by EPA before the effective date of the final aluminum effluent limit, the Permittee may apply for a permit modification, pursuant to 40 C.F.R 122.62(a)(3), to revise the time to meet the final aluminum effluent limit and/or for revisions to the permit based on whether there is reasonable potential for the facility's aluminum discharge to cause or contribute to a violation of the newly approved aluminum criteria."

Keene has calculated potential aluminum criteria scenarios utilizing the EPA aluminum criteria calculator available for public use. Keene has been sampling DOC, pH, and hardness levels simultaneously as part of this analysis. See Appendix E for sampling data. This data represents samples collected for both the Ashuelot River upstream (samples labeled as ASHUP*DATE*) and the secondary effluent (samples labeled as SEC*DATE*).

Based on these calculations, it appears that Keene would not have the reasonable potential to cause or contribute to an exceedance of WQS for aluminum. The data used and criteria calculated is presented in Table 4.1 below:

Tale 4.1: EPA 2018 Aluminum Criteria Keene Estimate	
Parameter	Value
DOC (mg/L)	4.10
Hardness (mg/L)	29.79
pH (S.U.)	6.43
Aluminum (acute criteria) (μg/L)	680
Aluminum (chronic criteria) (μg/L)	320

To impose a new limit based on superseded science would be an error and would prevent Keene the ability to take advantage of the newly developed and more appropriate criteria. The new EPA criteria accurately characterizes the bioavailability of aluminum by accounting for site specific data for parameters that directly impact the amount of aluminum that is bioavailable. pH, DOC and hardness each affect the toxicity level of aluminum in the receiving water. The current criterion does not consider these parameters, and therefore it is questioned if the existing criterion accurately depicts how much of the constituent is bioavailable. A review of the City's data indicates that Keene would be in compliance with the criteria calculated using the new EPA standard. Keene should be able to operate under a limit that is backed by the latest information in science and that is technically defensible in preventing any exceedances in WQS. Keene feels strongly that the limit set forth in the Draft Permit is inappropriate and unfair given the availability to provide a limit that is supported by the latest science, and the advancement of the requirements of the Draft Permit as is will not lead to any better environmental outcomes. Keene intends to continue to dispute the validity of the Draft Permit methodology for aluminum, if requested changes are not reflected in the Final Permit.

Keene is concerned that EPA is issuing a new aluminum limit given the recent adoption of new national guidance and the intention of NHDES to adopt the criteria. The criteria used to develop the 108 μg/L is an obsolete standard and should be delayed until such time as NHDES and EPA complete the process to adopt and approve the new WQS. If a new effluent limitation is anticipated to be re-calculated within the period of the Draft Permit, then it is inappropriate to impose a brand-new effluent limitation using an obsolete method. Regardless of the use of dated methodology to determine the permit limit, the proposed 108 μg /L does not account for site-specific data on acid soluble and total recoverable aluminum. As described in the Draft Permit, the fraction of acid soluble to total recoverable was assumed to be 1.0. **Keene respectfully requests that the Final Permit include language under a special condition that Keene has the option to submit a request to pursue a preliminary study evaluating the fraction of acid soluble aluminum to total recoverable aluminum. If Keene pursues this type of a study, additional language is requested to be in the Final Permit that the results of the study would be accepted and that a permit modification may be made to reflect site-specific limits.**

Given the term of the Draft Permit, the anticipated timely adoption of a new criterion, and to avoid relying on an obsolete and thus arbitrary and capricious standard, Keene respectfully requests that the aluminum limit be removed from the Final Permit.

4.2 Reporting Requirements

Keene also respectfully requests removal of the aluminum reporting requirements specific to developing an evaluation of alternative modes of operation at the wastewater treatment facility in order to reduce the effluent levels of aluminum from the Final Permit (Refer to page 17 of Draft Permit). Licensed operators are understood to be responsible for achieving mandated effluent limitations in accordance with the NPDES permit. The manner in which this happens is understood to be at the discretion of these professionals and not subject to EPA scrutiny or oversight. Conducting such evaluations as proposed in the Draft Permit reporting requirements can present a financial burden on Keene. The process of conducting these evaluations would entail hiring a consultant to evaluate the current dynamic of the treatment process and conducting research to determine alternative approaches that may be applicable. The system installed for Keene is an interconnected process, and the adjustments of one chemical addition to treat one parameter to meet effluent limitations can adversely affect the efficacy in meeting another parameter's effluent limitations. Due to the nature of the system, evaluating entirely new and formal approaches to meeting the aluminum limit can be both timely and costly, and thus must be reserved for situations in which WQS are unmet.

4.3 Alternative Low Flow on Total Recoverable Aluminum Limit Development

Section 2.0 of this report outlines comments requesting the use of an alternative low flow in place of the 7Q10. The 7Q10 calculated for the facility and identified in the Fact Sheet of the Draft Permit is used to establish the reasonable potential for a constituent to cause or contribute to an exceedance of WQS, as well as to developing permit effluent limits for constituents. **If the request for the use of an alternative low flow is granted through the Final Permit, Keene respectfully requests that the Reasonable Potential Analysis Table in Appendix B of the Draft Permit reflect this modification, and that the pollutant effluent limits be adjusted.**

5.0 TOTAL RECOVERABLE COPPER

The Draft Permit includes average monthly (chronic) and maximum daily (acute) effluent limitations of 5.9 μg/L and 7.9 μg/L, respectively, for total recoverable copper. Based on the permit review period comprised of 5 years of data, exceedances to copper effluent limitations occurred on two occasions. The data evaluated within the permit review period is assessed against the effluent limits that the City has been operating under. Appendix A indicates effluent limits as 5.9 μg/L and 7.9 μg/L for the review period. Keene would like to clarify that the modified permit effluent limits for copper that the City has been operating under were carried over from the 1994 permit, as 6.2 μg/L and 8.2 μg/L. See Appendix F attached to this document. The 1994 permit limits carried forward for copper, zinc, and lead are as follows: 6.2 μg/L chronic and 8.2 μg/L acute, 55.7 μg/L chronic and 61.5 μg/L acute, and 0.92 μg/L chronic and 23.8 μg/L acute. The violations determined for total copper were evaluated against incorrect effluent limitations as they are listed as 5.9 and 7.9 μg/L. **Keene requests that this clarification be reflected in the Final Permit and that EPA acknowledge that the 1994 permit effluent limits of 6.2 μg/L and 8.2 μg/L are appropriate; these requests are made notwithstanding the results of any site specific studies and alternative low flow discussed in this section below.**

The criteria were developed using the water quality standards equation dependent on the hardness (Env.-Wq. 1703). The Reasonable Potential Analysis Table is outlined in Appendix B and identifies the acute and chronic limits for copper. Although reasonable potential no longer applies to copper since limits have previously been enforced, Keene re-calculated limits based on the new criteria utilizing a hardness of 36.7 mg/L.

The Draft Permit states that limits may be developed utilizing a rearrangement of the mass balance equation and the use of the criterion in place of the downstream concentration. Keene reviewed EPA's approach to calculating the limits using the equation as understood below:

$$\text{Limit} = \frac{(\text{Q}_\text{d} * \text{Criteria} * 0.9 - \text{Q}_\text{s}\text{C}_\text{s})}{\text{Q}_\text{e}}$$

Solving for this equation using the values given in the Reasonable Potential Analysis Table, an acute limit would be 10.91 μg/L and a chronic limit would be 8.01 μg/L. These limits are appropriately adjusted based on new data collected during the review period which established a higher hardness concentration. 40 CFR § 122.44(l)(2)(i)(B)(1); *Great Basin Mine Watch v. State of Nevada*, No. 43943, 2006 WL 1668890, at *3 (Nev. Apr. 19, 2006). Recalculated limits accounting for current effluent and receiving water conditions is a proper consideration in establishing permit limits.

Although the current approach is hardness-dependent, the toxicity of copper is characterized by other parameters that are not considered by this approach. Keene has never failed a toxicity test even when operating under less stringent effluent copper concentration limits. Specifically, Keene has operated under a 20 μg/L copper concentration administrative testing, and never failed a toxicity test. In fact, due to the testing performance, EPA approved a reduction of WET testing frequency from four times annually to once annually.

There are additional studies that incorporate more data to characterize copper concentrations. NHDES water quality standards regulations allow for the use of approved methods including the Water Effect

Ratio (WER) and the Biotic Ligand Model (BLM) to characterize copper concentrations based on site-specific conditions (Env-Wq 1703.22 (d)). These are two options that NHDES specifies in their regulations, and therefore the opportunity is made available if Keene decides to advance with a site-specific approach. **Accordingly, Keene respectfully requests that language be included as a special condition in the Final Permit indicating that Keene may submit a permit modification request to apply for site-specific effluent copper limits, including the WER and the BLM. If Keene decided to move forward with a site-specific approach, Keene also respectfully requests that additional language be included in the Final Permit indicating that the results of a site-specific approach will be accepted and a permit modification may be made to reflect revised effluent limits.** Keene applied the BLM model previously in 2004 and the results confirmed that the corresponding criteria reflected in the state water quality standards are excessively conservative. Keene commented on the 2007 Draft Permit's proposed copper limits on a similar basis of toxicity and bioavailability stating that the limit: "…fails to take into account the fact that copper in municipal wastewater treatment facility effluents is not toxic…. Studies overwhelmingly support the conclusion that copper in biologically treated effluents exists in organo-complexes and is not bio available." Keene reiterates these arguments.

5.1 Alternative Low Flow on Total Recoverable Copper Limit Development

Section 2.0 of this report outlines comments requesting the use of an alternative low flow in place of the 7Q10. The 7Q10 calculated for the facility and identified in the Fact Sheet of the Draft Permit is used to establish the reasonable potential for a constituent to cause or contribute to an exceedance of WQS, as well as to developing permit effluent limits for constituents. **If the request for the use of an alternative low flow is granted through the Final Permit, Keene respectfully requests that the Reasonable Potential Analysis Table in Appendix B of the Draft Permit reflect this modification, and that the pollutant effluent limits be adjusted.**

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6.0 TOTAL PHOSPHORUS

6.1 Alternative Low Flow on Phosphorus Numerical Limit Development

Section 2.0 of this report outlines comments requesting the use of an alternative low flow in place of the 7Q10. The 7Q10 calculated for the facility and identified in the Fact Sheet of the Draft Permit is used to establish the reasonable potential for a constituent to cause or contribute to an exceedance of WQS, as well as to developing permit effluent limits for constituents. NHDES has discussed the potential benefits of using alternative low flows in establishing nutrient effluent limits, as depicted in Section 2.0. **If the request for the use of an alternative low flow is granted through the Final Permit, Keene respectfully requests that the Reasonable Potential Analysis Table in Appendix B of the Draft Permit reflect this modification, and that the pollutant effluent limits be adjusted.**

Further, NHDES regulations allow mixing zone studies dependent on department approval. In conjunction with the request for an alternative low flow, **Keene respectfully requests that language be included as a special condition of the Final Permit that allows Keene the option to conduct a CORMIX Mixing Zone model. If Keene decides to move forward with CORMIX modeling, it is requested that Keene be granted the ability to utilize alternative low flow conditions as described above. Further, additional language is requested to be included in the Final Permit indicating that the results of the study would be accepted, and a permit modification may be made to reflect the results.**

6.2 Numerical Effluent Limit

The Draft Permit includes Average Monthly (chronic) effluent limitations of 0.18 mg/L and 1.0 mg/L, respectively, for the periods April 1 through October 31 and November 1 through March 31. The acute condition is report only. These are based on the NHDES narrative WQS for Class B waters which, including the 10% held in reserve for assimilative capacity, targets an instream concentration of 0.09 mg/L based on 7Q10 flow conditions. The 2007 permit enforced a summer average monthly effluent limit of 0.20 mg/L. As confirmed in Appendix A of the Draft Permit, Keene has been successful in complying with both seasonal effluent limits with no violations during the permit review period. Further, ortho-phosphorus monitoring confirmed that minimal dissolved phosphorus was detected during the review period.

The criteria is based on nationally recommended values since there is no site-specific criteria adopted by NHDES. However, the nationally recommended Gold Book criteria does not justify receiving water conditions and characterize the accepted amount of the constituent that would be protective of the receiving waters.

NHDES provides reports for public viewing on the data collected in the Ashuelot River Watershed as part of VRAP. The intention of this program, as referenced in the 2007 VRAP report is ***"to assist NHDES in evaluating water quality throughout the state"***. The annual reports published between 2007 and 2010 utilize collected data which is interpreted as they relate to the surface WQS; available data is also collected by VRAP and published through NHDES for the years 2011 through 2019. Sampling station locations are arranged by VRAP staff annually. In 2007, data was collected at a total of 10 sampling stations in the Ashuelot River Watershed. These stations are located both upstream and downstream of the Keene WWTF discharge point.

Although NHDES does not provide a numeric WQS for total phosphorus, the NHDES "level of concern" is 0.05 mg/L. Based on this threshold, it is noted in the 2007 VRAP, that the majority of the samples ***"had total phosphorus levels that were always below the NHDES "level of concern""***. This statement also applies to the data collected as part of the 2008, 2009 and 2010 reports. Data collected at sampling stations 16D-ASH and 16A-ASH are representative of conditions 40 feet upstream of the Keene WWTF and at the mouth of the South Branch, downstream of the Keene WWTF. Presented in Appendix D are the VRAP annual reports from 2007-2010, as well as an analysis of the total phosphorus data collected from 2015-2019. The data confirms that the receiving water conditions consistently remain below the NH "level of concern", with only 5 samples of data exceeding the "level of concern" over 5 years. [3]

Based on Keene's success in meeting effluent limitations and the levels of total phosphorus in the receiving water, Keene believes that it would be appropriate to maintain the existing effluent limitations. **For these reasons, Keene respectfully requests that the summer average monthly effluent limit remain 0.20 mg/L; notwithstanding, and subject to, the results of any site-specific studies and alternative low flow discussed in this Section 6.1.**

6.3 Sampling Requirements

The Draft Permit proposes that Keene sample and collect data for ambient monitoring of total phosphorus to provide EPA with data for future use in their total phosphorus evaluation. Keene remains responsible for compliance with enforced effluent limitations to reduce potential to impair the receiving water. Keene does not believe that it would be appropriate to be required to sample and analyze data of the receiving water to confirm if EPA's enforced limits are protective. Monitoring of receiving water conditions is annually completed by state or volunteer organizations, such as the Volunteer River Assessment Program as discussed on page 30 of the Fact Sheet. Additional sampling requires operational efforts and monetary contributions from Keene. **For these reasons, the City respectfully requests that the monitoring requirement for ambient total phosphorus data be removed from the Final Permit.**

[3] It is the City's understanding that receiving water total phosphorus sampling conducted in support of the VRAP was discontinued in 2020 because the in-stream phosphorus concentrations are consistently below WQS concentrations.

7.0 ADDITIONAL DRAFT PERMIT COMMENTS

The City evaluated the Draft Permit requirements for parameters that do not constitute numerical effluent limits. Based on the evaluation, the City has developed several comments in response to the requirement changes set forth in the Draft Permit.

7.1 Technical Based Industrial Limits

Keene has previously conducted a study to develop specific effluent local limits for Industrial Users compliant with the requirements set forth in the Administrative Order, Docket No. 04-47. The comments were completed and submitted to EPA for review and approval in 2015. There was no further correspondence of comments or questions following the original submission. A re-evaluation of local limits should not be reiterated in this permit. The City is aware that the main contributors to the collection system are residential, with a total of 98% of users as residential. See Appendix G for significant industrial users list attached to this document. Further, data shows that the number of industrial users classified in the City have not greatly increased from 2015 to 2020. Given that the City has already completed such an assessment and that the number of users has primarily remained the same, a reassessment would not be appropriate. **Accordingly, Keene respectfully requests that the Reassessment of Technically Based Industrial Discharge Limits (Attachment C) be removed from the Final Permit.**

7.2 Dissolved Organic Carbon (DOC)

Keene respectfully requests clarification on Section 13 (Page 8, Draft Permit), which requires the addition of testing DOC as part of the Chemical Analysis for WET testing. Is data collection for DOC required for solely the initial effluent sample or for all three effluent samples?

In addition, the Draft Permit does not outline the minimum level for DOC in Attachments A and B for chronic and acute toxicity in the Part VI. Chemical Analysis table. **Keene requests that clarification on the minimum level be provided, and that language be included in the Final Permit's Attachment A and B identifying DOC.**

7.3 Alternate Dilution Water

Keene contracts out to a laboratory to conduct the WET Testing and has done so for years. They have been using laboratory soft water as the dilution water as part of the WET Testing procedure. Keene was previously granted the ability to use an alternate dilution water as EPA approved a request dated January 23, 1996, from the City. **Keene respectfully requests that the existing practices for utilizing an alternate dilution water be written into the Final Permit.**

7.4 Collection System

7.4.1 Maintenance Staff

The Draft Permit includes the following information specific to Operation and Maintenance of the Sewer System:

"The Permittee and co-Permittees shall each provide an adequate staff to carry out the operation, maintenance, repair, and testing functions required to ensure compliance with the terms and conditions of this permit."

This statement is vague and there is no regulatory authority cited for this requirement. The phrase “adequate staff” is unclear as there is no determination set forth that quantifies adequacy for staffing. **Without a defined regulatory authority as part of this requirement, Keene respectfully requests that Part C.1. requirement be removed from the Final Permit.**

7.4.2 Operation and Maintenance Plan

Section 5 of the Draft Permit (Pages 11-12) outlines requirements of the permittee and co-permittees regarding the Collection System Operation and Maintenance Plan. The annual summary reports and O&M Plan are required to be submitted to EPA and NHDES based on scheduled time frames as depicted in the Draft Permit. There is no authority cited for the submission of these items. This section does not consider authority of approval of the documents. Licensed operators and operations staff are understood to be responsible for achieving mandated effluent limitations in accordance with the NPDES permit. Therefore, operators are bound by effluent outcomes, not by the process to achieve that performance. The manner in which this happens is understood to be at the discretion of these professionals and not subject to EPA or NHDES scrutiny or oversight. **Without a defined regulatory authority as part of this requirement, Keene respectfully requests that the requirements set forth under Section 5 of the Draft Permit, Collection System Operation and Maintenance Plan be removed from the Final Permit.**

7.5 Industrial Pretreatment Reporting Requirements

7.5.1 Clarification on Language

Keene requests clarification on the following language:

“The permittee shall monitor according to sufficiently sensitive test procedures (i.e., methods) approved under 40 CFR Part 136 or required under 40 CFR Chapter I, Subchapter N or O, for the analysis of pollutants parameters (except WET).”

Does the requirement for sufficiently sensitive test procedures apply solely to the pollutants identified in the Part I. A Table? The City is seeking clarification on if the language also applies to “NPDES Requirement for IPP Annual Report”, item 5, pages 50-51 of the Draft Permit document.

7.5.2 Clarification on Language

Keene respectfully requests clarification on the following language:

The Draft Permit stipulates the Pretreatment Year as “… twelve (12) month period ending 60 days prior to the [report] due date…” of November 1st each year. Considering the 60 days prior to the report date, the Pretreatment Year would be from September 1st- August 31st. The City currently operates under a Pretreatment Year of October 1-September 30th. The City requests clarification on this change. **To remain consistent with current operating practices, Keene respectfully requests that the Pretreatment Year period remain the same.**

7.5.3 Section G.3 Nitrogen

Section G.3.b of the Draft Permit states, “… the annual report shall include a detailed explanation of the reasons why TN discharges have increased, including any changes in influent flows/loads and any operational changes.” The City is not required by the permit to report or monitor data on influent TN.

Therefore, Keene respectfully requests that the requirement to report on changes in influent TN be removed from the Final Permit.

7.5.4 Notice of Bypass or Upset

Keene respectfully requests clarification on the following language included under Notice of Bypass or Upset of the Draft Permit (Page 22 Draft Permit).

"…all public or privately owned water systems drawing water from the same receiving water and located within 20 mile downstream of the point of discharge regardless of whether or not it is on the same receiving water or not it is on the same receiving water or another surface water to which the receiving water is tributary."

This language does not provide a definition for "drawing water." Does this requirement apply to both surface water withdrawals and groundwater withdrawals? Keene is aware that there are no surface water withdrawals within 20 miles downstream of the effluent discharge. If this requirement pertains to only surface water withdrawals, and since Keene is aware that there are no existing surface water withdrawals within the defined distance, then Keene respectfully requests that this requirement be removed from the Draft Permit.

This section of the Draft Permit also requires that "a written notification, which shall be postmarked within 3 days of the bypass or upset." Keene does not have the ability to bypass their WWTF; accordingly, Keene respectfully requests the removal of the word "bypass" from this article. Further, Keene requests clarification on the term "upset" that would trigger this notification in advance of the issuance of the Final Permit such that the City can respond formally depending on the revised language and associated definition of the word "bypass."

7.6 Water Reservoirs and Wells

Section 2.3, Available Dilution, of the Draft Permit's Fact Sheet distinguishes Keene's water sources as two wells and the Babbidge Reservoir.

In Keene, there are three separate water supplies, with two surface water reservoirs located in Roxbury, NH. Surface water is conveyed from the Babbidge Reservoir to the Water Treatment Facility. The City's surface water supply is supplemented by four groundwater wells located on West Street and Court Street. Keene respectfully requests that the water sources be updated in the Final Permit to reflect the correct number of wells and reservoirs.

APPENDIX A

WWTF Upgrades

Phase 1, Investment $8.9 million

Construction began in 2013 and was completed in 2017 and included the following:

- Construction of two chemical feed buildings equipped with bulk storage tanks for increased capacity and treatment reliability.
- Construction of electrical building, replaced and decentralized original motor control centers and electrical gear
- Construction of new UV disinfection building and installation of UV disinfection system
- Installation of two Neuros 150hp turbo blowers
- Replacement of original three return activated sludge and two waste activated sludge pumps
- Retrofit clarifiers scum removal system and installation of algae cleaning system
- Replacement of 4 original raw sewage pumps, motors and controls at Martell Court pump station
- Installation of "Green" equipment including a heat recovery system, passive solar panels and solar tubes for lighting

Phase 2, Investment $2.7 million

Construction began in 2016 and was completed in 2017 and included the following:

- Replacement of original sludge dewatering equipment with two FKC screw presses and controls.

  This equipment is more efficient and produces a drier material that saves money in hauling and disposal costs
- Replacement of original polymer feed system with two Velodyne liquid emulsion feed system and controls
- Installation of enclosed screw conveyance system
- Installation of odor control system
- Installation of digital truck scale
- Repair and replacement of duct work in sludge dewatering and polymer rooms

The Wastewater Treatment Plant and Martell Court pump station came online in 1985. These upgrades were the first major improvements to the facilities since they came online 33 years ago.

Phase 3, Estimated Investment $1.8 million

Construction to begin in 2019 and be completed by 2021 and include the following:

- Installation of screening equipment to remove trash and non-flushable wipes at Martell Court pump station.

  This upgrade replaces the existing obsolete grinding system that has been in service for over 20 years

- Repair duct work and replace original HVAC system at the Martell Court pump station
- Replace original electrical transformer and emergency power generator at Martell Court pump station
- Perform Emergency Preparedness Evaluation for the Martell Court pump station
- Replace original emergency power generator at the Wastewater Treatment Plant

The City of Keene would like to acknowledge the New Hampshire Department of Environmental Services and the United States Environmental Protection Agency for providing State Revolving Fund low interest rate loans and $435,000 in grant funding for the phase 1 and phase 2 projects.

City of Keene Wastewater Treatment Plant

OPEN HOUSE JUNE 12, 2018

FKC Screw Press

APPENDIX B

Receiving Water pH Data

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
1/24/2018 09:00	6.9				
1/24/2018 10:00					
1/24/2018 11:00					
1/24/2018 12:00			6.6	4.8	
1/25/2018 10:00			6.3	5.0	
1/25/2018 11:00					
1/25/2018 12:00	6.8				
1/26/2018 08:00	6.7				
1/26/2018 09:00			6.5	4.7	
1/29/2018 08:00					
1/29/2018 09:00	6.9				
1/29/2018 10:00					
1/29/2018 11:00					
1/29/2018 12:00			7.2	4.8	
1/31/2018 09:00					
1/31/2018 10:00	7.0		6.9	4.9	
2/3/2018 07:00					
2/3/2018 08:00	6.7				
2/5/2018 10:00					
2/5/2018 11:00					
2/5/2018 12:00	7.0		7.3	4.9	
2/5/2018 13:00					
2/6/2018 11:00					
2/6/2018 12:00	7.2		6.7		
2/12/2018 07:00					
2/12/2018 08:00					3.9
2/12/2018 09:00					
2/12/2018 10:00					
2/12/2018 11:00					
2/12/2018 12:00	7.0		6.4	4.7	
2/12/2018 13:00					
2/13/2018 12:00	6.6				
2/13/2018 13:00			8.6		
2/14/2018 12:00	6.9				
2/14/2018 13:00			7.6		
2/15/2018 11:00			6.9	4.9	
2/15/2018 12:00	7.3				
2/16/2018 12:00	7.0				
2/16/2018 13:00			8.1	4.6	
2/26/2018 12:00	6.7				
2/26/2018 13:00			6.7	5.0	
2/27/2018 12:00	6.6				
2/27/2018 14:00				4.9	
2/28/2018 13:00	6.6		7.1		
3/1/2018 09:00	6.9				

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
3/1/2018 10:00			6.9	6.1	
3/5/2018 10:00	6.6				
3/5/2018 11:00					
3/5/2018 12:00					
3/5/2018 13:00			7.2	6.1	
3/6/2018 12:00	6.8				
3/6/2018 13:00			6.8	5.6	
3/7/2018 10:00	6.3		6.9	5.1	
3/9/2018 12:00	7.0		7.2	5.8	
3/12/2018 12:00	6.6		7.3	5.4	
3/15/2018 10:00	7.1				
3/15/2018 11:00					
3/15/2018 12:00			7.2	6.4	
3/16/2018 12:00	7.2			6.3	
3/16/2018 13:00			7.9		
3/19/2018 12:00	6.9		7.5	6.2	
3/20/2018 11:00					
3/20/2018 12:00			8.1	6.2	
3/20/2018 13:00	7.1				
3/21/2018 12:00	7.2			5.4	
3/21/2018 13:00			8.3		
3/22/2018 12:00	7.1		8.6	6.4	
3/23/2018 12:00	7.2		7.5	6.7	
3/26/2018 12:00	7.0		7.9	6.6	
3/27/2018 12:00	7.2		8.9		
3/28/2018 11:00					
3/28/2018 12:00	7.2				
3/28/2018 13:00			7.3	5.5	
3/29/2018 11:00			7.6	6.1	
3/29/2018 12:00	7.1				
3/30/2018 12:00	7.1		8.5	6.6	
4/2/2018 12:00	6.9	6.2	7.3	6.0	
4/3/2018 13:00	7.1	6.5	7.4	6.0	
4/4/2018 06:00					4.6
4/4/2018 12:00	7.0	6.6	8.2	5.9	
4/5/2018 12:00	7.0	6.7	7.3	5.7	
4/9/2018 12:00	7.2	7.0	8.2	6.1	
4/10/2018 12:00	7.1	6.4	7.6	6.3	
4/23/2018 10:00	7.0				
4/23/2018 11:00					
4/23/2018 12:00		6.3	7.4	6.5	
4/24/2018 13:00	7.0	6.4			
4/26/2018 10:00		6.2			
4/26/2018 11:00					
4/26/2018 12:00	7.0		8.0	6.1	
4/27/2018 09:00		6.4	7.2	6.0	

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
4/27/2018 13:00	6.9				
4/28/2018 07:00	7.0				
4/30/2018 06:00					4.7
4/30/2018 12:00			7.1	5.8	
4/30/2018 13:00	6.8	6.3			
5/1/2018 13:00	6.8	6.3	7.3	6.2	
5/2/2018 08:00	6.8			5.8	
5/2/2018 12:00		6.3	7.2		
5/3/2018 13:00	6.9	6.3	7.2	5.9	
5/4/2018 09:00		6.4			
5/4/2018 12:00	6.9		6.8	5.8	
5/7/2018 06:00					4.8
5/7/2018 10:00	6.8	6.2	7.4	6.5	
5/8/2018 11:00		6.1			
5/8/2018 12:00			7.6	6.2	
5/8/2018 13:00					
5/8/2018 14:00	6.9				
5/9/2018 12:00	6.8	6.2	7.3	6.0	
5/10/2018 10:00			7.7	5.8	
5/10/2018 13:00	6.8	6.2			
5/14/2018 12:00			8.1		
5/14/2018 13:00				6.1	
5/15/2018 12:00	7.2		7.6		
5/15/2018 13:00		6.3		6.0	
5/16/2018 08:00					5.3
5/16/2018 09:00					
5/16/2018 10:00		6.4			
5/16/2018 11:00					
5/16/2018 12:00					
5/16/2018 13:00	6.9		7.4	6.3	
5/18/2018 09:00		6.5			
5/18/2018 10:00	6.9		7.1	6.4	
5/20/2018 06:00					4.7
5/21/2018 10:00		6.3			
5/21/2018 11:00					
5/21/2018 12:00					
5/21/2018 13:00	6.8		7.0	6.3	
5/22/2018 11:00		6.5			
5/22/2018 12:00					
5/22/2018 13:00	6.8		7.7	6.3	
5/23/2018 09:00		6.3			
5/23/2018 10:00					
5/23/2018 11:00					
5/23/2018 12:00	6.9		8.0	6.0	
5/23/2018 13:00					
5/24/2018 11:00		6.6			

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
5/24/2018 12:00	6.9				
5/25/2018 10:00		6.7			
5/25/2018 11:00			7.5	6.2	
5/25/2018 12:00					
5/25/2018 13:00	6.9				
5/28/2018 10:00		6.3			
5/28/2018 11:00					
5/28/2018 12:00					
5/28/2018 13:00	6.8		7.5	6.2	
5/30/2018 09:00	7.0				
5/30/2018 10:00		6.3			
5/30/2018 11:00					
5/30/2018 12:00					
5/30/2018 13:00			8.2	6.1	
5/31/2018 10:00	6.9	6.4	7.4	6.2	
6/1/2018 09:00			7.6		
6/1/2018 10:00		6.4		6.4	
6/4/2018 07:00					5.3
6/4/2018 08:00					
6/4/2018 09:00	6.7	6.5	7.1	6.3	
6/5/2018 06:00					5.3
6/5/2018 10:00		6.4			
6/5/2018 11:00					
6/5/2018 12:00	7.0		7.5	6.0	
6/6/2018 08:00			7.1	6.1	
6/6/2018 09:00		6.6			
6/6/2018 12:00	7.0				
6/7/2018 09:00		6.7			
6/7/2018 10:00					
6/7/2018 11:00			7.6	6.0	
6/7/2018 12:00	7.0				
6/8/2018 08:00			7.3	6.1	
6/8/2018 10:00		6.6			
6/8/2018 11:00					
6/8/2018 12:00	6.7				
6/11/2018 10:00		6.4			
6/11/2018 14:00	6.7				
6/12/2018 08:00			7.2	6.2	
6/13/2018 09:00		6.2			
6/13/2018 10:00	6.9				
6/13/2018 13:00			7.6	6.1	
6/14/2018 09:00		6.2			
6/14/2018 13:00	6.8				
6/15/2018 09:00		6.3			
6/15/2018 14:00	6.8				
6/19/2018 10:00		6.4			

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
6/19/2018 13:00	6.8		7.3	6.4	
6/22/2018 10:00	6.8	6.7			
6/22/2018 13:00			7.3	6.2	
6/25/2018 06:00					4.8
6/25/2018 10:00		6.0			
6/25/2018 11:00					
6/25/2018 12:00			8.0	6.2	
6/25/2018 13:00	6.7				
6/26/2018 10:00		6.5			
6/26/2018 11:00					
6/26/2018 12:00					
6/26/2018 13:00	6.9		7.4	6.3	
6/27/2018 10:00		6.8			
6/27/2018 11:00					
6/27/2018 12:00	6.8				
6/27/2018 13:00			7.5	6.1	
6/28/2018 06:00					4.9
6/28/2018 10:00		6.5			
6/28/2018 11:00					
6/28/2018 12:00	6.8				
6/28/2018 13:00			7.6	6.2	
6/29/2018 06:00					4.8
6/29/2018 13:00	6.8	6.5	7.5	6.0	
7/2/2018 10:00		6.4			
7/3/2018 10:00		6.9			
7/3/2018 11:00					
7/3/2018 12:00					
7/3/2018 13:00	7.2				
7/9/2018 08:00	6.6				
7/9/2018 09:00			7.2		
7/9/2018 10:00		6.4			
7/10/2018 09:00			7.1	6.1	
7/10/2018 10:00	6.8	6.3			
7/11/2018 09:00				6.1	
7/11/2018 10:00		6.7			
7/12/2018 08:00					
7/12/2018 09:00		6.8			
7/12/2018 12:00				6.2	
7/12/2018 13:00	6.8		7.6		
7/13/2018 09:00		6.8			
7/13/2018 10:00	6.9				
7/13/2018 11:00			6.3	6.2	
7/15/2018 07:00					4.0
7/16/2018 10:00		6.6			
7/17/2018 06:00					4.5
7/17/2018 08:00					

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
7/17/2018 09:00		6.5			
7/18/2018 06:00					4.5
7/18/2018 09:00		6.6			
7/18/2018 10:00					
7/18/2018 11:00					
7/18/2018 12:00	6.7		7.0	6.1	
7/20/2018 10:00		6.5		6.2	
7/20/2018 11:00					
7/20/2018 12:00	6.9				
7/20/2018 13:00					
7/20/2018 14:00			8.0		
7/26/2018 10:00		6.5			
7/27/2018 10:00		6.6			
7/27/2018 11:00					
7/27/2018 12:00	6.7				
7/27/2018 13:00			7.1	6.1	4.6
7/30/2018 10:00		6.3			
7/30/2018 11:00					
7/30/2018 12:00					
7/30/2018 13:00	6.7		7.1	6.1	4.0
7/31/2018 11:00			7.2	6.2	
8/1/2018 10:00	6.7	6.6			
8/1/2018 11:00					
8/1/2018 12:00					
8/1/2018 13:00			7.1	6.2	
8/2/2018 12:00		6.4	6.8	6.1	
8/2/2018 13:00	6.7				
8/3/2018 10:00		6.6			
8/3/2018 11:00	6.8				
8/3/2018 12:00			7.0	5.8	
8/4/2018 07:00					4.6
8/6/2018 09:00		6.2	6.8	6.0	
8/6/2018 13:00	7.2				
8/7/2018 09:00		6.8			
8/7/2018 14:00	6.8		7.1	5.9	
8/8/2018 06:00					4.6
8/8/2018 10:00	6.5	6.8	7.1	6.2	
8/9/2018 09:00		6.6			
8/9/2018 10:00			7.2	6.1	
8/9/2018 13:00	6.6				
8/10/2018 09:00		6.5			
8/10/2018 10:00			7.2	6.0	
8/10/2018 11:00	6.5				
8/12/2018 07:00					4.3
8/13/2018 09:00		6.4			
8/13/2018 10:00			7.2	6.1	

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
8/13/2018 11:00					
8/13/2018 12:00	6.2				
8/14/2018 09:00		7.0	6.9	6.0	
8/14/2018 13:00	6.6				
8/15/2018 09:00		6.5			
8/15/2018 12:00			6.9	6.0	
8/15/2018 13:00					
8/15/2018 14:00	6.6				
8/16/2018 09:00		6.6			
8/16/2018 14:00	6.7				
8/17/2018 09:00		6.4			
8/17/2018 10:00	6.6				
8/20/2018 10:00		6.6			
8/20/2018 11:00					
8/20/2018 12:00	6.7		6.8	5.9	
8/21/2018 10:00		6.4			
8/21/2018 13:00	6.7		6.9	6.0	
8/22/2018 10:00		6.6	7.1	6.1	
8/22/2018 11:00	6.5				
8/23/2018 09:00		6.7			
8/24/2018 10:00		6.7			
8/24/2018 13:00			7.1	5.6	
8/27/2018 12:00			7.2	5.9	
8/27/2018 13:00	6.9	6.7			
8/28/2018 13:00	6.5	6.4	7.1	6.0	
8/29/2018 10:00		6.3			
8/29/2018 11:00					
8/29/2018 12:00			7.4	6.0	
8/29/2018 13:00	6.8				
8/30/2018 09:00		6.7			
8/30/2018 10:00					
8/30/2018 11:00			7.6	5.8	
8/30/2018 12:00					
8/30/2018 13:00	6.7				
8/31/2018 09:00		6.7			
8/31/2018 10:00					
8/31/2018 11:00					
8/31/2018 12:00					
8/31/2018 13:00	7.1		7.8	5.4	
9/4/2018 10:00		6.4			
9/4/2018 11:00					
9/4/2018 12:00					
9/4/2018 13:00			7.2	6.0	
9/4/2018 14:00	6.7				
9/6/2018 10:00		6.5			
9/7/2018 10:00		6.5			

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
9/7/2018 11:00					
9/7/2018 12:00					
9/7/2018 13:00	6.7		7.4	6.1	
9/10/2018 10:00		6.6			
9/10/2018 11:00					
9/10/2018 12:00					
9/10/2018 13:00	6.9		7.4	6.0	
9/11/2018 06:00					5.3
9/11/2018 10:00		6.8			
9/11/2018 11:00					
9/11/2018 12:00					
9/11/2018 13:00			7.5	6.0	
9/12/2018 10:00		6.7			
9/12/2018 11:00					
9/12/2018 12:00	6.6				
9/12/2018 13:00					
9/12/2018 14:00				5.9	
9/13/2018 11:00			7.1	5.7	
9/13/2018 12:00	6.8				
9/14/2018 10:00		6.8			
9/14/2018 11:00			7.4	5.8	
9/14/2018 12:00					
9/14/2018 13:00	7.0				
9/17/2018 10:00		6.1			
9/17/2018 11:00					
9/17/2018 12:00	4.9				
9/17/2018 13:00			7.4	6.0	
9/18/2018 10:00		6.2			
9/19/2018 10:00		6.8			
9/19/2018 11:00					
9/19/2018 12:00	6.6				
9/20/2018 10:00		6.4			
9/20/2018 11:00					
9/20/2018 12:00					
9/20/2018 13:00	6.9				
9/21/2018 09:00		6.3			
9/21/2018 13:00	7.1		7.3	5.9	
9/24/2018 09:00			7.1	7.0	
9/24/2018 10:00		6.2			
9/24/2018 14:00	7.1				
9/25/2018 10:00		6.5			
9/25/2018 11:00					
9/25/2018 12:00			7.4	6.0	
9/25/2018 13:00	6.9				
9/26/2018 06:00					5.0
9/26/2018 07:00					

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
9/26/2018 12:00	6.9	6.7	7.0	5.9	
9/27/2018 10:00		6.4			
9/27/2018 11:00			6.8	6.0	
9/27/2018 14:00	6.8				
9/28/2018 09:00		6.6			
9/28/2018 10:00					
9/28/2018 11:00			7.1	5.8	
9/28/2018 12:00					
9/28/2018 13:00	6.9				
10/3/2018 06:00					5.1
10/3/2018 07:00					
10/3/2018 08:00					
10/3/2018 09:00		6.8			
10/3/2018 13:00	6.8		7.0	6.0	
10/4/2018 10:00		6.6			
10/4/2018 11:00					
10/4/2018 12:00			7.6		
10/4/2018 13:00	6.8			5.9	
10/10/2018 11:00			7.2	5.7	
10/11/2018 10:00		6.7			
10/11/2018 11:00					
10/11/2018 12:00			7.1	5.8	
10/11/2018 13:00	7.1				
10/16/2018 13:00		6.5	7.4	5.6	
10/16/2018 14:00	7.1				
10/17/2018 11:00		6.5			
10/17/2018 12:00					
10/17/2018 13:00	7.2		7.3	5.4	
10/18/2018 10:00		6.5			
10/18/2018 11:00	6.9				
10/19/2018 10:00		6.6			
10/19/2018 11:00					
10/19/2018 12:00			8.3	5.4	
10/19/2018 13:00	7.1				
10/22/2018 09:00			7.2	6.2	
10/23/2018 10:00		6.5			
10/23/2018 11:00					
10/23/2018 12:00					
10/23/2018 13:00	7.2		7.5	6.4	
10/24/2018 10:00		6.4	7.2	6.6	
10/24/2018 11:00					
10/24/2018 12:00	6.8				
10/25/2018 10:00		6.4			
10/25/2018 11:00					
10/25/2018 12:00					
10/25/2018 13:00	6.8		8.2	5.9	

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
10/26/2018 09:00		6.4	7.1	5.7	
10/26/2018 10:00	6.8				
10/28/2018 07:00					4.8
10/29/2018 10:00		6.8			
10/29/2018 11:00					
10/29/2018 12:00					
10/29/2018 13:00			8.6	5.5	
10/29/2018 14:00	6.6				
10/30/2018 09:00		6.7			
10/30/2018 10:00					
10/30/2018 11:00					
10/30/2018 12:00					
10/30/2018 13:00	7.1		7.7	5.6	
10/31/2018 10:00		6.6			
10/31/2018 11:00					
10/31/2018 12:00			8.2	5.6	
10/31/2018 13:00	7.0				
11/1/2018 11:00		6.4			
11/1/2018 12:00					
11/1/2018 13:00			7.8	5.5	
11/2/2018 09:00		6.5			
11/2/2018 10:00					
11/2/2018 11:00					
11/2/2018 12:00	6.6			7.0	
11/2/2018 13:00			7.3		
11/5/2018 09:00		6.9			
11/5/2018 13:00	7.2		7.0	5.4	
11/6/2018 06:00					5.0
11/6/2018 13:00	7.0	6.9	7.0	5.4	
11/7/2018 10:00		6.8			
11/7/2018 14:00	6.9		6.9	5.5	
11/8/2018 12:00	6.5				
11/8/2018 13:00					
11/8/2018 14:00			6.6	5.3	
11/9/2018 10:00		6.6			
11/9/2018 13:00	7.0		6.9	5.3	
11/13/2018 10:00		6.6			
11/13/2018 11:00			6.7	5.1	
11/13/2018 12:00					
11/13/2018 13:00	6.6				
11/14/2018 10:00		6.8			
11/14/2018 11:00					
11/14/2018 12:00	6.9		6.5	5.4	
11/15/2018 10:00		6.9			
11/15/2018 11:00					
11/15/2018 12:00			6.8	5.3	

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
11/15/2018 13:00	6.9				
11/16/2018 06:00					4.6
11/16/2018 10:00		6.6			
11/16/2018 11:00					
11/16/2018 12:00			6.5	5.1	
11/16/2018 13:00	6.4				
11/19/2018 10:00		6.7			
11/19/2018 11:00	7.1				
11/19/2018 12:00					
11/19/2018 13:00			6.7	5.4	
11/20/2018 09:00		6.7			
11/20/2018 10:00	6.5				
11/20/2018 11:00					
11/20/2018 12:00					
11/20/2018 13:00			6.9	5.6	
11/21/2018 10:00		6.9	7.0	5.5	
11/21/2018 11:00	6.9				
11/26/2018 06:00					4.8
11/26/2018 10:00		6.8			
11/26/2018 13:00	6.8		7.1	5.5	
11/27/2018 10:00		6.6			
11/27/2018 11:00					
11/27/2018 12:00			7.5	5.4	
11/27/2018 13:00	7.2				
11/28/2018 10:00		6.6			
11/28/2018 11:00					
11/28/2018 12:00					
11/28/2018 13:00	7.0		7.1	5.7	
11/29/2018 06:00					4.8
11/29/2018 10:00		6.8			
11/29/2018 14:00	7.2		7.5	5.3	
11/30/2018 10:00		6.7			
11/30/2018 11:00					
11/30/2018 12:00					
11/30/2018 13:00	7.3		7.0	5.7	
12/3/2018 10:00	6.9	6.6			
12/3/2018 11:00					
12/3/2018 12:00			6.9	5.5	
12/4/2018 10:00	6.9	6.4			
12/4/2018 11:00					
12/4/2018 12:00			7.1	5.9	
12/5/2018 10:00		6.6			
12/5/2018 11:00					
12/5/2018 12:00					
12/5/2018 13:00	6.9		6.9	5.2	
12/6/2018 09:00		6.7			

2018 pH Data Collected by Keene					
Sampling Date	WWTF Primary Effluent Grab pH	WWTF Clarifier #2 pH	Martell Court pH	Ashuelot River Martell Court Bridge pH, upstream	Precipitation pH
	S.U.	S.U.	S.U.	S.U.	S.U.
12/6/2018 12:00					
12/6/2018 13:00	7.0		7.1	5.2	
12/7/2018 10:00		6.5			
12/7/2018 11:00					
12/7/2018 12:00	7.1		7.5	5.3	
12/10/2018 10:00		6.7			
12/10/2018 11:00					
12/10/2018 12:00			7.5	5.2	
12/10/2018 13:00	7.0				
Minimum	4.9	6.0	6.3	4.6	3.9
Maximum	7.3	7.0	8.9	7.0	5.3
Median	6.9	6.5	7.2	6.0	4.8
Median (Summer)	6.8	6.5	7.2	6.0	4.8
Median (Winter)	7.0	6.5	7.3	5.8	4.8

APPENDIX C

Parallel WET Tests Unadjusted pH

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY SUMMARY REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *5/1/2018 2:20:00 PM* ***Test End:*** *5/8/2018 2:00:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
50880	Keene WWTP 2° Clarifier #2	100	>100	100	>100

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *5/1/2018 2:00:00 PM* ***Test End:*** *5/8/2018 3:25:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
50880	Keene WWTP 2° Clarifier #2	100	>100	100	>100

SAMPLES RECEIVED:

Number	Sample Name	Date Time and Collected	Type
50880	Keene WWTP 2° Clarifier #2	4/30/2018 6:58:00 AM	Effluent
50881	Ashuelot River (Bridge at MC)	4/30/2018 8:40:00 AM	Receiving
50882	042718-soft		Lab Water
50889	Keene WWTP 2° Clarifier #2	5/2/2018 6:10:00 AM	Effluent
50890	Ashuelot River	5/2/2018 8:20:00 AM	Receiving
50891	Keene WWTP 2° Clarifier #2	5/4/2018 6:10:00 AM	Effluent
50892	Ashuelot River	5/4/2018 8:30:00 AM	Receiving

Submitted By:

Wednesday, May 16, 2018
SDG: 15326
Project 18017

Aquatec Environmental, Inc.
Reviewed by: EB Date: 5-18-18

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

TOXICITY DETAIL REPORT:

Sample ID: 50880 / Keene WWTP 2° Clarifier #2

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *5/1/2018 2:20:00 PM* ***Test End:*** *5/8/2018 2:00:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	97.5	100	97.5	100	100	100
7	97.5	97.5	100	95	97.5	100	100

Response: Growth per Original Number of Larvae (mean dry weight,mg)

	Additional Control	Concentration % 0	12	24	48	50	100
7	0.539	0.622	0.674	0.619	0.624	0.619	0.686

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *5/1/2018 2:00:00 PM* ***Test End:*** *5/8/2018 3:25:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	100	100	100	100	100	100
6	70	100	100	100	100	100	100

Response: Reproduction (mean neonates per female)

	Additional Control	Concentration % 0	12	24	48	50	100
6	23.9	25.8	22.1	25.6	28.7	27.8	26.3

Submitted By:

Friday, May 18, 2018

SDG: 15326

Project 18017

Aquatec Environmental, Inc.
Reviewed by: EB Date: 5-18-18

Aquatec Environmental, Inc.
273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: 5/1/2018 2:20:00 PM **Test End:** 5/8/2018 2:00:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	50880	97.5	100
7	50880	97.5	97.5

Response: Growth per Original Number of Larvae (mean dry weight, mg)

Day	Sample ID	Dilution Control	Additional Control
7	50880	0.622	0.539

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 13.8% **PMSD Criteria Range:** 12%-30%

The calculated test PMSD was within the acceptable boundary range indicating test data with acceptable variability and statistical sensitivity. The chronic values (C-NOEC, C-LOEC) were reported as calculated by the statistical program.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, the following special conditions or qualifiers relate to the samples in this report:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Achuelot River) was included in the test array as the additional control.

The temperature blank associated with renewal samples received on May 3, 2018 was measured at 6.7C, slightly above the target temperature range of 0C-6C.

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

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Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: 5/1/2018 2:00:00 PM **Test End:** 5/8/2018 3:25:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	50880	100	100
6	50880	100	70

Response: Reproduction (mean neonates per female)

Day	Sample ID	Dilution Control	Additional Control
6	50880	25.8	23.9

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 24.7% **PMSD Criteria Range:** 13%-47%

The calculated test PMSD was within the acceptable boundary range indicating test data with acceptable variability and statistical sensitivity. The chronic values (C-NOEC, C-LOEC) were reported as calculated by the statistical program.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, the following special conditions or qualifiers relate to the samples in this report:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Achuelot River) was included in the test array as the additional control.

The temperature blank associated with renewal samples received on May 3, 2018 was measured at 6.7C, slightly above the target temperature range of 0C-6C.

The primary control (lab water used as dilution water) met test acceptance criteria. The additional control (receiving water) did not meet the acceptance criterion for survival.

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Route 32
Swanzey, NH 03446

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Permit No. NH0100790

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION:

The results reported relate only to the the samples submitted as received.

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 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: May 29, 2018
(Date)

(Authorized signature)

John Williams
Director
Aquatec Environmental, Inc.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
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Route 32
Swanzey, NH 03446

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Client ID: Keene/Ley

Permit No. NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *5/1/2018 2:20:00 PM* ***Test End:*** *5/8/2018 2:00:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Pimephales promelas*	Effluent	Composite

Dilution Water:	Soft Water	
Additional Control:	Ashuelot River	
Effluent Sampling Dates:	April 30, May 2 & 4, 2018	
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)	
Effluent Salinity Adjusted?	No	If yes, to what value?
With Sea Salts?		Hypersaline Brine Solution?
Reference Toxicant Date:	April 3-10, 2018	
Reference Toxicant Test Acceptable?	Yes	
Age and Age Range of Test Organisms:	1-day old	
Source of Organisms:	Aquatic BioSystems - Fort Collins, CO	

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Permit No. NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *5/1/2018 2:20:00 PM* ***Test End:*** *5/8/2018 2:00:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 97.5 % Mean Control Growth: 0.622 (mg)

B. Additional Control: Ashuelot River
Mean Control Survival: 97.5 % Mean Control Growth: 0.539 (mg)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Growth (%): 13.8

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Dunnett Multiple Comparison Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *5/1/2018 2:20:00 PM* ***Test End:*** *5/8/2018 2:00:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was within the boundaries of 12%-30%, indicating test data with normal variability and statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or growth were not detected.

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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *5/1/2018 2:00:00 PM* ***Test End:*** *5/8/2018 3:25:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Ceriodaphnia dubia*	Effluent	Composite

Dilution Water:	Soft Water	
Additional Control:	Ashuelot River	
Effluent Sampling Dates:	April 30, May 2 & 4, 2018	
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)	
Effluent Salinity Adjusted?	No	If yes, to what value?
With Sea Salts?		Hypersaline Brine Solution?
Reference Toxicant Date:	April 3-10, 2018	
Reference Toxicant Test Acceptable?	Yes	
Age and Age Range of Test Organisms:	<24h collected within an 8h period	
Source of Organisms:	Aquatec Environmental, Inc. - Williston, VT	

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Williston, VT 05495
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E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *5/1/2018 2:00:00 PM* ***Test End:*** *5/8/2018 3:25:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Reproduction: 25.8 (neonates)

B. Additional Control: Ashuelot River
Mean Control Survival: 70 % Mean Control Reproduction: 23.9 (neonates)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Reproduction (%): 24.7

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Fisher Exact/Bonferroni-Holm Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *5/1/2018 2:00:00 PM* ***Test End:*** *5/8/2018 3:25:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) did not meet the acceptance criterion for survival.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was within the boundaries of 13%-47%, indicating test data with normal variability and statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or reproduction were not detected.

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT:	Keene NH NPDES
273 Commerce St	101170	WORK ORDER:	**1805-09567**
Williston, VT 05495		DATE RECEIVED:	May 01, 2018
		DATE REPORTED:	May 14, 2018
Atten: John Williams		SAMPLER:	BB/MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 05/14/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1805-09567**
PROJECT: Keene NH NPDES DATE RECEIVED: 05/01/2018

001 Site: Keene WWTP 2 Clarifier Composite Date Sampled: 4/30/18 Time: 6:58

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	4.2	mg/L	SM 5310C (00)	5/7/18	N JGM	A	
Hardness, Total as CaCO3	59	mg/L	EPA 200.7	5/7/18	W FAA	A	
Ammonia as N	0.39	mg/L	EPA 350.1, R.2	5/11/18	N JGM	A	
Solids, Total Dissolved	363	mg/L	SM 2540C-97	5/8/18	W JSS	A	B
Total Solids	494	mg/l	SM 2540 B.-97	5/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	5/3/18	W FAA	A	
Aluminum, Total	0.054	mg/L	EPA 200.8	5/9/18	W MGT	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	5/9/18	W MGT	A	
Calcium, Total	18	mg/L	EPA 200.7	5/7/18	W FAA	A	
Copper, Total	0.0020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	5/9/18	W MGT	A	
Magnesium, Total	3.4	mg/L	EPA 200.7	5/7/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	5/9/18	W MGT	A	
Zinc, Total	0.023	mg/L	EPA 200.8	5/9/18	W MGT	A	

002 Site: Ashuelot River Grab Date Sampled: 4/30/18 Time: 8:40

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	3.5	mg/L	SM 5310C (00)	5/7/18	N JGM	A	
Hardness, Total as CaCO3	7	mg/L	EPA 200.7	5/7/18	W FAA	A	
Ammonia as N	0.50	mg/L	EPA 350.1, R.2	5/11/18	N JGM	A	
Metals Digestion	Digested		EPA 200.7/200.8	5/3/18	W FAA	A	
Aluminum, Total	0.11	mg/L	EPA 200.8	5/9/18	W MGT	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	5/9/18	W MGT	A	
Calcium, Total	2.1	mg/L	EPA 200.7	5/7/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	5/9/18	W MGT	A	
Magnesium, Total	0.53	mg/L	EPA 200.7	5/7/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	5/9/18	W MGT	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	5/9/18	W MGT	A	

Report Summary of Qualifiers and Notes

B: Blank contamination was observed at levels that could affect analytical results.

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB/MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP 2 Clarifier	**04/30/18**	**6:58**	Grab: **N/A** Composite: **X**				
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2
			Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice (4C)	1
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
Ashuelot River (Bridge at	**04/30/18**	**8:40**	Grab: **X** Composite: **N/A**				
added TOC per J.W. email et			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
[signature]	5/1/18	14:30	[signature]	5/1/18	14:27	Cooler/Sample Temp.: 6.1 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1805-09567

1805-09567
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT:	Keene NH NPDES
273 Commerce St	101170	WORK ORDER:	**1805-10122**
Williston, VT 05495		DATE RECEIVED:	May 07, 2018
		DATE REPORTED:	May 17, 2018
Atten: John Williams		SAMPLER:	BB/MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

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Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 05/17/2018

CLIENT: Aquatec Environmental, Inc
PROJECT: Keene NH NPDES

WORK ORDER: **1805-10122**
DATE RECEIVED: 05/07/2018

001 Site: 50889 Keene WWTP 2' Clarifier Composite Date Sampled: 5/2/18 Time: 6:10

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.88	mg/L	EPA 350.1, R.2	5/17/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB/MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP 2° Clarifier 50889	**05/02/18**	**6:10**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	Cooler/Sample Temp.: 4.2
[signature]	5/7/18	12:50	Eileen Tormey	5/7/18	1250	Notes To Lab: temperature blank upon arrival was out of range (6.7C)- ice in cooler was all melted. Arrived in a small cooler so not enough room for adequate ice??-
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1805-10122

1805-10122

Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1805-10123**
Williston, VT 05495	DATE RECEIVED: May 07, 2018
	DATE REPORTED: May 17, 2018
Atten: John Williams	SAMPLER: BB, MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

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Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report

DATE REPORTED: 05/17/2018

CLIENT: Aquatec Environmental, Inc
PROJECT: Keene NH NPDES

WORK ORDER: **1805-10123**
DATE RECEIVED: 05/07/2018

001 Site: 50891 Keene WWTP 2' Clarifier Composite Date Sampled: 5/4/18 Time: 6:10

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.43	mg/L	EPA 350.1, R.2	5/17/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB; MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP 2° Clarifier	**05/04/18**	**6:10**	Grab: **N/A** Composite: **X**				
50891			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	
[signature]	5/7/18	12:50	Eileen Tomey	5/7	1250	Cooler/Sample Temp.: 4.2 Notes To Lab:
Relinquished by *(signature)*	**DATE**	**TIME**	**Received by: *(signature)***	**DATE**	**TIME**	

1805-10123

1805-10123

Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT:	Tox Lab QC
273 Commerce St	101170	WORK ORDER:	**1805-09573**
Williston, VT 05495		DATE RECEIVED:	May 01, 2018
		DATE REPORTED:	May 14, 2018
Atten: John Williams		SAMPLER:	John Williams

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

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Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 05/14/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1805-09573**
PROJECT: Tox Lab QC DATE RECEIVED: 05/01/2018

001 Site: 042718SOFT (50884) Date Sampled: 5/1/18 Time: 11:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	< 0.5	mg/L	SM 5310C (00)	5/7/18	N JGM	A	
Hardness, Total as CaCO3	49	mg/L	EPA 200.7	5/7/18	W FAA	A	
Ammonia as N	0.12	mg/L	EPA 350.1, R.2	5/11/18	N JGM	A	
Solids, Total Dissolved	143	mg/L	SM 2540C-97	5/8/18	W JSS	A	B
Total Solids	104	mg/l	SM 2540 B.-97	5/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	5/3/18	W FAA	A	
Aluminum, Total	< 0.020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	5/9/18	W MGT	A	
Calcium, Total	6.5	mg/L	EPA 200.7	5/7/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	5/9/18	W MGT	A	
Magnesium, Total	7.9	mg/L	EPA 200.7	5/7/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	5/9/18	W MGT	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	5/9/18	W MGT	A	

Report Summary of Qualifiers and Notes

B: Blank contamination was observed at levels that could affect analytical results.

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	Project Name:	Tox Lab QC
Address:	273 Commerce Street	Project Number:	18000
City/State/Zip:	Williston, VT 05403	Sampler Name(s):	JW
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
042718SOFT (50884)	**05/01/18**	**11:00**	Grab: **X** Composite: **N/A**				
			Metals: Al (0.02); Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Ca, Mg (0.05)	250mL	Plastic	HNO3	1
			Ammonia-Nitrogen(0.1)	250mL	Plastic	H2SO4	1
			TS/TDS-Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice(4C)	1
			TOC - Total Organic Carbon(0.5)	40mL	Glass	H2SO4	2

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
[signature]	5/1/18	14:30	Eileen Tawney	5/1/18	14:27	Cooler/Sample Temp.: 6.1 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1805-09573

1805-09573

Aquatec Environmental, Inc
Tox Lab QC

Supportive Documentation

Chain-Of-Custody

Toxicity Test Methods

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

Standard Reference Toxicant Control Charts

Chain-Of-Custody(s)

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION	PROJECT INFORMATION
NAME: Keene, NH	PROJECT: Keene NH/Ley
ADDRESS: 420 Airport Road	*(1st Sample Ship Monday)*
Swanzey, NH 03446	PROJECT #: 18017
TEL: (603) 357 – 9836 [x6502]	SAMPLERS NAME(S): Bob Bishop/Mike Merrell
CONTACT: Mary Ley	
E-MAIL: mley@ci.keene.nh.us	PERMIT NUMBER: NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
4/29-4/30/18 Keene WWTP 2° Clarifier #2	4/30/18	658		X	Effluent	2	1	1	1	1	2		
Ashuelot River (Bridge at MC)	4/30/18	840	X		Receiving	1	1			1	2		

ANALYSIS (TEST/DETECTION LIMITS) – TOX: 1000.0 & 1002.0 (P. promelas & C. dubia chronic toxicity; %) **– METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) **– TRC:** Total Residual Chlorine (0.02mg/L) **– TS/TDS:** Total Solids / Total Dissolved Solids **– AMMONIA:** (0.1mg/L) **– TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	4/30/18	930	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	DATE: 5/1/18	TIME: 9:50	RECEIVED BY: (Signature) KN
RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature)

TEMPERATURE ON DELIVERY (°C): 4.1°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab; Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION	PROJECT INFORMATION
NAME: Keene, NH	PROJECT: Keene NH/Ley
ADDRESS: 420 Airport Road	(2nd Sample Ship Wednesday)
Swanzey, NH 03446	PROJECT #: 18017
TEL: (603) 357 – 9836 [x6502]	SAMPLERS NAME(S): Bob Bishop
CONTACT: Mary Ley	Mike Martell
E-MAIL: mley@ci.keene.nh.us	PERMIT NUMBER: NH0100790

VOLUME/CONTAINER TYPE/ PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
(5/1-5/2/18) Keene WWTP 2° Clarifier #2	05/2/18	610		X	Effluent	2	1*	1	1*	1	2*		
Ashuelot River	5/2/18	820	X		Receiving	1							

ANALYSIS (TEST/DETECTION LIMITS) – **TOX:** Renewal (P. promelas and C. dubia chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	5/2/18	1000	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	DATE: 5/3/18	TIME: 950	RECEIVED BY: (Signature) KN Kendry Nh
RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature)

TEMPERATURE ON DELIVERY (°C): 6.7°C

temp out of range see BTR notes

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SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(3rd Sample Ship Friday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bishop
CONTACT:	Mary Ley		Mike Martell
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Comp 5/3–5/4/18 Keene WWTP 2° Clarifier #2	5/4/18	610		X	Effluent	3	1*	1	1*	1	2*		
Ashuelot River	5/4/18	830	X		Receiving	2							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (P. promelas and C. dubia chronic toxicity; %) – METALS: Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – TRC: Total Residual Chlorine (0.02mg/L) – TS/TDS: Total Solids / Total Dissolved Solids – AMMONIA: (0.1mg/L) – TOC: Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary L[illegible]	5/4/18	930	Priority Express
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)
Priority Express	5.5.18	0840	[illegible signature]
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 5.1°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab; Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

SAMPLE PREPARATION:

	Initial Sample		Second Sample		Third Sample		
	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	LAB CONTROL
Sample No.	50880	50881	50889	50890	50891	50892	50882
Filtration	60 Micron	60 Micron	60 Micron	60 Micron	60 Micron	60 Micron	N / A
Chlorine (1)	ND	—	ND	—	ND	/	N / A
Chlorine (2)	—	—	—	—	/	/	N / A
NaThio Lot No.	—	—	—	—	/	/	N / A
Original / Final Salinity:	N / A	N / A	N / A	N / A	N / A	N / A	N / A
FF Lot No.	N / A	N / A	N / A	N / A	N / A	N / A	N / A
Date / Initials:	5/1/18 KN	5/1/18 KN	5/3/18 KN	5/3/18 KN	5.5.18 KP	—	5/1/18 KN

(1) Record vol. 0.025 N sodium thiosulfate to dechlorinate 100mL sample or record "ND" (Not Detected)

(2) Dechlorination required if detected. Record vol. 0.25 N sodium thiosulfate added per gallon effluent.

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Client ID: Keene/Ley **Permit No.** NH0100790

ALKALINITY, HARDNESS, AND TRC REPORT:

Sample ID:	Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)	TRC: (mg/L)
50880 - Keene WWTP 2° Clarifier #2	5/1/2018	32.0	60.0	0.02
50881 - Ashuelot River (Bridge at MC)	5/1/2018	8.0	6.0	---
50882 - 042718-soft	4/30/2018	32.0	48.0	---
50889 - Keene WWTP 2° Clarifier #2	5/3/2018	44.0	72.0	0.00
50890 - Ashuelot River	5/3/2018	16.0	14.0	---
50891 - Keene WWTP 2° Clarifier #2	5/5/2018	44.0	56.0	0.00
50892 - Ashuelot River	5/5/2018	4.0	4.0	---

INF: Interference. The color endpoint was reached immediately

Aquatec Environmental, Inc.
Reviewed by: EB Date: 5-15-18

SDG: 15326
Project 18017

Toxicity Test Method(s)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25+/- 1C, Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s (50-100ft-c) (ambient laboratory levels)
5	Photoperiod:	16h light/8h dark
6	Test chamber size:	300mL
7	Test solution volume:	Nominal 250mL
8	Test solution renewal:	Daily
9	Age of test organisms:	Newly hatched larvae less than 24h old. If shipped, not more than 48h old, 24h range in age
10	No. larvae per test chamber:	10
11	No. replicate chambers per concentration:	4
12	No. larvae per concentration:	40
13	Source of food:	Newly hatched Artemia nauplii (< 24h old)
14	Feeding regime:	On days 0-6, feed 0.1g newly hatched (less than 24h old) brine shrimp nauplii three times daily at 4h intervals or, as a minimum, 0.15g twice daily at 6h intervals. Sufficient nauplii are added to provide an excess.
15	Cleaning:	Siphon daily, immediately before test solution renewal
16	Aeration:	None: unless DO concentration falls below 4.0mg/L.
17	Dilution water:	Soft Water
18	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
19	Additional control:	Ashuelot River
20	Test duration:	7 days
21	Endpoints:	Survival and growth (weight)
22	Test acceptability criteria:	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25mg
23	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
24	Sample volume required:	2.5L/day

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25 +/- 1C; Test temperatures must not deviate (i.e. maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s or 50-100ft-c (ambient laboratory levels)
5	Photoperiod:	16h light, 8h dark
6	Test chamber size:	30mL
7	Test solution volume	Nominal 15mL
8	renewal of test solutions:	Daily
9	Age of test organisms:	Less than 24h; and all released within a 8h period
10	No. neonates per test chamber:	1
11	No. replicate test chambers per concentration:	10
12	No. neonates per test concentration:	10
13	Feeding regime:	Feed 0.1mL each of YCT and algal suspension per test chamber daily
14	Cleaning:	Use new plastic cups daily
15	Aeration:	None
16	Dilution water:	Soft Water
17	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
18	Additional control:	Ashuelot River
19	Test duration:	Until 60% or more of surviving control females have three broods (maximum test duration 8 days)
20	Endpoints:	Survival and reproduction
21	Test acceptability criteria:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods
22	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
23	Sample volume required:	1L/day

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

CETIS Summary Report

Report Date: 11 May-18 10:13 (p 1 of 1)
Test Code: 81182 | 02-7346-8246

Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Batch ID:	08-1270-5667	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Kaitlyn Priest
Start Date:	01 May-18 14:20	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	08 May-18 14:00	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	7d	**Source:**	Aquatic Biosystems, CO	**Age:**	1d

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
13-2175-6198	2d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	5.25%
00-3153-9188	7d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	6.56%
19-1713-0255	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test	100	> 100	n/a	1	13.8%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
18-1114-0874	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
01-2479-5247	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	2.50%
24		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	2.50%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	0.00%
0	L	4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%
24		4	0.9500	0.8581	1.0000	0.9000	1.0000	0.0289	0.0577	6.08%	2.56%
48		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.5387	0.4839	0.5936	0.509	0.587	0.01724	0.03447	6.40%	0.00%
0	L	4	0.6218	0.5684	0.6751	0.594	0.67	0.01675	0.03351	5.39%	-15.41%
12		4	0.6735	0.5872	0.7598	0.62	0.743	0.02713	0.05426	8.06%	-25.01%
24		4	0.619	0.5184	0.7196	0.533	0.685	0.0316	0.0632	10.21%	-14.90%
48		4	0.6243	0.5452	0.7033	0.569	0.689	0.02484	0.04967	7.96%	-15.87%
50		4	0.6187	0.5603	0.6772	0.572	0.651	0.01838	0.03675	5.94%	-14.85%
100		4	0.686	0.5936	0.7784	0.6	0.727	0.02903	0.05806	8.46%	-27.33%

CETIS Analytical Report

Report Date: 11 May-18 10:13 (p 1 of 2)
Test Code: 81182 | 02-7346-8246

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	18-1114-0874	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:12	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	309903	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

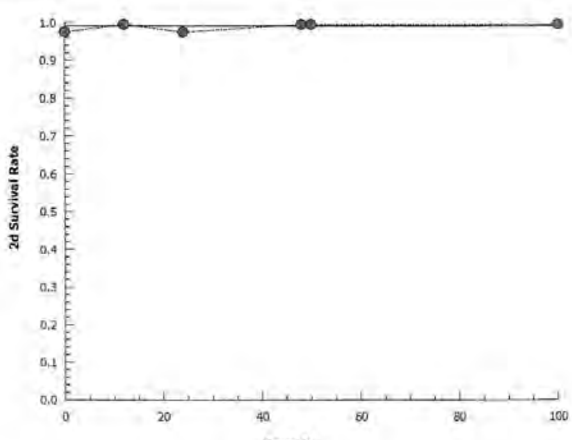
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	4	0.9750	0.9000	1.0000	0.0250	0.0500	5.13%	0.0%	39	40
12		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%	40	40
24		4	0.9750	0.9000	1.0000	0.0250	0.0500	5.13%	0.0%	39	40
48		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%	40	40
50		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%	40	40
100		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%	40	40

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	0.9000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		0.9000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Graphics



Analyst: EB 5-15-18 QA: JW

Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Analysis ID:	01-2479-5247	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:12	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1364446	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

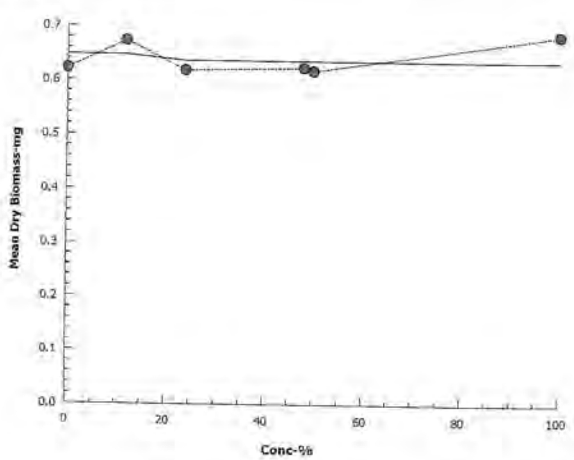
Mean Dry Biomass-mg Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	4	0.6218	0.594	0.67	0.01675	0.03351	5.39%	0.0%
12		4	0.6735	0.62	0.743	0.02713	0.05426	8.06%	-8.32%
24		4	0.619	0.533	0.685	0.0316	0.0632	10.21%	0.44%
48		4	0.6243	0.569	0.689	0.02484	0.04967	7.96%	-0.4%
50		4	0.6187	0.572	0.651	0.01838	0.03675	5.94%	0.48%
100		4	0.686	0.6	0.727	0.02903	0.05806	8.46%	-10.33%

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.617	0.594	0.606	0.67
12		0.62	0.743	0.688	0.643
24		0.533	0.633	0.625	0.685
48		0.689	0.569	0.627	0.612
50		0.651	0.645	0.572	0.607
100		0.705	0.6	0.712	0.727

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	13-2175-6198	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:12	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	5.25%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	20	10	1	6	Asymp	0.9516	Non-Significant Effect
		24	18	10	2	6	Asymp	0.8333	Non-Significant Effect
		48	20	10	1	6	Asymp	0.9516	Non-Significant Effect
		50	20	10	1	6	Asymp	0.9516	Non-Significant Effect
		100	20	10	1	6	Asymp	0.9516	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0088531	0.0017706	5	0.8	0.5640	Non-Significant Effect
Error	0.039839	0.0022133	18			
Total	0.0486921		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	7.2	4.248	7.3E-04	Unequal Variances
Variances	Mod Levene Equality of Variance Test	0.8	4.248	0.5640	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.6154	0.884	9.2E-07	Non-Normal Distribution

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%
24		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-2.97%
24		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	0.00%
48		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-2.97%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-2.97%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-2.97%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	0.9000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		0.9000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Fathead Minnow 7-d Larval Survival and Growth Test

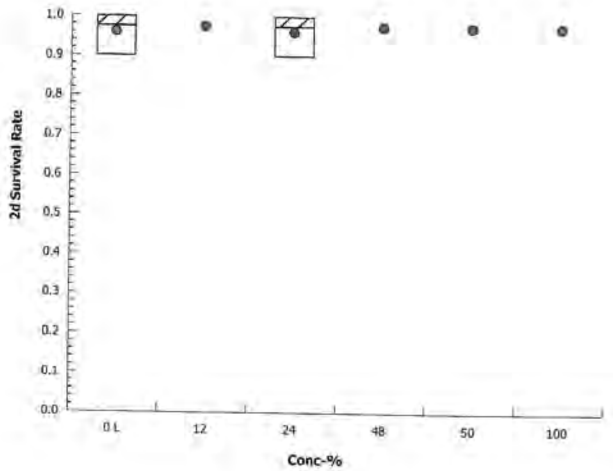
Aquatec Environmental, Inc.

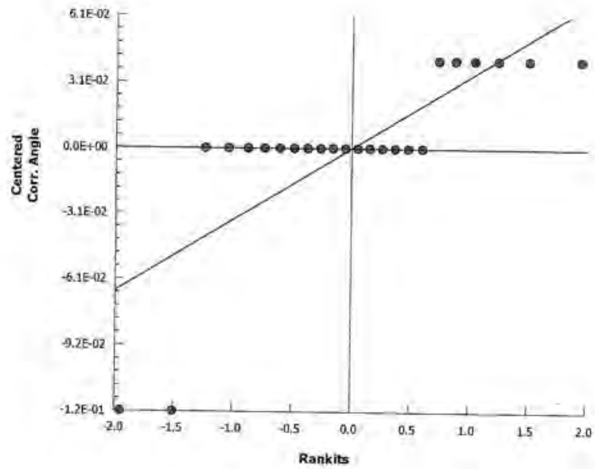
Analysis ID:	13-2175-6198	Endpoint:	2d Survival Rate	CETIS Version:	CETISv1.9.2
Analyzed:	11 May-18 10:12	Analysis:	Nonparametric-Control vs Treatments	Official Results:	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.249	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.249	1.412	1.412	1.412
48		1.412	1.412	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Analysis ID:	00-3153-9188	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:12	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	6.56%

Steel Many-One Rank Sum Test

Control vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	20	10	1	6	Asymp	0.9516	Non-Significant Effect
	24	16	10	2	6	Asymp	0.6105	Non-Significant Effect
	48	18	10	2	6	Asymp	0.8333	Non-Significant Effect
	50	20	10	1	6	Asymp	0.9516	Non-Significant Effect
	100	20	10	1	6	Asymp	0.9516	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0221328	0.0044266	5	1.2	0.3485	Non-Significant Effect
Error	0.0663983	0.0036888	18			
Total	0.0885311		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	10.4	4.248	8.2E-05	Unequal Variances
Variances	Mod Levene Equality of Variance Test	2	4.248	0.1274	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.8314	0.884	0.0010	Non-Normal Distribution

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%
24		4	0.9500	0.8581	1.0000	0.9500	0.9000	1.0000	0.0289	6.08%	2.56%
48		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	-2.56%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-2.97%
24		4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	2.97%
48		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	0.00%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-2.97%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-2.97%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	0.9000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		0.9000	0.9000	1.0000	1.0000
48		1.0000	1.0000	1.0000	0.9000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

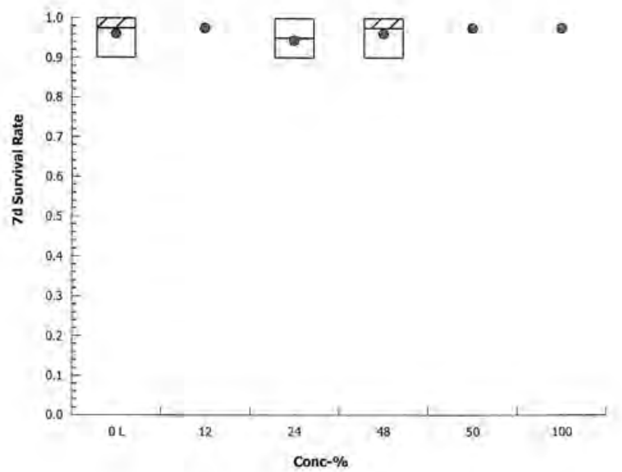
Fathead Minnow 7-d Larval Survival and Growth Test **Aquatec Environmental, Inc.**

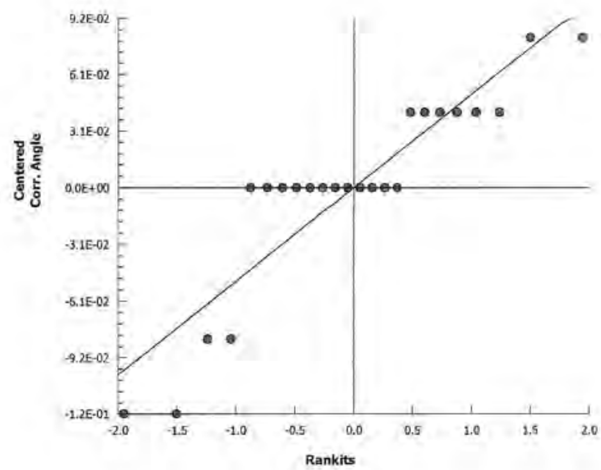
Analysis ID:	00-3153-9188	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:12	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.249	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.249	1.249	1.412	1.412
48		1.412	1.412	1.412	1.249
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	19-1713-0255	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:12	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	13.80%

Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	-1.452	2.407	0.086	6	CDF	0.9952	Non-Significant Effect
		24	0.07714	2.407	0.086	6	CDF	0.8096	Non-Significant Effect
		48	-0.07013	2.407	0.086	6	CDF	0.8532	Non-Significant Effect
		50	0.08415	2.407	0.086	6	CDF	0.8073	Non-Significant Effect
		100	-1.802	2.407	0.086	6	CDF	0.9984	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0188407	0.0037681	5	1.482	0.2444	Non-Significant Effect
Error	0.0457552	0.002542	18			
Total	0.0645959		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	1.587	15.09	0.9028	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.966	0.884	0.5690	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.6218	0.5684	0.6751	0.6115	0.594	0.67	0.01675	5.39%	0.00%
12		4	0.6735	0.5872	0.7598	0.6655	0.62	0.743	0.02713	8.06%	-8.32%
24		4	0.619	0.5184	0.7196	0.629	0.533	0.685	0.0316	10.21%	0.44%
48		4	0.6243	0.5452	0.7033	0.6195	0.569	0.689	0.02484	7.96%	-0.40%
50		4	0.6187	0.5603	0.6772	0.626	0.572	0.651	0.01838	5.94%	0.48%
100		4	0.686	0.5936	0.7784	0.7085	0.6	0.727	0.02903	8.46%	-10.33%

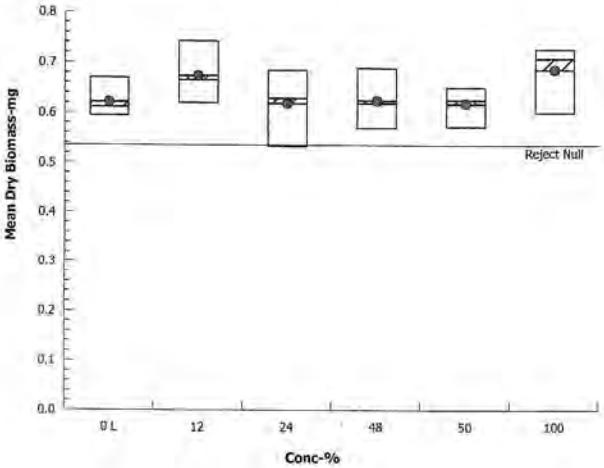
Mean Dry Biomass-mg Detail

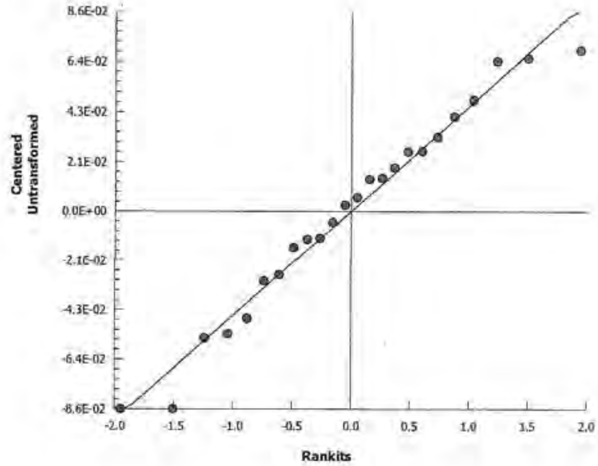
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.617	0.594	0.606	0.67
12		0.62	0.743	0.688	0.643
24		0.533	0.633	0.625	0.685
48		0.689	0.569	0.627	0.612
50		0.651	0.645	0.572	0.607
100		0.705	0.6	0.712	0.727

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	19-1713-0255	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:12	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Test Data Worksheet

Report Date: 11 May-18 10:11 (p 1 of 1)
Test Code/ID: 02-7346-8246/81182

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Start Date:	01 May-18 14:20	**Species:**	Pimephales promelas	**Sample Code:**	15326
End Date:	08 May-18 14:00	**Protocol:**	EPA/821/R-02-013 (2002)	**Sample Source:**	Permit # NH0100790
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Sample Station:**	Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Total Weight-mg	Tare Weight-mg	Pan Count	Notes
0	L	1	7	10		10					10	28.71	22.54	10	
0	L	2	2	10		9					9	27.59	21.65	9	
0	L	3	16	10		10					10	29.19	23.13	10	
0	L	4	19	10		10					10	28.34	21.64	10	
0	R	1	10	10		10					10	29.28	24.19	10	
0	R	2	6	10		10					9	25.5	20.11	9	
0	R	3	1	10		10					10	30.62	24.75	10	
0	R	4	28	10		10					10	29.22	24.02	10	
12		1	27	10		10					10	28.76	22.56	10	
12		2	17	10		10					10	29.46	22.03	10	
12		3	12	10		10					10	27.74	20.86	10	
12		4	3	10		10					10	28.43	22	10	
24		1	9	10		9					9	28.56	23.23	9	
24		2	24	10		10					9	29.99	23.66	9	
24		3	13	10		10					10	28.71	22.46	10	
24		4	5	10		10					10	28.14	21.29	10	
48		1	22	10		10					10	29.02	22.13	10	
48		2	25	10		10					10	28.21	22.52	10	
48		3	15	10		10					10	28.78	22.51	10	
48		4	14	10		10					9	31.36	25.24	9	
50		1	20	10		10					10	31.63	25.12	10	
50		2	26	10		10					10	27.89	21.44	10	
50		3	18	10		10					10	29.49	23.77	10	
50		4	8	10		10					10	28.29	22.22	10	
100		1	4	10		10					10	28.63	21.58	10	
100		2	11	10		10					10	29.13	23.13	10	
100		3	21	10		10					10	30.66	23.54	10	
100		4	23	10		10					10	29.77	22.5	10	

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81182

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. weighed [1]	Initial Pan Weight	Final Pan Weight
DW 0 % Soft CTRL	A	10	10	10	10	10	10	10	10	10	22.54	28.71
	B	10	10	9	9	9	9	9	9	9	21.65	27.59
	C	10	10	10	10	10	10	10	10	10	23.13	29.19
	D	10	10	10	10	10	10	10	10	10	21.64	28.34
0 % RW	A	10	10	10	10	10	10	10	10	10	24.19	29.28
	B	10	10	10	10	10	10	10	9	9	20.11	25.50
	C	10	10	10	10	10	10	10	10	10	24.75	30.62
	D	10	10	10	10	10	10	10	10	10	24.02	29.22
12 % EFF	A	10	10	10	10	10	10	10	10	10	22.56	28.76
	B	10	10	10	10	10	10	10	10	10	22.03	29.46
	C	10	10	10	10	10	10	10	10	10	20.86	27.71
	D	10	10	10	10	10	10	10	10	10	22.00	28.43
24 % EFF	A	10	9	~~9~~ 10 ①	9	9	9	9	9	9	23.23	28.56
	B	10	10	10	10	10	10	10	9	9	23.66	29.99
	C	10	10	10	10	10	10	10	10	10	22.46	28.71
	D	10	10	10	10	10	10	10	10	10	21.29	28.14
48 % EFF	A	10	10	10	10	10	10	10	10	10	22.13	29.02
	B	10	10	10	10	10	10	~~9~~ ② 10	10	10	22.52	28.21
	C	10	10	10	10	10	10	10	10	10	22.51	28.78
	D	10	10	10	10	10	10	9	9	9	25.24	31.36
50 % EFF	A	10	10	10	10	10	10	10	10	10	25.12	31.63
	B	10	10	10	10	10	10	10	10	10	21.44	27.89
	C	10	10	10	10	10	10	10	10	10	23.77	29.49
	D	10	10	10	10	10	10	10	10	10	22.22	28.29
100 % EFF	A	10	10	10	10	10	10	10	10	10	21.58	28.63
	B	10	10	10	10	10	10	10	10	10	23.13	29.13
	C	10	10	10	10	10	10	10	10	10	23.54	30.66
	D	10	10	10	10	10	10	10	10	10	22.50	29.77

Sample #	50880	50880	50889	50889	50891	50891	50891	Test End
Fed AM / Init.	------	835	830	855	0850 KP	900	840	------
Fed PM / Init.	1620 EB	1715 EB	1600 EB	1635 EB	1525 KP	1400	1640	------
Renewal (D / T / I)	5/1/18 1420 KN	5/2/18 1425 KN	5/3/18 15:20 KN	5/4/18 1610 KN	5.5.18 1155 KP	5/6/18 1315 KN	5/7/18 1430 KN	5/8/18 1400 KN

Date/Init (Initial Pan Weights): 5-7-18 EB

IN (Date/Time/Temp/Init): 5/8/18 1405 10.0°C KN

OUT (Date/Time/Temp/Init): 5/9/18 8:25 9.9°C KN

① recording error KN 5/3/18
② found alive on lip of container + healthy KN 5/7/18

Brine Shrimp Lot #: 211132-Brine

PP

1 The number weighed = the number actually weighed. For statistical purposes, the number weighed = original number of organisms on Day 0.

Aquatec Environmental, Inc.

Reviewed by: EB Date: 5-15-18

SDG: 15326

Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81182

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
pw 0 % Soft CTRL	pH	7.6	7.6	7.4	7.6	7.3	7.2	7.1
	DO	7.4	7.4	7.2	7.5	7.8	7.8	8.0
	Temp.	25.6	25.4	24.4	25.9	24.6	24.1	24.3
	Cond.	188	187	190	185	204	177	173
0 % RW	pH	7.3	7.3	7.0	7.2	7.3	7.0	7.0
	DO	8.3	7.3	7.5	8.0	8.3	8.7	7.9
	Temp.	25.4	25.6	25.6	25.2	24.9	24.7	25.0
	Cond.	68	70	53	50	60	59	58
12 % EFF	pH	7.5	7.5	7.3	7.4	7.3	7.2	7.3
	DO	7.5	7.4	7.3	7.5	7.8	7.9	7.9
	Temp.	25.3	25.1	24.4	25.8	24.7	24.3	24.3
	Cond.	279	280	289	283	274	266	269
24 % EFF	pH	7.5	7.5	7.5	7.4	7.3	7.2	7.5
	DO	7.6	7.4	7.2	7.5	7.8	7.9	7.9
	Temp.	25.3	25.1	24.6	25.7	24.7	24.3	24.4
	Cond.	370	372	373	381	377	369	364
48 % EFF	pH	7.4	7.4	7.4	7.3	7.3	7.2	7.6
	DO	7.7	7.5	7.3	7.9	7.9	8.0	7.9
	Temp.	25.2	25.1	24.8	25.5	24.9	24.4	24.6
	Cond.	551	553	584	570	555	539	548
50 % EFF	pH	7.4	7.4	7.3	7.3	7.3	7.2	7.6
	DO	7.7	7.5	7.3	7.9	7.8	8.0	7.9
	Temp.	25.1	25.1	24.9	25.5	24.9	24.5	24.5
	Cond.	569	570	591	587	581	571	564
100 % EFF	pH	7.2	7.3	7.2	7.1	7.2	7.1	7.6
	DO	7.9	7.5	7.4	8.2	7.9	8.2	8.0
	Temp.	25.7	25.5	25.5	25.6	25.1	24.6	25.2
	Cond.	913	929	964	960	962	940	937
	Sample #	50880	50880	50889	50889	50891	50891	50891
	Date	5-1-18	5-2-18	5/3/18	5-4-18	5-5-18	5/6/18	5/7/18
	Initials	EB	EB	KN	EB	KP	KN	KN

PP

Aquatec Environmental, Inc.

Reviewed by: EB Date: 5-15-18.

SDG: 15326

Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81182

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.3	7.1	7.1	7.2	7.0	6.9	7.1
	DO	6.7	5.9	6.1	6.4	7.2	6.4	6.7
	Temp.	24.0	24.5	24.4	24.4	24.0	24.3	24.4
	Cond.	197	200	198	195	179	191	190
0 % RW	pH	6.8	6.8	7.1	7.0	6.8	6.9	6.9
	DO	6.7	5.6	6.0	5.6	6.5	6.0	6.7
	Temp.	24.0	24.4	24.6	24.6	24.0	24.2	24.0
	Cond.	87	77	58	57	65	80	73
12 % EFF	pH	7.2	7.0	7.1	7.2	7.0	7.0	7.1
	DO	6.5	6.0	5.8	6.4	6.6	5.9	6.4
	Temp.	24.0	24.6	24.5	24.2	24.0	24.2	24.3
	Cond.	289	292	300	289	280	293	288
24 % EFF	pH	7.2	7.1	7.1	7.2	7.1	7.1	7.2
	DO	6.5	5.8	5.9	5.9	6.6	5.4	6.6
	Temp.	24.0	24.6	24.7	24.3	24.1	24.1	24.4
	Cond.	374	383	386	383	376	383	379
48 % EFF	pH	7.2	7.2	7.2	7.2	7.2	7.2	7.3
	DO	6.5	5.8	5.8	5.8	7.0	5.7	6.8
	Temp.	24.0	24.2	24.5	24.6	24.2	24.0	24.0
	Cond.	544	567	580	570	574	571	575
50 % EFF	pH	7.2	7.2	7.2	7.3	7.2	7.3	7.3
	DO	6.3	5.9	6.1	6.3	6.7	6.3	6.6
	Temp.	23.7	24.6	24.4	24.2	24.0	24.0	24.2
	Cond.	563	590	596	590	561	608	583
100 % EFF	pH	7.2	7.2	7.3	7.3	7.3	7.2	7.3
	DO	6.5	5.8	6.1	6.1	6.6	5.3	6.5
	Temp.	24.1	24.3	24.5	24.4	24.0	24.0	24.2
	Cond.	907	939	973	959	950	971	964
	Sample #	50880	50880	50889	50889	50891	50891	50891
	Date	5.2.18	5/3/18	5.4.18	5.5.18	5/6/18	5/7/18	5/8/18
	Initials	EB	KN	KP	KP	KN	KN	KN

PP

Aquatec Environmental, Inc.

Reviewed by: EB Date: 5-15-18

SDG: 15326

Project 18017

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

AQUATIC BIO SYSTEMS ABS INC.

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

ORGANISM HISTORY

DATE: 4/30/2018

SPECIES: *Pimephales promelas*

AGE: N/A

LIFE STAGE: Embryo

HATCH DATE: 4/30/2018

BEGAN FEEDING: N/A

FOOD: N/A

5/1/18 MN
10 25

Temp: 22.2°C
Cond: 374 μS
DO: 12.3 mg/L
PH: 7.8 pH
Condition: Normal / Active
Added to Soft Water

Water Chemistry Record:

	Current	Range
TEMPERATURE:	22°C	--
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	138 mg/l	--
TOTAL ALKALINITY (as $CaCO_3$):	95 mg/l	--
pH:	8.20	--

Comments:

Facility Supervisor

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

CETIS Summary Report

Report Date:	11 May-18 10:35 (p 1 of 1)
Test Code:	81183 | 01-6534-8880

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Batch ID: 01-5909-0250		**Test Type:**	Reproduction-Survival (2-8d)	**Analyst:**	Kaitlyn Priest
Start Date: 01 May-18 14:00		**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date: 08 May-18 15:25		**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration: 7d 1h		**Source:**	In-House Culture	**Age:**	<24h

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
15-4892-9563	2d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
16-2794-7872	7d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
00-5991-2442	Reproduction	Steel Many-One Rank Sum Test	100	> 100	n/a	1	24.7%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
07-8308-5278	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
18-0347-1104	Reproduction	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	0.7000	0.3544	1.0000	0.0000	1.0000	0.1528	0.4830	69.01%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-42.86%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-42.86%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-42.86%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-42.86%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-42.86%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-42.86%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	23.9	18.92	28.88	13	32	2.203	6.967	29.15%	0.00%
0	L	10	25.8	20.35	31.25	15	36	2.407	7.613	29.51%	-7.95%
12		10	22.1	18.52	25.68	14	29	1.581	4.999	22.62%	7.53%
24		10	25.6	18.45	32.75	2	35	3.159	9.991	39.03%	-7.11%
48		10	28.7	25.48	31.92	19	37	1.422	4.498	15.67%	-20.08%
50		10	27.8	24.86	30.74	21	32	1.298	4.104	14.76%	-16.32%
100		10	26.3	23.75	28.85	21	32	1.126	3.561	13.54%	-10.04%

CETIS Analytical Report

Report Date: 11 May-18 10:35 (p 1 of 2)
Test Code: 81183 | 01-6534-8880

Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

Analysis ID:	15-4892-9563	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:34	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes
Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		12	1.0000	Exact	1.0000	Non-Significant Effect
		24	1.0000	Exact	1.0000	Non-Significant Effect
		48	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

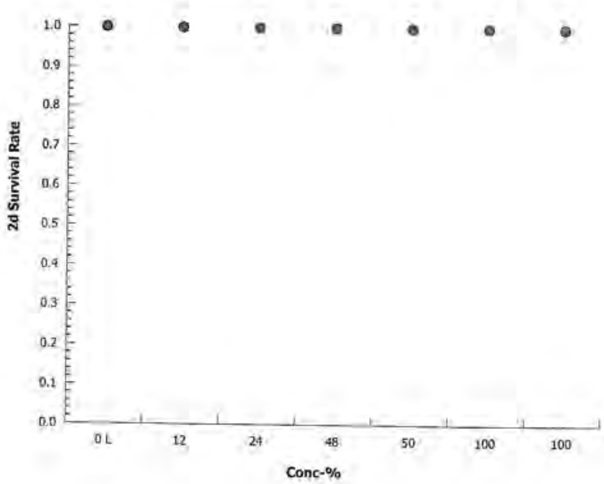
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	16-2794-7872	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:34	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes
Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water	12	1.0000	Exact	1.0000	Non-Significant Effect
	24	1.0000	Exact	1.0000	Non-Significant Effect
	48	1.0000	Exact	1.0000	Non-Significant Effect
	50	1.0000	Exact	1.0000	Non-Significant Effect
	100	1.0000	Exact	1.0000	Non-Significant Effect

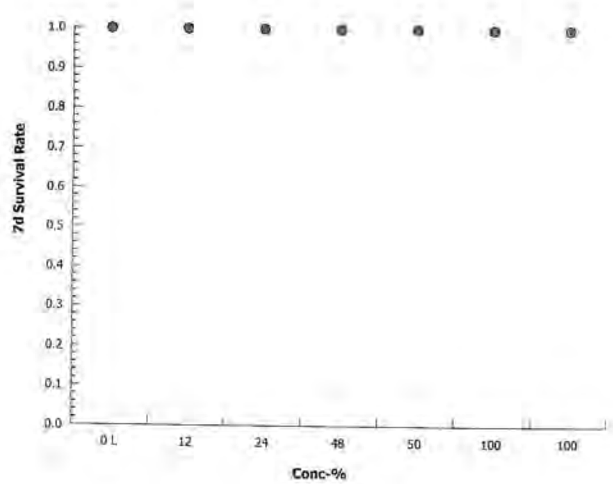
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date: 11 May-18 10:35 (p 1 of 2)
Test Code: 81183 | 01-6534-8880

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	07-8308-5278	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:35	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	346701	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

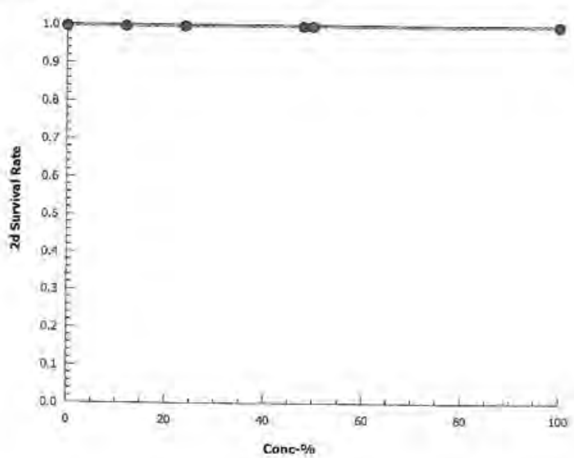
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
12		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
24		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
48		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	18-0347-1104	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:34	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1204051	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

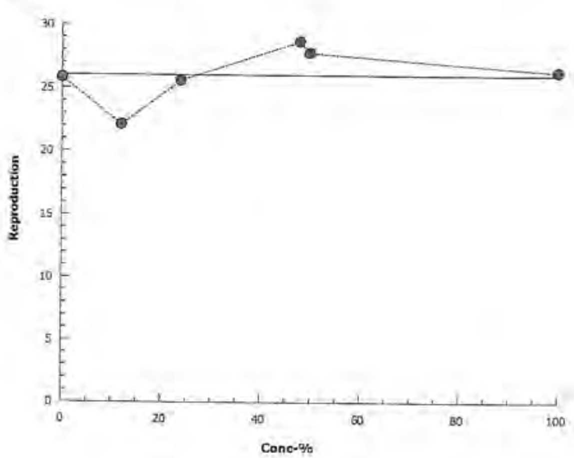
Reproduction Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	10	25.8	15	36	2.407	7.613	29.51%	0.0%
12		10	22.1	14	29	1.581	4.999	22.62%	14.34%
24		10	25.6	2	35	3.159	9.991	39.03%	0.78%
48		10	28.7	19	37	1.422	4.498	15.67%	-11.24%
50		10	27.8	21	32	1.298	4.104	14.76%	-7.75%
100		10	26.3	21	32	1.126	3.561	13.54%	-1.94%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	15	24	30	30	16	36	32	34	22	19
12		18	14	24	20	29	21	28	27	17	23
24		30	32	28	30	27	14	2	27	31	35
48		28	28	31	31	27	30	29	27	19	37
50		30	22	29	32	27	32	21	24	31	30
100		21	25	27	27	21	30	26	29	32	25

Graphics



CETIS Analytical Report

Report Date: 11 May-18 10:35 (p 1 of 2)
Test Code: 81183 | 01-6534-8880

Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

Analysis ID:	00-5991-2442	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:34	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	09-8352-6079	**Code:**	15326	**Client:**	Keene WWTP
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Project:**	WET Annual Compliance Test
Receipt Date:	01 May-18 09:50	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	24.70%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	88.5	75	1	18	Asymp	0.3061	Non-Significant Effect
		24	105.5	75	2	18	Asymp	0.8444	Non-Significant Effect
		48	112.5	75	2	18	Asymp	0.9503	Non-Significant Effect
		50	110	75	4	18	Asymp	0.9223	Non-Significant Effect
		100	104.5	75	2	18	Asymp	0.8218	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	260.15	52.03	5	1.343	0.2606	Non-Significant Effect
Error	2092.7	38.7537	54			
Total	2352.85		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	14.59	15.09	0.0123	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9311	0.9459	0.0022	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	10	25.8	20.35	31.25	27	15	36	2.407	29.51%	0.00%
12		10	22.1	18.52	25.68	22	14	29	1.581	22.62%	14.34%
24		10	25.6	18.45	32.75	29	2	35	3.159	39.03%	0.78%
48		10	28.7	25.48	31.92	28.5	19	37	1.422	15.67%	-11.24%
50		10	27.8	24.86	30.74	29.5	21	32	1.298	14.76%	-7.75%
100		10	26.3	23.75	28.85	26.5	21	32	1.126	13.54%	-1.94%

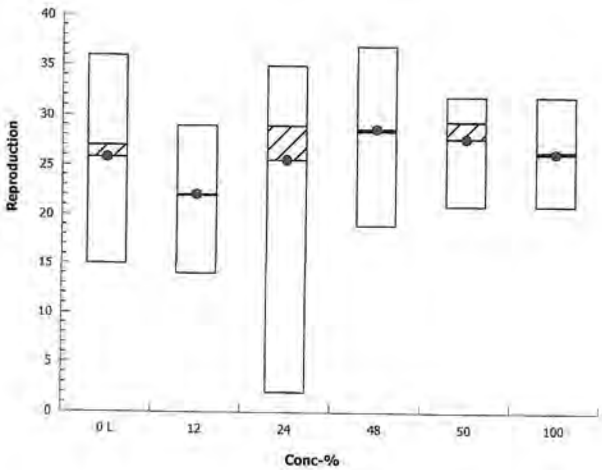
Reproduction Detail

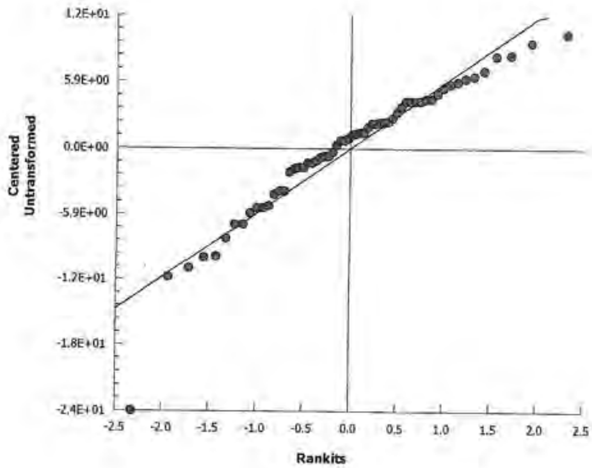
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	15	24	30	30	16	36	32	34	22	19
12		18	14	24	20	29	21	28	27	17	23
24		30	32	28	30	27	14	2	27	31	35
48		28	28	31	31	27	30	29	27	19	37
50		30	22	29	32	27	32	21	24	31	30
100		21	25	27	27	21	30	26	29	32	25

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	00-5991-2442	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	11 May-18 10:34	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Test Data Worksheet

Report Date: 11 May-18 10:34 (p 1 of 2)
Test Code/ID: 01-6534-8880/81183

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Start Date:	01 May-18 14:00	**Species:**	Ceriodaphnia dubia	**Sample Code:**	15326
End Date:	08 May-18 15:25	**Protocol:**	EPA/821/R-02-013 (2002)	**Sample Source:**	Permit # NH0100790
Sample Date:	30 Apr-18 06:58	**Material:**	POTW Effluent	**Sample Station:**	Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
0	L	1	56	1		1					1				7	8	0	0		0	
0	L	2	33	1		1					1				8	11	0	5		0	
0	L	3	37	1		1					1				7	11	0	12		0	
0	L	4	6	1		1					1				6	0	10	14		0	
0	L	5	49	1		1					1				7	9	0	0		0	
0	L	6	34	1		1					1				8	10	0	18		0	
0	L	7	39	1		1					1				6	0	10	16		0	
0	L	8	26	1		1					1				5	11	0	18		0	
0	L	9	8	1		1					1				7	12	0	3		0	
0	L	10	36	1		1					1				6	13	0	0		0	
0	R	1	9	1		1					1				4	10	0	14		0	
0	R	2	18	1		1					1				4	12	0	13		0	
0	R	3	5	1		1					1				5	10	0	15		0	
0	R	4	25	1		1					0				4	3	6	0		0	
0	R	5	50	1		1					1				4	7	0	10		0	
0	R	6	54	1		1					1				6	8	0	18		0	
0	R	7	69	1		1					1				0	5	6	11		0	
0	R	8	17	1		1					1				6	6	3	16		0	
0	R	9	2	1		1					0				4	12	0	0		0	
0	R	10	65	1		1					0				5	12	0	0		0	
12		1	7	1		1					1				5	5	0	8		0	
12		2	20	1		1					1				5	9	0	0		0	
12		3	67	1		1					1				7	8	0	9		0	
12		4	51	1		1					1				6	9	0	5		0	
12		5	59	1		1					1				4	10	0	15		0	
12		6	29	1		1					1				6	8	0	7		0	
12		7	12	1		1					1				7	0	5	16		0	
12		8	44	1		1					1				5	0	6	16		0	
12		9	68	1		1					1				6	10	0	1		0	
12		10	38	1		1					1				7	9	0	7		0	
24		1	1	1		1					1				6	11	0	13		0	
24		2	70	1		1					1				6	9	0	17		0	
24		3	48	1		1					1				7	7	0	14		0	
24		4	3	1		1					1				7	1	9	13		0	
24		5	23	1		1					1				6	8	0	13		0	
24		6	24	1		1					1				5	8	1	0		0	
24		7	21	1		1					1				0	1	1	0		0	
24		8	41	1		1					1				5	0	7	15		0	
24		9	28	1		1					1				6	9	0	16		0	
24		10	15	1		1					1				8	12	0	15		0	
48		1	40	1		1					1				6	9	0	13		0	
48		2	30	1		1					1				5	9	0	14		0	
48		3	46	1		1					1				6	10	0	15		0	
48		4	62	1		1					1				6	10	0	15		0	
48		5	61	1		1					1				4	0	9	14		0	

CETIS Test Data Worksheet

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
48		6	42	1		1					1				7	7	0	16		0	
48		7	55	1		1					1				5	5	2	17		0	
48		8	64	1		1					1				6	4	0	17		0	
48		9	14	1		1					1				0	0	7	12		0	
48		10	16	1		1					1				8	12	0	17		0	
50		1	66	1		1					1				7	9	0	14		0	
50		2	63	1		1					1				1	0	8	13		0	
50		3	22	1		1					1				6	9	0	14		0	
50		4	19	1		1					1				7	8	0	17		0	
50		5	11	1		1					1				6	8	0	13		0	
50		6	35	1		1					1				7	8	0	17		0	
50		7	27	1		1					1				5	0	5	11		0	
50		8	52	1		1					1				6	0	5	13		0	
50		9	10	1		1					1				6	11	0	14		0	
50		10	58	1		1					1				7	10	0	13		0	
100		1	53	1		1					1				6	5	0	10		0	
100		2	32	1		1					1				7	7	0	11		0	
100		3	45	1		1					1				6	7	0	14		0	
100		4	13	1		1					1				6	0	8	13		0	
100		5	43	1		1					1				4	0	6	11		0	
100		6	57	1		1					1				6	7	0	17		0	
100		7	60	1		1					1				6	0	8	12		0	
100		8	31	1		1					1				7	9	0	13		0	
100		9	47	1		1					1				7	10	0	15		0	
100		10	4	1		1					1				7	11	0	7		0	

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81183

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	1	0	0	0	0	7	8	0	0
	2	0	0	0	0	8	11	0	5
	3	0	0	0	0	7	11	0	12
	4	0	0	0	0	6	0	10	14
	5	0	0	0	0	7	9	0	0
	6	0	0	0	0	8	10	0	18
	7	0	0	0	0	6	0	10	16
	8	0	0	0	0	5	11	0	18
	9	0	0	0	0	7	12	0	3
	10	0	0	0	0	6	13	0	0
0 % RW	1	0	0	0	0	4	10	0	14
	2	0	0	0	0	4	12	0	13
	3	0	0	0	0	5	10	0	15
	4	0	0	0	0	4	3	D-6	—
	5	0	0	0	0	4	7	0	10
	6	0	0	0	0	6	8	0	18
	7	0	0	0	0	0	5	6	11
	8	0	0	0	0	6	6	3	16
	9	0	0	0	0	4	12	D-0	—
	10	0	0	0	0	5	12	D-0	—
12 % EFF	1	0	0	0	0	5	5	0	8
	2	0	0	0	0	5	9	0	0
	3	0	0	0	0	7	8	0	9
	4	0	0	0	0	6	9	0	5
	5	0	0	0	0	4	10	0	15
	6	0	0	0	0	6	8	0	7
	7	0	0	0	0	7	0	5	16
	8	0	0	0	0	5	0	6	16
	9	0	0	0	0	6	10	0	1
	10	0	0	0	0	7	9	0	7
24 % EFF	1	0	0	0	0	6	11	0	13
	2	0	0	0	0	6	9	0	17
	3	0	0	0	0	7	7	0	14
	4	0	0	0	0	7	1	9	13
	5	0	0	0	0	6	8	0	13
	6	0	0	0	0	5	8	1	0
	7	0	0	0	0	0	1	WN ~~0~~ 1	0
	8	0	0	0	0	5	0	7	15
	9	0	0	0	0	6	9	0	16
	10	0	0	0	0	8	12	0	15

cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc. **SDG:** 15326

Reviewed by: EB Date: 5-15-18 **Project** 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81183

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
48 % EFF	1	0	0	0	0	6	9	0	13
	2	0	0	0	0	5	9	0	14
	3	0	0	0	0	6	10	0	15
	4	0	0	0	0	6	10	0	15
	5	0	0	0	6	4	0	9	14
	6	0	0	0	0	7	7	0	16
	7	0	0	0	0	5	5	2	17
	8	0	0	0	0	6	4	0	17
	9	0	0	0	0	0	0	7	12
	10	0	0	0	0	8	12	0	17
50 % EFF	1	0	0	0	0	7	9	0	14
	2	0	0	0	0	1	0	8	13
	3	0	0	0	0	6	9	0	14
	4	0	0	0	0	7	8	0	17
	5	0	0	0	0	6	8	0	13
	6	0	0	0	0	7	8	0	17
	7	0	0	0	0	5	0	5	11
	8	0	0	0	0	6	0	5	13
	9	0	0	0	0	6	11	0	14
	10	0	0	0	0	7	10	0	13
100 % EFF	1	0	0	0	0	6	5	0	10
	2	0	0	0	0	7	7	0	11
	3	0	0	0	0	6	7	0	14
	4	0	0	0	0	6	0	8	13
	5	0	0	0	0	4	0	6	11
	6	0	0	0	0	6	7	0	17
	7	0	0	0	0	6	0	8	12
	8	0	0	0	0	7	9	0	13
	9	0	0	0	0	7	10	0	15
	10	0	0	0	0	7	11	0	7
	Sample #	50880	50880	50889	50889	50891	50891	50891	50891
	Fed	✓	✓	✓	✓	✓	✓	✓	—
	Renewal (D / T / I)	5/1/18 1400 KN	5-2-18 1425 EB	5/3/18 1430 KN	① ~~5/4/18~~ 15:35 KN 5/4/18	5.5.18 1055 KP	5/6/18 1245 KN	5/7/18 13:50 KN	5/8/18 1525 KN

YCT Lot Number: 032918 ARO Selenastrum Lot Number: 042618 Sel

① wrong date on 5/4/18

cd

0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality

Aquatec Environmental, Inc. **SDG:** 15326

Reviewed by: EB Date: 5-15-18 **Project** 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81183

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % Soft CTRL	pH							
	DO							
	Temp.							
	Cond.							
0 % RW	pH							
	DO							
	Temp.							
	Cond.							
12 % EFF	pH							
	DO							
	Temp.							
	Cond.							
24 % EFF	pH							
	DO							
	Temp.							
	Cond.							
48 % EFF	pH							
	DO							
	Temp.							
	Cond.							
50 % EFF	pH							
	DO							
	Temp.							
	Cond.							
100 % EFF	pH							
	DO							
	Temp.							
	Cond.							
	Sample #	50880	50880					
	Date							
	Initials							

See P. promelas Initial Chemistries for data. Data are common to both tests. EB 5-15-18

cd

Aquatec Environmental, Inc.

Reviewed by: EB Date: 5-15-18.

SDG: 15326
Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81183

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.5	7.3	7.3	7.4	7.3	7.2	7.2
	DO	7.1	7.1	7.6	7.6	7.8	7.9	7.5
	Temp.	25.4	24.7	25.0	24.5	24.5	24.0	24.0
	Cond.	216	204	202	197	185	184	185
0 % RW	pH	6.9	6.9	6.8	7.5	6.8	6.9	7.0
	DO	7.1	7.0	7.6	7.6	7.9	7.8	7.6
	Temp.	25.5	24.8	25.1	24.6	24.4	24.0	23.9
	Cond.	89	81	61	59	68	76	69
12 % EFF	pH	7.5	7.4	7.3	7.4	7.4	7.3	7.4
	DO	7.1	7.0	7.5	7.8	7.8	7.8	7.5
	Temp.	25.4	25.0	25.2	24.8	24.3	24.0	24.1
	Cond.	292	301	301	290	277	278	280
24 % EFF	pH	7.5	7.4	7.4	7.6	7.4	7.4	7.5
	DO	7.1	7.0	7.5	7.6	7.8	7.8	7.5
	Temp.	25.5	24.9	25.1	24.8	24.3	23.9	24.1
	Cond.	381	387	388	382	376	369	373
48 % EFF	pH	7.6	7.4	7.5	7.6	7.5	7.5	7.6
	DO	7.2	7.0	7.5	7.6	7.8	7.8	7.5
	Temp.	25.5	24.9	25.0	24.8	24.4	24.0	24.1
	Cond.	573	566	578	564	563	554	564
50 % EFF	pH	7.6	7.5	7.5	7.7	7.6	7.5	7.6
	DO	7.1	7.0	7.5	7.5	7.8	7.8	7.5
	Temp.	25.5	24.8	25.1	24.8	24.4	24.0	24.2
	Cond.	580	583	597	578	580	574	577
100 % EFF	pH	7.6	7.5	7.6	7.8	7.7	7.7	7.7
	DO	7.1	7.0	7.5	7.6	7.8	7.9	7.6
	Temp.	25.5	24.9	25.1	24.6	24.1	23.9	24.2
	Cond.	942	946	970	950	945	939	950
	Sample #	50880	50880	50889	50889	50891	50891	50891
	Date	5-2-18	5/3/18	5/4/18	5.5.18	5/6/18	5/7/18	5/8/18
	Initials	EB	KN	KN	KP	KN	KN	KN

cd

Aquatec Environmental, Inc.
Reviewed by: EB Date: 5-15-18

SDG: 15326
Project 18017

Documentation of Collection

Species:	*Ceriodaphnia dubia*	Client/Project:	Keene
Source:	In-House Cultures	Testing Date:	5/1/18

Acclimation/Holding Procedures: Transfer culture cups collected within 8-hour intervals to the top of the brood board, group each collection by collection time or Collect neonates into a small Carolina bowl of <24-hour pooled neonates. Acclimate/Hold at appropriate testing temperature.

Feeding: Feed 200µL 1:1 Mix of *Pseudokirschneriella subcapitata* formally *Selenastrum capricornutum* (Lot #: 042618 Sel) and YTC (Lot #: 12 032918 AR) to each culture cup or ~3mL 1:1 Mix to a small Carolina bowl of pooled neonates.

Culture ID	Date / Time / Init Cleared of Neonates	Date / Time / Init Neonate Collection	Number of Cups Collected*	Fed (✓)
042418BB	4/30/18 12:00 KN	4/30/18 1626 KN	5	✓
042518 BB	4/30/18 12:25 KN	4/30/18 1630 KN	5	✓
042418 BB	4/30/18 1626 KN	4/30/18 23:01	2	✓
042518BB	4/30/18 16:30 KN	4/30/18 23:07	1	✓
042418 BB	4/30/18 23:01	5/1/18 06:55	13	✓
042518 BB	4/30/18 23:07	5/1/18 07:07	5	✓

* *Neonates collected must number at least eight per cup, and be from a healthy adult female*

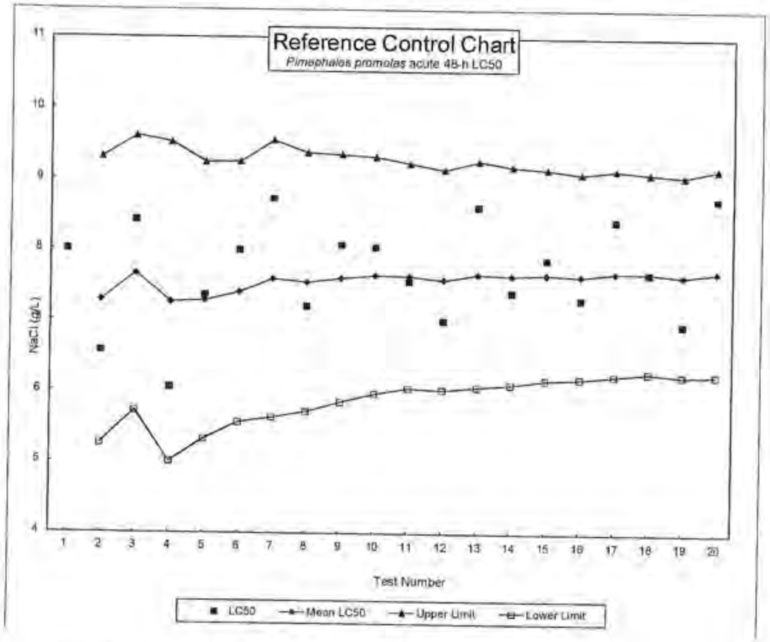
Aquatec Environmental, Inc.
DAPHNID COLLECTION FORM

Standard Reference Toxicant Control Chart(s)

***Pimephales promelas* acute survival LC50 Control Chart**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower	Source
1	2/23/16-2/25/16	8				Aquatic Biosystems
2	3/8/16-3/10/16	6.57	7.29	9.31	5.26	Aquatic Biosystems
3	4/5/16-4/12/16	8.42	7.66	9.60	5.72	Aquatic Biosystems
4	7/12/16-7/14/16	6.06	7.26	9.52	5.01	Aquatic Biosystems
5	8/12/16-8/14/16	7.36	7.28	9.24	5.33	Aquatic Biosystems
6	10/19-21/2016	7.994	7.40	9.24	5.56	Aquatic Biosystems
7	11/29/16-12/1/16	8.722	7.59	9.54	5.63	Aquatic Biosystems
8	1/10/17-1/12/17	7.204	7.54	9.37	5.71	Aquatic Biosystems
9	2/7/17-2/9/17	8.071	7.60	9.35	5.85	Aquatic Biosystems
10	3/21/17-3/23/17	8.042	7.64	9.32	5.97	Aquatic Biosystems
11	5/2/17-5/4/17	7.581	7.64	9.22	6.05	Aquatic Biosystems
12	7/12/17-7/14/17	7.005	7.58	9.14	6.03	Aquatic Biosystems
13	8/8/17-8/10/17	8.61	7.66	9.26	6.07	Aquatic Biosystems
14	9/12/17-9/14/14	7.403	7.64	9.18	6.11	Aquatic Biosystems
15	10/24/17-10/26/17	7.867	7.66	9.15	6.17	Aquatic Biosystems
16	11/7/17-11/9/17	7.31	7.64	9.09	6.19	Aquatic Biosystems
17	1/25/18-1/27/18	8.42	7.68	9.14	6.23	Aquatic Biosystems
18	2/6/18-2/8/18	7.678	7.68	9.09	6.27	Aquatic Biosystems
19	3/6/18-3/8/18	6.952	7.64	9.05	6.24	Aquatic Biosystems
20	4/3/18-4/5/18	8.722	7.70	9.15	6.24	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted.

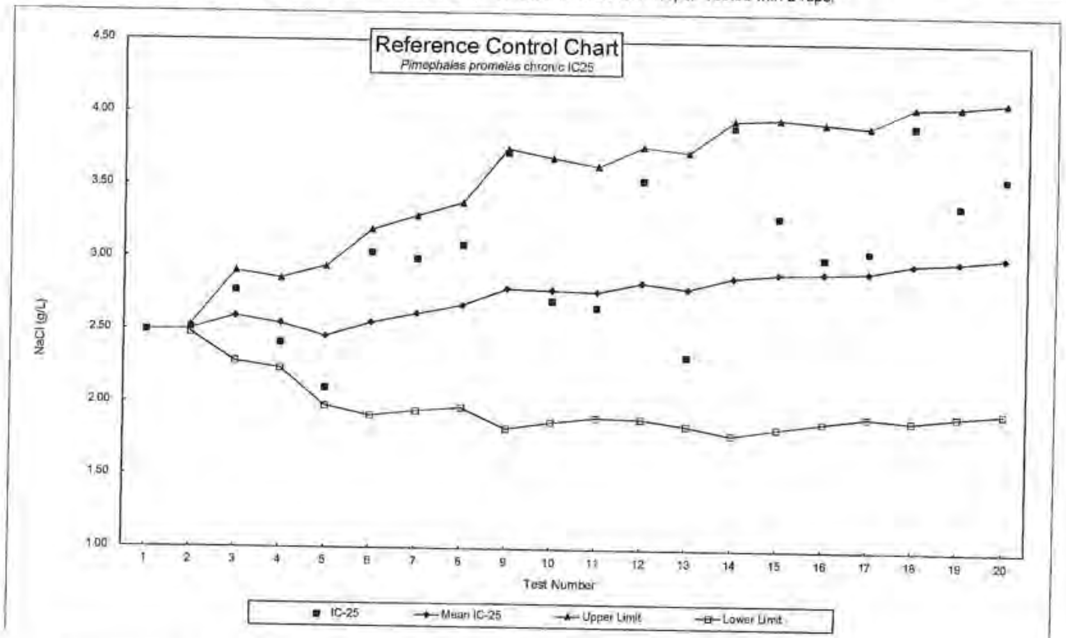


Note: Tests through September of 2016 were as Aquatec Biological Sciences, Inc. SRT tests beginning in October of 2016 were as Aquatec Environmental, Inc.

***Pimephales promelas* chronic IC25 Control Chart based on minnow growth**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Growth PMSD (%)	Avg. PMSD (%)	Source
1	2/23/16-3/1/16	2.49	2.49					12.70	12.70	Aquatic Biosystems
2	3/8/16-3/15/16	2.51	2.50	2.53	2.48	0.01	0.01	20.30	16.50	Aquatic Biosystems
3	4/5/16-4/12/16	2.77	2.59	2.90	2.28	0.06	0.03	11.00	15.65	Aquatic Biosystems
4	7/12/16-7/19/16	2.41	2.55	2.86	2.23	0.06	0.04	15.60	14.90	Aquatic Biosystems
5	8/12/16-8/19/16	2.10	2.46	2.94	1.98	0.10	0.06	11.70	14.26	Aquatic Biosystems
6	10/19-26/2016	3.04	2.55	3.19	1.91	0.13	0.07	18.00	14.88	Aquatic Biosystems
7	11/29/16-12/6/16	2.99	2.62	3.29	1.94	0.13	0.08	20.40	15.67	Aquatic Biosystems
8	1/10/17-1/17/17	3.09	2.68	3.38	1.97	0.13	0.09	11.20	15.11	Aquatic Biosystems
9	2/7/17-2/14/17	3.73	2.79	3.76	1.83	0.17	0.10	7.45	14.26	Aquatic Biosystems
10	3/21/17-3/28/17	2.71	2.78	3.70	1.87	0.16	0.11	14.80	14.32	Aquatic Biosystems
11	5/2/14-5/9/17	2.66	2.77	3.64	1.91	0.16	0.11	15.10	14.39	Aquatic Biosystems
12	7/12/17-7/19/17	3.55	2.84	3.78	1.90	0.17	0.12	12.90	14.26	Aquatic Biosystems
13	8/8/17-8/15/17	2.33	2.80	3.74	1.86	0.17	0.12	only 2 reps	13.17	Aquatic Biosystems
14	9/12/17-9/19/17	3.91	2.88	3.96	1.79	0.19	0.13	19.00	13.58	Aquatic Biosystems
15	10/24/17-10/31/17	3.29	2.91	3.97	1.84	0.18	0.13	22.10	14.15	Aquatic Biosystems
16	11/7/17-11/14/17	3.02	2.91	3.94	1.88	0.18	0.13	27.00	14.95	Aquatic Biosystems
17	1/25/18-2/1/18	3.06	2.92	3.92	1.92	0.17	0.13	15.50	14.99	Aquatic Biosystems
18	2/6/18-2/13/18	3.93	2.98	4.06	1.90	0.18	0.14	14.70	15.10	Aquatic Biosystems
19	3/6/18-3/13/18	3.38	3.00	4.07	1.93	0.18	0.14	19.20	15.19	Aquatic Biosystems
20	4/3/18-4/10/18	3.57	3.03	4.10	1.96	0.18	0.14	13.2	15.09	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted. Test of 8/8/17, insufficient minnows for 4 reps. Tested with 2 reps.



Assessment of test precision and sensitivity: The average CVs of IC25 values are within the 25th Percentile (0.21) for fathead minnow growth (Table 3-2, EPA 833-R-00-003) indicating high precision (only 25% of labs reported CVs of not more than 0.21). The per-test PMSD values were less than the EPA upper limit of 30% indicating low-to moderate variability (moderate to high sensitivity) for this method. The cumulative average PMSD value of 20 tests (15.1) was near the EPA lower boundary (12%), indicating high statistical sensitivity for this test method. Updated 4/20/18

Ceriodaphnia dubia
Reference Control Chart for NaCl Acute Toxicity

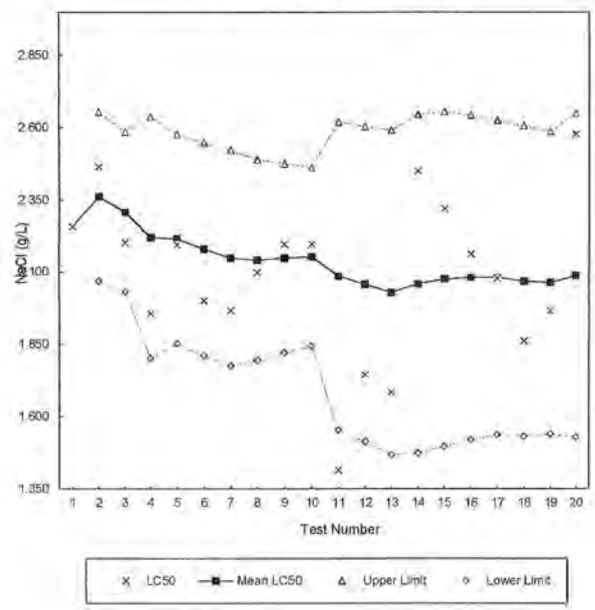
Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower
1	3/8/16-3/10/16	2.257	2.26		
2	4/5/16-4/7/16	2.464	2.36	2.65	2.07
3	7/12/16-7/14/16	2.200	2.31	2.58	2.03
4	9/20/16-9/22/16	1.956	2.22	2.64	1.80
5	10/18/16-10/20/16	2.195	2.21	2.58	1.85
6	11/29/16-12/1/16	2.000	2.18	2.55	1.81
7	1/10/17-1/12/17	1.966	2.15	2.52	1.78
8	2/14/17-2/16/17	2.098	2.14	2.49	1.79
9	3/21/17-3/23/17	2.195	2.15	2.47	1.82
10	5/16/17-5/18/17	2.195	2.15	2.46	1.84
11	7/11/17-7/13/17	1.414	2.09	2.62	1.55
12	8/1/17-8/3/17	1.743	2.06	2.60	1.51
13	9/12/17-9/14/17	1.684	2.03	2.59	1.47
14	9/28/17-9/30/17	2.449	2.06	2.64	1.47
15	10/31/17-11/2/17	2.319	2.08	2.66	1.50
16	11/28/17-11/30/17	2.161	2.08	2.64	1.52
17	1/9/18-1/11/18	2.077	2.08	2.62	1.54
18	2/6/18-2/8/18	1.861	2.07	2.61	1.53
19	3/6/18-3/8/18	1.966	2.06	2.59	1.54
20	4/3/18-4/5/18	2.577	2.09	2.65	1.53

Ceriodaphnia dubia
Reference Control Chart for NaCl Chronic Toxicity based on reproduction

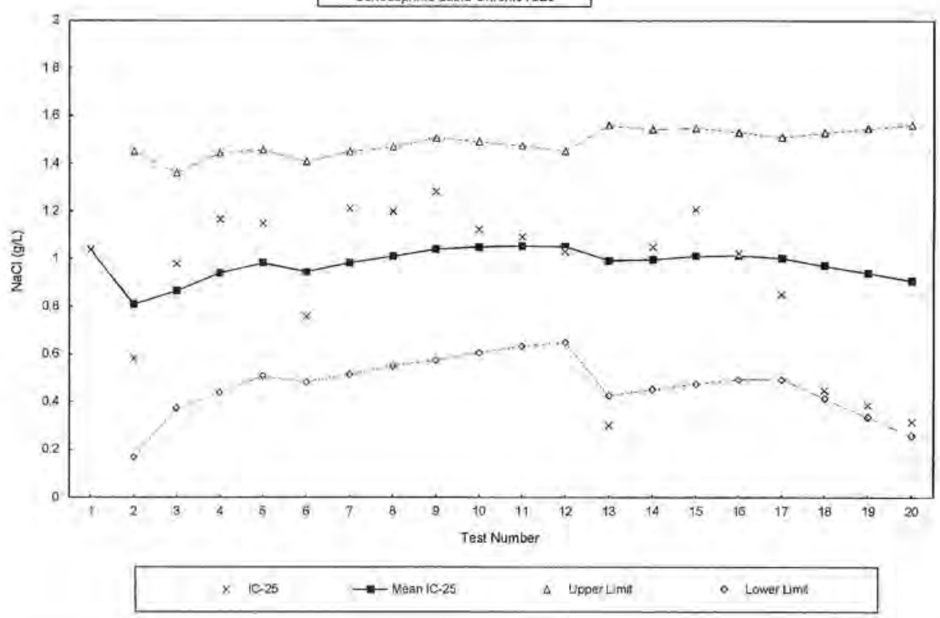
Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Repro. PMSD (%)	Avg. PMSD (%)
1	3/8/16-3/14/16	1.036	1.04					9.96	
2	4/5/16-4/11/16	0.582	0.81	1.45	0.17	0.40	0.40	15.3	10.0
3	7/12/16-7/18/16	0.978	0.87	1.36	0.37	0.29	0.34	16.7	12.6
4	9/20/16-9/26/16	1.167	0.94	1.44	0.44	0.27	0.32	32.6	14.0
5	10/18/19-10/25/16	1.149	0.98	1.46	0.51	0.24	0.30	10.7	18.6
6	11/29/16-12/5/16	0.7583	0.95	1.41	0.48	0.24	0.29	15.8	17.1
7	1/10/17-1/16/17	1.211	0.98	1.45	0.52	0.24	0.28	13.7	16.8
8	2/14/17-2/22/17	1.2	1.01	1.47	0.55	0.23	0.27	33.2	16.4
9	3/21/17-3/28/17	1.282	1.04	1.51	0.57	0.22	0.27	34.9	18.5
10	5/16/17-5/22/17	1.123	1.05	1.49	0.61	0.21	0.26	10.5	20.3
11	7/11/17-7/13/17	1.093	1.05	1.47	0.63	0.20	0.25	6.72	19.3
12	8/1/17-8/7/17	1.03	1.05	1.45	0.65	0.19	0.25	16	18.2
13	9/12/17-9/18/17	0.2996	0.99	1.56	0.43	0.29	0.25	32.1	18.0
14	9/28/17-10/4/17	1.048	1.00	1.54	0.45	0.27	0.25	15.8	19.1
15	10/31/17-11/6/17	1.208	1.01	1.55	0.47	0.27	0.25	9.47	18.9
16	11/28/17-12/4/17	1.023	1.01	1.53	0.49	0.26	0.25	9.72	18.2
17	1/9/18-1/16/18	0.85	1.00	1.51	0.49	0.25	0.25	30.3	17.7
18	2/6/18-2/12/18	0.4474	0.97	1.53	0.41	0.29	0.26	20.6	18.4
19	3/6/18-3/12/18	0.3857	0.94	1.55	0.34	0.32	0.26	13.8	18.6
20	4/3/18-4/10/18	0.315	0.91	1.56	0.26	0.36	0.26	36.3	19.2

Organisms Sources: Aquatec Biological Sciences, Inc. in-house cultures and Aquatec Environmental, Inc. in-house cultures (beginning in October 2016)

Reference Control Chart
Ceriodaphnia dubia Acute LC50



Reference Control Chart
Ceriodaphnia dubia Chronic IC25



Assessment of test precision and sensitivity: The cumulative average CV of 0.26 for reproduction was near the 50th Percentile (0.27, Table 3-2 of EPA 833-R-00-003) indicating normal (median) variability. The PMSD values were less than the EPA upper limit of 47% indicating acceptable variability (sensitivity) of test data . The cumulative average PMSD values were slightly above EPA lower boundary (13%), indicating high-to-moderate statistical sensitivity for this test method when averaged for the most recent 20 tests. Updated 4/20/18.

\qaqc\srts\Cd SRT including CV and PMSD

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY SUMMARY REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *6/5/2018 3:05:00 PM* ***Test End:*** *6/12/2018 2:00:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
50952	Keene WWTP SEC 2°Clar#2	100	>100	100	>100

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *6/5/2018 2:40:00 PM* ***Test End:*** *6/11/2018 1:50:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
50952	Keene WWTP SEC 2°Clar#2	100	>100	100	>100

SAMPLES RECEIVED:

Number	Sample Name	Date Time and Collected	Type
50952	Keene WWTP SEC 2°Clar#2	6/4/2018 7:00:00 AM	Effluent
50953	Ashuelot River	6/4/2018 8:35:00 AM	Receiving
50954	053018-SOFT-2		Lab Water
50955	Keene WWTP 2°Clar#2	6/6/2018 7:10:00 AM	Effluent
50956	Ashuelot River	6/6/2018 8:03:00 AM	Receiving
50957	Keene WWTP 2°Clar#2	6/8/2018 7:05:00 AM	Effluent
50958	Ashuelot River	6/8/2018 8:20:00 AM	Receiving

Submitted By:

Aquatec Environmental, Inc.
Reviewed by: EB 6-19-18 Date: JW 6/21/18

Tuesday, June 19, 2018
SDG: 15349
Project 18017

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY DETAIL REPORT:

Sample ID: 50952 / Keene WWTP SEC 2°Clar#2

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *6/5/2018 3:05:00 PM* ***Test End:*** *6/12/2018 2:00:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	100	100	100	97.5	100	100
7	100	100	100	100	97.5	100	100

Response: Growth per Original Number of Larvae (mean dry weight,mg)

	Additional Control	Concentration % 0	12	24	48	50	100
7	0.610	0.647	0.670	0.707	0.707	0.695	0.708

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *6/5/2018 2:40:00 PM* ***Test End:*** *6/11/2018 1:50:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100

Response: Reproduction (mean neonates per female)

	Additional Control	Concentration % 0	12	24	48	50	100
6	37.7	32.1	32.4	35.2	34.7	32.9	35.3

Submitted By:

Tuesday, June 19, 2018
SDG: 15349
Project 18017

Aquatec Environmental, Inc.
Reviewed by: EB 6-19-18 Date: JW 6/21/18

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273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: 6/5/2018 3:05:00 PM **Test End:** 6/12/2018 2:00:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	50952	100	100
7	50952	100	100

Response: Growth per Original Number of Larvae (mean dry weight, mg)

Day	Sample ID	Dilution Control	Additional Control
7	50952	0.647	0.61

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 12.9% **PMSD Criteria Range:** 12%-30%

The calculated test PMSD was within the acceptable boundary range indicating test data with acceptable variability and statistical sensitivity. The chronic values (C-NOEC, C-LOEC) were reported as calculated by the statistical program.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, the following special conditions or qualifiers relate to the samples in this report:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as the additional control.

Replicate A of the soft water control was inadvertently started with 9 individuals.

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420 Airport Road
Route 32
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TOXICITY QUALITY ASSURANCE REPORT:

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: 6/5/2018 2:40:00 PM **Test End:** 6/11/2018 1:50:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	50952	100	100
6	50952	100	100

Response: Reproduction (mean neonates per female)

Day	Sample ID	Dilution Control	Additional Control
6	50952	32.1	37.7

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 9.3% **PMSD Criteria Range:** 13%-47%

The calculated test PMSD was less than the lower bound indicating test data with low variability and high statistical sensitivity. In determining the C-NOEC, C-LOEC, test concentrations were not considered toxic if the relative difference from the control was less than the lower PMSD bounds.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, the following special conditions or qualifiers relate to the samples in this report:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as the additional control.

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

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E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION:

The results reported relate only to the the samples submitted as received.

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 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 26, 2018
(Date)

(Authorized signature)

John Williams
Director
Aquatec Environmental, Inc.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

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Route 32
Swanzey, NH 03446

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *6/5/2018 3:05:00 PM* ***Test End:*** *6/12/2018 2:00:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Pimephales promelas*	Effluent	Composite

Dilution Water:	Soft Water
Additional Control:	Ashuelot River
Effluent Sampling Dates:	June 4, 6, & 8, 2018
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)
Effluent Salinity Adjusted?	No If yes, to what value?
With Sea Salts?	Hypersaline Brine Solution?
Reference Toxicant Date:	June 5-12, 2018
Reference Toxicant Test Acceptable?	Yes
Age and Age Range of Test Organisms:	1-day old
Source of Organisms:	Aquatic BioSystems - Fort Collins, CO

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *6/5/2018 3:05:00 PM* ***Test End:*** *6/12/2018 2:00:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Growth: 0.647 (mg)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Growth: 0.610 (mg)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Growth (%): 12.9

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Dunnett Multiple Comparison Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *6/5/2018 3:05:00 PM* ***Test End:*** *6/12/2018 2:00:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was within the boundaries of 12%-30%, indicating test data with normal variability and statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or growth were not detected.

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Williston, VT 05495
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City of Keene NH
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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *6/5/2018 2:40:00 PM* ***Test End:*** *6/11/2018 1:50:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Ceriodaphnia dubia*	Effluent	Composite

Dilution Water:	Soft Water
Additional Control:	Ashuelot River
Effluent Sampling Dates:	June 4, 6, & 8, 2018
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)
Effluent Salinity Adjusted?	No If yes, to what value?
With Sea Salts?	Hypersaline Brine Solution?
Reference Toxicant Date:	May 15-21, 2018
Reference Toxicant Test Acceptable?	Yes
Age and Age Range of Test Organisms:	<24h collected within an 8h period
Source of Organisms:	Aquatec Environmental, Inc. - Williston, VT

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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *6/5/2018 2:40:00 PM* ***Test End:*** *6/11/2018 1:50:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Reproduction: 32.1 (neonates)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Reproduction: 37.7 (neonates)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Reproduction (%): 9.33

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Fisher Exact/Bonferroni-Holm Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *6/5/2018 2:40:00 PM* ***Test End:*** *6/11/2018 1:50:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was below the boundaries of 13%-47%, indicating test data with low variability and high statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or reproduction were not detected.

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1806-12859**
Williston, VT 05495	DATE RECEIVED: June 05, 2018
	DATE REPORTED: June 25, 2018
Atten: John Williams	SAMPLER: BB/MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 06/25/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1806-12859**
PROJECT: Keene NH NPDES DATE RECEIVED: 06/05/2018

001 Site: Keene WWTP Sec 2 Clar #2 Composite Date Sampled: 6/4/18 Time: 7:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	5.4	mg/L	SM 5310C (00)	6/11/18	N JGM	A	
Hardness, Total as CaCO3	53	mg/L	EPA 200.7	6/19/18	W FAA	A	
Ammonia as N	0.07	mg/L	EPA 350.1, R.2	6/12/18	N JGM	A	
Solids, Total Dissolved	403	mg/L	SM 2540C-97	6/7/18	W JSS	A	
Total Solids	428	mg/L	SM 2540 B.-97	6/20/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	6/12/18	W MGT	A	
Aluminum, Total	0.042	mg/L	EPA 200.8	6/13/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	6/13/18	W SJM	A	
Calcium, Total	16	mg/L	EPA 200.7	6/19/18	W FAA	A	
Copper, Total	0.0058	mg/L	EPA 200.8	6/13/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	6/13/18	W SJM	A	
Magnesium, Total	3.1	mg/L	EPA 200.7	6/19/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	6/13/18	W SJM	A	
Zinc, Total	0.022	mg/L	EPA 200.8	6/13/18	W SJM	A	

002 Site: Ashuelot River Grab Date Sampled: 6/4/18 Time: 8:35

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Hardness, Total as CaCO3	18	mg/L	EPA 200.7	6/19/18	W FAA	A	
Ammonia as N	0.09	mg/L	EPA 350.1, R.2	6/12/18	N JGM	A	
Metals Digestion	Digested		EPA 200.7/200.8	6/12/18	W MGT	A	
Aluminum, Total	0.088	mg/L	EPA 200.8	6/13/18	W SJM	A	
Cadmium, Total	0.0003	mg/L	EPA 200.8	6/13/18	W SJM	A	
Calcium, Total	5.3	mg/L	EPA 200.7	6/19/18	W FAA	A	
Copper, Total	0.0038	mg/L	EPA 200.8	6/13/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	6/13/18	W SJM	A	
Magnesium, Total	1.2	mg/L	EPA 200.7	6/19/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	6/13/18	W SJM	A	
Zinc, Total	0.032	mg/L	EPA 200.8	6/13/18	W SJM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	Project Name:	Keene NH NPDES
Address:	273 Commerce Street	Project Number:	18017
City/State/Zip:	Williston, VT 05403	Sampler Name(s):	BB/MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP SEC 2Clar#2	06/04/18	7:00	Grab: N/A Composite: X				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2
			Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice (4C)	1
Ashuelot River (50953)	06/04/18	8:35	Grab: X Composite: N/A				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	Cooler/Sample Temp.: -2.1
Ethan Bouffard	6/5/18	1530	Eileen Toomey	6/5/18	15:30	Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1806-12859

1806-12859
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT:	Keene NH NPDES
273 Commerce St	101170	WORK ORDER:	**1806-13385**
Williston, VT 05495		DATE RECEIVED:	June 11, 2018
		DATE REPORTED:	June 25, 2018
Atten: John Williams		SAMPLER:	BB, MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

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Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 06/25/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1806-13385**
PROJECT: Keene NH NPDES DATE RECEIVED: 06/11/2018

001 Site: Keene WWTP 2 Clarifier #2 Composite Date Sampled: 6/6/18 Time: 7:10

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.06	mg/L	EPA 350.1, R.2	6/22/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB/MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP 2°Clar#2 (5(	**06/06/18**	**7:10**	Grab: **N/A** Composite: **X**				
50957			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
[signature]	6/11/18	09:20	Eileen Tomey	6/11/18	9:23	Cooler/Sample Temp.: 3.7 Notes To Lab:
Relinquished by (signature)	**DATE**	**TIME**	**Received by: (signature)**	**DATE**	**TIME**	

1806-13385

1806-13385
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1806-13384**
Williston, VT 05495	DATE RECEIVED: June 11, 2018
	DATE REPORTED: June 25, 2018
Atten: John Williams	SAMPLER: BB, MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

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Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

www.endynelabs.com

ELAP 11263
160 James Brown Dr., Williston, VT 05495
Ph 802-879-4333 Fax 802-879-7103

56 Etna Road, Lebanon, NH 03766
Ph 603-678-4891 Fax 603-678-4893
NH2037

Laboratory Report

DATE REPORTED: 06/25/2018

CLIENT: Aquatec Environmental, Inc
PROJECT: Keene NH NPDES

WORK ORDER: **1806-13384**
DATE RECEIVED: 06/11/2018

001 Site: Keene WWTP 2 Clarifier #2 Composite — Date Sampled: 6/8/18 Time: 7:05

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.06	mg/L	EPA 350.1, R.2	6/22/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB; MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP 2°Clar#2 (5(50955	**06/08/18**	**7:05**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	Cooler/Sample Temp.: 3.7
[signature]	6/11/18	09:20	Eileen Tierney	6/11/18	9:23	Notes To Lab:
Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	

1806-13384

1806-13384
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT: Tox Lab QC
273 Commerce St	101170	WORK ORDER: **1805-09573**
Williston, VT 05495		DATE RECEIVED: May 01, 2018
		DATE REPORTED: May 14, 2018
Atten: John Williams		SAMPLER: John Williams

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

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Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 05/14/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1805-09573**
PROJECT: Tox Lab QC DATE RECEIVED: 05/01/2018

001 Site: 042718SOFT (50884) Date Sampled: 5/1/18 Time: 11:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	< 0.5	mg/L	SM 5310C (00)	5/7/18	N JGM	A	
Hardness, Total as CaCO3	49	mg/L	EPA 200.7	5/7/18	W FAA	A	
Ammonia as N	0.12	mg/L	EPA 350.1, R.2	5/11/18	N JGM	A	
Solids, Total Dissolved	143	mg/L	SM 2540C-97	5/8/18	W JSS	A	B
Total Solids	104	mg/l	SM 2540 B.-97	5/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	5/3/18	W FAA	A	
Aluminum, Total	< 0.020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	5/9/18	W MGT	A	
Calcium, Total	6.5	mg/L	EPA 200.7	5/7/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	5/9/18	W MGT	A	
Magnesium, Total	7.9	mg/L	EPA 200.7	5/7/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	5/9/18	W MGT	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	5/9/18	W MGT	A	

Report Summary of Qualifiers and Notes

B: Blank contamination was observed at levels that could affect analytical results.

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	Project Name:	Tox Lab QC
Address:	273 Commerce Street	Project Number:	18000
City/State/Zip:	Williston, VT 05403	Sampler Name(s):	JW
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
042718SOFT (50884)	05/01/18	11:00	Grab: X Composite: N/A				
			Metals: Al (0.02); Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Ca, Mg (0.05)	250mL	Plastic	HNO3	1
			Ammonia-Nitrogen(0.1)	250mL	Plastic	H2SO4	1
			TS/TDS-Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice(4C)	1
			TOC - Total Organic Carbon(0.5)	40mL	Glass	H2SO4	2

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	Cooler/Sample Temp.: 6.1
[signature]	5/1/18	14:30	Eleen Tawney	5/1/18	14:27	Notes To Lab:
Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	

1805-09573

1805-09573
Aquatec Environmental, Inc
Tox Lab QC

Supportive Documentation

Chain-Of-Custody

Toxicity Test Methods

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

Standard Reference Toxicant Control Charts

Chain-Of-Custody(s)

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION	PROJECT INFORMATION
NAME: Keene, NH	PROJECT: Keene NH/Ley
ADDRESS: 420 Airport Road	(1st Sample Ship Monday)
Swanzey, NH 03446	PROJECT #: 18017
TEL: (603) 357 – 9836 [x6502]	SAMPLERS NAME(S): Bob Bishop / Mike
CONTACT: Mary Ley	Mary Ley Martell
E-MAIL: mley@ci.keene.nh.us	PERMIT NUMBER: NH0100790

VOLUME/CONTAINER TYPE/ PRESERVATIVE — NUMBER OF CONTAINERS

6/3-6/4/18 WET

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Keene WWTP SEC 2°Clar #2	6/4/18	700		X	Effluent	2	1	1	1	1	2		
Ashuelot River	6/4/18	835	X		Receiving	1	1			1	2		

ANALYSIS (TEST/DETECTION LIMITS) – TOX: 1000.0 & 1002.0 (P. promelas & C. dubia chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	6/4/18	900	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	6/5/18	955	RECEIVED BY: (Signature) Kendig Ng
RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature)

TEMPERATURE ON DELIVERY (°C): 1.8°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab; Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(2nd Sample Ship Wednesday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bishop
CONTACT:	Mary Ley		Mike Martell
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
6-5 thru 6-6-18 Keene WWTP 2°Clar#2	6/6/18	710		X	Effluent	2	1*	1	1*	1	2*		
Ashuelot River	6/6/18	803	X		Receiving	1							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (P. promelas and C. dubia chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	6/6/18	830	Priority Express
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY: (Signature)** KN
Priority Express	6/7/18	10:00	Kendra J Nee
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY: (Signature)**

TEMPERATURE ON DELIVERY (°C): 1.7°C

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Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(3rd Sample Ship Friday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bishop
CONTACT:	Mary Ley		Mike Markell
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
WET 6/7-6/8/18 Keene WWTP 2° Clar #2	6/8/18	706		X	Effluent	3	1*	1	1*	1	2*		
Ashuelot River	6/8/18	820	X		Receiving	2							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (P. promelas and C. dubia chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	6/8/18	830	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	6.9.18	0840	**RECEIVED BY:** (Signature) [signature]
RELINQUISHED BY: (Signature)	DATE:	TIME:	**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 4.3°

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab; Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.
273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

ALKALINITY, HARDNESS, AND TRC REPORT:

Sample ID:	Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)	TRC: (mg/L)
50952 - Keene WWTP SEC 2°Clar#2	6/5/2018	52.0	60.0	0.01
50953 - Ashuelot River	6/5/2018	16.0	20.0	---
50954 - 053018-SOFT-2	5/31/2018	36.0	46.0	---
50955 - Keene WWTP 2°Clar#2	6/7/2018	52.0	60.0	0.07
50956 - Ashuelot River	6/7/2018	16.0	18.0	---
50957 - Keene WWTP 2°Clar#2	6/9/2018	56.0	60.0	0.00
50958 - Ashuelot River	6/9/2018	12.0	14.0	---

INF: Interference. The color endpoint was reached immediately

Aquatec Environmental, Inc.
Reviewed by: EB Date: 6/18/18

SDG: 15349
Project 18017

Aquatec Environmental, Inc.

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Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

SAMPLE PREPARATION:

	Initial Sample		Second Sample		Third Sample		
	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	LAB CONTROL
Sample No.	50952	50953	50955	50956	50957	50958	50954
Filtration	60 Micron ✓	60 Micron ✓	60 Micron ✓	60 Micron ✓	60 Micron ✓	60 Micron ✓	N / A
Chlorine (1)	ND	—	ND	—	ND	/	N / A
Chlorine (2)	—	—	—	—	/	/	N / A
NaThio Lot No.	—	—	—	—	/	/	N / A
Original / Final Salinity:	N / A	N / A	N / A	N / A	N / A	N / A	N / A
FF Lot No.	N / A	N / A	N / A	N / A	N / A	N / A	N / A
Date / Initials:	6/5/18 KN	6/5/18 KN	6/7/18 KN	6/7/18 KN	6.9.18 KP	—	6/5/18 KN

(1) Record vol. 0.025 N sodium thiosulfate to dechlorinate 100mL sample or record "ND" (Not Detected)

(2) Dechlorination required if detected. Record vol. 0.25 N sodium thiosulfate added per gallon effluent.

Toxicity Test Method(s)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25+/- 1C, Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s (50-100ft-c) (ambient laboratory levels)
5	Photoperiod:	16h light/8h dark
6	Test chamber size:	300mL
7	Test solution volume:	Nominal 250mL
8	Test solution renewal:	Daily
9	Age of test organisms:	Newly hatched larvae less than 24h old. If shipped, not more than 48h old, 24h range in age
10	No. larvae per test chamber:	10
11	No. replicate chambers per concentration:	4
12	No. larvae per concentration:	40
13	Source of food:	Newly hatched Artemia nauplii (< 24h old)
14	Feeding regime:	On days 0-6, feed 0.1g newly hatched (less than 24h old) brine shrimp nauplii three times daily at 4h intervals or, as a minimum, 0.15g twice daily at 6h intervals. Sufficient nauplii are added to provide an excess.
15	Cleaning:	Siphon daily, immediately before test solution renewal
16	Aeration:	None: unless DO concentration falls below 4.0mg/L.
17	Dilution water:	Soft Water
18	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
19	Additional control:	Ashuelot River
20	Test duration:	7 days
21	Endpoints:	Survival and growth (weight)
22	Test acceptability criteria:	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25mg
23	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
24	Sample volume required:	2.5L/day

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25 +/- 1C; Test temperatures must not deviate (i.e. maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s or 50-100ft-c (ambient laboratory levels)
5	Photoperiod:	16h light, 8h dark
6	Test chamber size:	30mL
7	Test solution volume	Nominal 15mL
8	renewal of test solutions:	Daily
9	Age of test organisms:	Less than 24h; and all released within a 8h period
10	No. neonates per test chamber:	1
11	No. replicate test chambers per concentration:	10
12	No. neonates per test concentration:	10
13	Feeding regime:	Feed 0.1mL each of YCT and algal suspension per test chamber daily
14	Cleaning:	Use new plastic cups daily
15	Aeration:	None
16	Dilution water:	Soft Water
17	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
18	Additional control:	Ashuelot River
19	Test duration:	Until 60% or more of surviving control females have three broods (maximum test duration 8 days)
20	Endpoints:	Survival and reproduction
21	Test acceptability criteria:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods
22	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
23	Sample volume required:	1L/day

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Batch ID:	02-3505-4525	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Kaitlyn Priest
Start Date:	05 Jun-18 15:05	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	12 Jun-18 14:00	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	6d 23h	**Source:**	Aquatic Biosystems, CO	**Age:**	1d

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
11-9455-9992	2d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	4.66%
13-2821-1407	7d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	4.66%
09-1229-8098	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test	100	> 100	n/a	1	12.9%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
05-3306-9979	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
20-3178-6747	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.61	0.5292	0.6908	0.542	0.657	0.02539	0.05079	8.33%	0.00%
0	L	4	0.6467	0.6147	0.6787	0.627	0.674	0.01004	0.02009	3.11%	-6.02%
12		4	0.6695	0.5804	0.7586	0.604	0.74	0.02799	0.05598	8.36%	-9.75%
24		4	0.707	0.6059	0.8081	0.653	0.799	0.03178	0.06356	8.99%	-15.90%
48		4	0.707	0.6181	0.7959	0.65	0.774	0.02792	0.05584	7.90%	-15.90%
50		4	0.6947	0.6185	0.771	0.651	0.755	0.02395	0.04789	6.89%	-13.89%
100		4	0.7078	0.6457	0.7698	0.651	0.737	0.01951	0.03902	5.51%	-16.02%

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	11-9455-9992	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	4.66%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		48	16	10	1	6	Asymp	0.6105	Non-Significant Effect
		50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		100	18	10	1	6	Asymp	0.8333	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0054311	0.0010862	5	0.9788	0.4572	Non-Significant Effect
Error	0.0199758	0.0011098	18			
Total	0.025407		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	8.809	4.248	2.3E-04	Unequal Variances
Variances	Mod Levene Equality of Variance Test	0.9788	4.248	0.4572	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.4936	0.884	4.9E-08	Non-Normal Distribution

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	2.50%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.41	1.403	1.417	1.412	1.403	1.412	0.002171	0.31%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%
48		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.74%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	0.9000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

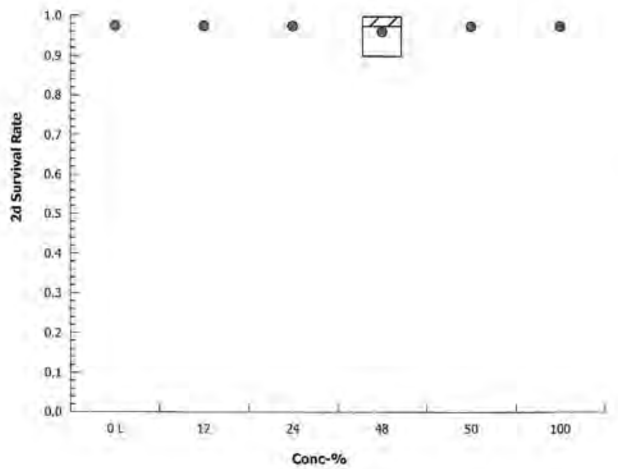
Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

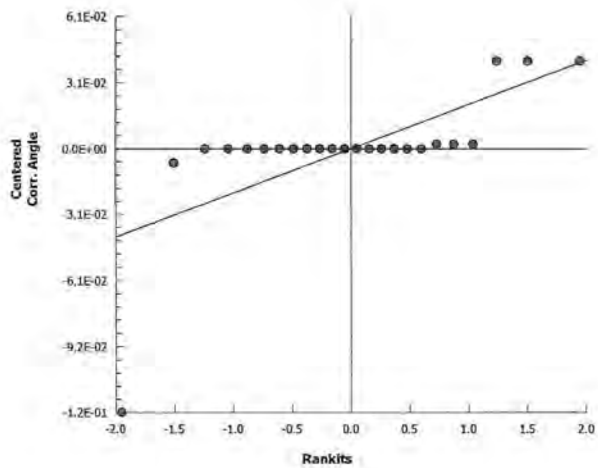
Analysis ID:	11-9455-9992	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.403	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.249	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





CETIS Analytical Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	13-2821-1407	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	4.66%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		48	16	10	1	6	Asymp	0.6105	Non-Significant Effect
		50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		100	18	10	1	6	Asymp	0.8333	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0054311	0.0010862	5	0.9788	0.4572	Non-Significant Effect
Error	0.0199758	0.0011098	18			
Total	0.025407		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	8.809	4.248	2.3E-04	Unequal Variances
Variances	Mod Levene Equality of Variance Test	0.9788	4.248	0.4572	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.4936	0.884	4.9E-08	Non-Normal Distribution

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	2.50%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.41	1.403	1.417	1.412	1.403	1.412	0.002171	0.31%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%
48		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.74%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	-0.15%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	0.9000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Analyst: ES 6-19-18 QA: [illegible]

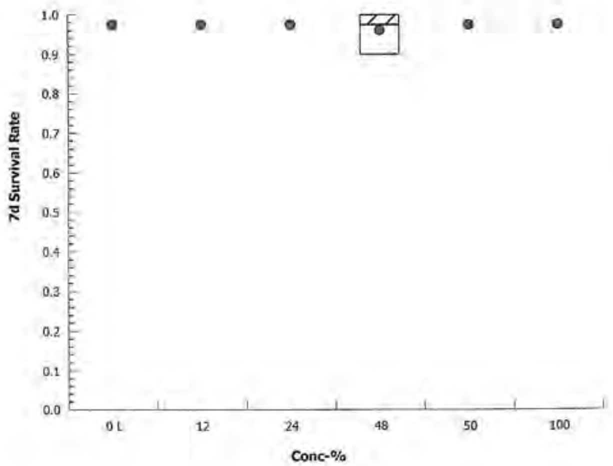
Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

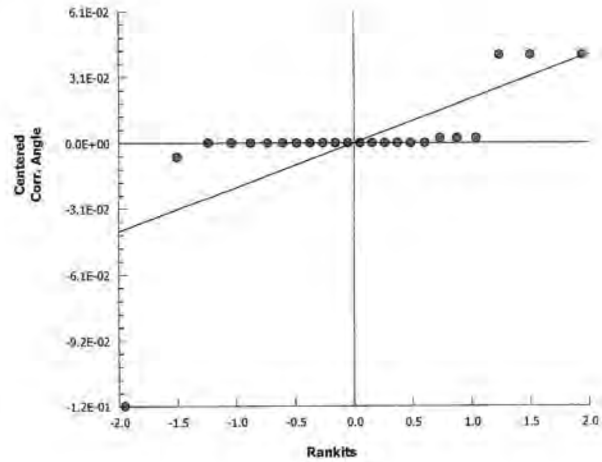
Analysis ID:	13-2821-1407	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.403	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.249	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test | **Aquatec Environmental, Inc.**

Analysis ID:	05-3306-9979	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:10	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1094552	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

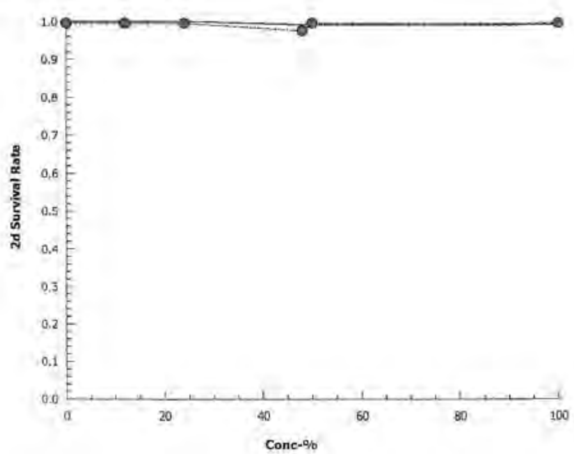
2d Survival Rate Summary

Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	Calculated Variate(A/B) A	B
0	L	4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	39	39
12		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
24		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
48		4	0.9750	0.9000	1.0000	0.0250	0.0500	5.13%	2.5%	39	40
50		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
100		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	0.9000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	09-1229-8098	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	18 Jun-18 14:56	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	12.94%

Dunnett Multiple Comparison Test

Control vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	-0.6558	2.407	0.084	6	CDF	0.9582	Non-Significant Effect
	24	-1.734	2.407	0.084	6	CDF	0.9980	Non-Significant Effect
	48	-1.734	2.407	0.084	6	CDF	0.9980	Non-Significant Effect
	50	-1.382	2.407	0.084	6	CDF	0.9941	Non-Significant Effect
	100	-1.756	2.407	0.084	6	CDF	0.9981	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0128094	0.0025619	5	1.059	0.4147	Non-Significant Effect
Error	0.0435347	0.0024186	18			
Total	0.0563441		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	3.401	15.09	0.6384	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9611	0.884	0.4610	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.6467	0.6147	0.6787	0.6429	0.627	0.674	0.01004	3.11%	0.00%
12		4	0.6695	0.5804	0.7586	0.667	0.604	0.74	0.02799	8.36%	-3.53%
24		4	0.707	0.6059	0.8081	0.688	0.653	0.799	0.03178	8.99%	-9.33%
48		4	0.707	0.6181	0.7959	0.702	0.65	0.774	0.02792	7.90%	-9.33%
50		4	0.6947	0.6185	0.771	0.6865	0.651	0.755	0.02395	6.89%	-7.43%
100		4	0.7078	0.6457	0.7698	0.7215	0.651	0.737	0.01951	5.51%	-9.44%

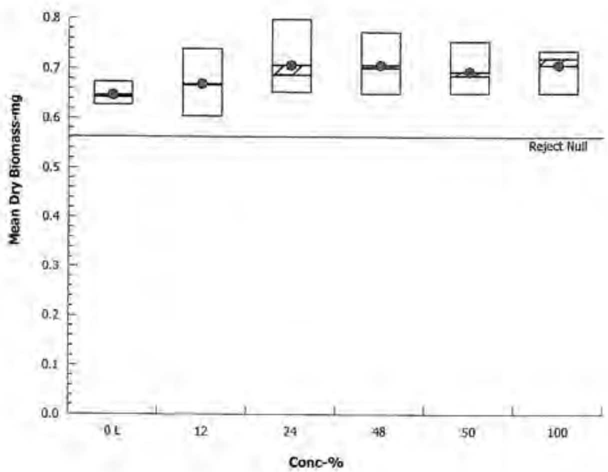
Mean Dry Biomass-mg Detail

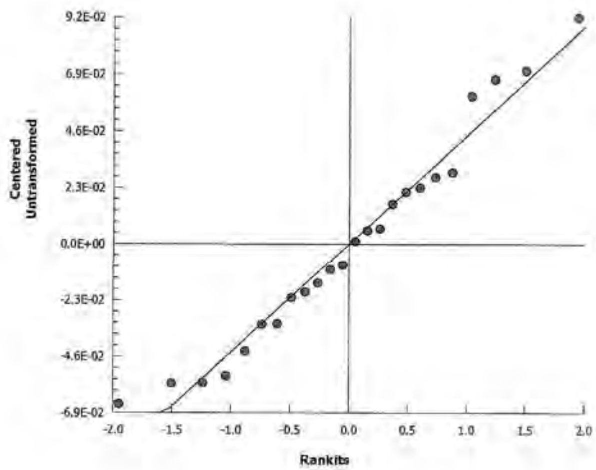
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.6478	0.674	0.638	0.627
12		0.74	0.675	0.659	0.604
24		0.691	0.685	0.799	0.653
48		0.674	0.65	0.774	0.73
50		0.755	0.651	0.662	0.711
100		0.729	0.714	0.737	0.651

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	09-1229-8098	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	18 Jun-18 14:56	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Analytical Report

Report Date:	18 Jun-18 14:59 (p 1 of 1)	Test Code:	81282 | 10-2220-4360

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	20-3178-6747	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	18 Jun-18 14:56	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	1834049	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

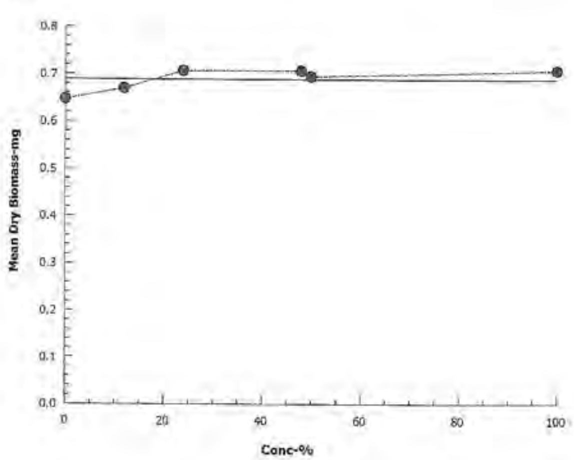
Mean Dry Biomass-mg Summary — **Calculated Variate**

Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	4	0.6467	0.627	0.674	0.01004	0.02009	3.11%	0.0%
12		4	0.6695	0.604	0.74	0.02799	0.05598	8.36%	-3.53%
24		4	0.707	0.653	0.799	0.03178	0.06356	8.99%	-9.33%
48		4	0.707	0.65	0.774	0.02792	0.05584	7.90%	-9.33%
50		4	0.6947	0.651	0.755	0.02395	0.04789	6.89%	-7.43%
100		4	0.7078	0.651	0.737	0.01951	0.03902	5.51%	-9.44%

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.6478	0.674	0.638	0.627
12		0.74	0.675	0.659	0.604
24		0.691	0.685	0.799	0.653
48		0.674	0.65	0.774	0.73
50		0.755	0.651	0.662	0.711
100		0.729	0.714	0.737	0.651

Graphics



CETIS Test Data Worksheet

Report Date: 19 Jun-18 11:09 (p 1 of 1)
Test Code/ID: 10-2220-4360/81282

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Start Date: 05 Jun-18 15:05 **Species:** Pimephales promelas **Sample Code:** 15349
End Date: 12 Jun-18 14:00 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 04 Jun-18 07:00 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Total Weight-mg	Tare Weight-mg	Pan Count	Notes
0	L	1	27	9		9					9	29.43	23.6	9	
0	L	2	18	10		10					10	29.08	22.34	10	
0	L	3	26	10		10					10	28.08	21.7	10	
0	L	4	15	10		10					10	31.43	25.16	10	
0	R	1	2	10		10					10	29.79	23.22	10	
0	R	2	12	10		10					10	29.31	22.92	10	
0	R	3	11	10		10					10	27.42	22	10	
0	R	4	3	10		10					10	27.94	21.92	10	
12		1	28	10		10					10	31.62	24.22	10	
12		2	21	10		10					10	28.3	21.55	10	
12		3	24	10		10					10	28.89	22.3	10	
12		4	9	10		10					10	31.12	25.08	10	
24		1	10	10		10					10	29.15	22.24	10	
24		2	25	10		10					10	29.7	22.85	10	
24		3	6	10		10					10	30.76	22.77	10	
24		4	5	10		10					10	29.69	23.16	10	
48		1	7	10		10					10	29.95	23.21	10	
48		2	20	10		9					9	28.53	22.03	9	
48		3	4	10		10					10	30.58	22.84	10	
48		4	13	10		10					10	29.33	22.03	10	
50		1	22	10		10					10	28.52	20.97	10	
50		2	8	10		10					10	28.95	22.44	10	
50		3	17	10		10					10	30.3	23.68	10	
50		4	1	10		10					10	29.8	22.69	10	
100		1	16	10		10					10	29	21.71	10	
100		2	14	10		10					10	29.53	22.39	10	
100		3	23	10		10					10	28.3	20.93	10	
100		4	19	10		10					10	27.31	20.8	10	

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81282

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. weighed [1]	Initial Pan Weight	Final Pan Weight
DW 0 % Soft CTRL	A	① 9 ~~10~~	9	9	9	9	9	9	9	9	23.60	29.43
	B	10	10	10	10	10	10	10	10	10	22.34	29.08
	C	10	10	10	10	10	10	10	10	10	21.70	28.08
	D	10	10	10	10	10	10	10	10	10	25.16	31.43
0 % RW	A	10	10	10	10	10	10	10	10	10	23.22	29.79
	B	10	10	10	10	10	10	10	10	10	22.92	29.31
	C	10	10	10	10	10	10	10	10	10	22.60	27.42
	D	10	10	10	10	10	10	10	10	10	21.92	27.94
12 % EFF	A	10	10	10	10	10	10	10	10	10	24.22	31.62
	B	10	10	10	10	10	10	10	10	10	21.55	28.30
	C	10	10	10	10	10	10	10	10	10	22.30	28.89
	D	10	10	10	10	10	10	10	10	10	25.08	31.12
24 % EFF	A	10	10	10	10	10	10	10	10	10	22.24	29.15
	B	10	10	10	10	10	10	10	10	10	22.85	29.70
	C	10	10	10	10	10	10	10	10	10	22.77	30.76
	D	10	10	10	10	10	10	10	10	10	23.16	29.69
48 % EFF	A	10	10	10	10	10	10	10	10	10	23.21	29.95
	B	10	10	9	9	9	9	9	9	9	22.03	28.53
	C	10	10	10	10	10	10	10	10	10	22.84	30.58
	D	10	10	10	10	10	10	10	10	10	22.03	29.33
50 % EFF	A	10	10	10	10	10	10	10	10	10	20.97	28.52
	B	10	10	10	10	10	10	10	10	10	22.44	28.95
	C	10	10	10	10	10	10	10	10	10	23.68	30.30
	D	10	10	10	10	10	10	10	10	10	22.69	29.80
100 % EFF	A	10	10	10	10	10	10	10	10	10	21.71	29.00
	B	10	10	10	10	10	10	10	10	10	22.39	29.53
	C	10	10	10	10	10	10	10	10	10	20.93	28.30
	D	10	10	10	10	10	10	10	10	10	20.80	27.31

Sample #	50952	50952	50955	50955	50957	50957	50957	Test End
Fed AM / Init.	------	840	835	830	0845 KP	840	840	------
Fed PM / Init.	16:10	1620	1615	1625	1625 KP	1445	1605	------
Renewal (D / T / I)	6/5/15 1505 KN	6/6/18 1535 KN	6/7/18 1520 KN	6/8/18 1335 KN	6.9.18 1220 KP	6/10/18 1200 KN	6/11/18 1435 KN	6/12/18 1400 KN

Date/Init (Initial Pan Weights): 6-11-18 / EB

IN (Date/Time/Temp/Init): 6/12/18 KN 1400 99°C

OUT (Date/Time/Temp/Init): 6/13/18 KN 825 100°C

Brine Shrimp Lot #: 211132-Brine

① No dead organism present in container [but only 9 observed]. Possible miscount during initiation of test KN 6/6/18

1 The number weighed = the number actually weighed. For statistical purposes, the number weighed = original number of organisms on Day 0.

Aquatec Environmental, Inc.

Reviewed by: EB Date: 6/18/18

SDG: 15349

Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81282

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % Soft CTRL	pH	7.8	7.5	7.5	7.5	7.6	7.5	7.3
	DO	7.8	7.7	7.8	7.3	7.9	7.8	7.9
	Temp.	24.9	24.2	24.6	24.5	24.9	24.8	24.5
	Cond.	187	184	185	185	177	171	171
0 % RW	pH	7.2	7.1	7.0	7.2	7.2	7.2	7.0
	DO	8.2	7.8	8.2	7.3	8.1	8.1	8.1
	Temp.	25.0	25.0	25.5	26.0	24.9	25.1	25.3
	Cond.	182	180	143	145	141	138	137
12 % EFF	pH	7.8	7.6	7.7	7.5	7.6	7.5	7.6
	DO	7.9	7.7	7.8	7.2	7.9	7.9	7.9
	Temp.	24.9	24.3	24.7	24.5	24.5	24.8	24.6
	Cond.	263	262	269	265	268	263	257
24 % EFF	pH	7.8	7.6	7.7	7.6	7.6	7.7	7.7
	DO	7.9	7.8	7.8	7.3	7.9	7.9	7.9
	Temp.	25.0	24.4	24.7	24.6	24.5	24.9	24.6
	Cond.	342	340	343	340	349	341	341
48 % EFF	pH	7.8	7.7	7.6	7.6	7.6	7.7	7.7
	DO	7.9	7.8	7.8	7.2	8.0	8.0	7.9
	Temp.	25.0	24.6	24.9	24.7	24.7	25.0	24.8
	Cond.	495	489	495	488	505	504	501
50 % EFF	pH	7.8	7.7	7.6	7.6	7.6	7.7	7.8
	DO	7.9	7.8	7.8	7.2	8.0	8.0	8.0
	Temp.	25.0	24.6	24.8	24.7	24.8	25.0	24.8
	Cond.	500	508	512	504	519	516	519
100 % EFF	pH	7.8	7.7	7.6	7.6	7.6	7.7	7.9
	DO	8.0	7.8	8.0	7.2	8.1	8.2	8.1
	Temp.	25.0	24.9	25.1	24.9	25.0	25.4	25.2
	Cond.	804	808	815	807	843	843	836
	Sample #	50952	50952	50955	50955	50957	50957	50957
	Date	6/5/18	6/6/18	6/7/18	6/8/18	6.9.18	6/10/18	6/11/18
	Initials	KN	KN	KN	KN	KP	KN	KN

Pp

Aquatec Environmental, Inc.
Reviewed by: EB Date: 6-18-18

SDG: 15349
Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81282

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Dr 0 % Soft CTRL	pH	7.2	7.2	7.4	7.3	7.3	7.1	7.1
	DO	6.7	6.0	6.7	6.2	6.9	6.1	7.0
	Temp.	24.4	24.4	24.5	24.6	24.1	23.9	24.0
	Cond.	191	194	193	192	184	191	179
0 % RW	pH	6.7	6.7	6.9	6.9	6.9	6.8	6.5
	DO	6.6	5.8	6.4	6.0	7.0	6.1	6.6
	Temp.	24.3	24.4	24.5	24.7	24.5	24.2	24.0
	Cond.	184	188	152	153	144	156	145
12 % EFF	pH	7.1	7.2	7.2	7.3	7.3	7.1	7.0
	DO	6.5	5.9	6.3	5.9	6.7	5.4	6.5
	Temp.	24.4	24.5	24.6	24.6	24.5	24.0	23.9
	Cond.	266	273	274	278	276	282	261
24 % EFF	pH	7.2	7.2	7.3	7.3	7.3	7.1	7.1
	DO	6.4	6.0	6.3	5.9	6.8	5.8	6.5
	Temp.	24.2	24.4	24.6	24.6	24.4	24.1	23.9
	Cond.	344	350	349	353	359	365	345
48 % EFF	pH	7.3	7.4	7.4	7.3	7.4	7.2	7.2
	DO	6.5	6.4	6.4	6.0	6.8	5.7	6.7
	Temp.	24.4	24.4	24.5	24.1	24.5	24.1	23.9
	Cond.	486	500	499	509	519	529	502
50 % EFF	pH	7.4	7.3	7.3	7.3	7.4	7.3	7.3
	DO	6.7	6.2	6.3	5.6	6.8	5.9	6.8
	Temp.	24.4	24.4	24.6	24.5	24.6	24.1	24.0
	Cond.	493	516	513	519	532	532	521
100 % EFF	pH	7.4	7.4	7.4	7.4	7.5	7.4	7.4
	DO	6.4	6.2	6.3	5.8	6.7	5.7	6.6
	Temp.	24.3	24.4	24.6	24.5	24.6	24.1	24.0
	Cond.	803	821	821	824	846	865	837
	Sample #	50952	50952	50955	50955	50957	50957	50957
	Date	6/6/18	6/7/18	6/8/18	6.9.18	6/10/18	6/11/18	6/12/18
	Initials	KN	KN	KN	KP	KN	KN	KN

Pf

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

AQUATIC BIO SYSTEMS ABS INC.

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

ORGANISM HISTORY

DATE:	6/4/2018
SPECIES:	*Pimephales promelas*
AGE:	N/A
LIFE STAGE:	Embryo
HATCH DATE:	6/4/2018
BEGAN FEEDING:	N/A
FOOD:	N/A

Rec 6/5/18
JCN @
11:05

Water Chemistry Record:

	Current	Range
TEMPERATURE:	25°C	--
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	125 mg/l	--
TOTAL ALKALINITY (as $CaCO_3$):	90 mg/l	--
pH:	7.60	--

Temp: 20.5°C
Cond: 384 µs
DO: 11.3 mg/L
pH: 7.9 pH
Condition:
Normal / Active

Comments:

Added soft 3/4
Added 1/4 to MHW

Facility Supervisor

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

CETIS Summary Report

Report Date: 18 Jun-18 15:08 (p 1 of 1)
Test Code: 81283 | 08-1633-6902

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Batch ID:	14-0088-2029	**Test Type:**	Reproduction-Survival (2-8d)	**Analyst:**	Kaitlyn Priest
Start Date:	05 Jun-18 14:40	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	11 Jun-18 13:50	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	5d 23h	**Source:**	In-House Culture	**Age:**	<24h

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
09-7836-5359	2d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
14-1310-4981	6d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
02-4610-2940	Reproduction	Steel Many-One Rank Sum Test	100	> 100	n/a	1	9.33%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
09-6975-0313	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
02-8820-2607	Reproduction	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

6d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	37.7	36.35	39.05	35	40	0.5972	1.889	5.01%	0.00%
0	L	10	32.1	28.72	35.48	20	37	1.494	4.725	14.72%	14.85%
12		10	32.4	29.94	34.86	26	36	1.087	3.438	10.61%	14.06%
24		10	35.2	33.45	36.95	31	39	0.7717	2.44	6.93%	6.63%
48		10	34.7	32.95	36.45	31	38	0.7753	2.452	7.07%	7.96%
50		10	32.9	31.53	34.27	30	36	0.6046	1.912	5.81%	12.73%
100		10	35.3	34.4	36.2	33	37	0.3958	1.252	3.55%	6.37%

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	09-7836-5359	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:04	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water	12	1.0000	Exact	1.0000	Non-Significant Effect
	24	1.0000	Exact	1.0000	Non-Significant Effect
	48	1.0000	Exact	1.0000	Non-Significant Effect
	50	1.0000	Exact	1.0000	Non-Significant Effect
	100	1.0000	Exact	1.0000	Non-Significant Effect

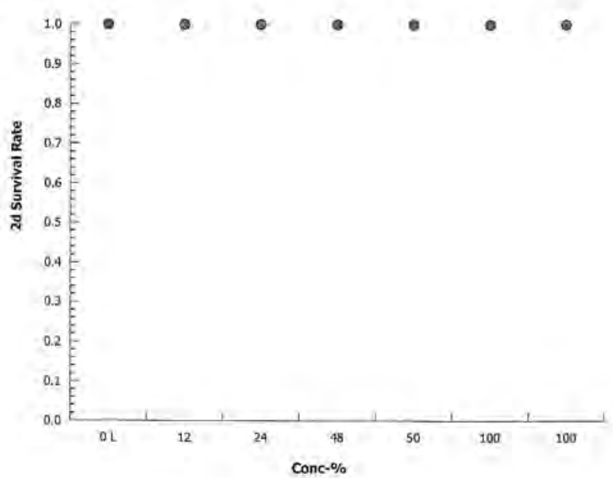
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	14-1310-4981	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:04	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water	12	1.0000	Exact	1.0000	Non-Significant Effect
	24	1.0000	Exact	1.0000	Non-Significant Effect
	48	1.0000	Exact	1.0000	Non-Significant Effect
	50	1.0000	Exact	1.0000	Non-Significant Effect
	100	1.0000	Exact	1.0000	Non-Significant Effect

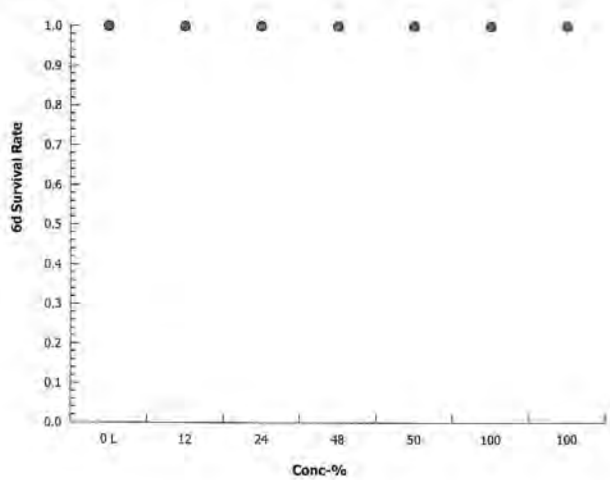
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

Analysis ID:	09-6975-0313	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	13 Jun-18 11:04	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	996799	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

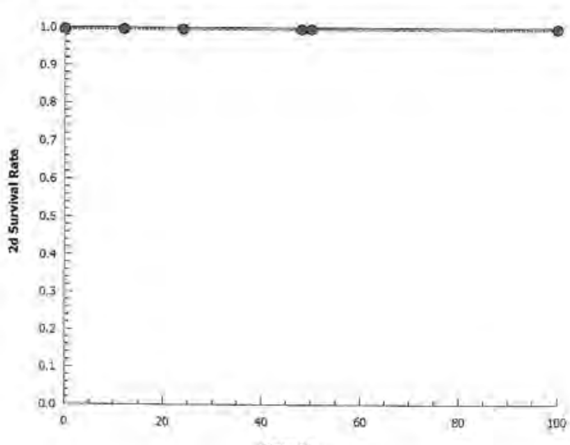
2d Survival Rate Summary — Calculated Variate(A/B)

Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
12		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
24		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
48		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date: 18 Jun-18 15:09 (p 1 of 1)
Test Code: 81283 | 08-1633-6902

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	02-8820-2607	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	18 Jun-18 15:06	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Log(X+1)	Linear	329072	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

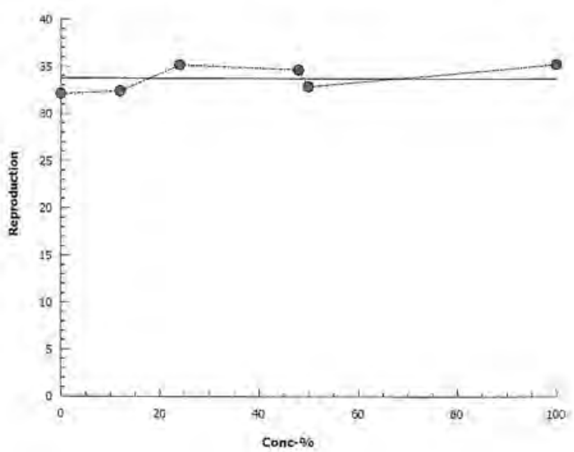
Reproduction Summary

			Calculated Variate						
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Err**	**Std Dev**	**CV%**	**%Effect**
0	L	10	32.1	20	37	1.494	4.725	14.72%	0.0%
12		10	32.4	26	36	1.087	3.438	10.61%	-0.93%
24		10	35.2	31	39	0.7717	2.44	6.93%	-9.66%
48		10	34.7	31	38	0.7753	2.452	7.07%	-8.1%
50		10	32.9	30	36	0.6046	1.912	5.81%	-2.49%
100		10	35.3	33	37	0.3958	1.252	3.55%	-9.97%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	37	20	35	36	33	32	30	33	33	32
12		36	29	34	33	36	36	32	33	26	29
24		37	33	39	37	37	36	33	31	34	35
48		34	35	37	33	37	32	33	37	31	38
50		32	33	35	35	33	36	30	31	32	32
100		35	36	34	35	36	37	33	35	35	37

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	02-4610-2940	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	18 Jun-18 15:05	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	06-5511-0449	**Code:**	15349	**Client:**	Keene WWTP
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	05 Jun-18 09:55	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	9.33%

Steel Many-One Rank Sum Test

Control vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	104.5	75	3	18	Asymp	0.8218	Non-Significant Effect
	24	129.5	75	4	18	Asymp	0.9993	Non-Significant Effect
	48	124	75	4	18	Asymp	0.9966	Non-Significant Effect
	50	102	75	5	18	Asymp	0.7570	Non-Significant Effect
	100	133.5	75	4	18	Asymp	0.9998	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	106.733	21.3467	5	2.495	0.0419	Significant Effect
Error	462	8.55556	54			
Total	568.733		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	17.09	15.09	0.0043	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9123	0.9459	3.8E-04	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	10	32.1	28.72	35.48	33	20	37	1.494	14.72%	0.00%
12		10	32.4	29.94	34.86	33	26	36	1.087	10.61%	-0.93%
24		10	35.2	33.45	36.95	35.5	31	39	0.7717	6.93%	-9.66%
48		10	34.7	32.95	36.45	34.5	31	38	0.7753	7.07%	-8.10%
50		10	32.9	31.53	34.27	32.5	30	36	0.6046	5.81%	-2.49%
100		10	35.3	34.4	36.2	35	33	37	0.3958	3.55%	-9.97%

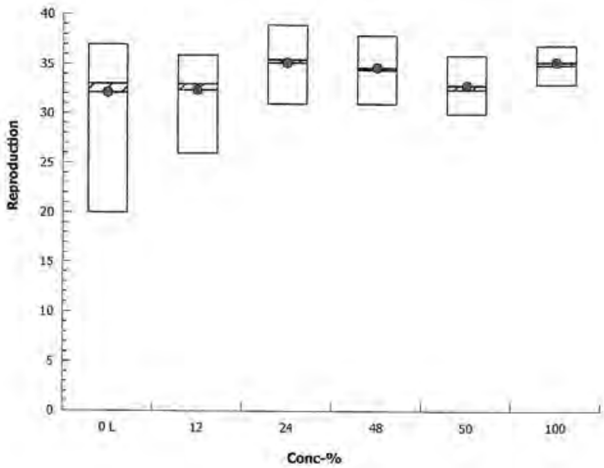
Reproduction Detail

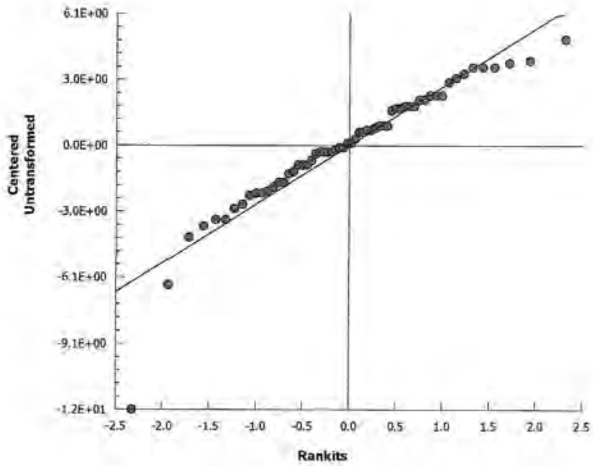
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	37	20	35	36	33	32	30	33	33	32
12		36	29	34	33	36	36	32	33	26	29
24		37	33	39	37	37	36	33	31	34	35
48		34	35	37	33	37	32	33	37	31	38
50		32	33	35	35	33	36	30	31	32	32
100		35	36	34	35	36	37	33	35	35	37

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID: 02-4610-2940		**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed: 18 Jun-18 15:05		**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Test Data Worksheet

Report Date: 19 Jun-18 09:50 (p 1 of 2)
Test Code/ID: 08-1633-6902/81283

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Start Date:	05 Jun-18 14:40	**Species:**	Ceriodaphnia dubia	**Sample Code:**	15349
End Date:	11 Jun-18 13:50	**Protocol:**	EPA/821/R-02-013 (2002)	**Sample Source:**	Permit # NH0100790
Sample Date:	04 Jun-18 07:00	**Material:**	POTW Effluent	**Sample Station:**	Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
0	L	1	39	1		1				1				0	9	12	16			0	
0	L	2	51	1		1				1				0	7	13	0			0	
0	L	3	11	1		1				1				0	7	12	16			0	
0	L	4	43	1		1				1				0	8	11	17			0	
0	L	5	8	1		1				1				6	0	11	16			0	
0	L	6	60	1		1				1				0	7	10	15			0	
0	L	7	64	1		1				1				0	6	11	13			0	
0	L	8	46	1		1				1				0	6	11	16			0	
0	L	9	36	1		1				1				7	0	11	15			0	
0	L	10	38	1		1				1				7	0	10	15			0	
0	R	1	23	1		1				1				0	8	15	15			0	
0	R	2	59	1		1				1				0	8	14	14			0	
0	R	3	63	1		1				1				0	8	15	17			0	
0	R	4	2	1		1				1				0	7	16	16			0	
0	R	5	16	1		1				1				7	0	13	15			0	
0	R	6	57	1		1				1				7	0	12	16			0	
0	R	7	1	1		1				1				0	9	16	15			0	
0	R	8	69	1		1				1				0	8	15	16			0	
0	R	9	27	1		1				1				6	0	13	19			0	
0	R	10	20	1		1				1				7	0	13	17			0	
12		1	4	1		1				1				0	7	14	15			0	
12		2	61	1		1				1				0	6	12	11			0	
12		3	32	1		1				1				0	8	14	12			0	
12		4	30	1		1				1				0	8	11	14			0	
12		5	24	1		1				1				5	0	13	18			0	
12		6	65	1		1				1				0	8	14	14			0	
12		7	67	1		1				1				0	7	14	11			0	
12		8	21	1		1				1				0	7	13	13			0	
12		9	34	1		1				1				0	6	9	11			0	
12		10	28	1		1				1				7	0	10	12			0	
24		1	37	1		1				1				0	9	12	16			0	
24		2	49	1		1				1				0	8	11	14			0	
24		3	55	1		1				1				0	8	16	15			0	
24		4	42	1		1				1				0	8	14	15			0	
24		5	70	1		1				1				8	0	13	16			0	
24		6	41	1		1				1				7	0	14	15			0	
24		7	40	1		1				1				0	7	13	13			0	
24		8	48	1		1				1				0	6	12	13			0	
24		9	31	1		1				1				6	0	11	17			0	
24		10	13	1		1				1				7	0	13	15			0	
48		1	7	1		1				1				0	7	14	13			0	
48		2	56	1		1				1				0	7	13	15			0	
48		3	33	1		1				1				0	8	15	14			0	
48		4	54	1		1				1				0	8	12	13			0	
48		5	15	1		1				1				7	0	13	17			0	

008-615-283-3 CETIS™ v1.9.2.4 Analyst: EB 6-19-18 QA: [illegible]

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
48		6	45	1		1				1				6	0	11	15			0	
48		7	3	1		1				1				0	7	13	13			0	
48		8	19	1		1				1				0	8	13	16			0	
48		9	9	1		1				1				5	0	12	14			0	
48		10	22	1		1				1				7	0	14	17			0	
50		1	66	1		1				1				0	8	12	12			0	
50		2	47	1		1				1				0	7	10	16			0	
50		3	68	1		1				1				0	9	13	13			0	
50		4	53	1		1				1				0	7	14	14			0	
50		5	58	1		1				1				6	0	10	17			0	
50		6	5	1		1				1				5	0	12	19			0	
50		7	29	1		1				1				6	0	10	14			0	
50		8	12	1		1				1				0	6	12	13			0	
50		9	52	1		1				1				5	0	11	16			0	
50		10	44	1		1				1				4	0	12	16			0	
100		1	50	1		1				1				0	8	14	13			0	
100		2	35	1		1				1				0	7	14	15			0	
100		3	26	1		1				1				0	8	13	13			0	
100		4	18	1		1				1				0	7	13	15			0	
100		5	6	1		1				1				7	0	12	17			0	
100		6	14	1		1				1				6	0	12	19			0	
100		7	10	1		1				1				0	7	12	14			0	
100		8	25	1		1				1				0	6	13	16			0	
100		9	62	1		1				1				6	0	12	17			0	
100		10	17	1		1				1				8	0	13	16			0	

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA: **Test ID** 81283

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW ✓ 0 % Soft CTRL	1	0	0	0	0	9	12	16	
	2	0	0	0	0	7	13	0	
	3	0	0	0	0	7	12	16	
	4	0	0	0	0	8	11	17	
	5	0	0	0	6	0	11	16	
	6	0	0	0	0	7	10	15	
	7	0	0	0	0	6	11	13	
	8	0	0	0	0	6	11	16	
	9	0	0	0	7	0	11	15	
	10	0	0	0	7	0	10	15	
0 % RW	1	0	0	0	0	8	15	15	
	2	0	0	0	0	8	14	14	
	3	0	0	0	0	8	15	17	
	4	0	0	0	0	7	16	16	
	5	0	0	0	7	0	13	15	
	6	0	0	0	7	0	12	16	
	7	0	0	0	0	9	16	15	
	8	0	0	0	0	8	15	16	
	9	0	0	0	6	0	13	19	
	10	0	0	0	7	0	13	17	
12 % EFF	1	0	0	0	0	7	14	15	
	2	0	0	0	0	6	12	11	
	3	0	0	0	0	8	14	12	
	4	0	0	0	0	8	11	14	
	5	0	0	0	5	0	13	18	
	6	0	0	0	0	8	14	14	
	7	0	0	0	0	7	14	11	
	8	0	0	0	0	7	13	13	
	9	0	0	0	0	6	9	11	
	10	0	0	0	7	0	10	12	
24 % EFF	1	0	0	0	0	9	12	16	
	2	0	0	0	0	8	11	14	
	3	0	0	0	0	8	16	15	
	4	0	0	0	0	8	14	15	
	5	0	0	0	8	0	13	16	
	6	0	0	0	7	0	14	15	
	7	0	0	0	0	7	13	13	
	8	0	0	0	0	6	12	13	
	9	0	0	0	6	0	11	17	
	10	0	0	0	7	0	13	15	

cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc.

Reviewed by: EB Date: 6-18-18

SDG: 15349

Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA: **Test ID** 81283

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
48 % EFF	1	0	0	0	8	7	14	13	
	2	0	0	0	0	7	13	15	
	3	0	0	0	0	8	15	14	
	4	0	0	0	0	8	12	13	
	5	0	0	0	7	0	13	17	
	6	0	0	0	6	0	11	15	
	7	0	0	0	0	7	13	13	
	8	0	0	0	0	8	13	16	
	9	0	0	0	5	0	12	14	
	10	0	0	0	7	0	14	17	
50 % EFF	1	0	0	0	0	8	12	12	
	2	0	0	0	0	7	10	16	
	3	0	0	0	0	9	13	13	
	4	0	0	0	0	7	14	14	
	5	0	0	0	6	0	10	17	
	6	0	0	0	5	0	12	19	
	7	0	0	0	6	0	10	14	
	8	0	0	0	0	6	12	13	
	9	0	0	0	5	0	11	16	
	10	0	0	0	4	0	12	16	
100 % EFF	1	0	0	0	0	8	14	13	
	2	0	0	0	0	7	14	15	
	3	0	0	0	0	8	13	13	
	4	0	0	0	0	7	13	15	
	5	0	0	0	7	0	12	17	
	6	0	0	0	6	0	12	19	
	7	0	0	0	0	7	12	14	
	8	0	0	0	0	6	13	16	
	9	0	0	0	6	0	12	17	
	10	0	0	0	8	0	13	16	
	Sample #	50952	50952	50955	50955	50957	50957	50957	
	Fed	✓	✓	✓	✓	✓	✓	—	
	Renewal (D / T / I)	6/5/18 1440 KN	6/6/18 15:05 KN	6/7/18 1450 KN	6/8/18 11:50 KN	6.9.18 1120 KP	6/10/18 11:20 KN	6/11/18 13:50 KN	

YCT Lot Number: 042618-ARO Selenastrum Lot Number: 052118 Sel

cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc.

Reviewed by: EB Date: 6/18/18

SDG: 15349

Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81283

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % Soft CTRL	pH							
	DO							
	Temp.							
	Cond.							
0 % RW	pH							
	DO							
	Temp.							
	Cond.							
12 % EFF	pH							
	DO							
	Temp.							
	Cond.							
24 % EFF	pH							
	DO							
	Temp.							
	Cond.							
48 % EFF	pH							
	DO							
	Temp.							
	Cond.							
50 % EFF	pH							
	DO							
	Temp.							
	Cond.							
100 % EFF	pH							
	DO							
	Temp.							
	Cond.							
	Sample #	50952	50952	50955	50955	50957	—	— dw
	Date							
	Initials							

Initial Chemistry data is recorded on P. promelas Initial Chemistry sheet. Data is common to both tests.

cd

Aquatec Environmental, Inc.

Reviewed by: EB Date: 6/18/18

SDG: 15349
Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA: **Test ID** **81283**

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.3	7.4	7.5	7.6	7.4	7.3	
	DO	7.3	7.5	7.1	7.6	7.6	7.6	
	Temp.	25.1	25.1	24.9	24.8	24.7	24.8	
	Cond.	194	196	200	186	184	186	
0 % RW	pH	6.9	7.0	7.1	7.3	7.1	7.1	
	DO	7.3	7.5	7.1	7.6	7.6	7.6	
	Temp.	25.1	25.2	25.0	24.9	24.7	24.7	
	Cond.	192	193	153	151	146	145	
12 % EFF	pH	7.3	7.4	7.5	7.6	7.4	7.4	
	DO	7.3	7.5	7.1	7.6	7.6	7.6	
	Temp.	24.9	25.2	25.0	24.9	24.7	24.6	
	Cond.	276	277	275	275	309	265	
24 % EFF	pH	7.4	7.4	7.5	7.7	7.5	7.5	
	DO	7.3	7.4	7.1	7.6	7.6	7.6	
	Temp.	25.1	25.1	24.9	25.0	24.7	24.4	
	Cond.	353	353	349	347	355	344	
48 % EFF	pH	7.4	7.5	7.6	7.8	7.6	7.7	
	DO	7.3	7.4	7.1	7.6	7.6	7.6	
	Temp.	25.2	25.1	25.1	25.0	24.7	24.4	
	Cond.	499	501	499	495	509	504	
50 % EFF	pH	7.4	7.5	7.6	7.8	7.6	7.7	
	DO	7.3	7.4	7.1	7.6	7.6	7.6	
	Temp.	25.0	25.1	25.0	24.9	24.7	24.6	
	Cond.	505	518	514	508	523	518	
100 % EFF	pH	7.5	7.6	7.8	8.0	7.8	7.9	
	DO	7.4	7.4	7.1	7.7	7.6	7.6	
	Temp.	25.6	25.1	24.9	24.8	24.7	24.5	
	Cond.	811	824	814	810	838	845	
	Sample #	50952	50952	50955	50955	50957	50957	
	Date	6/6/18	6/7/18	6/8/18	6.9.18	6/10/18	6/11/18	
	Initials	KN	KN	KN	KP	KN	KN	

cd

Aquatec Environmental, Inc.
Reviewed by: EB Date: 6-18-18

SDG: 15349
Project 18017

Documentation of Collection

Species:	*Ceriodaphnia dubia*	Client/Project:	Keene
Source:	In-House Cultures	Testing Date:	6/5/18

Acclimation/Holding Procedures: Transfer culture cups collected within 8-hour intervals to the top of the brood board, group each collection by collection time or Collect neonates into a small Carolina bowl of <24-hour pooled neonates. Acclimate/Hold at appropriate testing temperature.

Feeding: Feed 200µL 1:1 Mix of *Pseudokirschneriella subcapitata* formally *Selenastrum capricornutum* (Lot #: 52118 SEL) and YTC (Lot #: 042618 ARO) to each culture cup or ~3mL 1:1 Mix to a small Carolina bowl of pooled neonates.

Culture ID	Date / Time / Init Cleared of Neonates	Date / Time / Init Neonate Collection	Number of Cups Collected*	Fed (✓)
052918 BB	6/4/18 12:20 KN	6/4/18 16:23 KN	3	✓
053118 BB	6/4/18 11:50 KN	6/4/18 16:30 KN	1	✓
052918 BB	6/4/18 16:23 JN	6/4/18 22:55 JN	13	✓
053118 BB	6/4/18 16:30 JN	6/4/18 23:00 JN	9	✓
052918 BB	6/4/18 22:55	6/5/18 06:54	51	✓

* *Neonates collected must number at least eight per cup, and be from a healthy adult female*

Aquatec Environmental, Inc.
DAPHNID COLLECTION FORM

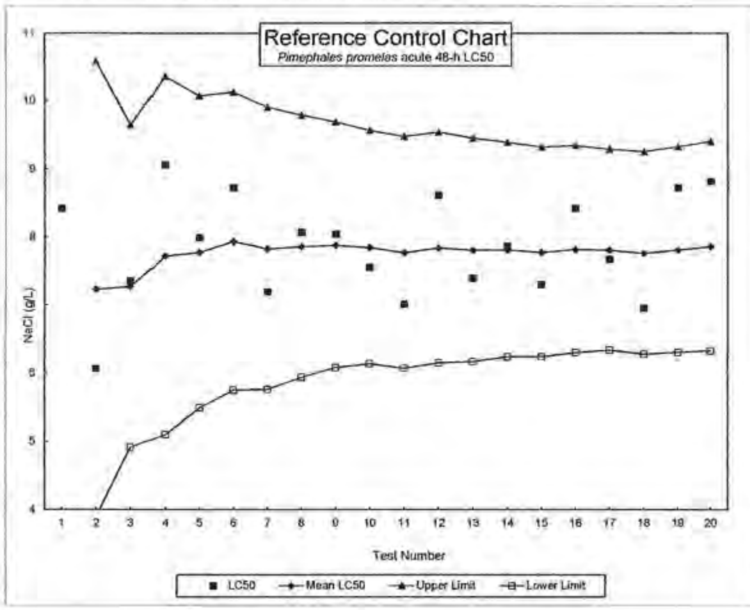
Standard Reference Toxicant Control Chart(s)

Pimephales promelas acute survival LC50 Control Chart

Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Lower	Source
1	4/5/16-4/12/16	8.42				Aquatic Biosystems
2	7/12/16-7/14/16	6.06	7.24	10.58	3.90	Aquatic Biosystems
3	8/12/16-8/14/16	7.36	7.28	9.64	4.92	Aquatic Biosystems
4	9/13/16-9/15/16	9.06	7.73	10.35	5.10	Aquatic Biosystems
5	10/19-21/2016	7.994	7.78	10.07	5.49	Aquatic Biosystems
6	11/29/16-12/1/16	8.722	7.94	10.12	5.75	Aquatic Biosystems
7	1/10/17-1/12/17	7.204	7.83	9.90	5.76	Aquatic Biosystems
8	2/7/17-2/9/17	8.071	7.86	9.79	5.94	Aquatic Biosystems
9	3/21/17-3/23/17	8.042	7.88	9.69	6.08	Aquatic Biosystems
10	5/2/17-5/4/17	7.561	7.85	9.56	6.14	Aquatic Biosystems
11	7/12/17-7/14/17	7.005	7.77	9.48	6.07	Aquatic Biosystems
12	8/8/17-8/10/17	8.61	7.84	9.54	6.15	Aquatic Biosystems
13	9/12/17-9/14/14	7.403	7.81	9.45	6.17	Aquatic Biosystems
14	10/24/17-10/26/17	7.867	7.81	9.39	6.24	Aquatic Biosystems
15	11/7/17-11/9/17	7.31	7.78	9.32	6.24	Aquatic Biosystems
16	1/25/18-1/27/18	8.42	7.82	9.34	6.30	Aquatic Biosystems
17	2/6/18-2/8/18	7.678	7.81	9.29	6.34	Aquatic Biosystems
18	3/6/18-3/8/18	6.952	7.76	9.25	6.28	Aquatic Biosystems
19	4/3/18-4/5/18	8.722	7.81	9.33	6.30	Aquatic Biosystems
20	6/5/18-6/7/18	8.819	7.86	9.40	6.33	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted.



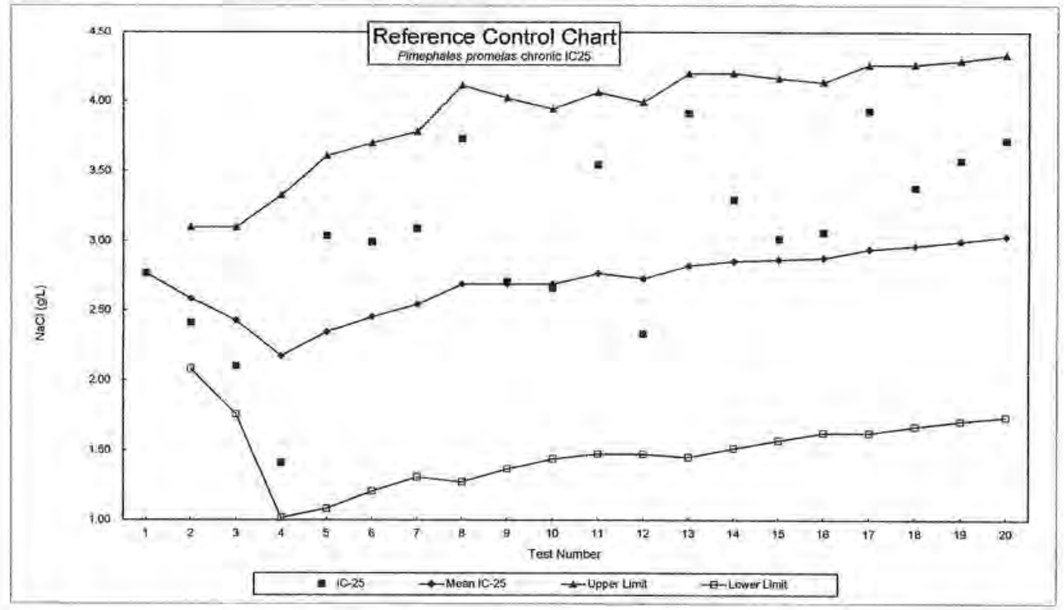
Note: Tests through September of 2016 were as Aquatec Biological Sciences, Inc. SRT tests beginning in October of 2016 were as Aquatec Environmental, Inc.

Pimephales promelas chronic IC25 Control Chart based on minnow growth

Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Lower	CV of Avg. IC25	Avg. CV	Growth PMSD (%)	Avg. PMSD (%)	Source
1	4/5/16-4/12/16	2.77	2.77					11.00	11.00	Aquatic Biosystems
2	7/12/16-7/19/16	2.41	2.59	3.10	2.08	0.10	0.10	15.60	13.30	Aquatic Biosystems
3	8/12/16-8/19/16	2.10	2.43	3.10	1.76	0.14	0.12	11.70	13.65	Aquatic Biosystems
4	9/13/16-9/20/16	1.41	2.17	3.33	1.02	0.27	0.17		12.77	Aquatic Biosystems
5	10/19-26/2016	3.04	2.35	3.61	1.08	0.27	0.19	18.00	14.08	Aquatic Biosystems
6	11/29/16-12/6/16	2.99	2.45	3.70	1.21	0.25	0.21	20.40	15.34	Aquatic Biosystems
7	1/10/17-1/17/17	3.09	2.54	3.78	1.31	0.24	0.21	11.20	14.65	Aquatic Biosystems
8	2/7/17-2/14/17	3.73	2.69	4.11	1.27	0.26	0.22	7.45	13.62	Aquatic Biosystems
9	3/21/17-3/28/17	2.71	2.69	4.02	1.37	0.25	0.22	14.80	13.77	Aquatic Biosystems
10	5/2/14-5/9/17	2.66	2.69	3.94	1.44	0.23	0.22	15.10	13.92	Aquatic Biosystems
11	7/12/17-7/19/17	3.55	2.77	4.06	1.47	0.23	0.22	12.90	13.82	Aquatic Biosystems
12	8/8/17-8/15/17	2.33	2.73	3.99	1.47	0.23	0.23	only 2 reps	12.56	Aquatic Biosystems
13	9/12/17-9/19/17	3.91	2.82	4.20	1.45	0.24	0.23	19.00	13.10	Aquatic Biosystems
14	10/24/17-10/31/17	3.29	2.86	4.20	1.51	0.23	0.23	22.10	13.79	Aquatic Biosystems
15	11/7/17-11/14/17	3.02	2.87	4.16	1.57	0.23	0.23	27.00	14.73	Aquatic Biosystems
16	1/25/18-2/1/18	3.06	2.88	4.14	1.62	0.22	0.23	15.50	14.78	Aquatic Biosystems
17	2/6/18-2/13/18	3.93	2.94	4.26	1.62	0.22	0.23	14.70	14.78	Aquatic Biosystems
18	3/6/18-3/13/18	3.38	2.97	4.26	1.67	0.22	0.23	19.20	15.29	Aquatic Biosystems
19	4/3/18-4/10/18	3.57	3.00	4.29	1.71	0.22	0.23	13.20	14.94	Aquatic Biosystems
20	6/5/18-6/12/18	3.72	3.03	4.33	1.74	0.21	0.22	12.80	14.82	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted. Test of 8/8/17, insufficient minnows for 4 reps. Tested with 2 reps.



Assessment of test precision and sensitivity: The average CVs of IC25 values are within the 25th Percentile (0.21) for fathead minnow growth (Table 3-2, EPA 833-R-00-003) indicating high precision (only 25% of labs reported CVs of not more than 0.21). The per-test PMSD values were less than the EPA upper limit of 30% indicating low-to moderate variability (moderate to high sensitivity) for this method. The cumulative average PMSD value of 20 tests (14.8) was near the EPA lower boundary (12%), indicating high statistical sensitivity for this test method. Updated 6/21/18

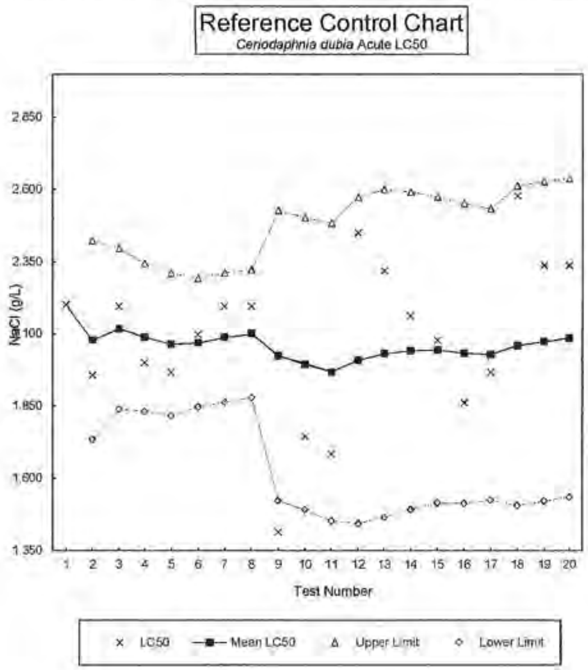
Ceriodaphnia dubia
Reference Control Chart for NaCl Acute Toxicity

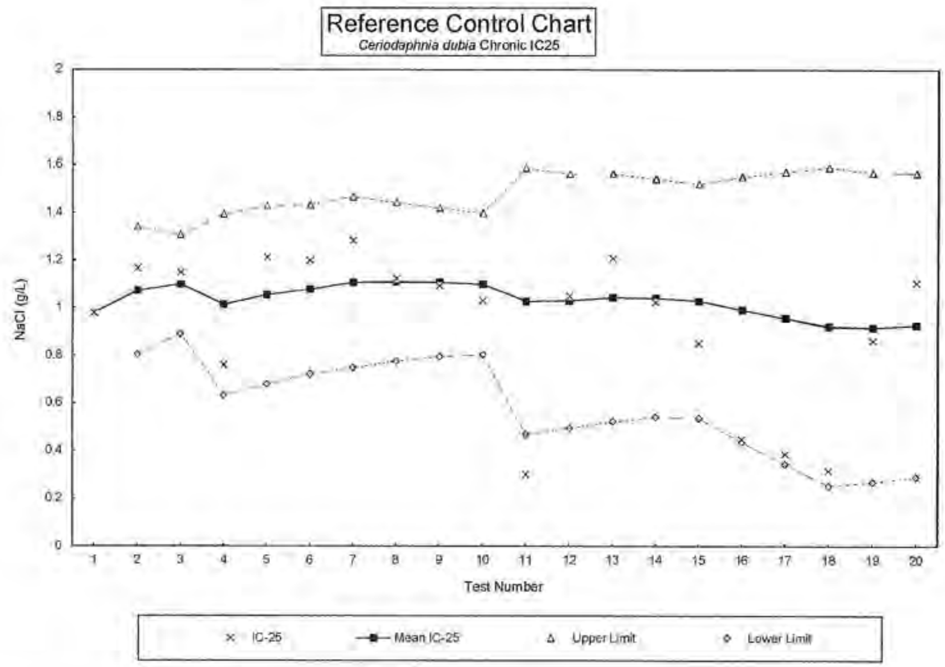
Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower
1	7/12/16-7/14/16	2.200	2.20		
2	9/20/16-9/22/16	1.956	2.08	2.42	1.73
3	10/18/16-10/20/16	2.195	2.12	2.40	1.84
4	11/29/16-12/1/16	2.000	2.09	2.34	1.83
5	1/10/17-1/12/17	1.966	2.06	2.31	1.82
6	2/14/17-2/16/17	2.098	2.07	2.29	1.85
7	3/21/17-3/23/17	2.195	2.09	2.31	1.86
8	5/16/17-5/18/17	2.195	2.10	2.32	1.88
9	7/11/17-7/13/17	1.414	2.02	2.53	1.52
10	8/1/17-8/3/17	1.743	2.00	2.50	1.49
11	9/12/17-9/14/17	1.684	1.97	2.48	1.45
12	9/28/17-9/30/17	2.449	2.01	2.57	1.44
13	10/31/17-11/2/17	2.319	2.03	2.60	1.46
14	11/28/17-11/30/17	2.161	2.04	2.59	1.49
15	1/9/18-1/11/18	2.077	2.04	2.57	1.51
16	2/6/18-2/8/18	1.861	2.03	2.55	1.51
17	3/6/18-3/8/18	1.966	2.03	2.53	1.52
18	4/3/18-4/5/18	2.577	2.06	2.61	1.51
19	5/15/18-5/17/18	2.337	2.07	2.63	1.52
20	6/12/18-6/14/18	2.337	2.09	2.64	1.54

Ceriodaphnia dubia
Reference Control Chart for NaCl Chronic Toxicity based on reproduction

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Repro. PMSD (%)	Avg. PMSD (%)
1	7/12/16-7/18/16	0.978	0.98					16.7	
2	9/20/16-9/26/16	1.167	1.07	1.34	0.81	0.12	0.12	32.6	16.7
3	10/18/19-10/25/16	1.149	1.10	1.31	0.89	0.10	0.11	10.7	24.7
4	11/29/16-12/5/16	0.7583	1.01	1.39	0.63	0.19	0.14	15.8	20.0
5	1/10/17-1/16/17	1.211	1.05	1.43	0.68	0.18	0.15	13.7	19.0
6	2/14/17-2/22/17	1.2	1.08	1.43	0.72	0.16	0.15	33.2	17.9
7	3/21/17-3/28/17	1.282	1.11	1.47	0.75	0.16	0.15	34.9	20.5
8	5/16/17-5/22/17	1.123	1.11	1.44	0.78	0.15	0.15	10.5	22.5
9	7/11/17-7/13/17	1.093	1.11	1.42	0.80	0.14	0.15	6.72	21.0
10	8/1/17-8/7/17	1.03	1.10	1.40	0.80	0.14	0.15	16	19.4
11	9/12/17-9/18/17	0.2996	1.03	1.59	0.47	0.27	0.16	32.1	19.1
12	9/28/17-10/4/17	1.048	1.03	1.56	0.50	0.26	0.17	15.8	20.3
13	10/31/17-11/6/17	1.208	1.04	1.56	0.52	0.25	0.18	9.47	19.9
14	11/28/17-12/4/17	1.023	1.04	1.54	0.54	0.24	0.18	9.72	19.1
15	1/9/18-1/16/18	0.85	1.03	1.52	0.54	0.24	0.19	30.3	18.4
16	2/6/18-2/12/18	0.4474	0.99	1.55	0.44	0.28	0.19	20.6	19.2
17	3/6/18-3/12/18	0.3857	0.96	1.57	0.34	0.32	0.20	13.8	19.3
18	4/3/18-4/10/18	0.315	0.92	1.59	0.25	0.36	0.21	36.3	19.0
19	5/15/18-5/21/18	0.8601	0.92	1.57	0.27	0.35	0.22	17.3	19.9
20	6/12/18-6/18/18	1.105	0.93	1.56	0.29	0.34	0.22	6.82	19.2

Organisms Sources: Aquatec Biological Sciences, Inc. in-house cultures and Aquatec Environmental, Inc. in-house cultures (beginning in October 2016)





Assessment of test precision and sensitivity: The cumulative average CV of 0.22 for reproduction was near the 50th Percentile (0.27, Table 3-2 of EPA 833-R-00-003) indicating normal (median) variability. The PMSD values were less than the EPA upper limit of 47% indicating acceptable variability (sensitivity) of test data. The cumulative average PMSD values were slightly above EPA lower boundary (13%), indicating high-to-moderate statistical sensitivity for this test method when averaged for the most recent 20 tests. Updated 06/21/18.

Aquatec Environmental, Inc.

273 Commerce Street
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Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY SUMMARY REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *7/10/2018 2:30:00 PM* ***Test End:*** *7/17/2018 2:50:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
50988	Keene WWTP SEC 2° Clar#2	100	>100	100	>100

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *7/10/2018 11:55:00 AM* ***Test End:*** *7/17/2018 1:40:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
50988	Keene WWTP SEC 2° Clar#2	100	>100	100	>100

SAMPLES RECEIVED:

Number	Sample Name	Date Time and Collected	Type
50988	Keene WWTP SEC 2° Clar#2	7/9/2018 7:03:00 AM	Effluent
50989	Ashuelot River	7/9/2018 10:05:00 AM	Receiving
50990	070618-SOFT		Lab Water
50991	Keene WWTP SEC 2° Clar#2	7/11/2018 7:15:00 AM	Effluent
50992	Ashuelot River	7/11/2018 8:45:00 AM	Receiving
50993	Keene WWTP SEC 2° Clar#2	7/13/2018 7:00:00 AM	Effluent
50994	Ashuelot River	7/13/2018 8:10:00 AM	Receiving

Submitted By:

Saturday, August 4, 2018
SDG: 15368
Project 18017

Aquatec Environmental, Inc.
Reviewed by: [signature] Date: 8/8/18

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Williston, VT 05495
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TOXICITY DETAIL REPORT:

Sample ID: 50988 / Keene WWTP SEC 2° Clar#2

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *7/10/2018 2:30:00 PM* ***Test End:*** *7/17/2018 2:50:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	100	100	100	100	100	97.5
7	95	95	95	97.5	92.5	97.5	85

Response: Growth per Original Number of Larvae (mean dry weight,mg)

	Additional Control	Concentration % 0	12	24	48	50	100
7	0.547	0.510	0.595	0.622	0.567	0.628	0.590

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *7/10/2018 11:55:00 AM* ***Test End:*** *7/17/2018 1:40:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	100	100	100	100	100	100
7	100	100	100	100	90	100	100

Response: Reproduction (mean neonates per female)

	Additional Control	Concentration % 0	12	24	48	50	100
7	37	36.7	33.7	35.6	32.6	32.2	34.4

Submitted By:

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Permit No. NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: 7/10/2018 2:30:00 PM **Test End:** 7/17/2018 2:50:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	50988	100	100
7	50988	95	95

Response: Growth per Original Number of Larvae (mean dry weight, mg)

Day	Sample ID	Dilution Control	Additional Control
7	50988	0.51	0.547

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 21.9% **PMSD Criteria Range:** 12%-30%

The calculated test PMSD was within the acceptable boundary range indicating test data with acceptable variability and statistical sensitivity. The chronic values (C-NOEC, C-LOEC) were reported as calculated by the statistical program.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, the following special conditions or qualifiers relate to the samples in this report:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as the additional control.

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TOXICITY QUALITY ASSURANCE REPORT:

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: 7/10/2018 11:55:00 AM **Test End:** 7/17/2018 1:40:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	50988	100	100
7	50988	100	100

Response: Reproduction (mean neonates per female)

Day	Sample ID	Dilution Control	Additional Control
7	50988	36.7	37

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 11.6% **PMSD Criteria Range:** 13%-47%

The calculated test PMSD was less than the lower bound indicating test data with low variability and high statistical sensitivity. In determining the C-NOEC, C-LOEC, test concentrations were not considered toxic if the relative difference from the control was less than the lower PMSD bounds.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, the following special conditions or qualifiers relate to the samples in this report:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as the additional control.

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WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION:

The results reported relate only to the the samples submitted as received.

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 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: August 8, 2018
(Date)

(Authorized signature)

John Williams
Director
Aquatec Environmental, Inc.

Aquatec Environmental, Inc.

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *7/10/2018 2:30:00 PM* ***Test End:*** *7/17/2018 2:50:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Pimephales promelas*	Effluent	Composite

Dilution Water:	Soft Water
Additional Control:	Ashuelot River
Effluent Sampling Dates:	July 9, 11, & 13, 2018
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)
Effluent Salinity Adjusted?	No If yes, to what value?
With Sea Salts?	Hypersaline Brine Solution?
Reference Toxicant Date:	July 24-31, 2018
Reference Toxicant Test Acceptable?	Yes
Age and Age Range of Test Organisms:	1-day old
Source of Organisms:	Aquatic BioSystems - Fort Collins, CO

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *7/10/2018 2:30:00 PM* ***Test End:*** *7/17/2018 2:50:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 95 % Mean Control Growth: 0.510 (mg)

B. Additional Control: Ashuelot River
Mean Control Survival: 95 % Mean Control Growth: 0.547 (mg)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Growth (%): 21.9

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Dunnett Multiple Comparison Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *7/10/2018 2:30:00 PM* ***Test End:*** *7/17/2018 2:50:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was within the boundaries of 12%-30%, indicating test data with normal variability and statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or growth were not detected.

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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *7/10/2018 11:55:00 AM* ***Test End:*** *7/17/2018 1:40:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Ceriodaphnia dubia*	Effluent	Composite

Dilution Water:	Soft Water
Additional Control:	Ashuelot River
Effluent Sampling Dates:	July 9, 11, & 13, 2018
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)
Effluent Salinity Adjusted?	No If yes, to what value?
With Sea Salts?	Hypersaline Brine Solution?
Reference Toxicant Date:	July 24-30, 2018
Reference Toxicant Test Acceptable?	Yes
Age and Age Range of Test Organisms:	<24h collected within an 8h period
Source of Organisms:	Aquatec Environmental, Inc. - Williston, VT

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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *7/10/2018 11:55:00 AM* ***Test End:*** *7/17/2018 1:40:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Reproduction: 36.7 (neonates)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Reproduction: 37 (neonates)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Reproduction (%): 11.6

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Fisher Exact/Bonferroni-Holm Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *7/10/2018 11:55:00 AM* ***Test End:*** *7/17/2018 1:40:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was below the boundaries of 13%-47%, indicating test data with low variability and high statistical sensitivity. Responses in the 12%, 48%, and 50% effluent were viewed as not significant because the % effect was lower than 13%, the lower PMSD boundary.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in reproduction were detected in the 12%, 48%, and 50% effluent concentrations by comparison to the response in the dilution water control.

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc 273 Commerce St 101170 Williston, VT 05495 Atten: John Williams	PROJECT: Keene NH NPDES WORK ORDER: **1807-16373** DATE RECEIVED: July 10, 2018 DATE REPORTED: July 26, 2018 SAMPLER: BB

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 07/26/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1807-16373**
PROJECT: Keene NH NPDES DATE RECEIVED: 07/10/2018

001 Site: Keene Sec 2 Clar#2 Date Sampled: 7/9/18 Time: 7:03

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	3.2	mg/L	SM 5310C (00)	7/19/18	N JGM	A	
Hardness, Total as CaCO3	62	mg/L	EPA 200.7	7/13/18	W FAA	A	
Ammonia as N	0.09	mg/L	EPA 350.1, R.2	7/17/18	N JGM	A	
Solids, Total Dissolved	474	mg/L	SM 2540C-97	7/18/18	W JSS	A	
Total Solids	447	mg/l	SM 2540 B.-97	7/24/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	7/11/18	W FAA	A	
Aluminum, Total	0.042	mg/L	EPA 200.8	7/12/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	7/12/18	W SJM	A	
Calcium, Total	19	mg/L	EPA 200.7	7/13/18	W FAA	A	
Copper, Total	0.0067	mg/L	EPA 200.8	7/12/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	7/12/18	W SJM	A	
Magnesium, Total	3.6	mg/L	EPA 200.7	7/13/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	7/12/18	W SJM	A	
Zinc, Total	0.029	mg/L	EPA 200.8	7/12/18	W SJM	A	

002 Site: Ashuelot River Date Sampled: 7/9/18 Time: 10:05

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	2.3	mg/L	SM 5310C (00)	7/19/18	N JGM	A	
Hardness, Total as CaCO3	32	mg/L	EPA 200.7	7/13/18	W FAA	A	
Ammonia as N	0.07	mg/L	EPA 350.1, R.2	7/17/18	N JGM	A	
Metals Digestion	Digested		EPA 200.7/200.8	7/11/18	W FAA	A	
Aluminum, Total	0.044	mg/L	EPA 200.8	7/12/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	7/12/18	W SJM	A	
Calcium, Total	9.5	mg/L	EPA 200.7	7/13/18	W FAA	A	
Copper, Total	0.0021	mg/L	EPA 200.8	7/12/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	7/12/18	W SJM	A	
Magnesium, Total	2.0	mg/L	EPA 200.7	7/13/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	7/12/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	7/12/18	W SJM	A	

1807-16373

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Keene NH NPDES

nvironmental, Inc.

of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

N	
Name: Aquatec Environmental, Inc.	
Address: 273 Commerce Street	
City/State/Zip: Williston, VT 05403	
Telephone: (802) 860 - 2960	
Contact Name: John Williams	

PROJECT INFORMATION

Project Name:	Keene NH NPDES
Project Number:	18017
Sampler Name(s):	BB

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP SEC 2 Clar#:	07/09/18	7:03	Grab: N/A Composite: X				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2
			Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice (4C)	1
Ashuelot River (50989)	07/09/18	10:05	Grab: X Composite: N/A				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			TOC	40ml	glass	H_2SO_4	2
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME
[signature]	7/10/18	12:10			
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME
			Rod Lamothe	7/10/18	12:10

Cooler/Sample Temp.: 7.1

Notes To Lab:

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT:	Keene NH NPDES 7/11
273 Commerce St	101170	WORK ORDER:	**1807-17141**
Williston, VT 05495		DATE RECEIVED:	July 16, 2018
		DATE REPORTED:	July 26, 2018
Atten: John Williams		SAMPLER:	BB, MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 07/26/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1807-17141**
PROJECT: Keene NH NPDES 7/11 DATE RECEIVED: 07/16/2018

001 Site: Keene WWTP Sec 2 Clarifier Composite Date Sampled: 7/11/18 Time: 7:15

Parameter	Result	Units	Method	Analysis Date/Time		Lab/Tech	NELAC	Qual.
Ammonia as N	< 0.05	mg/L	EPA 350.1, R.2	7/26/18	11:32	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB; MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP SEC 2° Clar#	**07/11/18**	**7:15**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
[signature]	7/16/18	12:30	Eileen Toomey	7/16	1230	Cooler/Sample Temp.: -0.7 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1807-17141

1807-17141

Aquatec Environmental, Inc
Keene NH NPDES 7/11

Page 1 of 2

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT:	Keene NH NPDES 7-13
273 Commerce St	101170	WORK ORDER:	**1807-17142**
Williston, VT 05495		DATE RECEIVED:	July 16, 2018
		DATE REPORTED:	July 26, 2018
Atten: John Williams		SAMPLER:	BB.MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and “N” the Plattsburgh, NY lab under certification ELAP 11892. “Sub” indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

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Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report

DATE REPORTED: 07/26/2018

CLIENT: Aquatec Environmental, Inc
PROJECT: Keene NH NPDES 7-13

WORK ORDER: **1807-17142**
DATE RECEIVED: 07/16/2018

001 Site: Keene WWTP Sec 2 Clarifier Composite Date Sampled: 7/13/18 Time: 7:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.05	mg/L	EPA 350.1, R.2	7/26/18 11:32	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB and MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP SEC 2° Clar#	**07/13/18**	**7:00**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	Cooler/Sample Temp.: 0.7 Notes To Lab:
	7/16/18	12:30	Eileen Twomey	7/16	12:30	
Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	

1807-17142

1807-17142
Aquatec Environmental, Inc
Keene NH NPDES 7-13

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Tox Lab QC
273 Commerce St 101170	WORK ORDER: **1805-09573**
Williston, VT 05495	DATE RECEIVED: May 01, 2018
	DATE REPORTED: May 14, 2018
Atten: John Williams	SAMPLER: John Williams

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and “N” the Plattsburgh, NY lab under certification ELAP 11892. “Sub” indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. “A” indicates the referenced laboratory is NELAC accredited for the parameter reported. “N” indicates the laboratory is not accredited. “U” indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an “A” meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 05/14/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1805-09573**
PROJECT: Tox Lab QC DATE RECEIVED: 05/01/2018

001 Site: 042718SOFT (50884) Date Sampled: 5/1/18 Time: 11:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	< 0.5	mg/L	SM 5310C (00)	5/7/18	N JGM	A	
Hardness, Total as CaCO3	49	mg/L	EPA 200.7	5/7/18	W FAA	A	
Ammonia as N	0.12	mg/L	EPA 350.1, R.2	5/11/18	N JGM	A	
Solids, Total Dissolved	143	mg/L	SM 2540C-97	5/8/18	W JSS	A	B
Total Solids	104	mg/l	SM 2540 B.-97	5/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	5/3/18	W FAA	A	
Aluminum, Total	< 0.020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	5/9/18	W MGT	A	
Calcium, Total	6.5	mg/L	EPA 200.7	5/7/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	5/9/18	W MGT	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	5/9/18	W MGT	A	
Magnesium, Total	7.9	mg/L	EPA 200.7	5/7/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	5/9/18	W MGT	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	5/9/18	W MGT	A	

Report Summary of Qualifiers and Notes

B: Blank contamination was observed at levels that could affect analytical results.

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	Project Name:	Tox Lab QC
Address:	273 Commerce Street	Project Number:	18000
City/State/Zip:	Williston, VT 05403	Sampler Name(s):	JW
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
042718SOFT (50884)	05/01/18	11:00	Grab: X Composite: N/A				
			Metals: Al (0.02); Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Ca, Mg (0.05)	250mL	Plastic	HNO3	1
			Ammonia-Nitrogen(0.1)	250mL	Plastic	H2SO4	1
			TS/TDS-Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice(4C)	1
			TOC - Total Organic Carbon(0.5)	40mL	Glass	H2SO4	2

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	Cooler/Sample Temp.: 6.1
	5/1/18	14:30	Eileen Tawney	5/1/18	14:27	Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1805-09573

1805-09573

Aquatec Environmental, Inc
Tox Lab QC

Supportive Documentation

Chain-Of-Custody

Toxicity Test Methods

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

Standard Reference Toxicant Control Charts

Chain-Of-Custody(s)

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		(1st Sample Ship Monday) 7/9/18
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bishop
CONTACT:	Mary Ley		
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Keene WWTP SEC 2° Clar#2	7/9/18	703		X	Effluent	2	1	1	1	1	2		
Ashuelot River	7/9/18	1005	X		Receiving	1	1			1	2		

ANALYSIS (TEST/DETECTION LIMITS) – TOX: 1000.0 & 1002.0 (P. promelas & C. dubia chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	7/9/18	1030	Priority Express
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)
Priority Express	7/10/18	1000	[illegible signature]
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 4.0°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab; Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		(2[nd] Sample Ship Wednesday)
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bisson / Mike Howell
CONTACT:	Mary Ley		
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

Comp 7/10 7/11

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	Tox: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
						NUMBER OF CONTAINERS							
Keene WWTP SEC 2° Clar#2	7/11/18	715		X	Effluent	2	1*	1	1*	1	2*		
Ashuelot River	7/11/18	845	X		Receiving	1							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (P. promelas and C. dubia chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	7/11/18	915	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	7-12-18	11:00	**RECEIVED BY:** (Signature) [signature]
RELINQUISHED BY: (Signature)			**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 2.6

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab; Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(3rd Sample Ship Friday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bishop
CONTACT:	Mary Ley		Mike Martell
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
						NUMBER OF CONTAINERS							
Keene WWTP SEC 2° Clar#2	7/12-7/13/18	700		X	Effluent	3	1*	1	1*	1	2*		
Ashuelot River	7/13/18	810	X		Receiving	2							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (P. promelas and C. dubia chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	7/13/18	900	Priority Express
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)
Priority Express	7-14-18	9:45	[signature]
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 5.0°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab; Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

SAMPLE PREPARATION:

	Initial Sample		Second Sample		Third Sample		
	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	LAB CONTROL
Sample No.	50988	50989	50991	50992	50993	50994	50990
Filtration	✓60 Micron	✓60 Micron	✓60 Micron	✓60 Micron	✓60 Micron	✓60 Micron	N / A
Chlorine (1)	ND	—	ND	—	ND	—	N / A
Chlorine (2)	—	—	—	—	—	—	N / A
NaThio Lot No.	—	—	—	—	—	—	N / A
Original / Final Salinity:	N / A	N / A	N / A	N / A	N / A	N / A	N / A
FF Lot No.	N / A	N / A	N / A	N / A	N / A	N / A	N / A
Date / Initials:	7/10/18 KN	7/10/18 KN	7-12-18 EB	7-12-18 EB	7-14-18 EB	7-14-18 EB	7/10/18 KN

(1) Record vol. 0.025 N sodium thiosulfate to dechlorinate 100mL sample or record "ND" (Not Detected)

(2) Dechlorination required if detected. Record vol. 0.25 N sodium thiosulfate added per gallon effluent.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

ALKALINITY, HARDNESS, AND TRC REPORT:

Sample ID:	Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)	TRC: (mg/L)
50988 - Keene WWTP SEC 2° Clar#2	7/10/2018	44.0	52.0	0.06
50989 - Ashuelot River	7/10/2018	16.0	32.0	---
50990 - 070618-SOFT	7/10/2018	28.0	44.0	---
50991 - Keene WWTP SEC 2° Clar#2	7/12/2018	56.0	56.0	0.04
50992 - Ashuelot River	7/12/2018	20.0	34.0	---
50993 - Keene WWTP SEC 2° Clar#2	7/14/2018	88.0	64.0	0.03
50994 - Ashuelot River	7/14/2018	28.0	36.0	---

INF: Interference. The color endpoint was reached immediately

Aquatec Environmental, Inc.
Reviewed by: JL Date: 8/4/18.

SDG: 15368
Project 18017

Toxicity Test Method(s)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25+/- 1C, Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s (50-100ft-c) (ambient laboratory levels)
5	Photoperiod:	16h light/8h dark
6	Test chamber size:	300mL
7	Test solution volume:	Nominal 250mL
8	Test solution renewal:	Daily
9	Age of test organisms:	Newly hatched larvae less than 24h old. If shipped, not more than 48h old, 24h range in age
10	No. larvae per test chamber:	10
11	No. replicate chambers per concentration:	4
12	No. larvae per concentration:	40
13	Source of food:	Newly hatched Artemia nauplii (< 24h old)
14	Feeding regime:	On days 0-6, feed 0.1g newly hatched (less than 24h old) brine shrimp nauplii three times daily at 4h intervals or, as a minimum, 0.15g twice daily at 6h intervals. Sufficient nauplii are added to provide an excess.
15	Cleaning:	Siphon daily, immediately before test solution renewal
16	Aeration:	None: unless DO concentration falls below 4.0mg/L.
17	Dilution water:	Soft Water
18	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
19	Additional control:	Ashuelot River
20	Test duration:	7 days
21	Endpoints:	Survival and growth (weight)
22	Test acceptability criteria:	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25mg
23	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
24	Sample volume required:	2.5L/day

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25 +/- 1C; Test temperatures must not deviate (i.e. maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s or 50-100ft-c (ambient laboratory levels)
5	Photoperiod:	16h light, 8h dark
6	Test chamber size:	30mL
7	Test solution volume	Nominal 15mL
8	renewal of test solutions:	Daily
9	Age of test organisms:	Less than 24h; and all released within a 8h period
10	No. neonates per test chamber:	1
11	No. replicate test chambers per concentration:	10
12	No. neonates per test concentration:	10
13	Feeding regime:	Feed 0.1mL each of YCT and algal suspension per test chamber daily
14	Cleaning:	Use new plastic cups daily
15	Aeration:	None
16	Dilution water:	Soft Water
17	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
18	Additional control:	Ashuelot River
19	Test duration:	Until 60% or more of surviving control females have three broods (maximum test duration 8 days)
20	Endpoints:	Survival and reproduction
21	Test acceptability criteria:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods
22	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
23	Sample volume required:	1L/day

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

CETIS Summary Report

Report Date: 03 Aug-18 10:31 (p 1 of 1)
Test Code: 81364 | 14-4145-2483

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Batch ID:	12-9637-5392	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Kaitlyn Priest
Start Date:	10 Jul-18 14:30	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	17 Jul-18 13:55	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	6d 23h	**Source:**	Aquatic Biosystems, CO	**Age:**	1d

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
00-8652-1501	2d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	4.57%
16-4057-0362	7d Survival Rate	Dunnett Multiple Comparison Test	100	> 100	n/a	1	16.5%
01-2469-6838	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test	100	> 100	n/a	1	21.9%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
06-3411-5524	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
17-3368-6811	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.9500	0.8581	1.0000	0.9000	1.0000	0.0289	0.0577	6.08%	0.00%
0	L	4	0.9500	0.8581	1.0000	0.9000	1.0000	0.0289	0.0577	6.08%	0.00%
12		4	0.9500	0.8581	1.0000	0.9000	1.0000	0.0289	0.0577	6.08%	0.00%
24		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	-2.63%
48		4	0.9250	0.7727	1.0000	0.8000	1.0000	0.0479	0.0957	10.35%	2.63%
50		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	-2.63%
100		4	0.8500	0.5744	1.0000	0.7000	1.0000	0.0866	0.1732	20.38%	10.53%

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.547	0.4973	0.5967	0.512	0.588	0.01563	0.03126	5.72%	0.00%
0	L	4	0.5095	0.4672	0.5518	0.486	0.547	0.01328	0.02656	5.21%	6.86%
12		4	0.595	0.4889	0.7011	0.527	0.686	0.03335	0.06671	11.21%	-8.78%
24		4	0.6217	0.4727	0.7708	0.552	0.76	0.04684	0.09368	15.07%	-13.67%
48		4	0.5667	0.5075	0.626	0.519	0.61	0.01863	0.03725	6.57%	-3.61%
50		4	0.6277	0.5579	0.6976	0.572	0.676	0.02194	0.04388	6.99%	-14.76%
100		4	0.5897	0.4433	0.7362	0.485	0.704	0.04603	0.09206	15.61%	-7.82%

Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Analysis ID:	06-3411-5524	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:30	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	767865	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

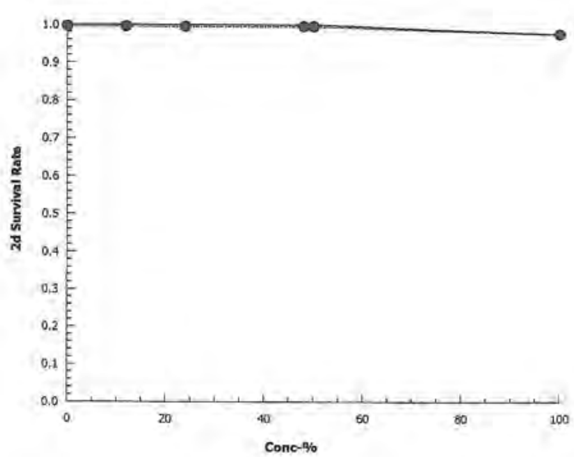
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
12		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
24		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
48		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
50		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
100		4	0.9750	0.9000	1.0000	0.0250	0.0500	5.13%	2.5%	39	40

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		0.9000	1.0000	1.0000	1.0000

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	17-3368-6811	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:30	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1236915	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

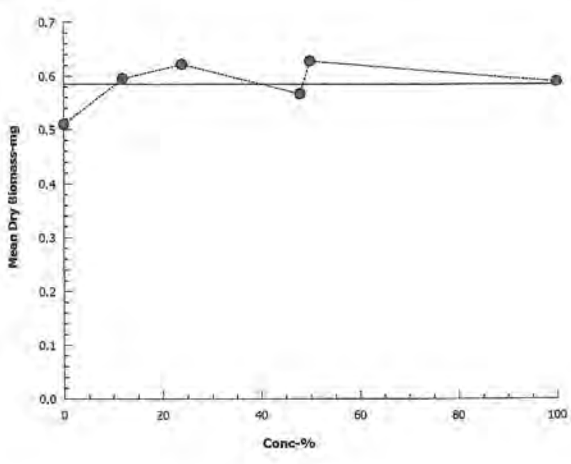
Mean Dry Biomass-mg Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	4	0.5095	0.486	0.547	0.01328	0.02656	5.21%	0.0%
12		4	0.595	0.527	0.686	0.03335	0.06671	11.21%	-16.78%
24		4	0.6217	0.552	0.76	0.04684	0.09368	15.07%	-22.03%
48		4	0.5667	0.519	0.61	0.01863	0.03725	6.57%	-11.24%
50		4	0.6277	0.572	0.676	0.02194	0.04388	6.99%	-23.21%
100		4	0.5897	0.485	0.704	0.04603	0.09206	15.61%	-15.75%

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.497	0.508	0.486	0.547
12		0.686	0.574	0.593	0.527
24		0.586	0.76	0.552	0.589
48		0.568	0.57	0.61	0.519
50		0.619	0.572	0.676	0.644
100		0.485	0.559	0.611	0.704

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	00-8652-1501	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:30	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	4.57%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		48	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		100	16	10	1	6	Asymp	0.6105	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0055332	0.0011066	5	1	0.4457	Non-Significant Effect
Error	0.0199195	0.0011066	18			
Total	0.0254527		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	9	4.248	2.0E-04	Unequal Variances
Variances	Mod Levene Equality of Variance Test	1	4.248	0.4457	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.4634	0.884	2.5E-08	Non-Normal Distribution

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	2.50%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
48		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
100		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.89%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		0.9000	1.0000	1.0000	1.0000

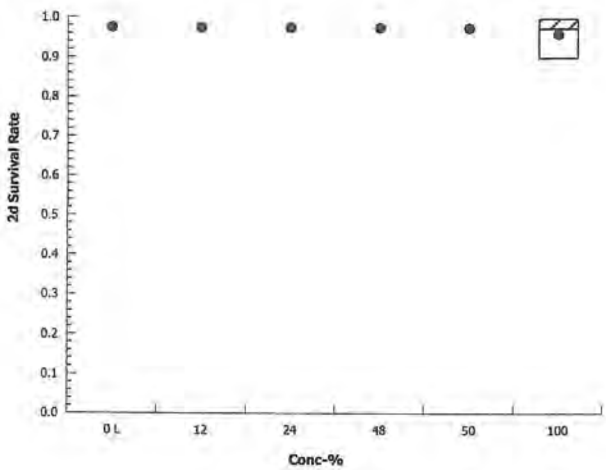
Fathead Minnow 7-d Larval Survival and Growth Test | **Aquatec Environmental, Inc.**

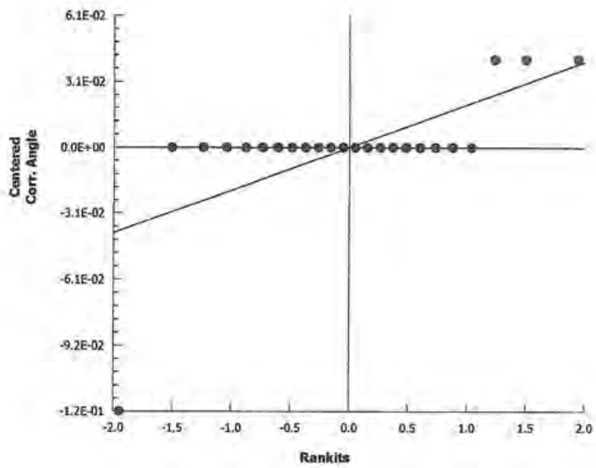
Analysis ID:	00-8652-1501	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:30	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.412	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.249	1.412	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test **Aquatec Environmental, Inc.**

Analysis ID:	16-4057-0362	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:30	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	16.53%

Dunnett Multiple Comparison Test

Control vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	0	2.407	0.232	6	CDF	0.8333	Non-Significant Effect
	24	-0.4224	2.407	0.232	6	CDF	0.9281	Non-Significant Effect
	48	0.3678	2.407	0.232	6	CDF	0.7032	Non-Significant Effect
	50	-0.4224	2.407	0.232	6	CDF	0.9281	Non-Significant Effect
	100	1.337	2.407	0.232	6	CDF	0.2842	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0802349	0.016047	5	0.8626	0.5248	Non-Significant Effect
Error	0.334866	0.0186037	18			
Total	0.415101		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	5.953	15.09	0.3108	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.94	0.884	0.1635	Normal Distribution

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.9500	0.8581	1.0000	0.9500	0.9000	1.0000	0.0289	6.08%	0.00%
12		4	0.9500	0.8581	1.0000	0.9500	0.9000	1.0000	0.0289	6.08%	0.00%
24		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	-2.63%
48		4	0.9250	0.7727	1.0000	0.9500	0.8000	1.0000	0.0479	10.35%	2.63%
50		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	-2.63%
100		4	0.8500	0.5744	1.0000	0.8500	0.7000	1.0000	0.0866	20.38%	10.53%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	0.00%
12		4	1.331	1.181	1.48	1.331	1.249	1.412	0.04705	7.07%	0.00%
24		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	-3.06%
48		4	1.295	1.061	1.529	1.331	1.107	1.412	0.07348	11.35%	2.67%
50		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	-3.06%
100		4	1.202	0.8149	1.588	1.202	0.9912	1.412	0.1215	20.22%	9.69%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	0.9000	0.9000	1.0000
12		0.9000	1.0000	1.0000	0.9000
24		1.0000	1.0000	1.0000	0.9000
48		0.9000	1.0000	1.0000	0.8000
50		1.0000	0.9000	1.0000	1.0000
100		0.7000	0.7000	1.0000	1.0000

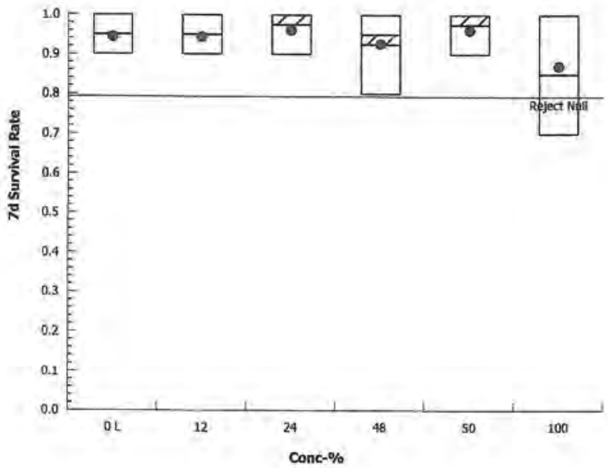
Fathead Minnow 7-d Larval Survival and Growth Test **Aquatec Environmental, Inc.**

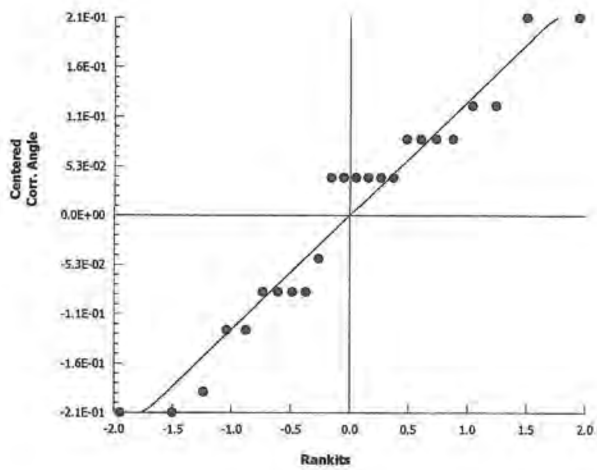
Analysis ID:	16-4057-0362	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:30	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.249	1.249	1.412
12		1.249	1.412	1.412	1.249
24		1.412	1.412	1.412	1.249
48		1.249	1.412	1.412	1.107
50		1.412	1.249	1.412	1.412
100		0.9912	0.9912	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Analysis ID: 01-2469-6838 **Endpoint:** Mean Dry Biomass-mg **CETIS Version:** CETISv1.9.2
Analyzed: 03 Aug-18 10:30 **Analysis:** Parametric-Control vs Treatments **Official Results:** Yes

Sample ID: 08-0834-5556 **Code:** 15368 **Client:** Keene WWTP
Sample Date: 09 Jul-18 07:03 **Material:** POTW Effluent **Project:** Special Studies
Receipt Date: 10 Jul-18 10:00 **Source:** Permit # NH0100790 (KEENE NH)
Sample Age: 31h **Station:** Keene WWTP

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	21.87%

Dunnett Multiple Comparison Test

Control vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	-1.847	2.407	0.111	6	CDF	0.9986	Non-Significant Effect
	24	-2.425	2.407	0.111	6	CDF	0.9998	Non-Significant Effect
	48	-1.237	2.407	0.111	6	CDF	0.9911	Non-Significant Effect
	50	-2.554	2.407	0.111	6	CDF	0.9998	Non-Significant Effect
	100	-1.733	2.407	0.111	6	CDF	0.9980	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0373358	0.0074672	5	1.742	0.1761	Non-Significant Effect
Error	0.0771579	0.0042866	18			
Total	0.114494		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	6.1	15.09	0.2967	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9572	0.884	0.3844	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.5095	0.4672	0.5518	0.5025	0.486	0.547	0.01328	5.21%	0.00%
12		4	0.595	0.4889	0.7011	0.5835	0.527	0.686	0.03335	11.21%	-16.78%
24		4	0.6217	0.4727	0.7708	0.5875	0.552	0.76	0.04684	15.07%	-22.03%
48		4	0.5667	0.5075	0.626	0.569	0.519	0.61	0.01863	6.57%	-11.24%
50		4	0.6277	0.5579	0.6976	0.6315	0.572	0.676	0.02194	6.99%	-23.21%
100		4	0.5897	0.4433	0.7362	0.585	0.485	0.704	0.04603	15.61%	-15.75%

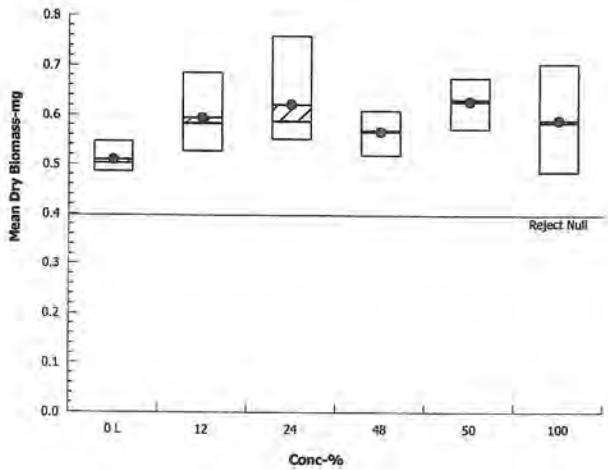
Mean Dry Biomass-mg Detail

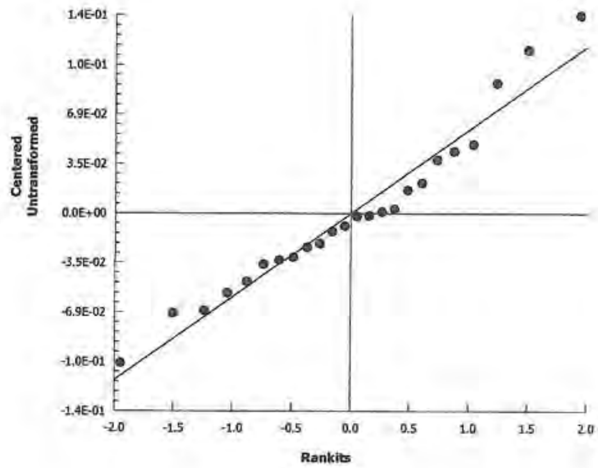
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.497	0.508	0.486	0.547
12		0.686	0.574	0.593	0.527
24		0.586	0.76	0.552	0.589
48		0.568	0.57	0.61	0.519
50		0.619	0.572	0.676	0.644
100		0.485	0.559	0.611	0.704

Fathead Minnow 7-d Larval Survival and Growth Test **Aquatec Environmental, Inc.**

Analysis ID:	01-2469-6838	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:30	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Test Data Worksheet

Report Date: 03 Aug-18 10:19 (p 1 of 1)
Test Code/ID: 14-4145-2483/81364

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Start Date: 10 Jul-18 14:30 **Species:** Pimephales promelas **Sample Code:** 15368
End Date: 17 Jul-18 13:55 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 09 Jul-18 07:03 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Total Weight-mg	Tare Weight-mg	Pan Count	Notes
0	L	1	2	10		10					10	26.72	21.75	10	
0	L	2	18	10		10					9	26.21	21.13	9	
0	L	3	9	10		10					9	26.29	21.43	9	
0	L	4	17	10		10					10	27.61	22.14	10	
0	R	1	11	10		10					9	26.58	21.12	9	
0	R	2	15	10		10					10	26.32	21.2	10	
0	R	3	6	10		10					9	26.61	21.19	9	
0	R	4	4	10		10					10	25.1	19.22	10	
12		1	8	10		10					9	26.95	20.09	9	
12		2	13	10		10					10	27.69	21.95	10	
12		3	7	10		10					10	27.69	21.76	10	
12		4	16	10		10					9	26.77	21.5	9	
24		1	5	10		10					10	29.67	23.81	10	
24		2	24	10		10					10	29.96	22.36	10	
24		3	22	10		10					10	27.81	22.29	10	
24		4	12	10		10					9	26.72	20.83	9	
48		1	25	10		10					9	27.32	21.64	9	
48		2	1	10		10					10	28.14	22.44	10	
48		3	14	10		10					10	28.88	22.78	10	
48		4	3	10		10					8	28.18	22.99	8	
50		1	21	10		10					10	27.22	21.03	10	
50		2	10	10		10					9	27.38	21.66	9	
50		3	26	10		10					10	28.44	21.68	10	
50		4	23	10		10					10	28.99	22.55	10	
100		1	28	10		9					7	27.32	22.47	7	
100		2	19	10		10					7	27.24	21.65	7	
100		3	20	10		10					10	27.18	21.07	10	
100		4	27	10		10					10	28.38	21.34	10	

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81364

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. weighed [1]	Initial Pan Weight	Final Pan Weight
DW 0 % Soft CTRL	A	10	10	10	10	10	10	10	10	10	21.75	26.72
	B	10	10	10	9	9	9	9	9	9	21.13	26.21
	C	10	10	10	9	9	9	9	9	9	21.43	26.29
	D	10	10	10	10	10	10	10	10	10	22.14	27.61
0 % RW	A	10	10	10	9	9	9	9	9	9	21.12	26.58
	B	10	10	10	10	10	10	10	10	10	21.20	26.32
	C	10	10	10	10	9	9	9	9	9	21.19	26.61
	D	10	10	10	10	10	10	10	10	10	19.22	25.10
12 % EFF	A	10	10	10	10	10	10	10	9	9	20.09	26.95
	B	10	10	10	10	10	10	10	10	10	21.95	27.69
	C	10	10	10	10	10	10	10	10	10	21.76	27.69
	D	10	10	10	9	9	9	9	9	9	21.50	26.77
24 % EFF	A	10	10	10	10	10	10	10	10	10	23.81	29.67
	B	10	10	10	10	10	10	10	10	10	22.36	29.96
	C	10	10	10	10	10	10	10	10	10	22.29	27.81
	D	10	10	10	9	9	9	9	9	9	20.83	26.72
48 % EFF	A	10	10	10	10	10	10	10	9	9	21.64	27.32
	B	10	10	10	10	10	10	10	10	10	22.44	28.14
	C	10	10	10	10	10	10	10	10	10	22.78	28.88
	D	10	10	10	9	9	8	8	8	8	22.99	28.18
50 % EFF	A	10	10	10	10	10	10	10	10	10	21.03	27.22
	B	10	10	10	10	10	10	9	9	9	21.66	27.38
	C	10	10	10	10	10	10	10	10	10	21.68	28.44
	D	10	10	10	10	10	10	10	10	10	22.55	28.49
100 % EFF	A	10	10	9	9	8	7	7	7	7	22.47	27.32
	B	10	10	10	8	8	7	7	7	7	21.65	27.24
	C	10	10	10	10	10	10	10	10	10	21.07	27.18
	D	10	10	10	10	10	10	10	10	10	21.34	28.38

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Sample #	50988	50988	~~50992~~	~~50992~~	50993	50993	50993	Test End
Fed AM / Init.	------	845	840	830	1030	920	825	------
Fed PM / Init.	1545	1540	1605	1515	1630 EB	15:22	1530	------
Renewal (D / T / I)	7-10-18 1430 EB	7-11-18 1445 EB	7/12/18 15:10 KN	7/13/18 1215 KN	7/14/18 1250 KN	7/15/18 1400 KN	7/16/18 1355 KN	7/17/18 1450 KN

50991 KN 7/12/18 50991 KN 7/13/18 sample # correction

Date/Init (Initial Pan Weights): 7/13/18 KN

IN (Date/Time/Temp/Init): 7/17/18 1450 102°C KN

OUT (Date/Time/Temp/Init): 7/18/18 825 100°C KN

Brine Shrimp Lot #: 211132-Brine

Pf

1 The number weighed = the number actually weighed. For statistical purposes, the number weighed = original number of organisms on Day 0.

Aquatec Environmental, Inc.

Reviewed by: [signature] Date: 8/4/18

SDG: 15368

Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81364

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % Soft CTRL	pH	7.4	7.1	7.0	7.1	7.2	7.4	7.4
	DO	7.6	7.4	8.2	8.0	8.3	8.2	7.7
	Temp.	24.7	24.6	25.0	24.1	24.2	24.1	24.7
	Cond.	181	165	172	168	167	174	182
0 % RW	pH	7.2	7.1	7.0	7.1	7.1	7.4	7.3
	DO	7.7	7.4	8.4	8.0	8.3	8.1	7.8
	Temp.	25.3	25.8	25.7	25.6	25.1	25.0	25.1
	Cond.	291	302	333	319	318	315	314
12 % EFF	pH	7.5	7.4	7.2	7.3	7.4	7.4	7.4
	DO	7.7	7.4	8.4	7.9	8.2	8.2	7.7
	Temp.	24.6	24.7	25.1	24.5	24.3	24.3	24.7
	Cond.	264	256	265	252	254	261	271
24 % EFF	pH	7.5	7.5	7.3	7.4	7.5	7.6	7.5
	DO	7.6	7.4	8.4	7.9	8.2	8.2	7.7
	Temp.	24.9	24.8	25.2	24.8	24.5	24.4	24.7
	Cond.	341	333	340	330	332	340	346
48 % EFF	pH	7.5	7.6	7.4	7.5	7.6	7.7	7.5
	DO	7.6	7.4	8.5	7.8	8.2	8.1	7.8
	Temp.	25.1	25.0	25.2	25.5	24.6	24.8	24.9
	Cond.	499	487	494	492	506	499	503
50 % EFF	pH	7.5	7.6	7.4	7.5	7.7	7.7	7.5
	DO	7.6	7.4	8.6	7.8	8.2	8.1	7.8
	Temp.	25.0	24.9	25.2	25.6	24.6	24.8	24.9
	Cond.	527	515	521	505	510	517	517
100 % EFF	pH	7.5	7.6	7.4	7.6	7.8	7.8	7.5
	DO	7.7	7.4	8.7	7.8	8.2	8.1	8.0
	Temp.	25.5	25.3	25.5	26.1	25.0	25.7	25.5
	Cond.	834	837	828	835	837	842	835
	Sample #	50988	50988	50992 ①	50992 ①	50993	—	—
	Date	7/10/18	7/11/18	7/12/18	7/13/18	7/14/18	7/15/18	7-16-18
	Initials	KN	KN	KN/EB	KN	KN	KN	EB

① 50991 is sample # KN 7/12/18

Pp

Aquatec Environmental, Inc.

Reviewed by: JW Date: 8/4/18

SDG: 15368

Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81364

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
0 % DW Soft CTRL	pH	7.2	7.0	7.0	6.9	7.0	7.1	7.0
	DO	6.8	6.6	7.0	7.2	7.3	6.9	6.5
	Temp.	24.8	25.3	24.2	24.3	24.4	24.7	24.3
	Cond.	183	177	173	176	173	186	189
0 % RW	pH	7.2	7.0	7.0	6.9	6.9	7.0	7.0
	DO	6.9	6.8	6.8	7.1	6.8	6.8	6.5
	Temp.	24.8	25.3	24.2	24.3	24.2	24.5	24.1
	Cond.	290	295	313	320	318	319	317
12 % EFF	pH	7.2	7.0	7.0	7.0	7.0	7.2	7.1
	DO	6.9	6.8	6.7	7.1	6.7	6.6	6.1
	Temp.	24.8	25.3	24.0	24.3	24.3	24.7	24.2
	Cond.	273	265	256	258	259	265	272
24 % EFF	pH	7.3	7.1	7.1	7.0	7.1	7.3	7.2
	DO	6.8	6.9	6.7	6.8	6.5	6.6	6.2
	Temp.	24.8	25.3	24.3	24.3	24.4	24.6	24.3
	Cond.	336	344	330	336	338	347	351
48 % EFF	pH	7.3	7.1	7.2	7.1	7.3	7.3	7.3
	DO	6.7	7.0	6.7	6.8	6.7	6.6	6.0
	Temp.	24.8	25.2	24.0	24.2	24.2	24.5	24.0
	Cond.	489	497	488	494	500	502	506
50 % EFF	pH	7.3	7.2	7.2	7.1	7.4	7.4	7.3
	DO	6.8	7.1	6.6	6.7	6.7	6.4	6.0
	Temp.	24.8	25.3	24.0	24.3	24.3	24.7	24.1
	Cond.	508	508	503	502	506	519	521
100 % EFF	pH	7.3	7.2	7.3	7.2	7.5	7.6	7.4
	DO	6.8	7.0	6.6	6.5	6.3	6.2	5.9
	Temp.	24.7	25.2	24.3	24.3	24.3	24.7	24.1
	Cond.	808	831	818	821	834	845	840
	Sample #	50988	50988	50992	50991	50993	50993	50993
	Date	7/11/18	7/12/18	7/13/18	7/14/18	7/15/18	7/16/18	7/17/18
	Initials	KN	KN	KN	KN	KN	KN	KN

① 50991 is sample # KN 7/13/18

Pp

Aquatec Environmental, Inc.

Reviewed by: ob Date: 8/9/18

SDG: 15368
Project 18017

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

AQUATIC BIO SYSTEMS
ABS
INC.

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

- Rec 7/10/18 @ 945
MN

ORGANISM HISTORY

DATE:	7/9/2018
SPECIES:	*Pimephales promelas*
AGE:	N/A
LIFE STAGE:	Embryo
HATCH DATE:	7/9/2018
BEGAN FEEDING:	N/A
FOOD:	N/A

Temp: 23.4
Cond: 368 ‰
DO: 10.0 mg/L
pH: 7.8 pH
Condition: Normal/Active

Added Soft water

Water Chemistry Record:	Current	Range
TEMPERATURE:	25°C	--
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	118 mg/l	--
TOTAL ALKALINITY (as $CaCO_3$):	90 mg/l	--
pH:	8.26	--

Comments:

Facility Supervisor

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

CETIS Summary Report

		Report Date:	03 Aug-18 10:32 (p 1 of 1)
		Test Code:	81365 | 09-3760-0454

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Batch ID:	15-5265-8396	**Test Type:**	Reproduction-Survival (2-8d)	**Analyst:**	Kaitlyn Priest
Start Date:	10 Jul-18 11:55	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	17 Jul-18 13:40	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	7d 2h	**Source:**	In-House Culture	**Age:**	<24h

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
13-0437-2543	2d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
20-7417-7213	7d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
02-1639-8495	Reproduction	Steel Many-One Rank Sum Test	~~≤12~~ 100	~~12~~ >100	n/a	>8.333	11.6% (2)

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
00-9891-1513	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
01-9711-9981	Reproduction	Linear Interpolation (ICPIN)	IC5	10.74	6.557	n/a	9.31	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	0.9000	0.6738	1.0000	0.0000	1.0000	0.1000	0.3162	35.14%	10.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	37	35.12	38.88	32	41	0.83	2.625	7.09%	0.00%
0	L	10	36.7	35.27	38.13	34	40	0.6333	2.003	5.46%	0.81% (1)
12		10	33.7	31.82	35.58	28	37	0.8307	2.627	7.79%	8.92%
24		10	35.6	33.84	37.36	32	39	0.7775	2.459	6.91%	3.78%
48		10	32.6	29.01	36.19	21	39	1.586	5.016	15.39%	11.89%
50		10	32.2	27.88	36.52	17	38	1.908	6.033	18.74%	12.97%
100		10	34.4	30.75	38.05	26	41	1.614	5.103	14.84%	7.03%

(1) Relative difference from control was <13% (lower PMSD boundary) By definition – no effect (EPA Protocol) – NOEC = 100

(2) PMSD < 13% (Lower Boundary)

CETIS Analytical Report

Report Date:	03 Aug-18 10:32 (p 1 of 2)
Test Code:	81365 | 09-3760-0454

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	13-0437-2543	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:31	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		12	1.0000	Exact	1.0000	Non-Significant Effect
		24	1.0000	Exact	1.0000	Non-Significant Effect
		48	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

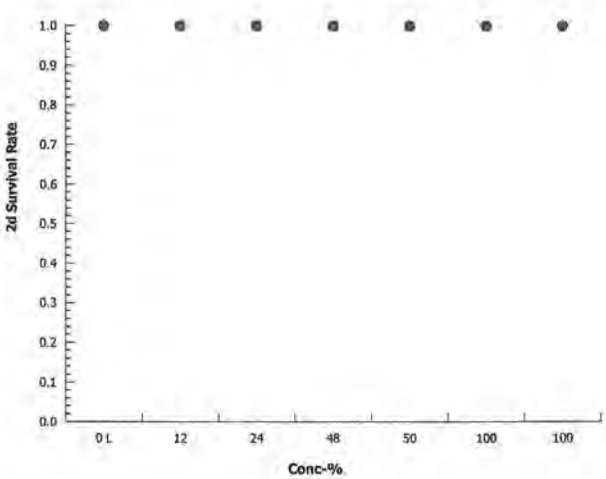
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test | **Aquatec Environmental, Inc.**

Analysis ID:	20-7417-7213	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:31	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		12	1.0000	Exact	1.0000	Non-Significant Effect
		24	1.0000	Exact	1.0000	Non-Significant Effect
		48	0.5000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

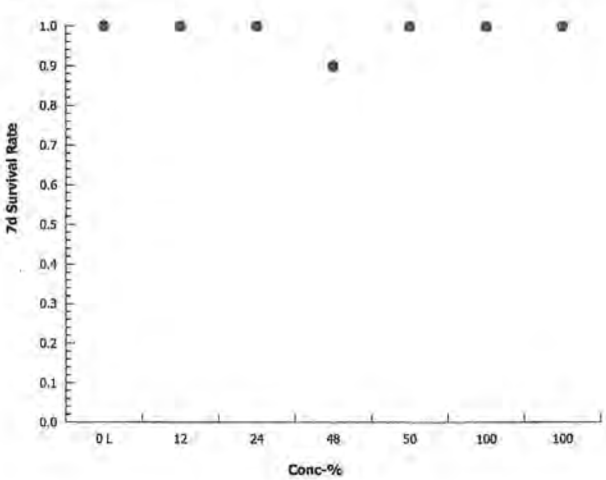
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		9	1	10	0.9	0.1	10.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	00-9891-1513	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:32	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	429105	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

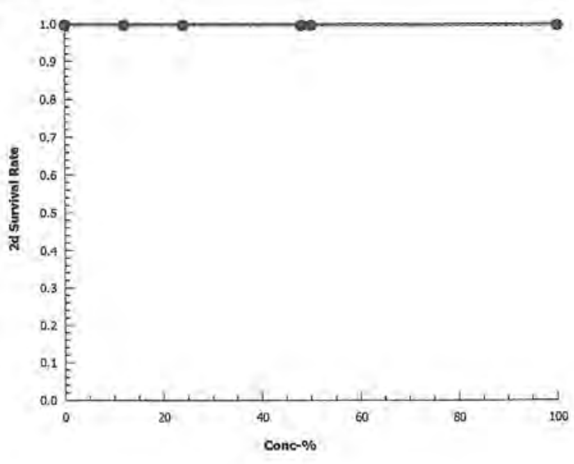
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
12		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
24		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
48		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	01-9711-9981	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:32	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1605442	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	10.74	6.557	n/a	9.31	n/a	15.25
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

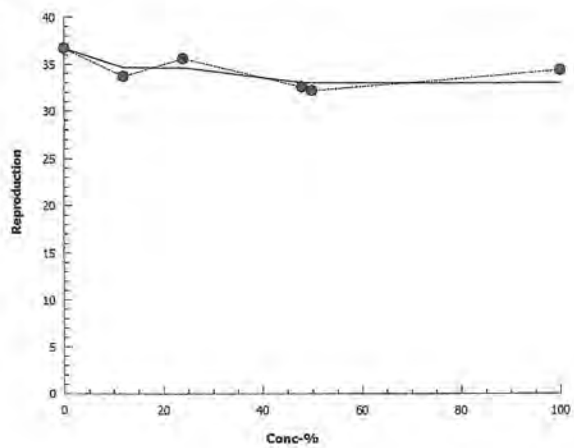
Reproduction Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	10	36.7	34	40	0.6333	2.003	5.46%	0.0%
12		10	33.7	28	37	0.8307	2.627	7.80%	8.17%
24		10	35.6	32	39	0.7775	2.459	6.91%	3.0%
48		10	32.6	21	39	1.586	5.016	15.39%	11.17%
50		10	32.2	17	38	1.908	6.033	18.74%	12.26%
100		10	34.4	26	41	1.614	5.103	14.84%	6.27%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	40	38	35	36	38	35	34	35	39	37
12		36	34	32	36	34	33	32	35	37	28
24		32	32	37	37	39	36	37	34	34	38
48		21	30	39	34	35	37	34	29	34	33
50		38	17	33	38	32	36	29	34	32	33
100		38	33	35	41	38	34	26	27	32	40

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test | **Aquatec Environmental, Inc.**

Analysis ID:	02-1639-8495	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:31	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	08-0834-5556	**Code:**	15368	**Client:**	Keene WWTP
Sample Date:	09 Jul-18 07:03	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	10 Jul-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

1

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	12 100	12 >100	n/a	>8.333	11.64%

Steel Many-One Rank Sum Test

Control	vs	Control II	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12*	73	75	4	18	Asymp	0.0318	Significant Effect
		24	92.5	75	5	18	Asymp	0.4393	Non-Significant Effect
		48*	73	75	4	18	Asymp	0.0318	Significant Effect
		50*	74	75	3	18	Asymp	0.0384	Significant Effect
		100	91.5	75	4	18	Asymp	0.4046	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	150.6	30.12	5	1.728	0.1438	Non-Significant Effect
Error	941	17.4259	54			
Total	1091.6		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	16.81	15.09	0.0049	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9055	0.9459	2.1E-04	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	10	36.7	35.27	38.13	36.5	34	40	0.6333	5.46%	0.00%
12		10	33.7	31.82	35.58	34	28	37	0.8307	7.79%	8.17%
24		10	35.6	33.84	37.36	36.5	32	39	0.7775	6.91%	3.00%
48		10	32.6	29.01	36.19	34	21	39	1.586	15.39%	11.17%
50		10	32.2	27.88	36.52	33	17	38	1.908	18.74%	12.26%
100		10	34.4	30.75	38.05	34.5	26	41	1.614	14.84%	6.27%

2

Reproduction Detail

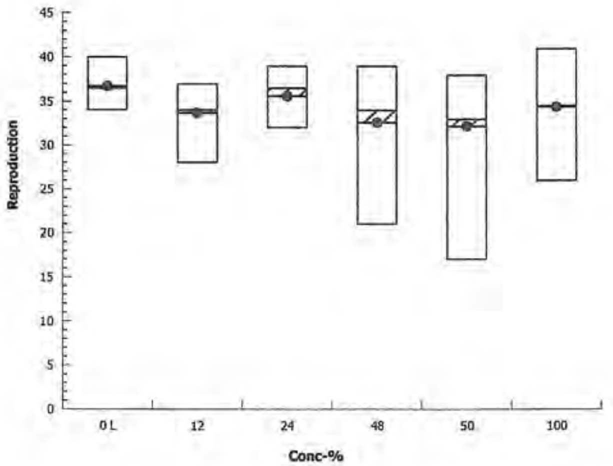
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	40	38	35	36	38	35	34	35	39	37
12		36	34	32	36	34	33	32	35	37	28
24		32	32	37	37	39	36	37	34	34	38
48		21	30	39	34	35	37	34	29	34	33
50		38	17	33	38	32	36	29	34	32	33
100		38	33	35	41	38	34	26	27	32	40

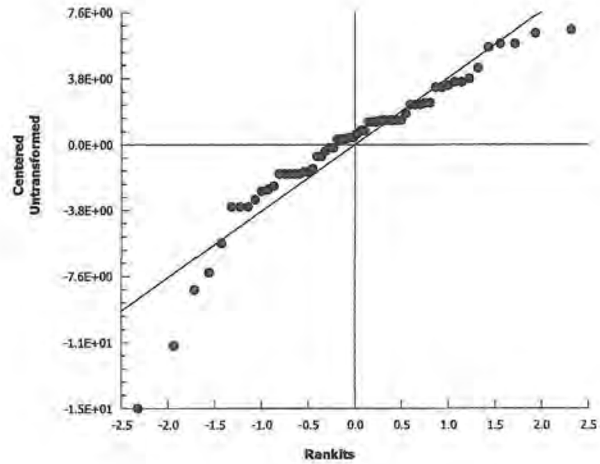
1. PMSD < 13% (EPA Lower Boundary) - highly sensitive test due to low variability in test data.
2. % Effect was < 13%. Defined as not toxic per EPA statistical protocol. JW C-NOEC = 100

Ceriodaphnia 7-d Survival and Reproduction Test | **Aquatec Environmental, Inc.**

Analysis ID:	02-1639-8495	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	03 Aug-18 10:31	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test **Aquatec Environmental, Inc.**

Start Date: 10 Jul-18 11:55 **Species:** Ceriodaphnia dubia **Sample Code:** 15368
End Date: 17 Jul-18 13:40 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 09 Jul-18 07:03 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
0	L	1	60	1		1					1				8	13	0	19		0	
0	L	2	6	1		1					1				9	14	0	15		0	
0	L	3	66	1		1					1				8	13	0	14		0	
0	L	4	63	1		1					1				8	13	0	15		0	
0	L	5	35	1		1					1				7	13	0	18		0	
0	L	6	37	1		1					1				7	12	0	16		0	
0	L	7	9	1		1					1				8	12	0	14		0	
0	L	8	59	1		1					1				7	12	0	16		0	
0	L	9	38	1		1					1				8	13	0	18		0	
0	L	10	36	1		1					1				8	12	0	17		0	
0	R	1	47	1		1					1				9	12	1	19		0	
0	R	2	15	1		1					1				9	13	0	17		0	
0	R	3	1	1		1					1				8	11	0	15		0	
0	R	4	30	1		1					1				8	11	1	16		0	
0	R	5	21	1		1					1				8	13	0	15		0	
0	R	6	67	1		1					1				7	13	0	18		0	
0	R	7	28	1		1					1				8	12	1	16		0	
0	R	8	22	1		1					1				8	12	0	19		0	
0	R	9	41	1		1					1				6	11	0	15		0	
0	R	10	64	1		1					1				8	13	0	17		0	
12		1	8	1		1					1				8	12	0	16		0	
12		2	69	1		1					1				8	11	0	15		0	
12		3	2	1		1					1				7	13	0	12		0	
12		4	52	1		1					1				8	13	0	15		0	
12		5	55	1		1					1				7	13	0	14		0	
12		6	31	1		1					1				6	12	0	15		0	
12		7	39	1		1					1				7	12	0	13		0	
12		8	19	1		1					1				7	12	0	16		0	
12		9	33	1		1					1				8	12	0	17		0	
12		10	32	1		1					1				6	9	0	13		0	
24		1	54	1		1					1				6	12	0	14		0	
24		2	70	1		1					1				7	12	0	13		0	
24		3	25	1		1					1				8	14	0	15		0	
24		4	12	1		1					1				6	13	0	18		0	
24		5	17	1		1					1				8	12	0	19		0	
24		6	56	1		1					1				7	11	0	18		0	
24		7	62	1		1					1				7	13	0	17		0	
24		8	65	1		1					1				6	11	0	17		0	
24		9	51	1		1					1				7	13	0	14		0	
24		10	58	1		1					1				7	13	0	18		0	
48		1	29	1		1					0				6	15	0	0		0	
48		2	44	1		1					1				7	11	0	12		0	
48		3	68	1		1					1				8	14	0	17		0	
48		4	3	1		1					1				8	12	0	14		0	
48		5	26	1		1					1				7	13	0	15		0	

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
48		6	40	1		1					1				6	14	0	17		0	
48		7	5	1		1					1				7	11	0	16		0	
48		8	4	1		1					1				7	0	7	15		0	
48		9	27	1		1					1				7	12	0	15		0	
48		10	48	1		1					1				6	13	0	14		0	
50		1	18	1		1					1				8	12	0	18		0	
50		2	57	1		1					1				0	0	11	6		0	
50		3	34	1		1					1				7	12	0	14		0	
50		4	50	1		1					1				7	14	0	17		0	
50		5	43	1		1					1				7	12	0	13		0	
50		6	10	1		1					1				6	11	0	19		0	
50		7	7	1		1					1				8	10	0	11		0	
50		8	49	1		1					1				8	10	0	16		0	
50		9	16	1		1					1				6	10	0	16		0	
50		10	20	1		1					1				6	12	0	15		0	
100		1	14	1		1					1				8	12	0	18		0	
100		2	53	1		1					1				7	11	0	15		0	
100		3	11	1		1					1				7	10	0	18		0	
100		4	46	1		1					1				7	12	0	22		0	
100		5	61	1		1					1				8	13	0	17		0	
100		6	23	1		1					1				6	12	0	16		0	
100		7	24	1		1					1				7	3	0	16		0	
100		8	42	1		1					1				6	3	0	18		0	
100		9	13	1		1					1				5	12	0	15		0	
100		10	45	1		1					1				7	13	0	20		0	

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81365

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	1	0	0	0	0	8	13	0	19
	2	0	0	0	0	9	14	0	15
	3	0	0	0	0	8	13	0	14
	4	0	0	0	0	8	13	0	15
	5	0	0	0	0	7	13	0	18
	6	0	0	0	0	7	12	0	16
	7	0	0	0	0	6	12	0	14
	8	0	0	0	0	7	12	0	16
	9	0	0	0	0	8	13	0	17
	10	0	0	0	0	8	12	0	17
0 % RW	1	0	0	0	0	9	12	1	19
	2	0	0	0	0	9	13	0	17
	3	0	0	0	0	8	11	0	15
	4	0	0	0	0	8	11	1	16
	5	0	0	0	0	8	13	0	15
	6	0	0	0	0	7	13	0	18
	7	0	0	0	0	8	12	1	16
	8	0	0	0	0	8	12	0	19
	9	0	0	0	0	6	11	0	15
	10	0	0	0	0	8	13	0	17
12 % EFF	1	0	0	0	0	8	12	0	16
	2	0	0	0	0	8	11	0	15
	3	0	0	0	0	7	13	0	12
	4	0	0	0	0	8	13	0	15
	5	0	0	0	0	7	13	0	14
	6	0	0	0	0	6	12	0	15
	7	0	0	0	0	7	12	0	13
	8	0	0	0	0	7	12	0	16
	9	0	0	0	0	8	12	0	17
	10	0	0	0	0	6	9	0	13
24 % EFF	1	0	0	0	0	6	12	0	14
	2	0	0	0	0	7	12	0	13
	3	0	0	0	0	8	14	0	15
	4	0	0	0	0	① ~~8~~ 6	13	0	18
	5	0	0	0	0	8	12	0	19
	6	0	0	0	0	7	11	0	18
	7	0	0	0	0	7	13	0	17
	8	0	0	0	0	6	11	0	17
	9	0	0	0	0	7	13	0	14
	10	0	0	0	0	7	13	0	18

① clarified recording KN 7/14/18

Cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc.

Reviewed by: JV Date: 8/4/18.

SDG: 15368

Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81365

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
48 % EFF	1	0	0	0	0	6	15	0 ①	D-0
	2	0	0	0	0	7	11	0	12
	3	0	0	0	0	8	14	0	17
	4	0	0	0	0	8	12	0	14
	5	0	0	0	0	7	13	0	15
	6	0	0	0	0	6	14	0	17
	7	0	0	0	0	7	11	0	16
	8	0	0	0	0	7	0	7	15
	9	0	0	0	0	7	12	0	15
	10	0	0	0	0	6	13	0	14
50 % EFF	1	0	0	0	0	8	12	② ~~11~~ 0	18
	2	0	0	0	0	0	0	11	6
	3	0	0	0	0	7	12	0	14
	4	0	0	0	0	7	14	0	17
	5	0	0	0	0	7	12	0	13
	6	0	0	0	0	6	11	0	19
	7	0	0	0	0	8	10	0	11
	8	0	0	0	0	8	10	0	16
	9	0	0	0	0	6	10	0	16
	10	0	0	0	0	6	12	0	15
100 % EFF	1	0	0	0	0	8	12	0	19
	2	0	0	0	0	7	11	0	15
	3	0	0	0	0	7	10	0	19
	4	0	0	0	0	7	12	0	22
	5	0	0	0	0	8	13	0	17
	6	0	0	0	0	6	12	0	16
	7	0	0	0	0	7	3	0	16
	8	0	0	0	0	6	3	0	18
	9	0	0	0	0	5	12	0	15
	10	0	0	0	0	7	13	0	20

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Sample #	50988	50988	~~50992~~ ③	~~50992~~ ③	50993	50993	50993	50993
Fed	✓	✓	✓	✓	✓	✓	✓	—
Renewal (D / T / I)	7/10/18 11:55 KN	7/11/18 1140 KN	7/12/18 12:40 KN	7/13/18 11:25 KN	7/14/18 12:05 KN	7/15/18 1315 KN	7/16/18 1500 KN	7/17/18 1340 KN

YCT Lot Number: 051718-1 Selenastrum Lot Number: 070218-Se1

① Organism appears weak KN 7/16/18
② wrote in wrong spot KN 7/16/18
③ 50991 is Sample # KN

cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc. Reviewed by: JW Date: 8/4/18

SDG: 15368
Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81365

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % Soft CTRL	pH							
	DO							
	Temp.							
	Cond.							
0 % RW	pH							
	DO							
	Temp.							
	Cond.							
12 % EFF	pH							
	DO							
	Temp.							
	Cond.							
24 % EFF	pH							
	DO							
	Temp.							
	Cond.							
48 % EFF	pH							
	DO							
	Temp.							
	Cond.							
50 % EFF	pH							
	DO							
	Temp.							
	Cond.							
100 % EFF	pH							
	DO							
	Temp.							
	Cond.							
	Sample #	50988	50988	50992				
	Date							
	Initials							

See data for P. promelas Initial Chem. Data are common to both tests.

cd

Aquatec Environmental, Inc.
Reviewed by: Date: 8/4/18

SDG: 15368
Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81365

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.2	7.3	7.2	7.2	7.1	7.2	7.4
	DO	7.2	7.5	8.0	8.2	8.2	7.7	7.7
	Temp.	25.0	25.4	24.4	24.5	24.6	25.2	24.4
	Cond.	192	186	176	176	174	185	195
0 % RW	pH	7.2	7.2	7.2	7.2	7.1	7.2	7.2
	DO	7.2	7.6	7.9	8.2	8.1	7.5	7.6
	Temp.	25.1	25.5	24.4	24.7	24.6	25.2	24.3
	Cond.	297	303	322	323	317	321	323
12 % EFF	pH	7.4	7.4	7.3	7.3	7.3	7.3	7.5
	DO	7.1	7.6	7.8	8.1	8.1	7.5	7.6
	Temp.	25.2	25.6	24.6	24.7	24.6	25.3	24.5
	Cond.	275	264	260	264	② 269	264	280
24 % EFF	pH	7.6	7.4	7.4	7.4	7.5	7.5	7.6
	DO	7.1	7.7	7.8	8.1	8.1	7.5	7.6
	Temp.	25.2	25.6	24.4	24.6	24.5	25.2	24.4
	Cond.	346	343	337	337	336	347	353
48 % EFF	pH	7.5	7.5	7.5	7.5	7.7	7.7	7.7
	DO	7.1	7.8	7.8	8.1	8.1	7.5	7.5
	Temp.	25.3	25.6	24.4	24.7	24.4	25.1	24.3
	Cond.	499	505	488	494	501	505	508
50 % EFF	pH	7.5	7.6	7.6	7.6	7.7	7.7	7.7
	DO	7.1	7.8	7.8	8.1	8.0	7.5	7.5
	Temp.	25.3	25.7	24.4	24.7	24.4	25.1	24.4
	Cond.	519	516	503	506	509	523	521
100 % EFF	pH	7.6	7.7	7.7	7.7	8.0	8.0	7.9
	DO	7.1	7.8	7.8	8.1	8.0	7.5	7.5
	Temp.	25.4	25.7	24.4	24.8	24.4	25.1	24.4
	Cond.	831	846	817	825	830	879	838
	Sample #	50988	50988	① 50991	① 50991	50993	50993	50993
	Date	7/11/18	7/12/18	7/13/18	7/14/18	7/15/18	7/16/18	7/17/18
	Initials	KN	KN	KN	KN	KN	KN	KN

① sample # 50991 KN 7/13/18
② Conductivity 269 us KN 7/15/18

Cd

Aquatec Environmental, Inc.
Reviewed by: [signature] Date: 8/4/18

SDG: 15368
Project 18017

Documentation of Collection

Species:	*Ceriodaphnia dubia*	Client/Project:	Keene / SRT
Source:	In-House Cultures	Testing Date:	7/10/18

Acclimation/Holding Procedures: Transfer culture cups collected within 8-hour intervals to the top of the brood board, group each collection by collection time or Collect neonates into a small Carolina bowl of <24-hour pooled neonates. Acclimate/Hold at appropriate testing temperature.

Feeding: Feed 200µL 1:1 Mix of *Pseudokirschneriella subcapitata* formally *Selenastrum capricornutum* (Lot #: 070218 (KN)) and YTC (Lot #: ~~120~~ KN051718) to each culture cup or ~3mL 1:1 Mix to a small Carolina bowl of pooled neonates.

Culture ID	Date / Time / Init Cleared of Neonates	Date / Time / Init Neonate Collection	Number of Cups Collected*	Fed (✓)
070318 bb	7/9/18 12:10 KN	7/9/18 16:22 KN	0	—
070418 bb	7/9/18 11:50 KN	7/9/18 16:25 KN	0	—
070318 bb	7/9/18 16:22 KN	7/9/18 23:05 JR	13	✓
070418 bb	7/9/18 16:25 KN	7/9/18 23:10 JR	37	✓
070318 BB	7/9/18 23:05 JR	7/10/18 06:40	52	✓
070418 BB	7/9/18 23:10 JR	7/10/18 06:50	61	✓

* *Neonates collected must number at least eight per cup, and be from a healthy adult female*

Aquatec Environmental, Inc.
DAPHNID COLLECTION FORM

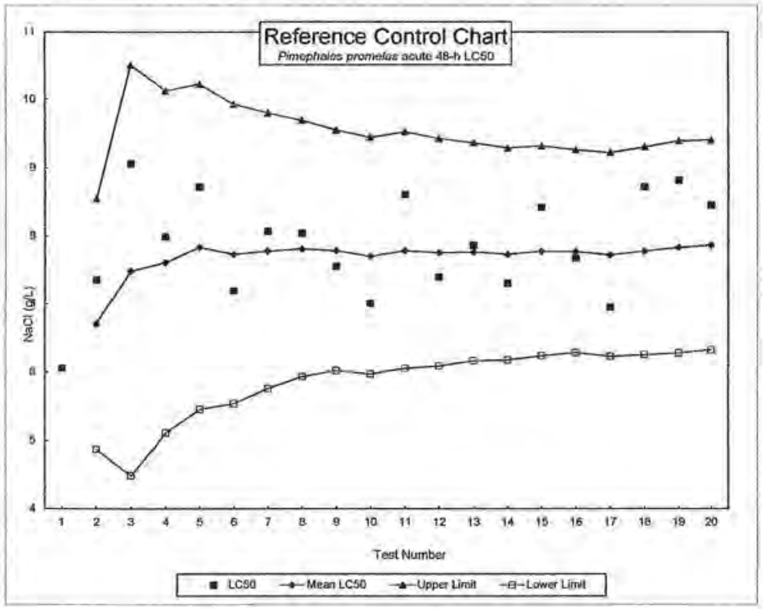
JR 8/4/18

Standard Reference Toxicant Control Chart(s)

Pimephales promelas **acute survival LC50 Control Chart**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Lower	Source
1	7/12/16-7/14/16	6.06				Aquatic Biosystems
2	8/12/16-8/14/16	7.36	6.71	8.55	4.87	Aquatic Biosystems
3	9/13/16-9/15/16	9.06	7.49	10.50	4.48	Aquatic Biosystems
4	10/19-21/2016	7.994	7.62	10.13	5.11	Aquatic Biosystems
5	11/29/16-12/1/16	8.722	7.84	10.22	5.45	Aquatic Biosystems
6	1/10/17-1/12/17	7.204	7.73	9.93	5.54	Aquatic Biosystems
7	2/7/17-2/9/17	8.071	7.78	9.80	5.76	Aquatic Biosystems
8	3/21/17-3/23/17	8.042	7.81	9.69	5.93	Aquatic Biosystems
9	5/2/17-5/4/17	7.561	7.79	9.55	6.02	Aquatic Biosystems
10	7/12/17-7/14/17	7.005	7.71	9.44	5.97	Aquatic Biosystems
11	8/8/17-8/10/17	8.61	7.79	9.53	6.05	Aquatic Biosystems
12	9/12/17-9/14/14	7.403	7.76	9.43	6.09	Aquatic Biosystems
13	10/24/17-10/26/17	7.867	7.77	9.37	6.17	Aquatic Biosystems
14	11/7/17-11/9/17	7.31	7.73	9.29	6.18	Aquatic Biosystems
15	1/25/18-1/27/18	8.42	7.78	9.32	6.24	Aquatic Biosystems
16	2/6/18-2/8/18	7.678	7.77	9.26	6.28	Aquatic Biosystems
17	3/6/18-3/8/18	6.952	7.72	9.22	6.23	Aquatic Biosystems
18	4/3/18-4/5/18	8.722	7.78	9.31	6.25	Aquatic Biosystems
19	6/5/18-6/7/18	8.819	7.83	9.39	6.28	Aquatic Biosystems
20	7/24/18-7/26/18	8.451	7.87	9.41	6.32	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted.

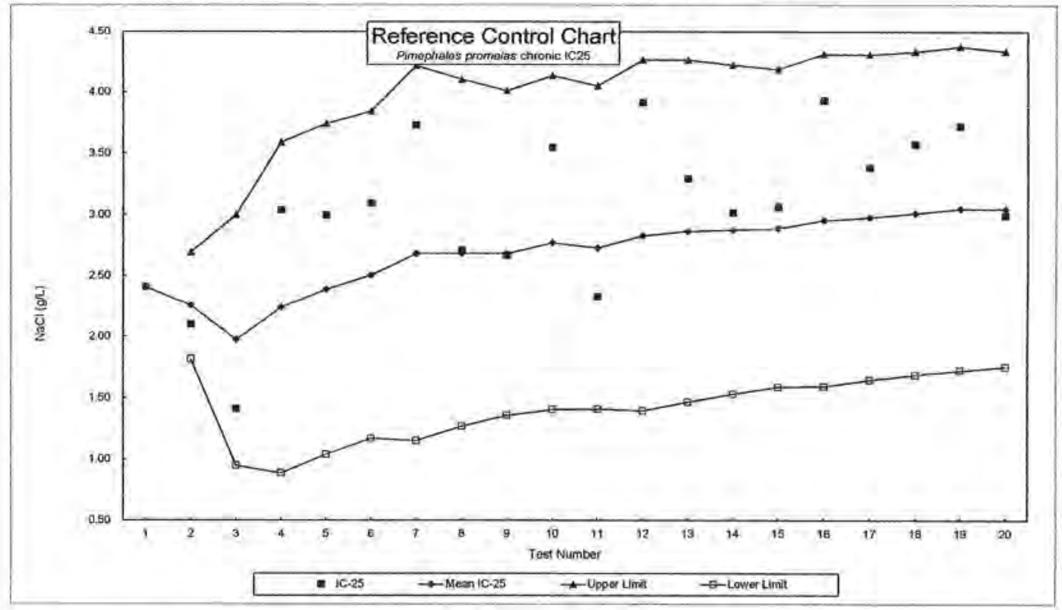


Note: Tests through September of 2016 were as Aquatec Biological Sciences, Inc. SRT tests beginning in October of 2016 were as Aquatec Environmental, Inc.

Pimephales promelas **chronic IC25 Control Chart based on minnow growth**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Lower	CV of Avg. IC25	Avg. CV	Growth PMSD (%)	Avg. PMSD (%)	Source
1	7/12/16-7/19/16	2.41	2.41					15.60	15.60	Aquatic Biosystems
2	8/12/16-8/19/16	2.10	2.26	2.69	1.82	0.10	0.10	11.70	13.65	Aquatic Biosystems
3	9/13/16-9/20/16	1.41	1.97	3.00	0.95	0.26	0.18		11.70	Aquatic Biosystems
4	10/19-26/2016	3.04	2.24	3.59	0.89	0.30	0.22	18.00	15.10	Aquatic Biosystems
5	11/29/16-12/6/16	2.99	2.39	3.74	1.04	0.28	0.24	20.40	16.43	Aquatic Biosystems
6	1/10/17-1/17/17	3.09	2.51	3.84	1.17	0.27	0.24	11.20	15.38	Aquatic Biosystems
7	2/7/17-2/14/17	3.73	2.68	4.21	1.15	0.29	0.25	7.45	14.06	Aquatic Biosystems
8	3/21/17-3/28/17	2.71	2.68	4.10	1.27	0.26	0.25	14.80	14.16	Aquatic Biosystems
9	5/2/14-5/9/17	2.66	2.68	4.01	1.36	0.25	0.25	15.10	14.28	Aquatic Biosystems
10	7/12/17-7/19/17	3.55	2.77	4.13	1.40	0.25	0.25	12.90	14.13	Aquatic Biosystems
11	8/8/17-8/15/17	2.33	2.73	4.05	1.41	0.24	0.25	only 2 reps	12.72	Aquatic Biosystems
12	9/12/17-9/19/17	3.91	2.83	4.26	1.39	0.25	0.25	19.00	13.29	Aquatic Biosystems
13	10/24/17-10/31/17	3.29	2.86	4.26	1.47	0.24	0.25	22.10	14.02	Aquatic Biosystems
14	11/7/17-11/14/17	3.02	2.87	4.22	1.53	0.23	0.25	27.00	15.02	Aquatic Biosystems
15	1/25/18-2/1/18	3.06	2.89	4.19	1.59	0.22	0.25	15.50	15.05	Aquatic Biosystems
16	2/6/18-2/13/18	3.93	2.95	4.31	1.59	0.23	0.25	14.70	15.03	Aquatic Biosystems
17	3/6/18-3/13/18	3.38	2.98	4.31	1.65	0.22	0.24	19.20	15.29	Aquatic Biosystems
18	4/3/18-4/10/18	3.57	3.01	4.33	1.69	0.22	0.24	13.20	15.14	Aquatic Biosystems
19	6/5/18-6/12/18	3.72	3.05	4.37	1.72	0.22	0.24	12.80	15.04	Aquatic Biosystems
20	7/24/18-7/31/18	2.99	3.04	4.33	1.75	0.21	0.24	20.80	15.34	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted. Test of 8/8/17, insufficient minnows for 4 reps. Tested with 2 reps.



Assessment of test precision and sensitivity: The average CVs of IC25 values are within the 25th Percentile (0.21) for fathead minnow growth (Table 3-2, EPA 833-R-00-003) indicating high precision (only 25% of labs reported CVs of not more than 0.21). The per-test PMSD values were less than the EPA upper limit of 30% indicating low-to moderate variability (moderate to high sensitivity) for this method. The cumulative average PMSD value of 20 tests (15.3) was near the EPA lower boundary (12%), indicating high statistical sensitivity for this test method. Updated 08/07/18

Ceriodaphnia dubia
Reference Control Chart for NaCl Acute Toxicity

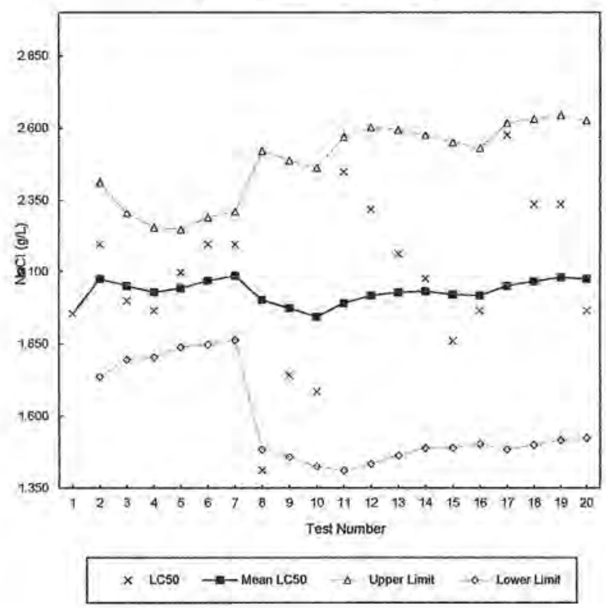
Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower
1	9/20/16-9/22/16	1.956	1.96		
2	10/18/16-10/20/16	2.195	2.08	2.41	1.74
3	11/29/16-12/1/16	2.000	2.05	2.30	1.80
4	1/10/17-1/12/17	1.966	2.03	2.25	1.81
5	2/14/17-2/16/17	2.098	2.04	2.25	1.84
6	3/21/17-3/23/17	2.195	2.07	2.29	1.85
7	5/16/17-5/18/17	2.195	2.09	2.31	1.86
8	7/11/17-7/13/17	1.414	2.00	2.52	1.48
9	8/1/17-8/3/17	1.743	1.97	2.49	1.46
10	9/12/17-9/14/17	1.684	1.94	2.46	1.43
11	9/28/17-9/30/17	2.449	1.99	2.57	1.41
12	10/31/17-11/2/17	2.319	2.02	2.60	1.43
13	11/28/17-11/30/17	2.161	2.03	2.59	1.46
14	1/9/18-1/11/18	2.077	2.03	2.57	1.49
15	2/6/18-2/8/18	1.861	2.02	2.55	1.49
16	3/6/18-3/8/18	1.966	2.02	2.53	1.50
17	4/3/18-4/5/18	2.577	2.05	2.62	1.48
18	5/15/18-5/17/18	2.337	2.07	2.63	1.50
19	6/12/18-6/14/18	2.337	2.08	2.64	1.52
20	7/24/18-7/26/18	1.966	2.07	2.63	1.52

Ceriodaphnia dubia
Reference Control Chart for NaCl Chronic Toxicity based on reproduction

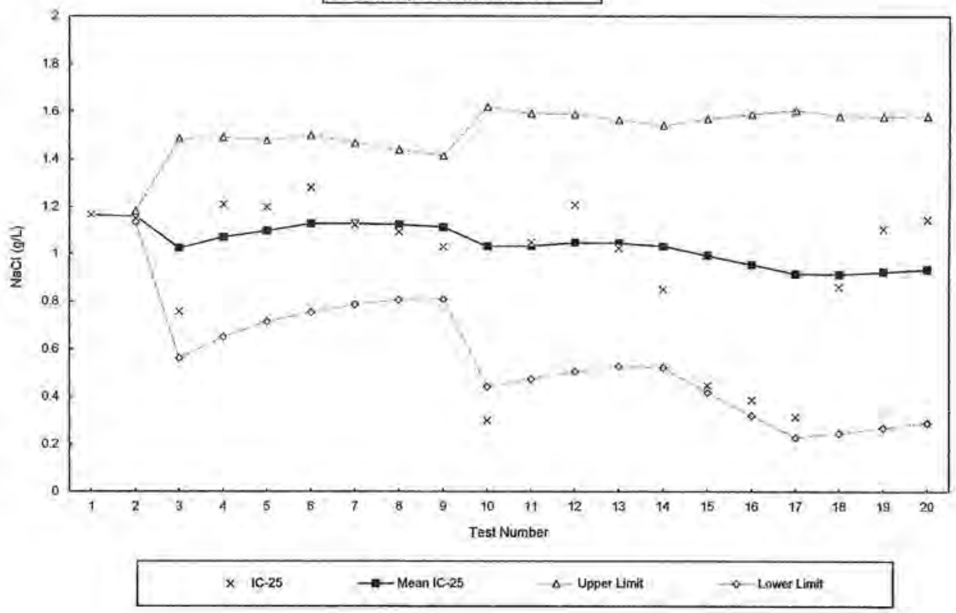
Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Repro. PMSD (%)	Avg. PMSD (%)
1	9/20/16-9/26/16	1.167	1.17					32.6	
2	10/18/19-10/25/16	1.149	1.16	1.18	1.13	0.01	0.01	10.7	32.6
3	11/29/16-12/5/16	0.7583	1.02	1.49	0.56	0.23	0.12	15.8	21.7
4	1/10/17-1/16/17	1.211	1.07	1.49	0.65	0.20	0.14	13.7	19.7
5	2/14/17-2/22/17	1.2	1.10	1.48	0.72	0.17	0.15	33.2	18.2
6	3/21/17-3/28/17	1.282	1.13	1.50	0.75	0.17	0.15	34.9	21.2
7	5/16/17-5/22/17	1.123	1.13	1.47	0.79	0.15	0.15	10.5	23.5
8	7/11/17-7/13/17	1.093	1.12	1.44	0.81	0.14	0.15	6.72	21.6
9	8/1/17-8/7/17	1.03	1.11	1.42	0.81	0.14	0.15	16	19.8
10	9/12/17-9/18/17	0.2996	1.03	1.62	0.44	0.29	0.17	32.1	19.3
11	9/28/17-10/4/17	1.048	1.03	1.59	0.47	0.27	0.18	15.8	20.6
12	10/31/17-11/6/17	1.208	1.05	1.59	0.51	0.26	0.18	9.47	20.2
13	11/28/17-12/4/17	1.023	1.05	1.56	0.53	0.25	0.19	9.72	19.3
14	1/9/18-1/16/18	0.85	1.03	1.54	0.52	0.25	0.19	30.3	18.6
15	2/6/18-2/12/18	0.4474	0.99	1.57	0.42	0.29	0.20	20.6	19.4
16	3/6/18-3/12/18	0.3857	0.95	1.59	0.32	0.33	0.21	13.8	19.5
17	4/3/18-4/10/18	0.315	0.92	1.60	0.23	0.37	0.22	36.3	19.1
18	5/15/18-5/21/18	0.8601	0.91	1.58	0.25	0.37	0.23	17.3	20.1
19	6/12/18-6/18/18	1.105	0.92	1.58	0.27	0.35	0.23	6.82	20.0
20	7/24/18-7/30/19	1.145	0.94	1.58	0.29	0.34	0.24	16.1	19.1

Organisms Sources: Aquatec Biological Sciences, Inc. in-house cultures and Aquatec Environmental, Inc. in-house cultures (beginning in October 2016)

Reference Control Chart
Ceriodaphnia dubia Acute LC50



Reference Control Chart
Ceriodaphnia dubia Chronic IC25



Assessment of test precision and sensitivity: The cumulative average CV of 0.24 for reproduction was near the 50th Percentile (0.27, Table 3-2 of EPA 833-R-00-003) indicating normal (median) variability. The PMSD values were less than the EPA upper limit of 47% indicating acceptable variability (sensitivity) of test data . The cumulative average PMSD values were slightly above EPA lower boundary (13%), indicating high-to-moderate statistical sensitivity for this test method when averaged for the most recent 20 tests. Updated 08/07/18.

\qaqc\srts\Cd SRT including CV and PMSD

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

TOXICITY SUMMARY REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *8/7/2018 3:10:00 PM* ***Test End:*** *8/14/2018 3:10:00 PM*

Number	Sample Name	ACUTE % NOEC	ACUTE % LC50	CHRONIC % NOEC	CHRONIC % LOEC
51048	Keene WWTP (2° Clarifier #2)	100	>100	100	>100

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *8/7/2018 1:00:00 PM* ***Test End:*** *8/13/2018 2:50:00 PM*

Number	Sample Name	ACUTE % NOEC	ACUTE % LC50	CHRONIC % NOEC	CHRONIC % LOEC
51048	Keene WWTP (2° Clarifier #2)	100	>100	100	>100

SAMPLES RECEIVED:

Number	Sample Name	Date Time and Collected	Type
51048	Keene WWTP (2° Clarifier #2)	8/6/2018 7:00:00 AM	Effluent
51049	Ashuelot River	8/6/2018 8:56:00 AM	Receiving
51050	080518-SOFT	8/7/2018 10:45:00 AM	Lab Water
51063	Keene WWTP (2° Clarifier #2)	8/8/2018 6:30:00 AM	Effluent
51064	Ashuelot River	8/8/2018 9:50:00 AM	Receiving
51067	Keene WWTP (2° Clarifier #2)	8/10/2018 6:33:00 AM	Effluent
51068	Ashuelot River	8/10/2018 9:40:00 AM	Receiving

Submitted By:

Wednesday, August 29, 2018
SDG: 15390
Project 18017

Aquatec Environmental, Inc.
Reviewed by: ______ Date: 9/4/18

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY DETAIL REPORT: Sample ID: 51048 / Keene WWTP (2° Clarifier #2)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *8/7/2018 3:10:00 PM* ***Test End:*** *8/14/2018 3:10:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	100	100	100	100	100	100
7	97.5	100	100	100	100	100	100

Response: Growth per Original Number of Larvae (mean dry weight,mg)

	Additional Control	Concentration % 0	12	24	48	50	100
7	0.646	0.625	0.655	0.682	0.676	0.689	0.701

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *8/7/2018 1:00:00 PM* ***Test End:*** *8/13/2018 2:50:00 PM*

Response: Survival (%)

Day	Additional Control	Concentration % 0	12	24	48	50	100
2	100	100	100	100	100	100	100
6	100	100	100	100	100	100	100

Response: Reproduction (mean neonates per female)

	Additional Control	Concentration % 0	12	24	48	50	100
6	29.6	38.44	40.5	42	38.9	40.6	38.5

Submitted By:

Wednesday, August 29, 2018
SDG: 15390
Project 18017

Aquatec Environmental, Inc.
Reviewed by: JV Date: 9/4/18

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: 8/7/2018 3:10:00 PM **Test End:** 8/14/2018 3:10:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	51048	100	100
7	51048	100	97.5

Response: Growth per Original Number of Larvae (mean dry weight, mg)

Day	Sample ID	Dilution Control	Additional Control
7	51048	0.625	0.646

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 11.4% **PMSD Criteria Range:** 12%-30%

The calculated test PMSD was less than the lower bound indicating test data with low variability and high statistical sensitivity. In determining the C-NOEC, C-LOEC, test concentrations were not considered toxic if the relative difference from the control was less than the lower PMSD bounds.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, there were no special conditions or qualifiers that relate to the samples in this report with the following exceptions:

Soft water was used as dilution water and statistical control. Receiving water (Ashuelot River) was the additional control.

The ambient temperature (temperature blank) of the third cooler (received on August 11, 2018) was 8.5°C which was above the target range of 0-6°C.

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: 8/7/2018 1:00:00 PM **Test End:** 8/13/2018 2:50:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	51048	100	100
6	51048	100	100

Response: Reproduction (mean neonates per female)

Day	Sample ID	Dilution Control	Additional Control
6	51048	38.4	29.6

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 10.7% **PMSD Criteria Range:** 13%-47%

The calculated test PMSD was less than the lower bound indicating test data with low variability and high statistical sensitivity. In determining the C-NOEC, C-LOEC, test concentrations were not considered toxic if the relative difference from the control was less than the lower PMSD bounds.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, there were no special conditions or qualifiers that relate to the samples in this report with the following exceptions:

Soft water was used as dilution water and statistical control. Receiving water (Ashuelot River) was the additional control.

The ambient temperature (temperature blank) of the third cooler (received on August 11, 2018) was 8.5°C which was above the target range of 0-6°C.

An accidental mortality of one of the parent organisms in the Laboratory Control replicates occurred on Day 2. The survival and reproduction data for this organism was excluded from data tabulations and statistical analysis.

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

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WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION:

The results reported relate only to the the samples submitted as received.

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 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: September 9, 2018
(Date)

(Authorized signature)

John Williams
Director
Aquatec Environmental, Inc.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
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Swanzey, NH 03446

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Client ID: Keene/Ley

Permit No. NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *8/7/2018 3:10:00 PM* ***Test End:*** *8/14/2018 3:10:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Pimephales promelas*	Effluent	Composite

Dilution Water:	Soft Water
Additional Control:	Ashuelot River
Effluent Sampling Dates:	August 6, 8, & 10, 2018
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)
Effluent Salinity Adjusted?	No If yes, to what value?
With Sea Salts?	Hypersaline Brine Solution?
Reference Toxicant Date:	August 14-21, 2018
Reference Toxicant Test Acceptable?	Yes
Age and Age Range of Test Organisms:	1-day old
Source of Organisms:	Aquatic BioSystems - Fort Collins, CO

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *8/7/2018 3:10:00 PM* ***Test End:*** *8/14/2018 3:10:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Growth: 0.625 (mg)

B. Additional Control: Ashuelot River
Mean Control Survival: 97.5 % Mean Control Growth: 0.646 (mg)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Growth (%): 11.4

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Dunnett Multiple Comparison Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *8/7/2018 3:10:00 PM* ***Test End:*** *8/14/2018 3:10:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was below the boundaries of 12%-30%, indicating test data with low variability and high statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or growth were not detected.

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273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test
Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *8/7/2018 1:00:00 PM* ***Test End:*** *8/13/2018 2:50:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Ceriodaphnia dubia*	Effluent	Composite

Dilution Water:	Soft Water
Additional Control:	Ashuelot River
Effluent Sampling Dates:	August 6, 8, & 10, 2018
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)
Effluent Salinity Adjusted?	No If yes, to what value?
With Sea Salts?	Hypersaline Brine Solution?
Reference Toxicant Date:	August 14-20, 2018
Reference Toxicant Test Acceptable?	Yes
Age and Age Range of Test Organisms:	<24h collected within an 8h period
Source of Organisms:	Aquatec Environmental, Inc. - Williston, VT

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273 Commerce Street
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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test
Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *8/7/2018 1:00:00 PM* ***Test End:*** *8/13/2018 2:50:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Reproduction: 38.44 (neonates)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Reproduction: 29.6 (neonates)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Reproduction (%): 10.7

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Fisher Exact/Bonferroni-Holm Test, Linear Interpolation (ICPIN), Wilcoxon Rank Sum Two-Sample Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

Aquatec Environmental, Inc.
Reviewed by: JL Date: 9/4/18.

SDG: 15390
Project 18017

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Williston, VT 05495
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City of Keene NH
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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *8/7/2018 1:00:00 PM* ***Test End:*** *8/13/2018 2:50:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was below the boundaries of 13%-47%, indicating test data with low variability and high statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or reproduction were not detected.

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT: Keene NH NPDES
273 Commerce St	101170	WORK ORDER: **1808-19506**
Williston, VT 05495		DATE RECEIVED: August 07, 2018
		DATE REPORTED: August 29, 2018
Atten: John Williams		SAMPLER: BB/MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and “N” the Plattsburgh, NY lab under certification ELAP 11892. “Sub” indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. “A” indicates the referenced laboratory is NELAC accredited for the parameter reported. “N” indicates the laboratory is not accredited. “U” indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an “A” meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 08/29/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1808-19506**
PROJECT: Keene NH NPDES DATE RECEIVED: 08/07/2018

001 Site: Keene WWTP Composite Date Sampled: 8/6/18 Time: 7:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	5.1	mg/L	SM 5310C (00)	8/10/18	N JGM	A	
Total Hardness, Total as CaCO3	67	mg/L	EPA 200.7	8/27/18	W FAA	A	
Ammonia as N	0.11	mg/L	EPA 350.1, R.2	8/13/18	N JGM	A	
Solids, Total Dissolved	437	mg/L	SM 2540C-97	8/8/18	W JSS	A	
Total Solids	19	mg/L	SM 2540 B.-97	8/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	8/20/18	W SJM	A	
Aluminum, Total	0.048	mg/L	EPA 200.8	8/21/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	8/21/18	W SJM	A	
Calcium, Total	22	mg/L	EPA 200.7	8/27/18	W FAA	A	
Copper, Total	0.0065	mg/L	EPA 200.8	8/21/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	8/21/18	W SJM	A	
Magnesium, Total	2.9	mg/L	EPA 200.7	8/27/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	8/21/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	

002 Site: (51049) Ashuelot River Grab Date Sampled: 8/6/18 Time: 8:56

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	8.2	mg/L	SM 5310C (00)	8/10/18	N JGM	A	
Total Hardness, Total as CaCO3	8	mg/L	EPA 200.7	8/23/18	W FAA	A	
Ammonia as N	0.09	mg/L	EPA 350.1, R.2	8/13/18	N JGM	A	
Metals Digestion	Digested		EPA 200.7/200.8	8/20/18	W SJM	A	
Aluminum, Total	0.21	mg/L	EPA 200.8	8/21/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	8/21/18	W SJM	A	
Calcium, Total	2.2	mg/L	EPA 200.7	8/23/18	W FAA	A	
Copper, Total	0.0022	mg/L	EPA 200.8	8/21/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	8/21/18	W SJM	A	
Magnesium, Total	0.57	mg/L	EPA 200.7	8/23/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	8/21/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB/MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2 Clarifier	**08/06/18**	**7:00**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2
			Total Solids/Total Dissolved Solids	1/2gal	Plastic	ice (4C)	1
Ashuelot River (51049)	**08/06/18**	**8:56**	Grab: **X** Composite: **N/A**				
			Ammonia (0.1) TOC per JW phone call	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
Ellen Bouffard	8/7/18	15:20	Eileen Toomey	8/7	1520	Cooler/Sample Temp.: 5.6 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1808-19506

1808-19506
Aquatec Environmental, Inc
Keene NH NPDES

Page 1 of 1

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc 273 Commerce St 101170 Williston, VT 05495 Atten: John Williams	PROJECT: Keene NH NPDES WORK ORDER: **1808-19921** DATE RECEIVED: August 09, 2018 DATE REPORTED: August 22, 2018 SAMPLER: MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 08/22/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1808-19921**
PROJECT: Keene NH NPDES DATE RECEIVED: 08/09/2018

001 Site: 51063 Keene WWTP 2 Clarifier Composite Date Sampled: 8/8/18 Time: 6:30

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.55	mg/L	EPA 350.1, R.2	8/21/18	N CAL	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	Project Name:	Keene NH NPDES
Address:	273 Commerce Street	Project Number:	18017
City/State/Zip:	Williston, VT 05403	Sampler Name(s):	MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2 Clarifier	08/08/18	6:30	Grab: N/A Composite: X				
51063			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
Ellen Bouffard	8/9/18	11:35	Eileen Twomey	8/9/18	11:35	Cooler/Sample Temp.: 3.7 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1808-19921

1808-19921
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1808-20446**
Williston, VT 05495	DATE RECEIVED: August 14, 2018
	DATE REPORTED: September 10, 2018
Atten: John Williams	SAMPLER: BB,MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 09/10/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1808-20446**
PROJECT: Keene NH NPDES DATE RECEIVED: 08/14/2018

001 Site: 51067 Keene WWTP 2 Clairifier Composite Date Sampled: 8/10/18 Time: 6:33

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	1.1	mg/L	EPA 350.1, R.2	9/7/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	BB; MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2° Clarifier	**08/10/18**	**6:33**	Grab: **N/A** Composite: **X**				
51067			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	Cooler/Sample Temp.: 2.5
	8/14/18	15:45	Toomey	8/14	1549	Notes To Lab: Temperature out of range (1-6°C) 8.5°C.
Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	

1808-20446

1808-20446
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc		PROJECT:	Tox Lab QC
273 Commerce St	101170	WORK ORDER:	**1808-19923**
Williston, VT 05495		DATE RECEIVED:	August 09, 2018
		DATE REPORTED:	August 29, 2018
Atten: John Williams		SAMPLER:	EB

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 08/29/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1808-19923**
PROJECT: Tox Lab QC DATE RECEIVED: 08/09/2018

001 Site: (51058) 080518 Soft Date Sampled: 8/7/18 Time: 16:20

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	< 0.5	mg/L	SM 5310C (00)	8/16/18	N CAL	A	
Total Hardness, Total as CaCO3	53	mg/L	EPA 200.7	8/27/18	W FAA	A	
Ammonia as N	< 0.05	mg/L	EPA 350.1, R.2	8/21/18	N CAL	A	
Solids, Total Dissolved	111	mg/L	SM 2540C-97	8/10/18	W JSS	A	
Total Solids	94	mg/L	SM 2540 B.-97	8/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	8/20/18	W SJM	A	
Aluminum, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	8/21/18	W SJM	A	
Calcium, Total	10	mg/L	EPA 200.7	8/27/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	8/21/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	8/21/18	W SJM	A	
Magnesium, Total	6.8	mg/L	EPA 200.7	8/27/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	8/21/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Tox Lab QC
Address:	273 Commerce Street	**Project Number:**	18000
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	EB
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
080518SOFT (51058)	**08/07/18**	**16:20**	Grab: **X** Composite: **N/A**				
			Ammonia-Nitrogen(0.1)	250mL	Plastic	H2SO4	1
			Metals: Al (0.02); Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Ca, Mg (0.05)	250mL	Plastic	HNO3	1
			TOC - Total Organic Carbon(0.5)	40mL	Glass	H2SO4	2
			TS/TDS-Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice(4C)	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
Ellen Bouffard	8/9/18	11:35	Eileen Toomey	8/9	11:35	Cooler/Sample Temp.: 3.7 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1808-19923

1808-19923
Aquatec Environmental, Inc
Tox Lab QC

Supportive Documentation

Chain-Of-Custody

Toxicity Test Methods

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

Standard Reference Toxicant Control Charts

Chain-Of-Custody(s)

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 – 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Keene, NH	Project:	Keene NH/Ley
Address:	420 Airport Road		(1st Sample Ship Monday)
	Swanzey, NH 03446	Project #:	18017
Tel:	(603) 357 – 9836 [x6502]	Samplers Name(s):	Bob Bishop
Contact:	Mary Ley		Mike Mortell
E-mail:	mley@ci.keene.nh.us	Permit Number:	NH0100790

Comp 8/5-8/6

Sample Identification	Final Collection Date	Final Collection Time	Grab	Composite	Matrix	Tox: 1 Gallon | Plastic | 4°C	Metals: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	Ammonia: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
						Number of Containers							
Keene WWTP (2° Clarifier #2)	8/6/18	700		X	Effluent	2	1	1	1	1	2		
Ashuelot River	8/6/18	856	X		Receiving	1	1			1	2		

Analysis (Test/Detection limits) – Tox: 1000.0 & 1002.0 (*P. promelas* & *C. dubia* chronic toxicity; %) – **Metals:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **Ammonia:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

Relinquished by: (Signature)	Date:	Time:	Received by: (Signature or carrier)
Mary L	8/6/18	915	Priority Express
Relinquished by: (Signature or carrier)	**Date:**	**Time:**	**Received by:** (Signature)
Priority Express	8/7/18	10:00	KW Aquatec Env
Relinquished by: (Signature)	**Date:**	**Time:**	**Received by:** (Signature)

Temperature on Delivery (°C): 2.4°C

Notes: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

Sample Acceptance Policy: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(2nd Sample Ship Wednesday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Mike Martell
CONTACT:	Mary Ley		
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/ PRESERVATIVE — NUMBER OF CONTAINERS

8/7-8/8

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Keene WWTP (2° Clarifier #2)	8/8/18	630		X	Effluent	2	1*	1		1			
Ashuelot River	8/8/18	0950	X		Receiving	1							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (*P. promelas* and *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
[signature]	8/8/18	1005	Priority Express
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)
Priority Express	8/9/18	9:50	[signature]
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 1.4°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Metals analysis only if ≥50% mortality.

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

Aquatec Environmental, Inc.

Chain-of-Custody

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(3rd Sample Ship Friday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bishop
CONTACT:	Mary Ley		Mike Markell
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/ PRESERVATIVE — NUMBER OF CONTAINERS

WET 8-9/8-10

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Keene WWTP (2° Clarifier #2)	8/10/18	633		X	Effluent	3	1*	1		1			
Ashuelot River	8/10/18	940	X		Receiving	2							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (*P. promelas* and *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary L	8/10/18	1000	Priority Express
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY: (Signature)**
Priority Express	8/11/18	0835	[signature]
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY: (Signature)**

TEMPERATURE ON DELIVERY (°C): 8.5°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Metals analysis of renewal samples only if ≥50% mortality.

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

SAMPLE PREPARATION:

	Initial Sample		Second Sample		Third Sample		
	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	LAB CONTROL
Sample No.	51048	51049	51063	51064	51067	51068	51050
Filtration	60 Micron	60 Micron	60 Micron	60 Micron	60 Micron ✓	60 Micron ✓	N / A
Chlorine (1)	ND	—	ND	—	ND	/	N / A
Chlorine (2)	—	—	—	—	/	/	N / A
NaThio Lot No.	—	—	—	—	/	/	N / A
Original / Final Salinity:	N / A	N / A	N / A	N / A	N / A	N / A	N / A
FF Lot No.	N / A	N / A	N / A	N / A	N / A	N / A	N / A
Date / Initials:	8/7/18 KN	8/7/18 KN	8/9/18 KN	8/9/18 KN	8.11.18 KP	→	8/7/18 KN

(1) Record vol. 0.025 N sodium thiosulfate to dechlorinate 100mL sample or record "ND" (Not Detected)

(2) Dechlorination required if detected. Record vol. 0.25 N sodium thiosulfate added per gallon effluent.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

ALKALINITY, HARDNESS, AND TRC REPORT:

Sample ID:	Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)	TRC: (mg/L)
51048 - Keene WWTP (2° Clarifier #2)	8/7/2018	48.0	64.0	0.00
51049 - Ashuelot River	8/7/2018	8.0	14.0	---
51050 - 080518-SOFT	8/7/2018	40.0	54.0	---
51063 - Keene WWTP (2° Clarifier #2)	8/9/2018	136.0	68.0	0.05
51064 - Ashuelot River	8/9/2018	20.0	18.0	---
51067 - Keene WWTP (2° Clarifier #2)	8/11/2018	68.0	68.0	0.00
51068 - Ashuelot River	8/11/2018	12.0	10.0	---

INF: Interference. The color endpoint was reached immediately

Aquatec Environmental, Inc.
Reviewed by: ___Ow___ Date: ___9/4/18___

SDG: 15390
Project 18017

Toxicity Test Method(s)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25+/- 1C, Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s (50-100ft-c) (ambient laboratory levels)
5	Photoperiod:	16h light/8h dark
6	Test chamber size:	300mL
7	Test solution volume:	Nominal 250mL
8	Test solution renewal:	Daily
9	Age of test organisms:	Newly hatched larvae less than 24h old. If shipped, not more than 48h old, 24h range in age
10	No. larvae per test chamber:	10
11	No. replicate chambers per concentration:	4
12	No. larvae per concentration:	40
13	Source of food:	Newly hatched Artemia nauplii (< 24h old)
14	Feeding regime:	On days 0-6, feed 0.1g newly hatched (less than 24h old) brine shrimp nauplii three times daily at 4h intervals or, as a minimum, 0.15g twice daily at 6h intervals. Sufficient nauplii are added to provide an excess.
15	Cleaning:	Siphon daily, immediately before test solution renewal
16	Aeration:	None: unless DO concentration falls below 4.0mg/L.
17	Dilution water:	Soft Water
18	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
19	Additional control:	Ashuelot River
20	Test duration:	7 days
21	Endpoints:	Survival and growth (weight)
22	Test acceptability criteria:	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25mg
23	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
24	Sample volume required:	2.5L/day

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25 +/- 1C; Test temperatures must not deviate (i.e. maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s or 50-100ft-c (ambient laboratory levels)
5	Photoperiod:	16h light, 8h dark
6	Test chamber size:	30mL
7	Test solution volume	Nominal 15mL
8	renewal of test solutions:	Daily
9	Age of test organisms:	Less than 24h; and all released within a 8h period
10	No. neonates per test chamber:	1
11	No. replicate test chambers per concentration:	10
12	No. neonates per test concentration:	10
13	Feeding regime:	Feed 0.1mL each of YCT and algal suspension per test chamber daily
14	Cleaning:	Use new plastic cups daily
15	Aeration:	None
16	Dilution water:	Soft Water
17	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
18	Additional control:	Ashuelot River
19	Test duration:	Until 60% or more of surviving control females have three broods (maximum test duration 8 days)
20	Endpoints:	Survival and reproduction
21	Test acceptability criteria:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods
22	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
23	Sample volume required:	1L/day

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

CETIS Summary Report

Report Date:	29 Aug-18 11:50 (p 1 of 1)
Test Code:	81463 | 14-2513-8174

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Batch ID:	12-2030-0203	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Kaitlyn Priest
Start Date:	07 Aug-18 15:10	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	14 Aug-18 15:10	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	7d 0h	**Source:**	Aquatic Biosystems, CO	**Age:**	1d

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
09-1941-8578	2d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	n/a
08-6450-5659	7d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	n/a
17-4172-2926	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test	100	> 100	n/a	1	11.4%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
13-1616-5088	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
01-8806-3816	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	-2.56%

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.6457	0.6075	0.684	0.619	0.676	0.01202	0.02405	3.72%	0.00%
0	L	4	0.6247	0.583	0.6665	0.591	0.655	0.0131	0.02621	4.20%	3.25%
12		4	0.6552	0.6014	0.7091	0.628	0.703	0.01691	0.03383	5.16%	-1.47%
24		4	0.6823	0.5846	0.7799	0.63	0.751	0.03067	0.06135	8.99%	-5.65%
48		4	0.6755	0.5878	0.7632	0.604	0.73	0.02755	0.0551	8.16%	-4.61%
50		4	0.6893	0.6483	0.7302	0.659	0.718	0.01286	0.02572	3.73%	-6.74%
100		4	0.701	0.6471	0.7549	0.653	0.731	0.01693	0.03385	4.83%	-8.56%

CETIS Analytical Report

Report Date:	29 Aug-18 11:50 (p 1 of 2)
Test Code:	81463 | 14-2513-8174

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	13-1616-5088	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:49	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1443544	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

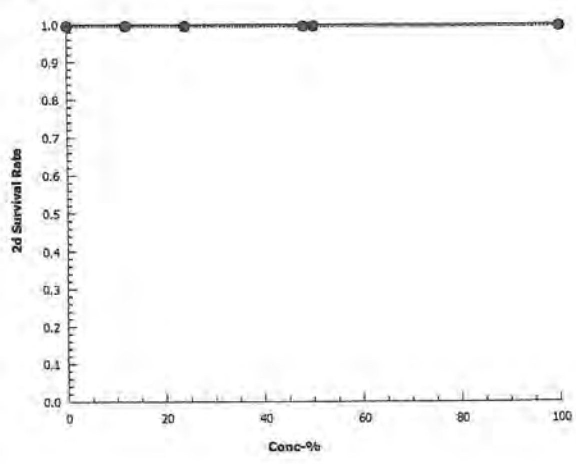
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
12		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
24		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
48		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
50		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
100		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	01-8806-3816	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:49	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	843006	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

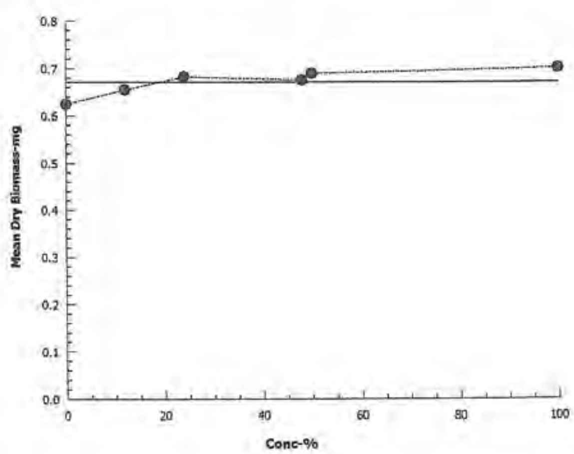
Mean Dry Biomass-mg Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	4	0.6247	0.591	0.655	0.0131	0.02621	4.20%	0.0%
12		4	0.6552	0.628	0.703	0.01691	0.03383	5.16%	-4.88%
24		4	0.6823	0.63	0.751	0.03067	0.06135	8.99%	-9.2%
48		4	0.6755	0.604	0.73	0.02755	0.0551	8.16%	-8.12%
50		4	0.6893	0.659	0.718	0.01286	0.02572	3.73%	-10.32%
100		4	0.701	0.653	0.731	0.01693	0.03385	4.83%	-12.2%

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.591	0.627	0.626	0.655
12		0.655	0.703	0.635	0.628
24		0.751	0.631	0.63	0.717
48		0.73	0.663	0.705	0.604
50		0.679	0.718	0.701	0.659
100		0.653	0.704	0.731	0.716

Graphics



CETIS Analytical Report

Report Date:	29 Aug-18 11:49 (p 1 of 6)
Test Code:	81463 | 14-2513-8174

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	09-1941-8578	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:49	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Angular (Corrected)	C > T	100	> 100	n/a	1

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		48	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		100	18	10	1	6	Asymp	0.8333	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	5	65540	<1.0E-37	Significant Effect
Error	0	0	18			
Total	0		23			

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
48		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

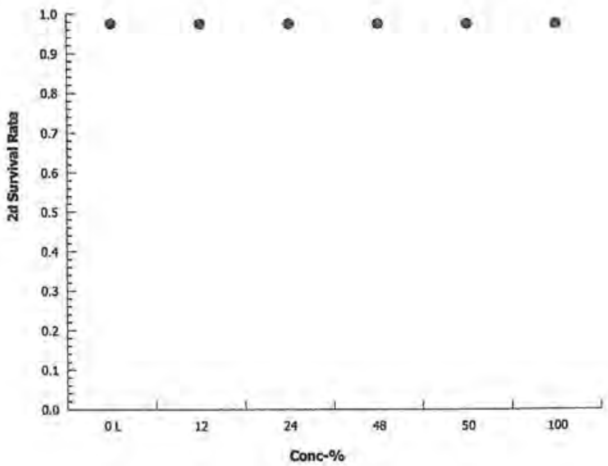
Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

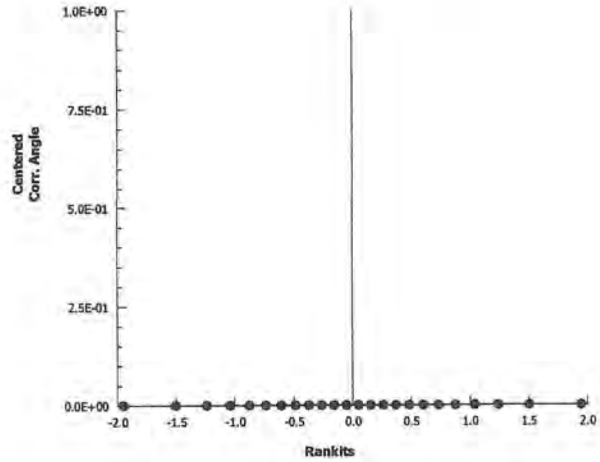
Analysis ID:	09-1941-8578	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:49	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.412	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID: 08-6450-5659 **Endpoint:** 7d Survival Rate **CETIS Version:** CETISv1.9.2
Analyzed: 29 Aug-18 11:49 **Analysis:** Nonparametric-Control vs Treatments **Official Results:** Yes

Sample ID: 03-3867-3810 **Code:** 15390 **Client:** Keene WWTP
Sample Date: 06 Aug-18 07:00 **Material:** POTW Effluent **Project:** Special Studies
Receipt Date: 07 Aug-18 10:00 **Source:** Permit # NH0100790 (KEENE NH)
Sample Age: 32h **Station:** Keene WWTP

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Angular (Corrected)	C > T	100	> 100	n/a	1

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		48	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		100	18	10	1	6	Asymp	0.8333	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	5	65540	<1.0E-37	Significant Effect
Error	0	0	18			
Total	0		23			

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
48		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

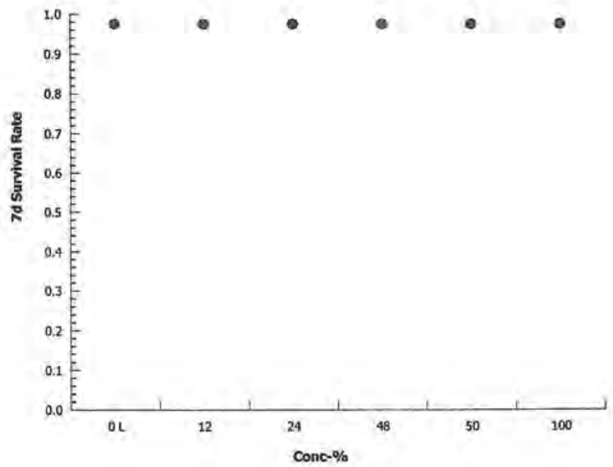
Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

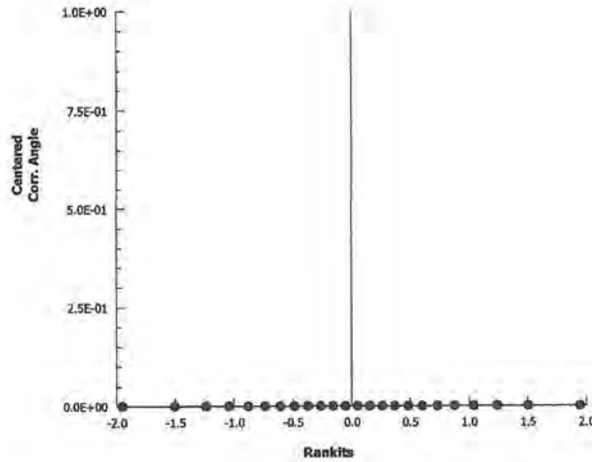
Analysis ID:	08-6450-5659	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:49	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.412	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	17-4172-2926	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:49	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	32h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	11.36%

Dunnett Multiple Comparison Test

Control vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	-1.034	2.407	0.071	6	CDF	0.9843	Non-Significant Effect
	24	-1.95	2.407	0.071	6	CDF	0.9990	Non-Significant Effect
	48	-1.721	2.407	0.071	6	CDF	0.9979	Non-Significant Effect
	50	-2.187	2.407	0.071	6	CDF	0.9995	Non-Significant Effect
	100	-2.585	2.407	0.071	6	CDF	0.9999	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0150654	0.0030131	5	1.732	0.1783	Non-Significant Effect
Error	0.031316	0.0017398	18			
Total	0.0463814		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	3.729	15.09	0.5890	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9799	0.884	0.8942	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.6247	0.583	0.6665	0.6265	0.591	0.655	0.0131	4.20%	0.00%
12		4	0.6552	0.6014	0.7091	0.645	0.628	0.703	0.01691	5.16%	-4.88%
24		4	0.6823	0.5846	0.7799	0.674	0.63	0.751	0.03067	8.99%	-9.20%
48		4	0.6755	0.5878	0.7632	0.684	0.604	0.73	0.02755	8.16%	-8.12%
50		4	0.6893	0.6483	0.7302	0.69	0.659	0.718	0.01286	3.73%	-10.32%
100		4	0.701	0.6471	0.7549	0.71	0.653	0.731	0.01693	4.83%	-12.20%

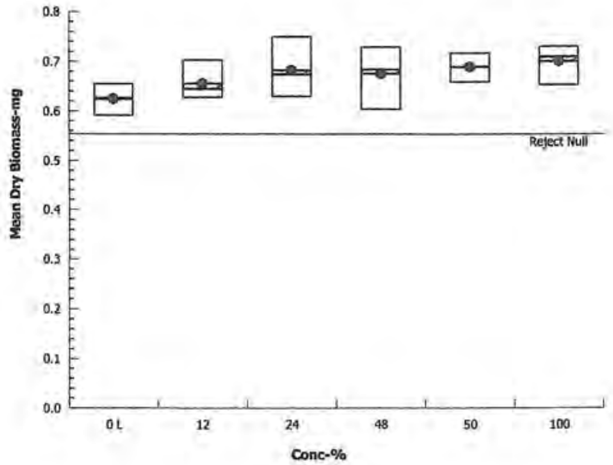
Mean Dry Biomass-mg Detail

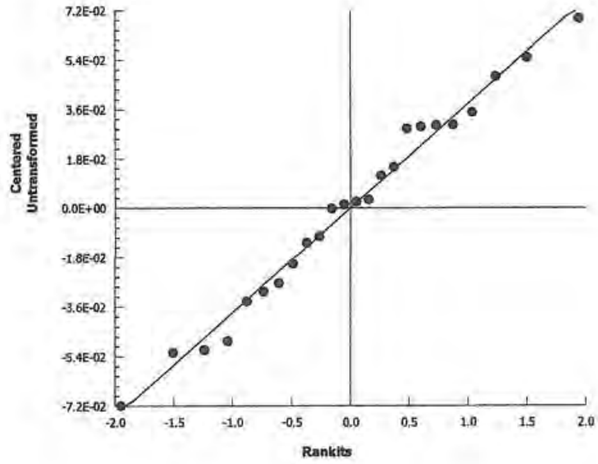
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.591	0.627	0.626	0.655
12		0.655	0.703	0.635	0.628
24		0.751	0.631	0.63	0.717
48		0.73	0.663	0.705	0.604
50		0.679	0.718	0.701	0.659
100		0.653	0.704	0.731	0.716

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	17-4172-2926	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:49	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Test Data Worksheet

Report Date: 29 Aug-18 11:49 (p 1 of 1)
Test Code/ID: 14-2513-8174/81463

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Start Date: 07 Aug-18 15:10 **Species:** Pimephales promelas **Sample Code:** 15390
End Date: 14 Aug-18 15:10 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 06 Aug-18 07:00 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Total Weight-mg	Tare Weight-mg	Pan Count	Notes
0	L	1	2	10		10					10	29.39	23.48	10	
0	L	2	11	10		10					10	26.97	20.7	10	
0	L	3	12	10		10					10	27.96	21.7	10	
0	L	4	22	10		10					10	28.25	21.7	10	
0	R	1	3	10		10					9	26.97	20.78	9	
0	R	2	15	10		10					10	27.84	21.08	10	
0	R	3	24	10		10					10	27.38	21.01	10	
0	R	4	17	10		10					10	27.5	20.99	10	
12		1	14	10		10					10	27.78	21.23	10	
12		2	16	10		10					10	31.32	24.29	10	
12		3	13	10		10					10	29.55	23.2	10	
12		4	6	10		10					10	27.68	21.4	10	
24		1	10	10		10					10	31.04	23.53	10	
24		2	8	10		10					10	27.76	21.45	10	
24		3	28	10		10					10	27.68	21.38	10	
24		4	25	10		10					10	29.05	21.88	10	
48		1	18	10		10					10	28.56	21.26	10	
48		2	4	10		10					10	27.67	21.04	10	
48		3	7	10		10					10	28.06	21.01	10	
48		4	1	10		10					10	27.22	21.18	10	
50		1	27	10		10					10	28.12	21.33	10	
50		2	21	10		10					10	28.1	20.92	10	
50		3	20	10		10					10	27.33	20.32	10	
50		4	19	10		10					10	27.14	20.55	10	
100		1	26	10		10					10	27.97	21.44	10	
100		2	5	10		10					10	27.61	20.57	10	
100		3	9	10		10					10	29.04	21.73	10	
100		4	23	10		10					10	28.44	21.28	10	

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81463

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. weighed [1]	Initial Pan Weight	Final Pan Weight
DW 0 % Soft CTRL	A	10	10	10	10	10	10	10	10	10	23.48	29.39
	B	10	10	10	10	10	10	10	10	10	20.70	26.97
	C	10	10	10	10	10	10	10	10	10	21.70	27.96
	D	10	10	10	10	10	10	10	10	10	21.70	28.25
0 % RW	A	10	10	10	10	9	9	9	9	9	20.78	26.97
	B	10	10	10	10	10	10	10	10	10	21.08	27.84
	C	10	10	10	10	10	10	10	10	10	21.01	27.38
	D	10	10	10	10	10	10	10	10	10	20.99	27.50
12 % EFF	A	10	10	10	10	10	10	10	10	10	21.23	27.78
	B	10	10	10	10	10	10	10	10	10	② 24.92	31.32
	C	10	10	10	10	10	10	10	10	10	23.20	29.55
	D	10	10	10	10	10	10	10	10	10	21.40	27.68
24 % EFF	A	10	10	10	10	10	10	10	10	10	23.53	③ 31.04
	B	10	10	10	10	10	10	10	10	10	21.45	27.76
	C	10	10	10	10	10	10	10	10	10	21.38	27.68
	D	10	10	10	10	10	10	10	10	10	21.88	29.05
48 % EFF	A	10	10	10	10	10	10	10	10	10	21.26	28.56
	B	10	10	10	10	10	10	10	10	10	21.04	27.67
	C	10	10	10	10	10	10	10	10	10	21.01	28.06
	D	10	10	10	10	10	10	10	10	10	21.18	27.22
50 % EFF	A	10	10	10	10	10	10	10	10	10	21.33	28.12
	B	10	10	10	10	10	10	10	10	10	20.92	28.10
	C	10	10 ~~9~~ 0	10	10	10	10	10	10	10	20.32	27.33
	D	10	10	10	10	10	10	10	10	10	20.55	27.14
100 % EFF	A	10	10	10	10	10	10	10	10	10	21.44	27.97
	B	10	10	10	10	10	10	10	10	10	20.57	27.61
	C	10	10	10	10	10	10	10	10	10	21.73	29.04
	D	10	10	10	10	10	10	10	10	10	21.28	28.44

Sample #	51048	51048	51063	51063	51067	51067	51067	Test End
Fed AM / Init.	------	815	800	815	0845 KP	0935 EB	840	------
Fed PM / Init.	1545	1550	1530	1445	1630 KP	1900 EB	1640	------
Renewal (D / T / I)	8/7/18 1510 KN	8/8/18 1520 KN	8/9/18 1505 KN	8/10/18 1410 KN	8.11.18 1435 KP	8-12-18 1820 EB	8/13/18 1615 KN	8/14/18 1510 KN

Date/Init (Initial Pan Weights): 8/9/18 KN

IN (Date/Time/Temp/Init): 8/14/18 15:10 97°C KN

OUT (Date/Time/Temp/Init): 8/15/18 840 95°C KN

Brine Shrimp Lot #: 211132-Brine

① organism alive KN 8/8/18
② Recording error KN 8/9/18
③ Recording error KN 8/15/18

Pp

1 The number weighed = the number actually weighed. For statistical purposes, the number weighed = original number of organisms on Day 0.

Aquatec Environmental, Inc.

Reviewed by: EB Date: 8/30/18

SDG: 15390

Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81463

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % Soft CTRL	pH	7.3	7.1	7.2	7.2	7.2	7.3	7.0
	DO	7.5	8.3	7.6	7.3	8.1	7.9	7.9
	Temp.	25.5	25.3	25.1	24.9	25.~~9~~4 KP	25.1	25.6
	Cond.	187	188	181	182	167	164	177
0 % RW	pH	7.3	7.1	7.1	7.2	7.5	7.2	7.1
	DO	8.2	8.3	7.7	7.6	7.7	7.9	7.9
	Temp.	25.5	25.6	25.5	25.3	24.9	25.3	25.3
	Cond.	57	56	79	79	101	97	99
12 % EFF	pH	7.4	7.3	7.5	7.6	7.1	7.6	7.3
	DO	7.8	8.3	7.6	7.4	7.9	7.9	7.9
	Temp.	25.5	25.3	25.1	25.1	25.5	25.2	25.5
	Cond.	266	270	305	297	271	266	282
24 % EFF	pH	7.4	7.4	7.7	7.7	7.2	7.6	7.3
	DO	7.8	8.3	7.6	7.4	8.0	7.9	7.8
	Temp.	25.5	25.3	25.0	25.1	25.6	25.1	25.5
	Cond.	345	349	409	410	374	368	382
48 % EFF	pH	7.4	7.4	7.8	8.0	7.2	7.8	7.3
	DO	7.8	8.2	7.5	7.4	7.9	7.9	7.7
	Temp.	25.6	25.3	24.9	25.1	25.7	25.1	25.4
	Cond.	504	500	629	633	575	567	571
50 % EFF	pH	7.4	7.5	7.9	8.0	7.3	7.9	7.4
	DO	7.8	8.2	7.6	7.4	7.9	7.9	7.8
	Temp.	25.6	25.3	24.9	25.1	25.8	25.1	25.4
	Cond.	525	513	648	657	597	583	594
100 % EFF	pH	7.3	7.5	8.0	8.1	7.4	8.0	7.4
	DO	7.9	8.2	7.6	7.5	7.7	7.9	7.8
	Temp.	26.0	25.4	24.7	25.3	25.9	25.2	25.2
	Cond.	824	820	1085	1103	1014	973	986
	Sample #	51048	51048	51063	51063	51067	51067	51067
	Date	8/7/18	8/8/18	8/9/18	8/10/18	8.11.18	8-12-18	8/13/18
	Initials	KN	KN	KN	KN	KP	EB	KN

Pp

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81463

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.2	7.3	7.1	7.1	7.2	6.8	6.9
	DO	6.9	6.3	6.2	6.9	6.4	5.7	6.3
	Temp.	25.4	25.0	25.4	25.5	25.9	25.4	25.4
	Cond.	195	189	189	177	177	174	193
0 % RW	pH	7.4	7.0	7.0	6.8	6.8	6.7	6.9
	DO	6.9	6.1	5.8	6.7	6.4	5.3	6.1
	Temp.	25.2	25.3	25.5	25.5	25.7	25.5	25.4
	Cond.	75	73	89	83	105	107	117
12 % EFF	pH	7.2	7.2	7.1	7.1	6.9	6.8	6.9
	DO	6.8	6.0	5.7	6.8	6.1	5.2	6.2
	Temp.	25.2	25.3	25.4	25.5	25.7	25.5	25.5
	Cond.	270	276	317	307	280	279	297
24 % EFF	pH	7.2	7.3	7.2	7.2	7.0	6.9	7.0
	DO	6.7	5.9	5.8	6.4	6.0	5.3	6.0
	Temp.	25.2	25.3	25.4	25.6	25.7	25.4	25.4
	Cond.	353	354	409	421	382	380	398
48 % EFF	pH	7.2	7.4	7.4	7.4	7.1	7.0	7.2
	DO	6.8	6.0	5.7	6.2	5.7	5.5	6.1
	Temp.	25.1	25.4	25.4	25.6	25.7	25.3	25.4
	Cond.	499	505	630	649	589	583	594
50 % EFF	pH	7.3	7.4	7.6	7.5	7.2	7.1	7.2
	DO	6.5	6.1	5.7	6.5	6.1	5.3	6.1
	Temp.	25.1	25.4	25.4	25.5	25.8	25.5	25.4
	Cond.	524	519	658	672	606	602	611
100 % EFF	pH	7.3	7.4	7.8	7.9	7.4	7.3	7.4
	DO	6.7	5.9	5.7	6.3	6.1	5.3	6.1
	Temp.	25.1	25.1	25.3	25.5	25.7	25.3	25.4
	Cond.	822	829	1024	1107	1002	1003	1010
	Sample #	51048	51048	51063	51063	51067	51067	51067
	Date	8/8/18	8/9/18	8/10/18	8.11.18	8.12.18	8/13/18	8/14/18
	Initials	KN	EB	KN	KP	EB	KN	KN

PP

Aquatec Environmental, Inc.
Reviewed by: JW Date: 9/4/18

SDG: 15390
Project 18017

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

AQUATIC BIO SYSTEMS ABS INC.

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

ORGANISM HISTORY

Rec 8/7/18
KN
@ 9:35

DATE:	8/6/2018
SPECIES:	*Pimephales promelas*
AGE:	N/A
LIFE STAGE:	Embryo
HATCH DATE:	8/6/2018
BEGAN FEEDING:	N/A
FOOD:	N/A

Temp: 23.3°C
Cond: 384 µS
DO: 13.2 mg/L
PH: 7.6 pH
condition: Normal
Active

Water Chemistry Record:

	Current	Range
TEMPERATURE:	25°C	--
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	132 mg/l	--
TOTAL ALKALINITY (as $CaCO_3$):	90 mg/l	--
pH:	7.89	--

Added to
Soft

Comments:

Facility Supervisor

Aquatic BioSystems, Inc • Quality Research Organisms

9/4/18

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

CETIS Summary Report

Report Date:	29 Aug-18 11:44 (p 1 of 1)
Test Code:	81464 | 01-0882-6929

Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

Batch ID:	04-2172-3624	Test Type:	Reproduction-Survival (2-8d)	Analyst:	Kaitlyn Priest
Start Date:	07 Aug-18 13:00	Protocol:	EPA/821/R-02-013 (2002)	Diluent:	Soft Synthetic Water
Ending Date:	13 Aug-18 14:50	Species:	Ceriodaphnia dubia	Brine:	Not Applicable
Duration:	6d 2h	Source:	In-House Culture	Age:	<24h

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
11-0911-9481	2d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
08-1206-9633	6d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
19-1279-4998	Reproduction	Wilcoxon/Bonferroni Adj Test	100	> 100	n/a	1	10.7%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
03-0353-5415	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
16-7238-8179	Reproduction	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	9	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

6d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	9	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	29.6	21.98	37.22	11	43	3.367	10.65	35.97%	0.00%
0	L	9	38.44	34.32	42.57	30	46	1.788	5.364	13.95%	-29.88%
12		10	40.5	38.95	42.05	37	44	0.6872	2.173	5.37%	-36.82%
24		10	42	40.22	43.78	39	47	0.7888	2.494	5.94%	-41.89%
48		10	38.9	34.89	42.91	27	46	1.773	5.607	14.41%	-31.42%
50		10	40.6	38.05	43.15	34	46	1.127	3.565	8.78%	-37.16%
100		10	38.5	37.59	39.41	36	40	0.4014	1.269	3.30%	-30.07%

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	11-0911-9481	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:44	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes

Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	30h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		12	1.0000	Exact	1.0000	Non-Significant Effect
		24	1.0000	Exact	1.0000	Non-Significant Effect
		48	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

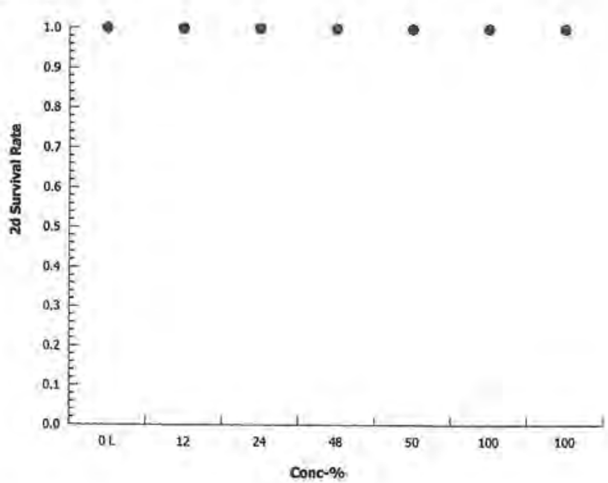
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	9	0	9	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	08-1206-9633	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:44	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes
Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	30h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		12	1.0000	Exact	1.0000	Non-Significant Effect
		24	1.0000	Exact	1.0000	Non-Significant Effect
		48	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

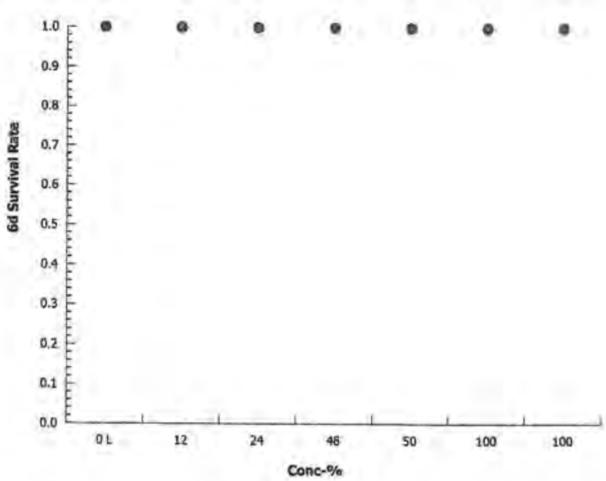
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	9	0	9	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date: 29 Aug-18 11:44 (p 1 of 2)
Test Code: 81464 | 01-0882-6929

Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

Analysis ID:	03-0353-5415	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:44	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	30h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1295958	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

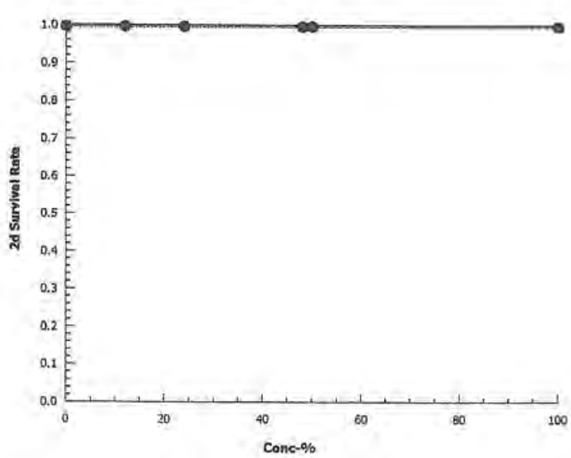
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	9	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	9	9
12		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
24		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
48		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date: 29 Aug-18 11:44 (p 2 of 2)
Test Code: 81464 | 01-0882-6929

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	16-7238-8179	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:44	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	03-3867-3810	**Code:**	15390	**Client:**	Keene WWTP
Sample Date:	06 Aug-18 07:00	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	07 Aug-18 10:00	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	30h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	597230	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

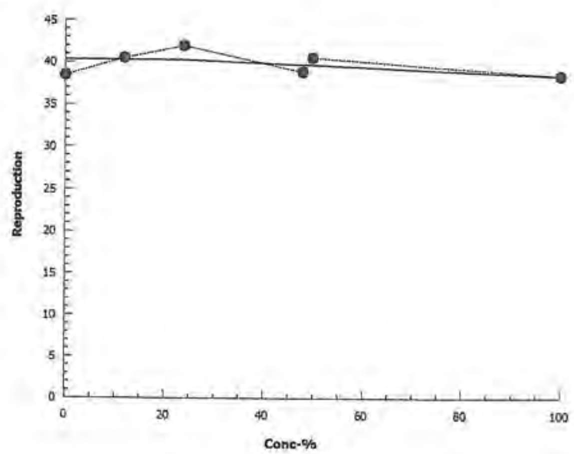
Reproduction Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	9	38.44	30	46	1.788	5.364	13.95%	0.0%
12		10	40.5	37	44	0.6872	2.173	5.37%	-5.35%
24		10	42	39	47	0.7888	2.494	5.94%	-9.25%
48		10	38.9	27	46	1.773	5.607	14.41%	-1.19%
50		10	40.6	34	46	1.127	3.565	8.78%	-5.61%
100		10	38.5	36	40	0.4014	1.269	3.30%	-0.14%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	41	42	30	41	46	30	40	39	37	
12		38	41	44	40	39	41	37	43	40	42
24		41	41	43	45	47	43	40	39	40	41
48		38	36	38	44	46	35	27	45	40	40
50		38	42	38	42	46	43	34	44	41	38
100		38	36	37	39	39	40	40	39	38	39

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test

Aquatec Environmental, Inc.

Analysis ID: 19-1279-4998
Analyzed: 29 Aug-18 11:44
Endpoint: Reproduction
Analysis: Nonparametric-Multiple Comparison
CETIS Version: CETISv1.9.2
Official Results: Yes

Sample ID: 03-3867-3810
Sample Date: 06 Aug-18 07:00
Receipt Date: 07 Aug-18 10:00
Sample Age: 30h
Code: 15390
Material: POTW Effluent
Source: Permit # NH0100790 (KEENE NH)
Station: Keene WWTP
Client: Keene WWTP
Project: Special Studies

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	10.72%

Wilcoxon/Bonferroni Adj Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	108.5	n/a	5	17	Exact	1.0000	Non-Significant Effect
		24	118.5	n/a	3	17	Exact	1.0000	Non-Significant Effect
		48	98.5	n/a	2	17	Exact	1.0000	Non-Significant Effect
		50	111.5	n/a	3	17	Exact	1.0000	Non-Significant Effect
		100	88.5	n/a	3	17	Exact	0.9029	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	101.105	20.221	5	1.447	0.2228	Non-Significant Effect
Error	740.522	13.9721	53			
Total	841.627		58			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	23.23	15.09	3.0E-04	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9504	0.9451	0.0175	Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	9	38.44	34.32	42.57	40	30	46	1.788	13.95%	0.00%
12		10	40.5	38.95	42.05	40.5	37	44	0.6872	5.37%	-5.35%
24		10	42	40.22	43.78	41	39	47	0.7888	5.94%	-9.25%
48		10	38.9	34.89	42.91	39	27	46	1.773	14.41%	-1.18%
50		10	40.6	38.05	43.15	41.5	34	46	1.127	8.78%	-5.61%
100		10	38.5	37.59	39.41	39	36	40	0.4014	3.30%	-0.14%

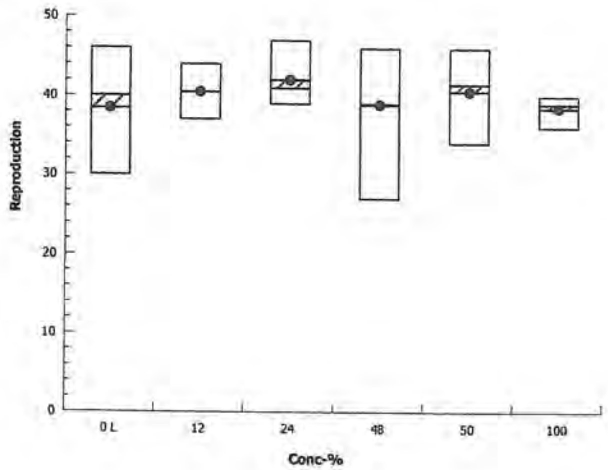
Reproduction Detail

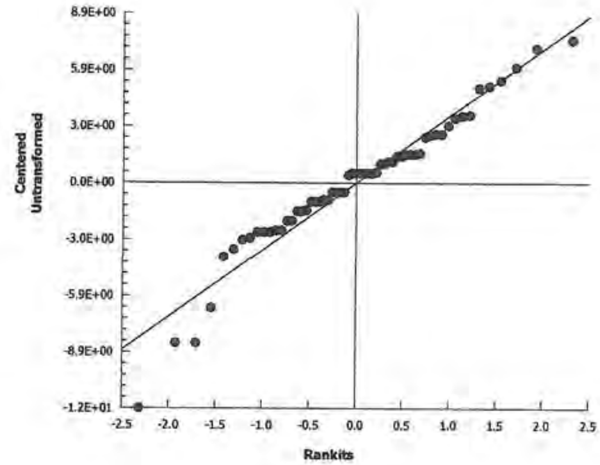
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	41	42	30	41	46	30	40	39	37	
12		38	41	44	40	39	41	37	43	40	42
24		41	41	43	45	47	43	40	39	40	41
48		38	36	38	44	46	35	27	45	40	40
50		38	42	38	42	46	43	34	44	41	38
100		38	36	37	39	39	40	40	39	38	39

Ceriodaphnia 7-d Survival and Reproduction Test | **Aquatec Environmental, Inc.**

Analysis ID:	19-1279-4998	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	29 Aug-18 11:44	**Analysis:**	Nonparametric-Multiple Comparison	**Official Results:**	Yes

Graphics





Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Start Date: 07 Aug-18 13:00 **Species:** Ceriodaphnia dubia **Sample Code:** 15390
End Date: 13 Aug-18 14:50 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 06 Aug-18 07:00 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
0	L	2	65	1		1				1				0	7	14	20			0	
0	L	3	19	1		1				1				0	7	16	19			0	
0	L	4	28	1		1				1				0	6	9	15			0	
0	L	5	60	1		1				1				0	8	14	19			0	
0	L	6	43	1		1				1				0	8	17	21			0	
0	L	7	13	1		1				1				0	8	9	13			0	
0	L	8	42	1		1				1				0	8	14	18			0	
0	L	9	37	1		1				1				0	7	16	16			0	
0	L	10	52	1		1				1				6	0	13	18			0	
0	R	1	9	1		1				1				0	5	12	3			0	
0	R	2	41	1		1				1				0	0	7	4			0	
0	R	3	27	1		1				1				0	7	15	2			0	
0	R	4	50	1		1				1				0	7	12	22			0	
0	R	5	17	1		1				1				0	5	14	2			0	
0	R	6	26	1		1				1				0	5	16	22			0	
0	R	7	3	1		1				1				0	6	10	17			0	
0	R	8	8	1		1				1				0	5	15	7			0	
0	R	9	58	1		1				1				0	6	13	17			0	
0	R	10	38	1		1				1				5	0	16	19			0	
12		1	32	1		1				1				0	6	13	19			0	
12		2	54	1		1				1				0	7	14	20			0	
12		3	51	1		1				1				0	9	17	18			0	
12		4	47	1		1				1				0	7	12	21			0	
12		5	2	1		1				1				0	8	12	19			0	
12		6	34	1		1				1				0	8	14	19			0	
12		7	40	1		1				1				0	7	12	18			0	
12		8	70	1		1				1				0	9	15	19			0	
12		9	66	1		1				1				0	8	15	17			0	
12		10	31	1		1				1				6	0	15	21			0	
24		1	45	1		1				1				0	8	14	19			0	
24		2	57	1		1				1				0	7	16	18			0	
24		3	29	1		1				1				0	7	17	19			0	
24		4	20	1		1				1				0	8	17	20			0	
24		5	7	1		1				1				0	9	16	22			0	
24		6	10	1		1				1				0	7	17	19			0	
24		7	15	1		1				1				0	6	15	19			0	
24		8	22	1		1				1				0	6	14	19			0	
24		9	63	1		1				1				0	7	15	18			0	
24		10	36	1		1				1				6	0	15	20			0	
48		1	24	1		1				1				0	6	15	17			0	
48		2	6	1		1				1				0	5	13	18			0	
48		3	56	1		1				1				0	6	15	17			0	
48		4	35	1		1				1				0	7	18	19			0	
48		5	33	1		1				1				0	7	18	21			0	
48		6	12	1		1				1				0	7	12	16			0	

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
48		7	39	1		1				1				0	6	13	8			0	
48		8	59	1		1				1				0	9	15	21			0	
48		9	61	1		1				1				0	7	14	19			0	
48		10	44	1		1				1				6	0	16	18			0	
50		1	5	1		1				1				0	8	12	18			0	
50		2	14	1		1				1				0	7	17	18			0	
50		3	18	1		1				1				0	5	14	19			0	
50		4	21	1		1				1				0	8	16	18			0	
50		5	67	1		1				1				0	8	17	21			0	
50		6	30	1		1				1				0	7	15	21			0	
50		7	53	1		1				1				0	8	13	13			0	
50		8	11	1		1				1				0	6	16	22			0	
50		9	16	1		1				1				0	7	14	20			0	
50		10	68	1		1				1				7	0	14	17			0	
100		1	1	1		1				1				0	7	13	18			0	
100		2	48	1		1				1				0	6	14	16			0	
100		3	62	1		1				1				0	8	12	17			0	
100		4	4	1		1				1				0	7	16	16			0	
100		5	46	1		1				1				0	7	14	18			0	
100		6	23	1		1				1				0	6	15	19			0	
100		7	25	1		1				1				0	7	15	18			0	
100		8	69	1		1				1				0	8	13	18			0	
100		9	55	1		1				1				0	8	14	16			0	
100		10	49	1		1				1				5	0	15	19			0	

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81464

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	1	0	0	D-0 ①	—	—	—	—	—
	2	0	0	0	0	7	14	20	
	3	0	0	0	0	7	16	19	
	4	0	0	0	0	6	9	15	
	5	0	0	0	0	8	14	19	
	6	0	0	0	0	8	17	21	
	7	0	0	0	0	8	9	13	
	8	0	0	0	0	8	14	18	
	9	0	0	0	0	7	16	16	
	10	0	0	0	6	0	13	18	
0 % RW	1	0	0	0	0	5	12	3	
	2	0	0	0	0	0	7	4	
	3	0	0	0	0	7	15	2	
	4	0	0	0	0	7	12	22	
	5	0	0	0	0	5	14	2	
	6	0	0	0	0	5	16	22	
	7	0	0	0	0	6	10	17	
	8	0	0	0	0	5	15	7	
	9	0	0	0	0	6	13	17	
	10	0	0	0	5	0	16	19	
12 % EFF	1	0	0	0	0	6	13	19	
	2	0	0	0	0	7	14	20	
	3	0	0	0	0	9	17	18	
	4	0	0	0	0	7	12	21	
	5	0	0	0	0	8	12	19	
	6	0	0	0	0	8	14	19	
	7	0	0	0	0	7	12	18	
	8	0	0	0	0	9	15	19	
	9	0	0	0	0	8	15	17	
	10	0	0	0	6	0	15	21	
24 % EFF	1	0	0	0	0	8	14	19	
	2	0	0	0	0	7	16	18	
	3	0	0	0	0	7	17	19	
	4	0	0	0	0	8	17	20	
	5	0	0	0	0	9	16	22	
	6	0	0	0	0	7	17	19	
	7	0	0	0	0	6	15	19	
	8	0	0	0	0	6	14	19	
	9	0	0	0	0	7	15	18	
	10	0	0	0	6	0	15	20	

① Laboratory induced mortality KN 8/9/18

cd

0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality

Aquatec Environmental, Inc.

Reviewed by: EB Date: 8-30-18

SDG: 15390

Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81464

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
48 % EFF	1	0	0	0	0	6	15	17	
	2	0	0	0	0	5	13	18	
	3	0	0	0	0	6	15	17	
	4	0	0	0	0	7	18	19	
	5	0	0	0	0	7	18	21	
	6	0	0	0	0	7	12	16	
	7	0	0	0	0	6	13	18	
	8	0	0	0	0	9	15	21	
	9	0	0	0	0	7	14	19	
	10	0	0	0	6	0	16	18	
50 % EFF	1	0	0	0	0	8	12	18	
	2	0	0	0	0	7	17	18	
	3	0	0	0	0	5	14	19	
	4	0	0	0	0	8	16	18	
	5	0	0	0	0	8	17	21	
	6	0	0	0	0	7	15	21	
	7	0	0	0	0	8	13	13	
	8	0	0	0	0	6	16	22	
	9	0	0	0	0	7	14	20	
	10	0	0	0	7	0	14	17	
100 % EFF	1	0	0	0	0	7	13	18	
	2	0	0	0	0	6	14	16	
	3	0	0	0	0	8	12	17	
	4	0	0	0	0	7	16	16	
	5	0	0	0	0	7	14	18	
	6	0	0	0	0	6	15	19	
	7	0	0	0	0	7	15	18	
	8	0	0	0	0	8	13	18	
	9	0	0	0	0	8	14	16	
	10	0	0	0	5	0	15	19	

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
Sample #	51048	51048	51063	51063	51067	51067	51067	
Fed	✓	✓	✓	✓	✓	✓	—	
Renewal (D / T / I)	8/7/18 1300 KN	8/8/18 1415 KN	8/9/18 1340 KN	8/10/18 1140 KN	8.11.18 1305 KP	8-12-18 1500 EB	8/13/18 1450 KN	

YCT Lot Number: 051718-1 Selenastrum Lot Number: 080618-Sel

cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc.

Reviewed by: EB Date: 8-30-18

SDG: 15390

Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81464

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % Soft CTRL	pH							
	DO							
	Temp.							
	Cond.							
0 % RW	pH							
	DO							
	Temp.							
	Cond.							
12 % EFF	pH							
	DO							
	Temp.							
	Cond.							
24 % EFF	pH							
	DO							
	Temp.							
	Cond.							
48 % EFF	pH							
	DO							
	Temp.							
	Cond.							
50 % EFF	pH							
	DO							
	Temp.							
	Cond.							
100 % EFF	pH							
	DO							
	Temp.							
	Cond.							
	Sample #	51048	51048	51063	51063			
	Date							
	Initials							

Initial chemistry data are recorded for P. promelas test. Data are common to both tests. JV

cd

Aquatec Environmental, Inc.
Reviewed by: JV Date: 9/4/18

SDG: 15390
Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81464

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.2	7.2	7.2	7.2	7.0	7.2	
	DO	7.7	7.1	7.2	7.9	7.6	7.5	
	Temp.	25.8	25.4	25.7	25.7	25.9	25.9	
	Cond.	202	207	190	187	176	176	
0 % RW	pH	7.2	6.9	7.0	7.2	6.9	6.9	
	DO	7.6	7.2	7.2	7.9	7.7	7.2	
	Temp.	25.8	25.6	25.6	25.8	26.0	26.0	
	Cond.	68	65	92	85	106	190	
12 % EFF	pH	7.3	7.3	7.6	7.3	7.1	7.3	
	DO	8.0	7.2	7.3	7.8	7.7	7.3	
	Temp.	25.8	25.6	25.8	25.8	26.0	26.0	
	Cond.	278	279	319	303	277	233	
24 % EFF	pH	7.4	7.4	7.7	7.6	7.2	7.5	
	DO	7.7	7.1	7.2	7.8	7.8	7.3	
	Temp.	25.9	25.7	25.7	25.8	25.9	26.0	
	Cond.	355	357	421	416	381	282	
48 % EFF	pH	7.5	7.4	7.9	7.9	7.5	7.7	
	DO	7.8	7.2	7.2	7.8	7.7	7.3	
	Temp.	25.8	25.5	25.6	25.8	25.9	26.0	
	Cond.	531	508	638	638	593	①382	
50 % EFF	pH	7.5	7.5	8.0	8.0	7.5	7.8	
	DO	7.9	7.2	7.2	7.8	7.8	7.3	
	Temp.	25.8	25.5	25.7	25.7	25.9	26.0	
	Cond.	538	520	658	660	607	563	
100 % EFF	pH	7.6	7.5	8.2	8.3	7.8	8.0	
	DO	7.8	7.3	7.4	7.8	7.9	7.3	
	Temp.	25.7	25.6	25.7	25.8	25.9	26.0	
	Cond.	824	833	1103	1097	1017	914	
	Sample #	51048	51048	51063	51063	51067	51067	
	Date	8/8/18	8/9/18	8/10/18	8.11.18	8-12-18	8/13/18	
	Initials	KN	KN	KN	KP	EB	KN	

① Recheck on conductivity = 383 KN 8/13/18

cd

Aquatec Environmental, Inc.
Reviewed by: [illegible] Date: 9/4/18

SDG: 15390
Project 18017

Documentation of Collection

Species:	*Ceriodaphnia dubia*	Client/Project:	Keene cd
Source:	In-House Cultures	Testing Date:	8/7/18

Acclimation/Holding Procedures: Transfer culture cups collected within 8-hour intervals to the top of the brood board, group each collection by collection time or Collect neonates into a small Carolina bowl of <24-hour pooled neonates. Acclimate/Hold at appropriate testing temperature.

Feeding: Feed 200µL 1:1 Mix of *Pseudokirschneriella subcapitata* formally *Selenastrum capricornutum* (Lot #: 071718) and YTC (Lot #: 072618-YCT) to each culture cup or ~3mL 1:1 Mix to a small Carolina bowl of pooled neonates.

Culture ID	Date / Time / Init Cleared of Neonates	Date / Time / Init Neonate Collection	Number of Cups Collected*	Fed (✓)
073118	8-6-18 11:15 EB	8/6/18 1623 KN	0	—
080118	8-6-18 12:00 EB	8/6/18 1627 KN	0	—
073118	8/6/18 1623 KN	8/6/18 23:03	1	✓
080118	8/6/18 1627 KN	8/6/18 23:07	0	—
073118	8/6/18 23:03	8/7/18 06:40	58	✓
080118	8/6/18 23:07	8/7/18 06:50	7	✓

* *Neonates collected must number at least eight per cup, and be from a healthy adult female*

Aquatec Environmental, Inc.
DAPHNID COLLECTION FORM

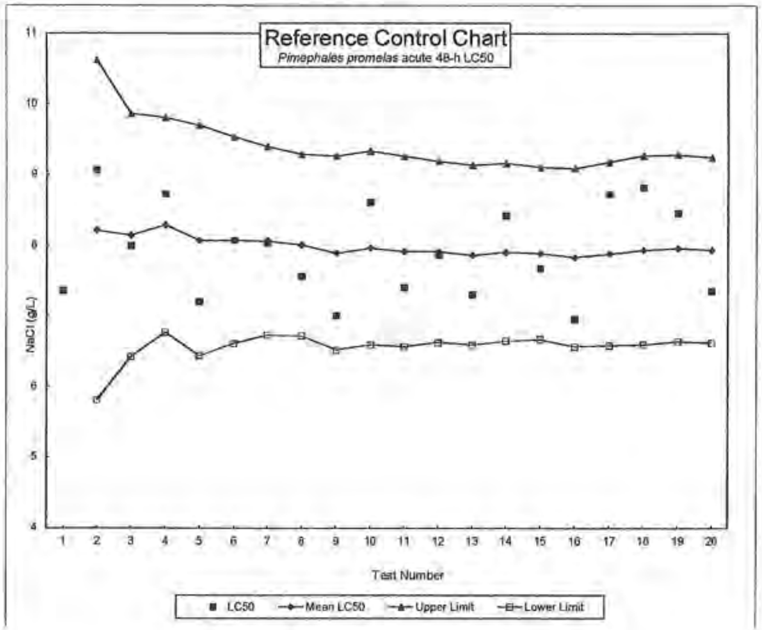
9/4/18

Standard Reference Toxicant Control Chart(s)

***Pimephales promelas* acute survival LC50 Control Chart**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower	Source
1	8/12/16-8/14/16	7.36				Aquatic Biosystems
2	9/13/16-9/15/16	9.06	8.21	10.61	5.81	Aquatic Biosystems
3	10/19-21/2016	7.994	8.14	9.86	6.42	Aquatic Biosystems
4	11/29/16-12/1/16	8.722	8.28	9.80	6.76	Aquatic Biosystems
5	1/10/17-1/12/17	7.204	8.07	9.70	6.44	Aquatic Biosystems
6	2/7/17-2/9/17	8.071	8.07	9.53	6.61	Aquatic Biosystems
7	3/21/17-3/23/17	8.042	8.06	9.40	6.73	Aquatic Biosystems
8	5/2/17-5/4/17	7.561	8.00	9.29	6.72	Aquatic Biosystems
9	7/12/17-7/14/17	7.005	7.89	9.26	6.52	Aquatic Biosystems
10	8/8/17-8/10/17	8.61	7.96	9.34	6.59	Aquatic Biosystems
11	9/12/17-9/14/14	7.403	7.91	9.26	6.57	Aquatic Biosystems
12	10/24/17-10/26/17	7.867	7.91	9.19	6.63	Aquatic Biosystems
13	11/7/17-11/9/17	7.31	7.86	9.13	6.59	Aquatic Biosystems
14	1/25/18-1/27/18	8.42	7.90	9.16	6.64	Aquatic Biosystems
15	2/6/18-2/8/18	7.678	7.89	9.10	6.67	Aquatic Biosystems
16	3/6/18-3/8/18	6.952	7.83	9.09	6.56	Aquatic Biosystems
17	4/3/18-4/5/18	8.722	7.88	9.18	6.58	Aquatic Biosystems
18	6/5/18-6/7/18	8.819	7.93	9.27	6.60	Aquatic Biosystems
19	7/24/18-7/26/18	8.451	7.96	9.28	6.64	Aquatic Biosystems
20	8/14/18-8/16/18	7.35	7.93	9.24	6.62	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted.

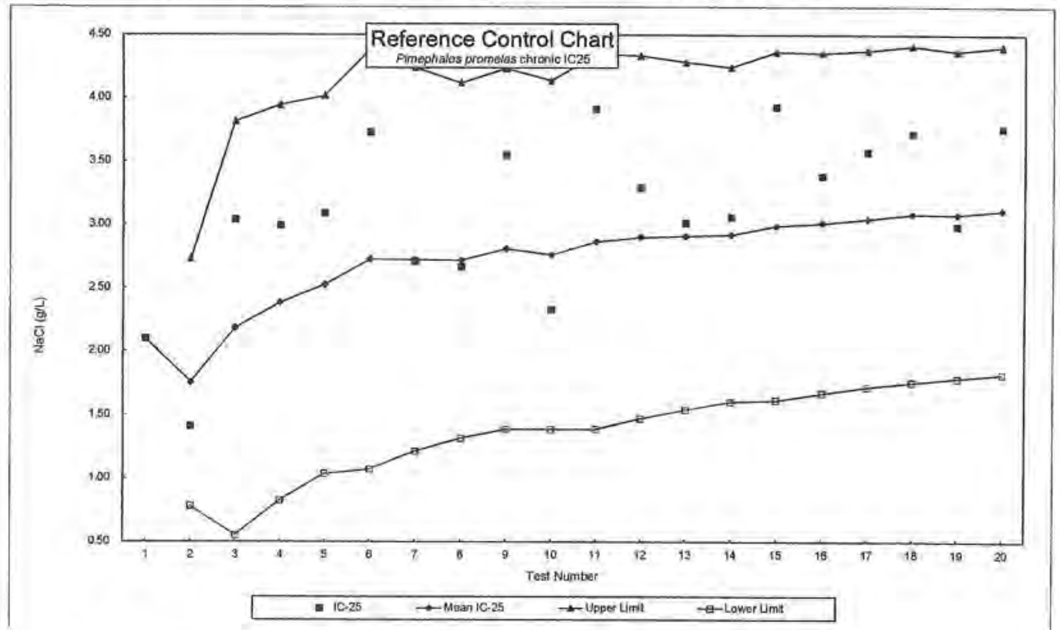


Note: Tests through September of 2016 were as Aquatec Biological Sciences, Inc. SRT tests beginning in October of 2016 were as Aquatec Environmental, Inc.

***Pimephales promelas* chronic IC25 Control Chart based on minnow growth**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Growth PMSD (%)	Avg. PMSD (%)	Source
1	8/12/16-8/19/16	2.10	2.10					11.70	11.70	Aquatic Biosystems
2	9/13/16-9/20/16	1.41	1.76	2.73	0.78	0.28	0.28		11.70	Aquatic Biosystems
3	10/19-26/2016	3.04	2.18	3.81	0.55	0.37	0.33	18.00	18.00	Aquatic Biosystems
4	11/29/16-12/6/16	2.99	2.38	3.94	0.82	0.33	0.33	20.40	16.70	Aquatic Biosystems
5	1/10/17-1/17/17	3.09	2.53	4.02	1.03	0.30	0.32	11.20	15.33	Aquatic Biosystems
6	2/7/17-2/14/17	3.73	2.73	4.38	1.07	0.30	0.32	7.45	13.75	Aquatic Biosystems
7	3/21/17-3/28/17	2.71	2.72	4.24	1.21	0.28	0.31	14.80	13.93	Aquatic Biosystems
8	5/2/14-5/9/17	2.66	2.72	4.12	1.32	0.26	0.30	15.10	14.09	Aquatic Biosystems
9	7/12/17-7/19/17	3.55	2.81	4.23	1.39	0.25	0.30	12.90	13.94	Aquatic Biosystems
10	8/8/17-8/15/17	2.33	2.76	4.14	1.39	0.25	0.29	only 2 reps	12.39	Aquatic Biosystems
11	9/12/17-9/19/17	3.91	2.87	4.34	1.39	0.26	0.29	19.00	13.06	Aquatic Biosystems
12	10/24/17-10/31/17	3.29	2.90	4.33	1.47	0.25	0.28	22.10	13.88	Aquatic Biosystems
13	11/7/17-11/14/17	3.02	2.91	4.28	1.54	0.24	0.28	27.00	14.97	Aquatic Biosystems
14	1/25/18-2/1/18	3.06	2.92	4.24	1.60	0.23	0.28	15.50	15.01	Aquatic Biosystems
15	2/6/18-2/13/18	3.93	2.99	4.36	1.61	0.23	0.27	14.70	14.99	Aquatic Biosystems
16	3/6/18-3/13/18	3.38	3.01	4.35	1.67	0.22	0.27	19.20	15.27	Aquatic Biosystems
17	4/3/18-4/10/18	3.57	3.05	4.37	1.72	0.22	0.27	13.20	15.14	Aquatic Biosystems
18	6/5/18-6/12/18	3.72	3.08	4.41	1.76	0.22	0.26	12.80	15.21	Aquatic Biosystems
19	7/24/18-7/31/18	2.99	3.08	4.37	1.79	0.21	0.26	20.80	15.33	Aquatic Biosystems
20	8/14/18-8/21/18	3.76	3.11	4.40	1.82	0.21	0.26	9.11	15.00	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted. Test of 8/8/17, insufficient minnows for 4 reps. Tested with 2 reps.



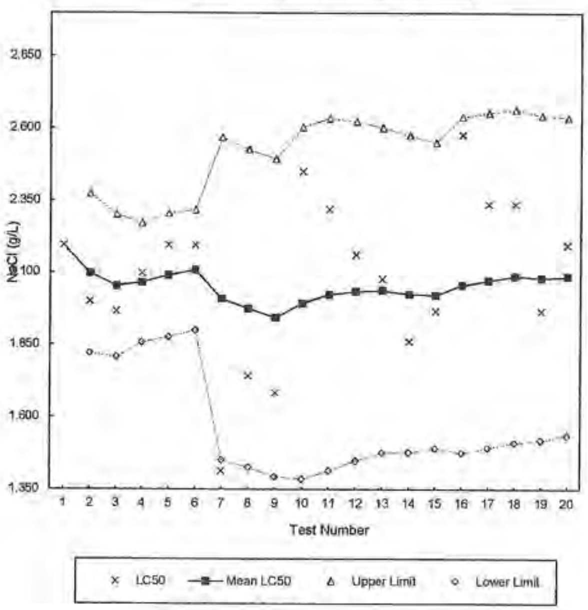
Assessment of test precision and sensitivity: Thev CV of average IC25 values was within the 25th Percentile (0.21) for fathead minnow growth (Table 3-2, EPA 833-R-00-003) indicating high precision (only 25% of labs reported CVs of not more than 0.21). The per-test PMSD values were less than the EPA upper limit of 30% indicating low-to moderate variability (moderate to high sensitivity) for this method. The cumulative average PMSD value of 20 tests (15.0) was near the EPA lower boundary (12%), indicating high statistical sensitivity for this test method. Updated 9/2/18

Ceriodaphnia dubia
Reference Control Chart for NaCl Acute Toxicity

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower
1	10/18/16-10/20/16	2.195	2.20		
2	11/29/16-12/1/16	2.000	2.10	2.37	1.82
3	1/10/17-1/12/17	1.966	2.05	2.30	1.81
4	2/14/17-2/16/17	2.098	2.06	2.27	1.86
5	3/21/17-3/23/17	2.195	2.09	2.30	1.88
6	5/16/17-5/18/17	2.195	2.11	2.32	1.90
7	7/11/17-7/13/17	1.414	2.01	2.57	1.45
8	8/1/17-8/3/17	1.743	1.98	2.53	1.43
9	9/12/17-9/14/17	1.684	1.94	2.49	1.39
10	9/28/17-9/30/17	2.449	1.99	2.60	1.38
11	10/31/17-11/2/17	2.319	2.02	2.63	1.41
12	11/28/17-11/30/17	2.161	2.03	2.62	1.45
13	1/9/18-1/11/18	2.077	2.04	2.60	1.48
14	2/6/18-2/8/18	1.861	2.03	2.57	1.48
15	3/6/18-3/8/18	1.966	2.02	2.55	1.49
16	4/3/18-4/5/18	2.577	2.06	2.64	1.47
17	5/15/18-5/17/18	2.337	2.07	2.65	1.49
18	6/12/18-6/14/18	2.337	2.09	2.66	1.51
19	7/24/18-7/26/18	1.966	2.08	2.64	1.52
20	8/14/18-8/16/18	2.195	2.09	2.64	1.54

Organisms Sources: Aquatec Environmental, Inc. in-house cultures

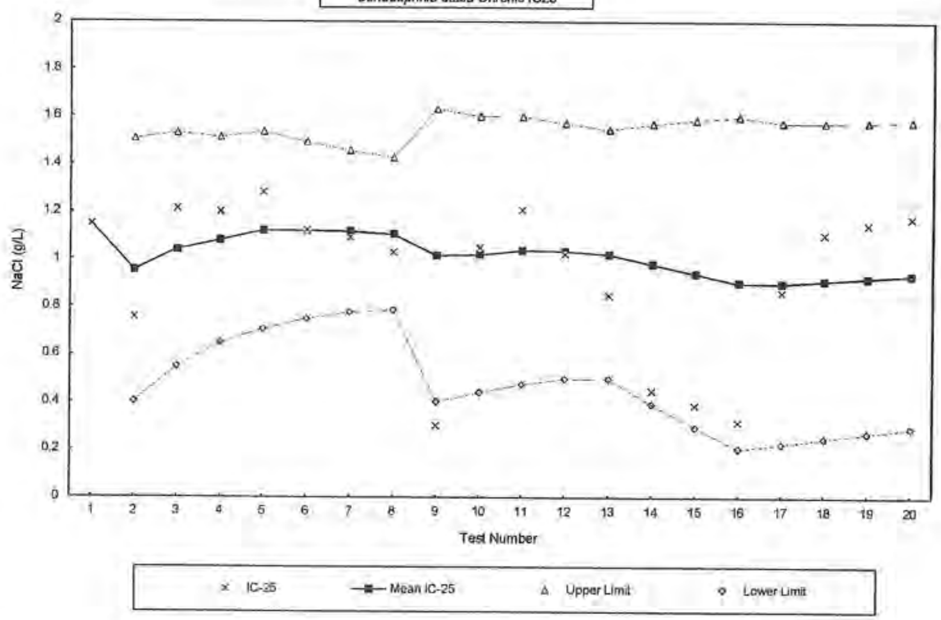
Reference Control Chart
Ceriodaphnia dubia Acute LC50



Ceriodaphnia dubia
Reference Control Chart for NaCl Chronic Toxicity based on reproduction

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Repro. PMSD (%)	Avg. PMSD (%)
1	10/18/19-10/25/16	1.149	1.15					10.7	
2	11/29/16-12/5/16	0.7583	0.95	1.51	0.40	0.29	0.29	15.8	10.7
3	1/10/17-1/16/17	1.211	1.04	1.53	0.55	0.24	0.26	13.7	13.3
4	2/14/17-2/22/17	1.2	1.08	1.51	0.65	0.20	0.24	33.2	13.4
5	3/21/17-3/28/17	1.282	1.12	1.54	0.70	0.19	0.23	34.9	18.4
6	5/16/17-5/22/17	1.123	1.12	1.49	0.75	0.17	0.22	10.5	21.7
7	7/11/17-7/13/17	1.093	1.12	1.46	0.78	0.15	0.20	6.72	19.8
8	8/1/17-8/7/17	1.03	1.11	1.43	0.79	0.14	0.20	16	17.9
9	9/12/17-9/18/17	0.2996	1.02	1.63	0.40	0.30	0.21	32.1	17.7
10	9/28/17-10/4/17	1.048	1.02	1.60	0.44	0.28	0.22	15.8	19.3
11	10/31/17-11/6/17	1.208	1.04	1.60	0.47	0.27	0.22	9.47	18.9
12	11/28/17-12/4/17	1.023	1.04	1.57	0.50	0.26	0.23	9.72	18.1
13	1/9/18-1/16/18	0.85	1.02	1.54	0.50	0.26	0.23	30.3	17.4
14	2/6/18-2/12/18	0.4474	0.98	1.57	0.39	0.30	0.23	20.6	18.4
15	3/6/18-3/12/18	0.3857	0.94	1.59	0.30	0.34	0.24	13.8	18.5
16	4/3/18-4/10/18	0.315	0.90	1.60	0.20	0.39	0.25	36.3	18.2
17	5/15/18-5/21/18	0.8601	0.90	1.57	0.22	0.38	0.26	17.3	19.4
18	6/12/18-6/18/18	1.105	0.91	1.57	0.25	0.36	0.27	6.82	19.2
19	7/24/18-7/30/19	1.145	0.92	1.58	0.27	0.35	0.27	16.1	18.5
20	8/14/18-8/20/18	1.174	0.94	1.58	0.29	0.35	0.27	11.6	18.1

Reference Control Chart
Ceriodaphnia dubia Chronic IC25



Assessment of test precision and sensitivity: The cumulative average CV of 0.27 for reproduction was near the 50th Percentile (0.27, Table 3-2 of EPA 833-R-00-003) indicating normal (median) variability. The PMSD values were less than the EPA upper limit of 47% indicating acceptable variability (sensitivity) of test data . The cumulative average PMSD values were slightly above EPA lower boundary (13%), indicating high-to-moderate statistical sensitivity for this test method when averaged for the most recent 20 tests. Updated 09/02/18.

\qaqc\srts\Cd SRT including CV and PMSD

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY SUMMARY REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *9/11/2018 2:40:00 PM* ***Test End:*** *9/18/2018 11:25:00 AM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
51115	Keene WWTP (2 Clarifier #2)	100	>100	100	>100

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *9/11/2018 12:40:00 PM* ***Test End:*** *9/17/2018 2:30:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
51115	Keene WWTP (2 Clarifier #2)	100	>100	100	>100

SAMPLES RECEIVED:

Number	Sample Name	Date Time and Collected	Type
51115	Keene WWTP (2 Clarifier #2)	9/10/2018 7:18:00 AM	Effluent
51116	Ashuelot River	9/10/2018 8:20:00 AM	Receiving
51117	091018SOFT	9/11/2018 10:20:00 AM	Lab Water
51124	Keene WWTP (2 Clarifier #2)	9/12/2018 7:02:00 AM	Effluent
51125	Ashuelot River	9/12/2018 8:02:00 AM	Receiving
51130	Keene WWTP (2 Clarifier #2)	9/14/2018 7:01:00 AM	Effluent
51131	Ashuelot River	9/14/2018 8:35:00 AM	Receiving

Submitted By:

Saturday, September 22, 2018
SDG: 15421
Project 18017

Aquatec Environmental, Inc.
Reviewed by: Date: 9/23/18

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY DETAIL REPORT: Sample ID: 51115 / Keene WWTP (2 Clarifier #2)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *9/11/2018 2:40:00 PM* ***Test End:*** *9/18/2018 11:25:00 AM*

Response: Survival (%)

		|--------- Concentration % ---------|					
Day	Additional Control	0	12	24	48	50	100
2	100	100	100	100	100	100	100
7	100	100	100	100	97.5	97.5	97.5

Response: Growth per Original Number of Larvae (mean dry weight,mg)

		|--------- Concentration % ---------|					
	Additional Control	0	12	24	48	50	100
7	0.583	0.641	0.609	0.646	0.617	0.609	0.673

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *9/11/2018 12:40:00 PM* ***Test End:*** *9/17/2018 2:30:00 PM*

Response: Survival (%)

		|--------- Concentration % ---------|					
Day	Additional Control	0	12	24	48	50	100
2	100	100	100	100	100	100	100
6	100	90	100	100	100	100	100

Response: Reproduction (mean neonates per female)

		|--------- Concentration % ---------|					
	Additional Control	0	12	24	48	50	100
6	29.4	21.8	29	25.3	27.8	30.9	30

Submitted By:

Saturday, September 22, 2018
SDG: 15421
Project 18017

Aquatec Environmental, Inc.
Reviewed by: JV Date: 9/23/18

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: 9/11/2018 2:40:00 PM **Test End:** 9/18/2018 11:25:00 AM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	51115	100	100
7	51115	100	100

Response: Growth per Original Number of Larvae (mean dry weight, mg)

Day	Sample ID	Dilution Control	Additional Control
7	51115	0.641	0.583

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 10.0% **PMSD Criteria Range:** 12%-30%

The calculated test PMSD was less than the lower bound indicating test data with low variability and high statistical sensitivity. In determining the C-NOEC, C-LOEC, test concentrations were not considered toxic if the relative difference from the control was less than the lower PMSD bounds.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, there were no special conditions or qualifiers that relate to the samples in this report, with the following exceptions:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as an additional control.

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: 9/11/2018 12:40:00 PM **Test End:** 9/17/2018 2:30:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	51115	100	100
6	51115	90	100

Response: Reproduction (mean neonates per female)

Day	Sample ID	Dilution Control	Additional Control
6	51115	21.8	29.4

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 28.4% **PMSD Criteria Range:** 13%-47%

The calculated test PMSD was within the acceptable boundary range indicating test data with acceptable variability and statistical sensitivity. The chronic values (C-NOEC, C-LOEC) were reported as calculated by the statistical program.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, there were no special conditions or qualifiers that relate to the samples in this report, with the following exceptions:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as an additional control.

City of Keene NH
420 Airport Road
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Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION:

The results reported relate only to the the samples submitted as received.

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 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: September 27, 2018 ____________________
(Date) (Authorized signature)

John Williams
Director
Aquatec Environmental, Inc.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *9/11/2018 2:40:00 PM* ***Test End:*** *9/18/2018 11:25:00 AM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Pimephales promelas*	Effluent	Composite

Dilution Water:	Soft Water	
Additional Control:	Ashuelot River	
Effluent Sampling Dates:	September 10, 12, & 14, 2018	
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)	
Effluent Salinity Adjusted?	No	If yes, to what value?
With Sea Salts?		Hypersaline Brine Solution?
Reference Toxicant Date:	September 11-18, 2018	
Reference Toxicant Test Acceptable?	Yes	
Age and Age Range of Test Organisms:	1-day old	
Source of Organisms:	Aquatic BioSystems - Fort Collins, CO	

Aquatec Environmental, Inc.

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *9/11/2018 2:40:00 PM* ***Test End:*** *9/18/2018 11:25:00 AM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Growth: 0.641 (mg)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Growth: 0.583 (mg)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Growth (%): 10

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Dunnett Multiple Comparison Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *9/11/2018 2:40:00 PM* ***Test End:*** *9/18/2018 11:25:00 AM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was below the boundaries of 12%-30%, indicating test data with low variability and high statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or growth were not detected.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *9/11/2018 12:40:00 PM* ***Test End:*** *9/17/2018 2:30:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Ceriodaphnia dubia*	Effluent	Composite

Dilution Water:	Soft Water	
Additional Control:	Ashuelot River	
Effluent Sampling Dates:	September 10, 12, & 14, 2018	
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)	
Effluent Salinity Adjusted?	No	If yes, to what value?
With Sea Salts?		Hypersaline Brine Solution?
Reference Toxicant Date:	August 14-20, 2018	
Reference Toxicant Test Acceptable?	Yes	
Age and Age Range of Test Organisms:	<24h collected within an 8h period	
Source of Organisms:	Aquatec Environmental, Inc. - Williston, VT	

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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *9/11/2018 12:40:00 PM* ***Test End:*** *9/17/2018 2:30:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 90 % Mean Control Reproduction: 21.8 (neonates)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Reproduction: 29.4 (neonates)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Reproduction (%): 28.4

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Fisher Exact/Bonferroni-Holm Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

Aquatec Environmental, Inc.
Reviewed by: ____ Date: 9/23/18.

SDG: 15421
Project 18017

Aquatec Environmental, Inc.

273 Commerce Street
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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *9/11/2018 12:40:00 PM* ***Test End:*** *9/17/2018 2:30:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was within the boundaries of 13%-47%, indicating test data with normal variability and statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or reproduction were not detected.

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1809-23171**
Williston, VT 05495	DATE RECEIVED: September 11, 2018
	DATE REPORTED: September 26, 2018
Atten: John Williams	SAMPLER: DC

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 09/26/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1809-23171**
PROJECT: Keene NH NPDES DATE RECEIVED: 09/11/2018

001 Site: 51115 Keene WWTP Composite Date Sampled: 9/10/18 Time: 7:18

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	7.1	mg/L	SM 5310C (00)	9/19/18	N JGM	A	
Total Hardness, Total as CaCO3	59	mg/L	EPA 200.7	9/21/18	W FAA	A	
Ammonia as N	0.42	mg/L	EPA 350.1, R.2	9/25/18	N JGM	A	
Solids, Total Dissolved	471	mg/L	SM 2540C-97	9/12/18	W JSS	A	
Total Solids	569	mg/l	SM 2540 B.-97	9/13/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	9/12/18	W SJM	A	
Aluminum, Total	0.11	mg/L	EPA 200.8	9/14/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	9/14/18	W SJM	A	
Calcium, Total	18	mg/L	EPA 200.7	9/21/18	W FAA	A	
Copper, Total	0.0035	mg/L	EPA 200.8	9/14/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	9/14/18	W SJM	A	
Magnesium, Total	3.3	mg/L	EPA 200.7	9/21/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	9/14/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	9/14/18	W SJM	A	

002 Site: 51116 Ashuelot River Grab Date Sampled: 9/10/18 Time: 8:20

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	3.3	mg/L	SM 5310C (00)	9/19/18	N JGM	A	
Total Hardness, Total as CaCO3	23	mg/L	EPA 200.7	9/21/18	W FAA	A	
Ammonia as N	0.08	mg/L	EPA 350.1, R.2	9/25/18	N JGM	A	
Metals Digestion	Digested		EPA 200.7/200.8	9/12/18	W SJM	A	
Aluminum, Total	0.12	mg/L	EPA 200.8	9/14/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	9/14/18	W SJM	A	
Calcium, Total	6.7	mg/L	EPA 200.7	9/21/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	9/14/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	9/14/18	W SJM	A	
Magnesium, Total	1.4	mg/L	EPA 200.7	9/21/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	9/14/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	9/14/18	W SJM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	DC
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2 Clarifier	**09/10/18**	**7:18**	Grab: **N/A** Composite: **X**				
51115			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2
			Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice (4C)	1
Ashuelot River (51116)	**09/10/18**	**8:20**	Grab: **X** Composite: **N/A**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	
	9/11/18	14:50	E Toomey	9/11/18	1458	Cooler/Sample Temp.: -0.2 Notes To Lab:
Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	

1809-23171

1809-23171
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1809-23856**
Williston, VT 05495	DATE RECEIVED: September 17, 2018
	DATE REPORTED: September 28, 2018
Atten: John Williams	SAMPLER: DC/BB

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and “N” the Plattsburgh, NY lab under certification ELAP 11892. “Sub” indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. “A” indicates the referenced laboratory is NELAC accredited for the parameter reported. “N” indicates the laboratory is not accredited. “U” indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an “A” meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 09/28/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1809-23856**
PROJECT: Keene NH NPDES DATE RECEIVED: 09/17/2018

001 Site: 51124 Keene NH WWTP Composite Date Sampled: 9/12/18 Time: 7:02

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.22	mg/L	EPA 350.1, R.2	9/27/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	DC/BB
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2 Clarifier #2) (51124)	**09/12/18**	**7:02**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
[signature]	9-17-18	14:50	[signature]	9/17	1450	Cooler/Sample Temp.: 6.7 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1809-23856

1809-23856
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1809-23857**
Williston, VT 05495	DATE RECEIVED: September 17, 2018
	DATE REPORTED: September 28, 2018
Atten: John Williams	SAMPLER: DC/BB

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report

DATE REPORTED: 09/28/2018

CLIENT: Aquatec Environmental, Inc
PROJECT: Keene NH NPDES

WORK ORDER: **1809-23857**
DATE RECEIVED: 09/17/2018

001 Site: 51130 Keenw NH WWTP Composite Date Sampled: 9/14/18 Time: 7:01

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.13	mg/L	EPA 350.1, R.2	9/27/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	Project Name:	Keene NH NPDES
Address:	273 Commerce Street	Project Number:	18017
City/State/Zip:	Williston, VT 05403	Sampler Name(s):	DC/BB
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2 Clarifier #2) (51130)	09/14/18	7:01	Grab: N/A Composite: X				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
Chris Bouffard	9-17-18	14:50	C Toomey	9/17	1458	Cooler/Sample Temp.: 6.7 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1809-23857

1809-23857
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Tox Lab QC
273 Commerce St 101170	WORK ORDER: **1808-19923**
Williston, VT 05495	DATE RECEIVED: August 09, 2018
	DATE REPORTED: August 29, 2018
Atten: John Williams	SAMPLER: EB

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and “N” the Plattsburgh, NY lab under certification ELAP 11892. “Sub” indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. “A” indicates the referenced laboratory is NELAC accredited for the parameter reported. “N” indicates the laboratory is not accredited. “U” indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an “A” meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 08/29/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1808-19923**
PROJECT: Tox Lab QC DATE RECEIVED: 08/09/2018

001 Site: (51058) 080518 Soft Date Sampled: 8/7/18 Time: 16:20

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	< 0.5	mg/L	SM 5310C (00)	8/16/18	N CAL	A	
Total Hardness, Total as CaCO3	53	mg/L	EPA 200.7	8/27/18	W FAA	A	
Ammonia as N	< 0.05	mg/L	EPA 350.1, R.2	8/21/18	N CAL	A	
Solids, Total Dissolved	111	mg/L	SM 2540C-97	8/10/18	W JSS	A	
Total Solids	94	mg/L	SM 2540 B.-97	8/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	8/20/18	W SJM	A	
Aluminum, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	8/21/18	W SJM	A	
Calcium, Total	10	mg/L	EPA 200.7	8/27/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	8/21/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	8/21/18	W SJM	A	
Magnesium, Total	6.8	mg/L	EPA 200.7	8/27/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	8/21/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Tox Lab QC
Address:	273 Commerce Street	**Project Number:**	18000
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	EB
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
080518SOFT (51058)	**08/07/18**	**16:20**	Grab: **X** Composite: **N/A**				
			Ammonia-Nitrogen(0.1)	250mL	Plastic	H2SO4	1
			Metals: Al (0.02); Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Ca, Mg (0.05)	250mL	Plastic	HNO3	1
			TOC - Total Organic Carbon(0.5)	40mL	Glass	H2SO4	2
			TS/TDS-Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice(4C)	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	Cooler/Sample Temp.: 3.7
Ellen Bouchard	8/9/18	11:35	Eileen Toomey	8/9	11:35	Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1808-19923

1808-19923
Aquatec Environmental, Inc
Tox Lab QC

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Supportive Documentation

Chain-Of-Custody

Toxicity Test Methods

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

Standard Reference Toxicant Control Charts

Chain-Of-Custody(s)

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

Aquatec Environmental, Inc.

Chain-of-Custody

COMPANY INFORMATION	PROJECT INFORMATION
NAME: Keene, NH	**PROJECT:** Keene NH/Ley
ADDRESS: 420 Airport Road	*(1st Sample Ship Monday)*
Swanzey, NH 03446	**PROJECT #:** 18017
TEL: (603) 357 – 9836 [x6502]	**SAMPLERS NAME(S):** Darren Candello
CONTACT: Mary Ley	
E-MAIL: mley@ci.keene.nh.us	**PERMIT NUMBER:** NH0100790

VOLUME/CONTAINER TYPE/ PRESERVATIVE — NUMBER OF CONTAINERS

	SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
9/9-9/10/18	Keene WWTP (2° Clarifier #2)	9/10/18	718		X	Effluent	2	1	1	1	1	2		
	Ashuelot River	9/10/18	820	X		Receiving	1	1			1	2		

ANALYSIS (TEST/DETECTION LIMITS) – TOX: 1000.0 & 1002.0 (*P. promelas* & *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	9/10/18	1000	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	9/11/18	10:20	**RECEIVED BY:** (Signature) KN Karla
RELINQUISHED BY: (Signature)			**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 2.4°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION
NAME:	Keene, NH	PROJECT: Keene NH/Ley
ADDRESS:	420 Airport Road	*(2nd Sample Ship Wednesday)*
	Swanzey, NH 03446	PROJECT #: 18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):
CONTACT:	Mary Ley	Darren Candello / Bob Bishop
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER: NH0100790

VOLUME/CONTAINER TYPE/ PRESERVATIVE — NUMBER OF CONTAINERS

	SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
9-11 thru 9/12	Keene WWTP (2° Clarifier #2)	9/12/18	702		X	Effluent	2	1*	1		1			
	Ashuelot River	9/12/18	802	X		Receiving	1							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (*P. promelas* and *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	9/12/18	900	Priority Express
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)
Priority Express	9-13-18	10:10	[signature]
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 1.9 °C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Metals analysis only if ≥50% mortality.

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(3rd Sample Ship Friday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Darren Candello / Bob Bishop
CONTACT:	Mary Ley		
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Keene WWTP (2° Clarifier #2)	9/14/18	701		X	Effluent	3	1*	1		1			
Ashuelot River	9/14/18	835	X		Receiving	2							

WET 2°Clar #2 9-13/9-14/18

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (*P. promelas* and *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	9/14/18	1000	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	9/15/18	8:30	**RECEIVED BY:** (Signature) [illegible]
RELINQUISHED BY: (Signature)	DATE:	TIME:	**RECEIVED BY:** (Signature)

TEMPERATURE ON DELIVERY (°C): 3.4°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Metals analysis of renewal samples only if ≥50% mortality.

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

SAMPLE PREPARATION:

	Initial Sample		Second Sample		Third Sample		
	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	LAB CONTROL
Sample No.	51115	51116	51124	51125	51130	51131	51117
Filtration	60 Micron	60 Micron	60 Micron	60 Micron	60 Micron	60 Micron	N / A
Chlorine (1)	ND	—	ND	—	ND	—	N / A
Chlorine (2)	—	—	—	—	—	—	N / A
NaThio Lot No.	—	—	—	—	—	—	N / A
Original / Final Salinity:	N / A	N / A	N / A	N / A	N / A	N / A	N / A
FF Lot No.	N / A	N / A	N / A	N / A	N / A	N / A	N / A
Date / Initials:	9/11/18 KN	9/11/18 KN	9-13-18 / EB	9-13-18 / EB	9/15/18 KN	9/15/18 KN	9/11/18 KN

(1) Record vol. 0.025 N sodium thiosulfate to dechlorinate 100mL sample or record "ND" (Not Detected)

(2) Dechlorination required if detected. Record vol. 0.25 N sodium thiosulfate added per gallon effluent.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

ALKALINITY, HARDNESS, AND TRC REPORT:

Sample ID:	Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)	TRC: (mg/L)
51115 - Keene WWTP (2 Clarifier #2)	9/11/2018	128.0	68.0	0.07
51116 - Ashuelot River	9/11/2018	32.0	40.0	---
51117 - 091018SOFT	9/11/2018	28.0	46.0	---
51124 - Keene WWTP (2 Clarifier #2)	9/13/2018	124.0	64.0	0.04
51125 - Ashuelot River	9/13/2018	16.0	16.0	---
51130 - Keene WWTP (2 Clarifier #2)	9/15/2018	68.0	76.0	0.01
51131 - Ashuelot River	9/15/2018	24.0	24.0	---

INF: Interference. The color endpoint was reached immediately

Aquatec Environmental, Inc.
Reviewed by: ___ Date: 9/23/18

SDG: 15421
Project 18017

Toxicity Test Method(s)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25+/- 1C, Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s (50-100ft-c) (ambient laboratory levels)
5	Photoperiod:	16h light/8h dark
6	Test chamber size:	300mL disposable plastic or 600mL glass
7	Test solution volume:	Nominal 250mL
8	Test solution renewal:	Daily
9	Age of test organisms:	Newly hatched larvae less than 24h old. If shipped, not more than 48h old, 24h range in age
10	No. larvae per test chamber:	10
11	No. replicate chambers per concentration:	4
12	No. larvae per concentration:	40
13	Source of food:	Newly hatched Artemia nauplii (< 24h old)
14	Feeding regime:	On days 0-6, feed 0.1g newly hatched (less than 24h old) brine shrimp nauplii three times daily at 4h intervals or, as a minimum, 0.15g twice daily at 6h intervals. Sufficient nauplii are added to provide an excess.
15	Cleaning:	Siphon daily, immediately before test solution renewal
16	Aeration:	None: unless DO concentration falls below 4.0mg/L.
17	Dilution water:	Soft Water
18	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
19	Additional control:	Ashuelot River
20	Test duration:	7 days
21	Endpoints:	Survival and growth (weight)
22	Test acceptability criteria:	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25mg
23	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
24	Sample volume required:	2.5L/day

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25 +/- 1C; Test temperatures must not deviate (i.e. maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s or 50-100ft-c (ambient laboratory levels)
5	Photoperiod:	16h light, 8h dark
6	Test chamber size:	30mL
7	Test solution volume	Nominal 15mL
8	renewal of test solutions:	Daily
9	Age of test organisms:	Less than 24h; and all released within a 8h period
10	No. neonates per test chamber:	1
11	No. replicate test chambers per concentration:	10
12	No. neonates per test concentration:	10
13	Feeding regime:	Feed 0.1mL each of YCT and algal suspension per test chamber daily
14	Cleaning:	Use new plastic cups daily
15	Aeration:	None
16	Dilution water:	Soft Water
17	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
18	Additional control:	Ashuelot River
19	Test duration:	Until 60% or more of surviving control females have three broods (maximum test duration 8 days)
20	Endpoints:	Survival and reproduction
21	Test acceptability criteria:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods
22	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
23	Sample volume required:	1L/day

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

CETIS Summary Report

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Batch ID:	04-4336-3879	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Kaitlyn Priest
Start Date:	11 Sep-18 14:40	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	18 Sep-18 11:25	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	6d 21h	**Source:**	Aquatic Biosystems, CO	**Age:**	1d

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
09-5244-7472	2d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	n/a
10-9728-4269	7d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	6.45%
15-9198-3712	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test	100	> 100	n/a	1	10.0%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
12-7352-2657	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
21-4552-0765	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
50		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
100		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.5825	0.5216	0.6434	0.529	0.62	0.01914	0.03828	6.57%	0.00%
0	L	4	0.6413	0.6208	0.6617	0.631	0.66	0.006421	0.01284	2.00%	-10.09%
12		4	0.6085	0.5641	0.6529	0.585	0.64	0.01396	0.02791	4.59%	-4.46%
24		4	0.6463	0.5839	0.7086	0.595	0.686	0.0196	0.0392	6.07%	-10.94%
48		4	0.6165	0.575	0.658	0.578	0.636	0.01305	0.0261	4.23%	-5.84%
50		4	0.609	0.5482	0.6698	0.581	0.663	0.0191	0.03819	6.27%	-4.55%
100		4	0.6725	0.5724	0.7726	0.584	0.727	0.03144	0.06288	9.35%	-15.45%

Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	R	1.0000	1.0000	1.0000	1.0000
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	R	1.0000	1.0000	1.0000	1.0000
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	0.9000	1.0000
50		1.0000	1.0000	0.9000	1.0000
100		1.0000	1.0000	0.9000	1.0000

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	R	0.529	0.62	0.59	0.591
0	L	0.66	0.631	0.636	0.638
12		0.624	0.585	0.585	0.64
24		0.595	0.639	0.665	0.686
48		0.636	0.578	0.626	0.626
50		0.583	0.581	0.609	0.663
100		0.705	0.727	0.674	0.584

CETIS Analytical Report

Report Date: 22 Sep-18 09:10 (p 1 of 2)
Test Code: 81546 | 19-7443-8667

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	12-7352-2657	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	22 Sep-18 9:10	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1549503	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

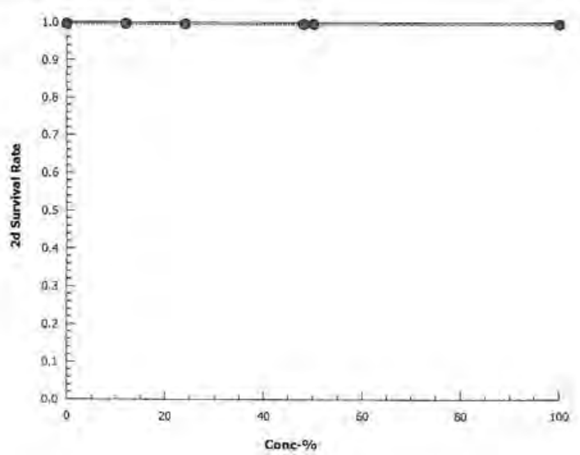
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	**Code**	**Count**	**Mean**	**Min**	**Max**	**Std Err**	**Std Dev**	**CV%**	**%Effect**	**A**	**B**
0	L	4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
12		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
24		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
48		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
50		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
100		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date:	22 Sep-18 09:10 (p 2 of 2)
Test Code:	81546 | 19-7443-8667

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	21-4552-0765	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	22 Sep-18 9:10	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1515787	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

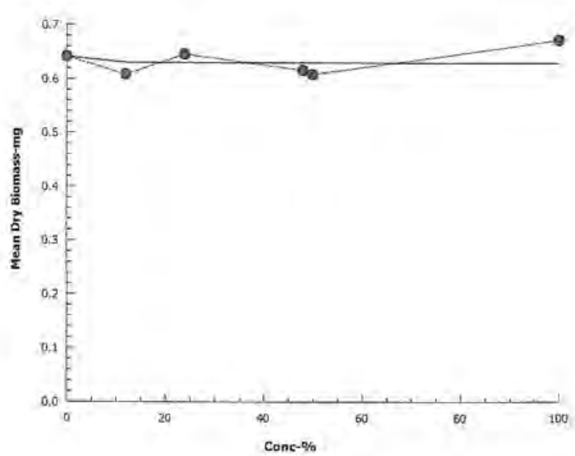
Mean Dry Biomass-mg Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	4	0.6413	0.631	0.66	0.006421	0.01284	2.00%	0.0%
12		4	0.6085	0.585	0.64	0.01396	0.02791	4.59%	5.11%
24		4	0.6463	0.595	0.686	0.0196	0.0392	6.07%	-0.78%
48		4	0.6165	0.578	0.636	0.01305	0.0261	4.23%	3.86%
50		4	0.609	0.581	0.663	0.0191	0.03819	6.27%	5.03%
100		4	0.6725	0.584	0.727	0.03144	0.06288	9.35%	-4.87%

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.66	0.631	0.636	0.638
12		0.624	0.585	0.585	0.64
24		0.595	0.639	0.665	0.686
48		0.636	0.578	0.626	0.626
50		0.583	0.581	0.609	0.663
100		0.705	0.727	0.674	0.584

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	09-5244-7472	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	22 Sep-18 9:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Angular (Corrected)	C > T	100	> 100	n/a	1

Steel Many-One Rank Sum Test

Control vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
	24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
	48	18	10	1	6	Asymp	0.8333	Non-Significant Effect
	50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
	100	18	10	1	6	Asymp	0.8333	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	5	65540	<1.0E-37	Significant Effect
Error	0	0	18			
Total	0		23			

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
48		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

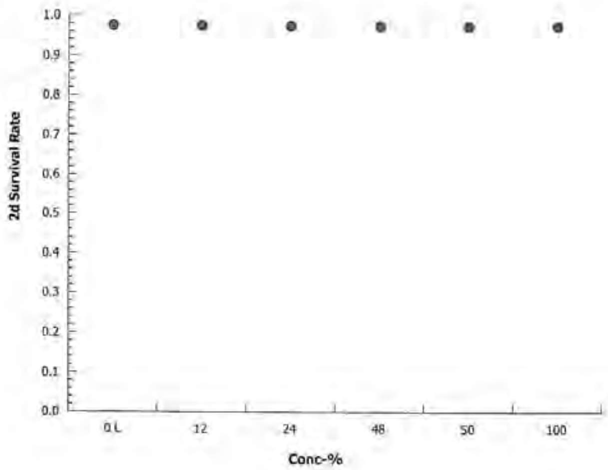
Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

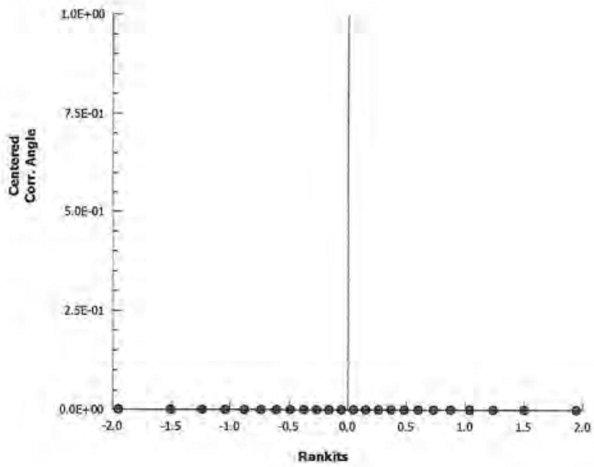
Analysis ID:	09-5244-7472	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	22 Sep-18 9:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.412	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	10-9728-4269	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	22 Sep-18 9:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	6.45%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		48	16	10	1	6	Asymp	0.6105	Non-Significant Effect
		50	16	10	1	6	Asymp	0.6105	Non-Significant Effect
		100	16	10	1	6	Asymp	0.6105	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0099598	0.001992	5	0.6	0.7006	Non-Significant Effect
Error	0.0597585	0.0033199	18			
Total	0.0697182		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	5.4	4.248	0.0033	Unequal Variances
Variances	Mod Levene Equality of Variance Test	0.6	4.248	0.7006	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.6694	0.884	4.1E-06	Non-Normal Distribution

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	2.50%
50		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	2.50%
100		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	2.50%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
48		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.89%
50		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.89%
100		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.89%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	0.9000	1.0000
50		1.0000	1.0000	0.9000	1.0000
100		1.0000	1.0000	0.9000	1.0000

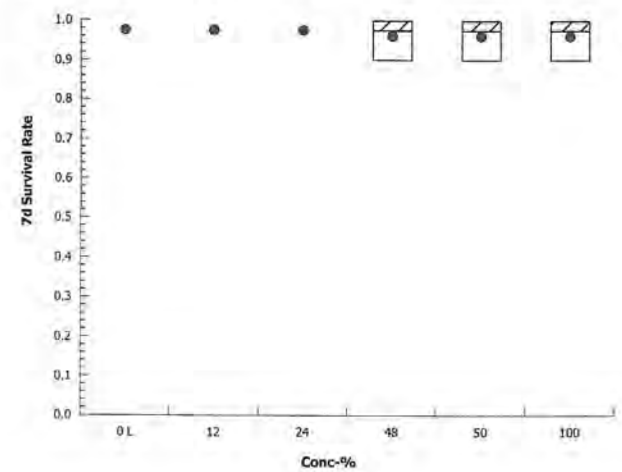
Fathead Minnow 7-d Larval Survival and Growth Test | **Aquatec Environmental, Inc.**

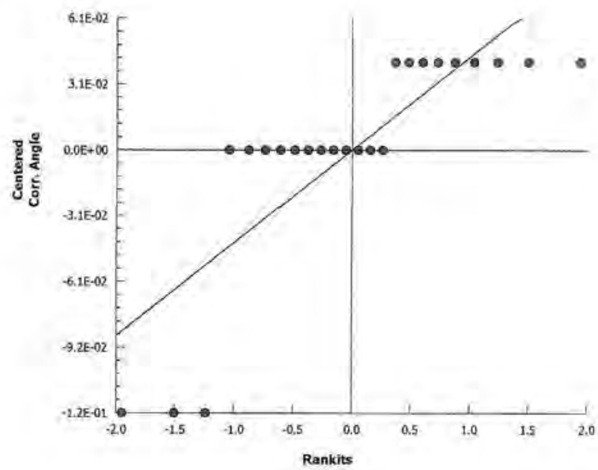
Analysis ID:	10-9728-4269	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	22 Sep-18 9:10	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.412	1.249	1.412
50		1.412	1.412	1.249	1.412
100		1.412	1.412	1.249	1.412

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID: 15-9198-3712		**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed: 22 Sep-18 9:10		**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	31h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	10.03%

Dunnett Multiple Comparison Test

Control vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water	12	1.225	2.407	0.064	6	CDF	0.3270	Non-Significant Effect
	24	-0.187	2.407	0.064	6	CDF	0.8825	Non-Significant Effect
	48	0.9259	2.407	0.064	6	CDF	0.4549	Non-Significant Effect
	50	1.206	2.407	0.064	6	CDF	0.3345	Non-Significant Effect
	100	-1.169	2.407	0.064	6	CDF	0.9892	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0129989	0.0025998	5	1.819	0.1598	Non-Significant Effect
Error	0.0257225	0.0014290	18			
Total	0.0387214		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	6.364	15.09	0.2724	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9687	0.884	0.6355	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.6413	0.6208	0.6617	0.637	0.631	0.66	0.006421	2.00%	0.00%
12		4	0.6085	0.5641	0.6529	0.6045	0.585	0.64	0.01396	4.59%	5.11%
24		4	0.6463	0.5839	0.7086	0.652	0.595	0.686	0.0196	6.07%	-0.78%
48		4	0.6165	0.575	0.658	0.626	0.578	0.636	0.01305	4.23%	3.86%
50		4	0.609	0.5482	0.6698	0.596	0.581	0.663	0.0191	6.27%	5.03%
100		4	0.6725	0.5724	0.7726	0.6895	0.584	0.727	0.03144	9.35%	-4.87%

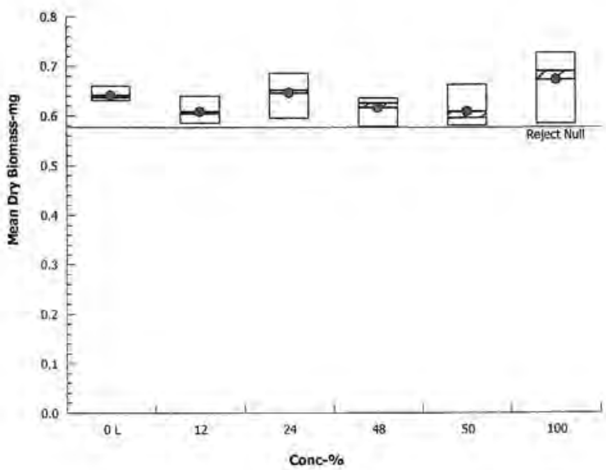
Mean Dry Biomass-mg Detail

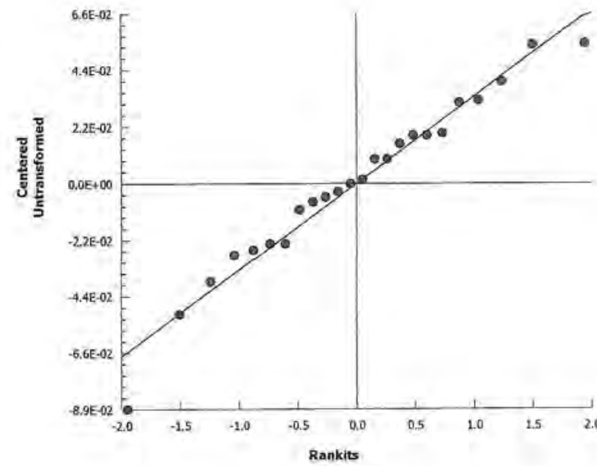
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.66	0.631	0.636	0.638
12		0.624	0.585	0.585	0.64
24		0.595	0.639	0.665	0.686
48		0.636	0.578	0.626	0.626
50		0.583	0.581	0.609	0.663
100		0.705	0.727	0.674	0.584

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	15-9198-3712	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	22 Sep-18 9:10	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Start Date: 11 Sep-18 14:40 **Species:** Pimephales promelas **Sample Code:** 15421
End Date: 18 Sep-18 11:25 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 10 Sep-18 07:18 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Total Weight-mg	Tare Weight-mg	Pan Count	Notes
0	L	1	23	10		10					10	25.54	18.94	10	
0	L	2	2	10		10					10	26.62	20.31	10	
0	L	3	11	10		10					10	26.36	20	10	
0	L	4	15	10		10					10	29.11	22.73	10	
0	R	1	18	10		10					10	24.86	19.57	10	
0	R	2	20	10		10					10	26.6	20.4	10	
0	R	3	27	10		10					10	26.01	20.11	10	
0	R	4	16	10		10					10	28.15	22.24	10	
12		1	22	10		10					10	29.77	23.53	10	
12		2	3	10		10					10	24.38	18.53	10	
12		3	10	10		10					10	26.12	20.27	10	
12		4	25	10		10					10	27.88	21.48	10	
24		1	19	10		10					10	27.19	21.24	10	
24		2	13	10		10					10	28.05	21.66	10	
24		3	4	10		10					10	30.39	23.74	10	
24		4	12	10		10					10	28.84	21.98	10	
48		1	28	10		10					10	27.45	21.09	10	
48		2	14	10		10					10	27.83	22.05	10	
48		3	21	10		10					9	28.48	22.22	9	
48		4	7	10		10					10	31.39	25.13	10	
50		1	17	10		10					10	28.22	22.39	10	
50		2	26	10		10					10	28.32	22.51	10	
50		3	6	10		10					9	28.88	22.79	9	
50		4	24	10		10					10	31.18	24.55	10	
100		1	5	10		10					10	27.33	20.28	10	
100		2	1	10		10					10	27.61	20.34	10	
100		3	8	10		10					9	28.95	22.21	9	
100		4	9	10		10					10	28.03	22.19	10	

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81546

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. weighed [1]	Initial Pan Weight	Final Pan Weight
DW 0 % Soft CTRL	A	10	10	10	10	10	10	10	10	10	18.94	25.54
	B	10	10	10	10	10	10	10	10	10	20.31	26.62
	C	10	10	10	10	10	10	10	10	10	20.00	26.36
	D	10	10	10	10	10	10	10	10	10	22.73	29.11
0 % RW	A	10	10	10	10	10	10	10	10	10	19.57	24.86
	B	10	10	10	10	10	10	10	10	10	20.40	26.40
	C	10	10	10	10	10	10	10	10	10	20.11	26.01
	D	10	10	10	10	10	10	10	10	10	22.24	28.15
12 % EFF	A	10	10	10	10	10	10	10	10	10	23.53	29.77
	B	10	10	10	10	10	10	10	10	10	18.53	24.38
	C	10	10	10	10	10	10	10	10	10	20.27	26.12
	D	10	10	10	10	10	10	10	10	10	21.48	27.88
24 % EFF	A	10	10	10	10	10	10	10	10	10	21.24	27.19
	B	10	10	10	10	10	10	10	10	10	21.66	28.05
	C	10	10	10	10	10	10	10	10	10	23.74	30.39
	D	10	10	10	10	10	10	10	10	10	21.98	28.84
48 % EFF	A	10	10	10	10	10	10	10	10	10	21.09	27.45
	B	10	10	10	10	10	10	10	10	10	22.05	27.83
	C	10	10	10	10	10	9	9	9	9	22.22	28.48
	D	10	10	10	10	10	10	10	10	10	25.13	31.39
50 % EFF	A	10	10	10	10	10	10	10	10	10	22.39	28.22
	B	10	10	10	10	10	10	10	10	10	22.57	28.32
	C	10	10	10	10	10	9	9	9	9	22.79	28.88
	D	10	10	10	10	10	10	10	10	10	24.55	31.18
100 % EFF	A	10	10	10	10	10	10	10	10	10	20.28	27.33
	B	10	10	10	10	10	10	10	10	10	20.34	27.61
	C	10	10	10	10	10	9	9	9	9	22.21	28.95
	D	10	10	10	10	10	10	10	10	10	22.19	28.03

Sample #	51115	51115	51124	51124	51130	51130	51130	Test End
Fed AM / Init.	------	825	825	830	805	0850 KP	830	------
Fed PM / Init.	16:05	1630	1605 EB	1615 ①	② 1455	1635	1630 EB	------
Renewal (D / T / I)	9-11-18 14:40 EB	9/12/18 1430 KN	9/13/18 1450 KN	9/14/18 1515 KN	9/15/18 1350 KN	9-16-18 1355 KP	9-17-18 1555 EB	9-18-18 11:25 EB

Date/Init (Initial Pan Weights): 9-14-18 / EB

IN (Date/Time/Temp/Init): 9-18-18 / 1130 / 105°C / EB

OUT (Date/Time/Temp/Init): 9-19-18 11:00 105°C EB

①1455 Brine Shrimp Lot #: 211132-Brine

KP

1 The number weighed = the number actually weighed. For statistical purposes, the number weighed = original number of organisms on Day 0.

Aquatec Environmental, Inc.

Reviewed by: [signature] Date: 9/28/18

SDG: 15421

Project 18017

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81546

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
0 % SOFT CTRL DW	pH	8.2	7.6	8.0	7.7	8.0	7.4	7.4
	DO	7.2	7.3	7.1	7.3	7.5	7.6	7.4
	Temp.	25.3	25.0	25.5	25.5	25.8	25.6	26.0
	Cond.	181	183	194	198	199	195	195
0 % RW	pH	7.4	7.4	7.1	7.90 ①	7.8	7.3	7.2
	DO	7.9	7.7	7.8	8.0	8.1	7.8	7.7
	Temp.	25.6	25.6	25.5	25.7	25.8	25.7	25.5
	Cond.	203	200	113	113	110	110	109
12 % EFF	pH	7.8	7.7	7.6	7.7	7.8	7.3	7.2
	DO	7.3	7.5	7.3	7.3	7.6	7.6	7.8
	Temp.	25.2	25.4	25.4	25.5	25.5	25.8	25.4
	Cond.	276	275	277	283	284	281	201
24 % EFF	pH	7.8	7.7	7.7	7.7	7.7	7.4	7.2
	DO	7.3	7.5	7.2	7.3	7.7	7.6	7.7
	Temp.	25.4	25.6	25.4	25.5	25.5	25.8	25.5
	Cond.	362	368	362	367	368	367	296
48 % EFF	pH	7.7	7.8	7.6	7.9	7.6	7.5	7.1
	DO	7.6	7.5	7.5	7.4	8.0	7.5	7.8
	Temp.	25.3	25.7	25.4	25.5	25.6	25.9	25.6
	Cond.	548	551	523	526	528	531	482
50 % EFF	pH	7.6	7.8	7.6	7.9	7.6	7.6	7.2
	DO	7.6	7.4	7.5	7.5	8.0	7.5	7.8
	Temp.	25.2	25.7	25.4	25.5	25.5	25.9	25.5
	Cond.	564	569	541	541	543	551	509
100 % EFF	pH	7.6	7.8	7.5	7.8	7.5	7.7	7.3
	DO	8.0	7.5	7.8	7.6	8.6	7.5	7.8
	Temp.	25.4	26.0	25.4	25.6	25.6	25.9	25.6
	Cond.	920	938	865	860	877	887	863
	Sample #	51115	51115	51124	51124	51130	51130	51130
	Date	9-11-18	9-12-18	9-13-18	9/14/18	9/15/18	9.16.18	9/17/18
	Initials	EB	EB	EB	KN	KN	KP	KN

① Recheck of pH = 7.91 pH KN 9/14/18

PP

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81546

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.4	7.2	7.1	7.3	7.1	7.1	7.4
	DO	6.9	6.2	5.9	6.6	6.2	6.1	5.6
	Temp.	25.3	25.4	25.1	24.9	25.8	25.4	25.4
	Cond.	190	196	208	214	213	201	202
0 % RW	pH	7.0	6.9	7.0	7.0	7.1	7.0	7.1
	DO	6.7	6.2	6.0	6.1	5.9	5.9	5.7
	Temp.	25.1	25.3	25.2	25.0	25.8	25.5	25.4
	Cond.	211	216	140	129	123	118	116
12 % EFF	pH	7.2	7.1	7.1	7.1	7.1	7.1	7.0
	DO	6.5	5.6	5.8	5.7	5.9	6.1	5.6
	Temp.	24.9	25.4	25.1	24.9	25.8	25.4	25.4
	Cond.	284	294	296	300	301	290	234
24 % EFF	pH	7.4	7.3	7.2	7.2	7.2	7.3	7.0
	DO	6.5	5.6	5.5	5.5	5.8	6.1	5.8
	Temp.	25.3	25.4	25.1	25.0	25.9	25.5	25.4
	Cond.	367	385	378	384	389	375	316
48 % EFF	pH	7.6	7.6	7.4	7.4	7.4	7.4	7.2
	DO	6.6	6.1	5.4	5.8	6.0	6.1	5.7
	Temp.	25.3	25.3	25.1	24.9	25.6	25.4	25.3
	Cond.	539	569	541	548	554	540	509
50 % EFF	pH	7.6	7.6	7.5	7.5	7.5	7.4	7.2
	DO	6.4	6.2	5.8	6.1	5.8	5.8	5.5
	Temp.	25.3	25.3	25.2	24.8	25.8	25.4	25.3
	Cond.	565	585	557	563	566	557	522
100 % EFF	pH	7.8	7.9	7.5	7.7	7.6	7.5	7.5
	DO	6.2	6.0	5.8	5.8	5.8	5.7	5.7
	Temp.	25.1	25.3	25.1	24.7	25.8	25.3	25.4
	Cond.	915	947	892	880	898	893	886
	Sample #	51115	51115	51124	51124	51130	51130	51130
	Date	9/12/18	9/13/18	9-14-18	9/15/18	9.16.18	9/17/18	9-18-18
	Initials	KN	KN	EB	KN	KP	KN	EB

Pp

Aquatec Environmental, Inc.
Reviewed by: [signature] Date: 9/23/18

SDG: 15421
Project 18017

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

AQUATIC BIO SYSTEMS ABS INC.

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

ORGANISM HISTORY

DATE:	9/10/2018
SPECIES:	*Pimephales promelas*
AGE:	N/A
LIFE STAGE:	Embryo
HATCH DATE:	9/10/2018
BEGAN FEEDING:	N/A
FOOD:	N/A

Received 9/11/18 EB
@ 10:20
Temp: 20.3
DO: 12.3
pH: 7.5
Conductivity: 360
Condition: Normal

Water Chemistry Record:

	Current	Range
TEMPERATURE:	25°C	--
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	130 mg/l	--
TOTAL ALKALINITY (as $CaCO_3$):	90 mg/l	--
pH:	7.93	--

Add to SOFT water
and fed artemia
10:50 ES

Comments:

Facility Supervisor

JV 9/23/18

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

CETIS Summary Report

Report Date:	19 Sep-18 08:52 (p 1 of 1)
Test Code:	81547 | 06-9861-0493

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Batch ID:	04-8292-7172	**Test Type:**	Reproduction-Survival (2-8d)	**Analyst:**	Kaitlyn Priest
Start Date:	11 Sep-18 12:40	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	17 Sep-18 14:30	**Species:**	Ceriodaphnia dubia	**Brine:**	
Duration:	6d 2h	**Source:**	In-House Culture	**Age:**	<24h

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
04-5604-7256	2d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
03-0208-9387	6d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
18-9275-8188	Reproduction	Steel Many-One Rank Sum Test	100	> 100	n/a	1	28.4%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
07-1817-1368	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
15-0249-6485	Reproduction	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

6d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	0.9000	0.6738	1.0000	0.0000	1.0000	0.1000	0.3162	35.14%	10.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	29.4	25.12	33.68	17	37	1.893	5.985	20.36%	0.00%
0	L	10	21.8	13.81	29.79	0	32	3.533	11.17	51.25%	25.85%
12		10	29	27	31	23	33	0.8819	2.789	9.62%	1.36%
24		10	25.3	20.88	29.72	16	32	1.955	6.183	24.44%	13.95%
48		10	27.8	23.71	31.89	21	36	1.806	5.712	20.55%	5.44%
50		10	30.9	29.3	32.5	28	35	0.7063	2.234	7.23%	-5.10%
100		10	30	27.57	32.43	21	33	1.075	3.399	11.33%	-2.04%

CETIS Analytical Report

Report Date: 19 Sep-18 08:52 (p 1 of 2)
Test Code: 81547 | 06-9861-0493

Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

Analysis ID:	04-5604-7256	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	19 Sep-18 8:51	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes
Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water	12	1.0000	Exact	1.0000	Non-Significant Effect
	24	1.0000	Exact	1.0000	Non-Significant Effect
	48	1.0000	Exact	1.0000	Non-Significant Effect
	50	1.0000	Exact	1.0000	Non-Significant Effect
	100	1.0000	Exact	1.0000	Non-Significant Effect

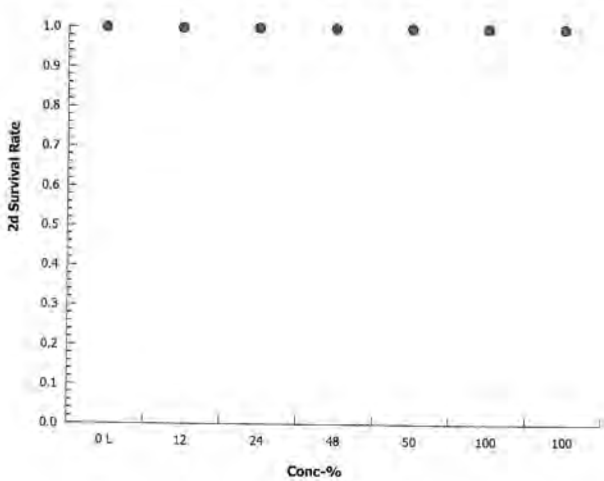
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date: 19 Sep-18 08:52 (p 2 of 2)
Test Code: 81547 | 06-9861-0493

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	03-0208-9387	**Endpoint:**	6d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	19 Sep-18 8:51	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes
Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		12	1.0000	Exact	1.0000	Non-Significant Effect
		24	1.0000	Exact	1.0000	Non-Significant Effect
		48	1.0000	Exact	1.0000	Non-Significant Effect
		50	1.0000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

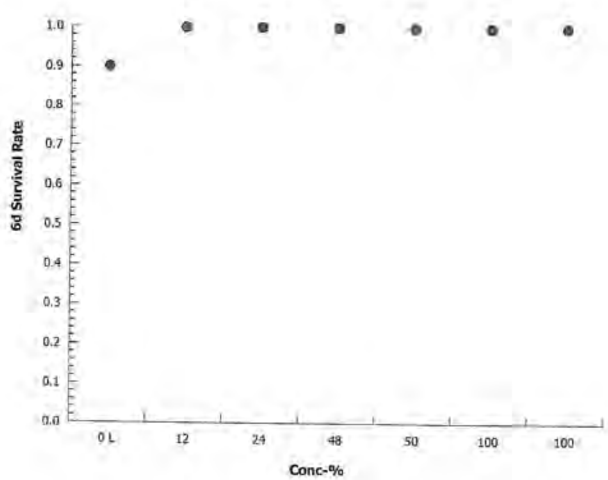
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	9	1	10	0.9	0.1	0.0%
12		10	0	10	1	0	-11.11%
24		10	0	10	1	0	-11.11%
48		10	0	10	1	0	-11.11%
50		10	0	10	1	0	-11.11%
100		10	0	10	1	0	-11.11%

6d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	0.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date:	19 Sep-18 08:51 (p 1 of 2)
Test Code:	81547 | 06-9861-0493

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	07-1817-1368	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	19 Sep-18 8:51	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1321618	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

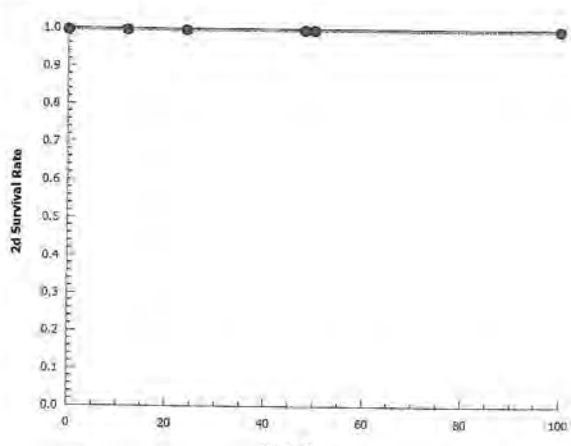
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
12		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
24		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
48		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



CETIS Analytical Report

Report Date: 19 Sep-18 08:51 (p 2 of 2)
Test Code: 81547 | 06-9861-0493

Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

Analysis ID:	15-0249-6485	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	19 Sep-18 8:51	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes
Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	344720	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

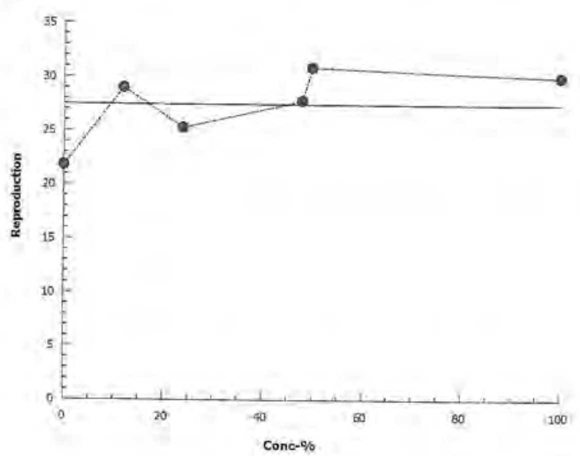
Reproduction Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	10	21.8	0	32	3.533	11.17	51.25%	0.0%
12		10	29	23	33	0.8819	2.789	9.62%	-33.03%
24		10	25.3	16	32	1.955	6.183	24.44%	-16.06%
48		10	27.8	21	36	1.806	5.712	20.55%	-27.52%
50		10	30.9	28	35	0.7063	2.234	7.23%	-41.74%
100		10	30	21	33	1.075	3.399	11.33%	-37.61%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	27	0	26	3	22	23	32	30	25	30
12		28	23	28	30	33	30	32	27	30	29
24		22	19	31	17	32	30	30	16	29	27
48		22	31	32	30	35	21	36	21	25	25
50		30	29	30	35	34	28	32	31	31	29
100		29	32	31	32	33	21	31	29	31	31

Graphics



CETIS Analytical Report

Report Date: 19 Sep-18 08:51 (p 1 of 2)
Test Code: 81547 | 06-9861-0493

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	18-9275-8188	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	19 Sep-18 8:51	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes
Sample ID:	19-9179-6712	**Code:**	15421	**Client:**	Keene WWTP
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	11 Sep-18 10:20	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	29h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	28.44%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	129.5	75	4	18	Asymp	0.9993	Non-Significant Effect
		24	111.5	75	4	18	Asymp	0.9403	Non-Significant Effect
		48	117	75	4	18	Asymp	0.9803	Non-Significant Effect
		50	139.5	75	2	18	Asymp	1.0000	Non-Significant Effect
		100	136	75	1	18	Asymp	0.9999	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	574.733	114.947	5	3.135	0.0148	Significant Effect
Error	1980.2	36.6704	54			
Total	2554.93		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	30.63	15.09	1.1E-05	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.8982	0.9459	1.1E-04	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	10	21.8	13.81	29.79	25.5	0	32	3.533	51.25%	0.00%
12		10	29	27	31	29.5	23	33	0.8819	9.62%	-33.03%
24		10	25.3	20.88	29.72	28	16	32	1.955	24.44%	-16.06%
48		10	27.8	23.71	31.89	27.5	21	36	1.806	20.55%	-27.52%
50		10	30.9	29.3	32.5	30.5	28	35	0.7063	7.23%	-41.74%
100		10	30	27.57	32.43	31	21	33	1.075	11.33%	-37.61%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	27	0	26	3	22	23	32	30	25	30
12		28	23	28	30	33	30	32	27	30	29
24		22	19	31	17	32	30	30	16	29	27
48		22	31	32	30	35	21	36	21	25	25
50		30	29	30	35	34	28	32	31	31	29
100		29	32	31	32	33	21	31	29	31	31

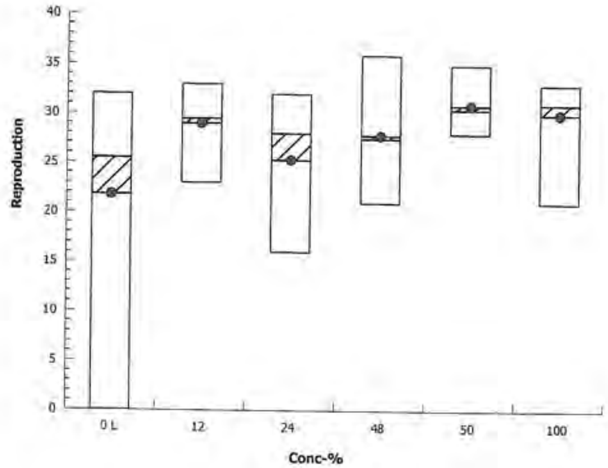
CETIS Analytical Report

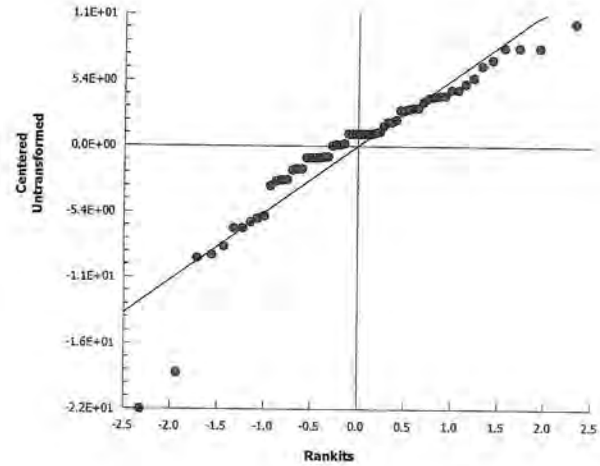
		Report Date:	19 Sep-18 08:51 (p 2 of 2)
		Test Code:	81547 | 06-9861-0493

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	18-9275-8188	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	19 Sep-18 8:51	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Test Data Worksheet

Report Date: 19 Sep-18 08:51 (p 1 of 2)
Test Code/ID: 06-9861-0493/81547

Ceriodaphnia 7-d Survival and Reproduction Test

Aquatec Environmental, Inc.

Start Date:	11 Sep-18 12:40	**Species:**	Ceriodaphnia dubia	**Sample Code:**	15421
End Date:	17 Sep-18 14:30	**Protocol:**	EPA/821/R-02-013 (2002)	**Sample Source:**	Permit # NH0100790
Sample Date:	10 Sep-18 07:18	**Material:**	POTW Effluent	**Sample Station:**	Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
0	L	1	43	1		1				1					5	12	10			0	
0	L	2	25	1		1				0					0	0	0			0	
0	L	3	6	1		1				1					6	10	10			0	
0	L	4	7	1		1				1					3	0	0			0	
0	L	5	22	1		1				1					0	10	12			0	
0	L	6	65	1		1				1					4	12	7			0	
0	L	7	67	1		1				1					4	11	17			0	
0	L	8	17	1		1				1					5	12	13			0	
0	L	9	10	1		1				1					5	10	10			0	
0	L	10	47	1		1				1					6	12	12			0	
0	R	1	19	1		1				1					7	12	15			0	
0	R	2	42	1		1				1					7	10	12			0	
0	R	3	32	1		1				1					8	12	17			0	
0	R	4	35	1		1				1					0	5	16			0	
0	R	5	55	1		1				1					4	10	18			0	
0	R	6	8	1		1				1					5	12	0			0	
0	R	7	9	1		1				1					5	11	14			0	
0	R	8	5	1		1				1					7	11	14			0	
0	R	9	70	1		1				1					6	12	13			0	
0	R	10	69	1		1				1					6	12	13			0	
12		1	27	1		1				1					3	12	13			0	
12		2	51	1		1				1					5	10	8			0	
12		3	38	1		1				1					4	11	13			0	
12		4	31	1		1				1					6	10	14			0	
12		5	1	1		1				1					7	12	14			0	
12		6	56	1		1				1					6	12	12			0	
12		7	62	1		1				1					7	10	15			0	
12		8	63	1		1				1					6	10	11			0	
12		9	23	1		1				1					6	11	13			0	
12		10	52	1		1				1					6	12	11			0	
24		1	60	1		1				1					0	11	11			0	
24		2	26	1		1				1					0	10	9			0	
24		3	48	1		1				1					6	13	12			0	
24		4	2	1		1				1					5	12	0			0	
24		5	29	1		1				1					6	12	14			0	
24		6	24	1		1				1					7	12	11			0	
24		7	61	1		1				1					7	11	12			0	
24		8	41	1		1				1					3	13	0			0	
24		9	36	1		1				1					6	11	12			0	
24		10	54	1		1				1					3	10	14			0	
48		1	44	1		1				1					7	0	15			0	
48		2	14	1		1				1					7	10	14			0	
48		3	11	1		1				1					7	12	13			0	
48		4	16	1		1				1					6	14	10			0	
48		5	57	1		1				1					7	12	16			0	

CETIS Test Data Worksheet

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
48		6	3	1		1				1					3	10	8			0	
48		7	68	1		1				1					7	14	15			0	
48		8	18	1		1				1					6	0	15			0	
48		9	46	1		1				1					6	7	12			0	
48		10	58	1		1				1					0	13	12			0	
50		1	37	1		1				1					6	13	11			0	
50		2	12	1		1				1					5	12	12			0	
50		3	30	1		1				1					6	13	11			0	
50		4	50	1		1				1					7	12	16			0	
50		5	33	1		1				1					7	11	16			0	
50		6	20	1		1				1					6	12	10			0	
50		7	53	1		1				1					6	12	14			0	
50		8	28	1		1				1					6	10	15			0	
50		9	4	1		1				1					5	12	14			0	
50		10	40	1		1				1					6	11	12			0	
100		1	13	1		1				1					6	10	13			0	
100		2	49	1		1				1					6	12	14			0	
100		3	64	1		1				1					3	12	16			0	
100		4	21	1		1				1					6	12	14			0	
100		5	15	1		1				1					6	12	15			0	
100		6	39	1		1				1					5	3	13			0	
100		7	66	1		1				1					6	11	14			0	
100		8	45	1		1				1					7	10	12			0	
100		9	34	1		1				1					6	11	14			0	
100		10	59	1		1				1					6	12	13			0	

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA: **Test ID** 81547

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	1	0	0	0	0	5	12	10	
	2	0	0	0	D-0	—	—	—	—
	3	0	0	0	0	6	10	10	
	4	0	0	0	0	3	0	0	
	5	0	0	0	0	0	10	12	
	6	0	0	0	0	4	12	7	
	7	0	0	0	0	4	11	17	
	8	0	0	0	0	5	12	13	
	9	0	0	0	0	5	10	10	
	10	0	0	0	0	6	12	12	
0 % RW	1	0	0	0	0	7	12	15	
	2	0	0	0	0	7	10	12	
	3	0	0	0	0	0	12	17	
	4	0	0	0	0	0	5	16	
	5	0	0	0	0	4	10	15	
	6	0	0	0	0	5	12	0	
	7	0	0	0	0	5	11	14	
	8	0	0	0	0	7	11	14	
	9	0	0	0	0	6	12	13	
	10	0	0	0	0	6	12	13	
12 % EFF	1	0	0	0	0	3	12	13	
	2	0	0	0	0	5	10	8	
	3	0	0	0	0	4	11	13	
	4	0	0	0	0	6	10	14	
	5	0	0	0	0	7	12	14	
	6	0	0	0	0	6	12	12	
	7	0	0	0	0	7	10	15	
	8	0	0	0	0	6	10	11	
	9	0	0	0	0	6	11	13	
	10	0	0	0	0	6	12	11	
24 % EFF	1	0	0	0	0	0	11	11	
	2	0	0	0	0	0	10	9	
	3	0	0	0	0	6	13	12	
	4	0	0	0	0	5	12	0	
	5	0	0	0	0	6	12	14	
	6	0	0	0	0	7	12	11	
	7	0	0	0	0	7	11	12	
	8	0	0	0	0	3	13	0	
	9	0	0	0	0	6	11	12	
	10	0	0	0	0	3	10	14	

cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc.

Reviewed by: JV Date: 9/28/18

SDG: 15421

Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA: **Test ID** 81547

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
48 % EFF	1	0	0	0	0	7	0	15	
	2	0	0	0	0	7	10	14	
	3	0	0	0	0	7	12	13	
	4	0	0	0	0	6	14	10	
	5	0	0	0	0	7	12	16	
	6	0	0	0	0	3	10	8	
	7	0	0	0	0	7	14	15	
	8	0	0	0	0	6	0	15	
	9	0	0	0	0	6	7	12	
	10	0	0	0	0	0	13	12	
50 % EFF	1	0	0	0	0	6	13	11	
	2	0	0	0	0	5	12	12	
	3	0	0	0	0	6	13	11	
	4	0	0	0	0	7	12	16	
	5	0	0	0	0	7	11	16	
	6	0	0	0	0	6	12	10	
	7	0	0	0	0	6	12	14	
	8	0	0	0	0	6	10	15	
	9	0	0	0	0	5	12	14	
	10	0	0	0	0	6	11	12	
100 % EFF	1	0	0	0	0	6	10	13	
	2	0	0	0	0	6	12	14	
	3	0	0	0	0	3	12	16	
	4	0	0	0	0	6	12	14	
	5	0	0	0	0	6	12	15	
	6	0	0	0	0	5	3	13	
	7	0	0	0	0	6	11	14	
	8	0	0	0	0	7	10	12	
	9	0	0	0	0	6	11	14	
	10	0	0	0	0	6	12	13	
	Sample #	51115	51115	51124	51124	51130	51130	51130	51130
	Fed	✓	✓	✓	✓	✓	✓	—	
	Renewal (D / T / I)	9/11/18 1240 KN	9/12/18 13:10 KN	9/13/18 1400 KN	9/14/18 1410 KN	9/15/18 1250 KN	9-16-18 1310 KP	9/17/18 14:30 KN	

YCT Lot Number: 081018 Selenastrum Lot Number: 082718

cd

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc. **SDG:** 15421

Reviewed by: JV Date: 9/23/18. **Project** 18017

Documentation of Collection

Species: *Ceriodaphnia dubia*
Source: In-House Cultures
Client/Project: Keene CC
Testing Date: 9/11/18

Acclimation/Holding Procedures: Transfer culture cups collected within 8-hour intervals to the top of the brood board, group each collection by collection time or Collect neonates into a small Carolina bowl of <24-hour pooled neonates. Acclimate/Hold at appropriate testing temperature.

Feeding: Feed 200µL 1:1 Mix of *Pseudokirschneriella subcapitata* formally *Selenastrum capricornutum* (Lot #: 082718) and YTC (Lot #: 090718) to each culture cup or ~3mL 1:1 Mix to a small Carolina bowl of pooled neonates.

Culture ID	Date / Time / Init Cleared of Neonates	Date / Time / Init Neonate Collection	Number of Cups Collected*	Fed (✓)
090418-A	9/10/18 11:45 KN	9/10/18 1640 KN	7	✓
090418-B	9/10/18 11:20 KN	9/10/18 16:35 KN	0	—
090418-A	9/10/18 16:40 KN	9/10/18 18:35 EB	14	✓
090418-B	9/10/18 1635 KN	9/10/18 18:40 EB	1	✓
090418-A	9/10/18 18:35	9/10/18 23:00	17	✓
090418-B	9/10/18 18:40	9/10/18 23:06	4	✓
090418-A	9/10/18 23:00	9/11/18 06:55	27	✓
090418-B	9/10/18 23:06	9/11/18 07:00	26	✓

* *Neonates collected must number at least eight per cup, and be from a healthy adult female*

Aquatec Environmental, Inc.
DAPHNID COLLECTION FORM

9/23/18

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81547

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
0 % CTRL	pH							
	DO							
	Temp.							
	Cond.							
0 % RW	pH							
	DO							
	Temp.							
	Cond.							
12 % EFF	pH							
	DO							
	Temp.							
	Cond.							
24 % EFF	pH							
	DO							
	Temp.							
	Cond.							
48 % EFF	pH							
	DO							
	Temp.							
	Cond.							
50 % EFF	pH							
	DO							
	Temp.							
	Cond.							
100 % EFF	pH							
	DO							
	Temp.							
	Cond.							
	Sample #	51115	51115	51124	51124	51130	51130	51130
	Date							
	Initials							

See P. promelas initial chemistry

Data are common to both tests

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

FINAL CHEMISTRY DATA:

Test ID 81547

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % Soft CTRL	pH	7.4	7.3	7.5	7.3	7.4	7.2	
	DO	7.3	7.3	7.5	7.4	7.3	7.2	
	Temp.	24.9	25.5	25.2	25.1	25.2	25.8	
	Cond.	190	197	199	208	213	209	
0 % RW	pH	7.2	7.3	7.6	7.3	7.2	7.2	
	DO	7.2	7.3	7.5	7.4	7.3	7.2	
	Temp.	24.9	25.4	25.1	25.1	25.3	25.8	
	Cond.	217	213	121	121	116	150	
12 % EFF	pH	7.4	7.6	7.5	7.5	7.4	7.3	
	DO	7.3	7.3	7.5	7.4	7.3	7.2	
	Temp.	24.9	25.4	25.1	25.1	25.3	25.8	
	Cond.	283	291	281	291	290	302	
24 % EFF	pH	7.6	7.6	7.6	7.7	7.5	7.4	
	DO	7.3	7.3	7.5	7.4	7.3	7.2	
	Temp.	24.9	25.4	25.1	25.0	25.4	25.9	
	Cond.	373	381	363	372	379	376	
48 % EFF	pH	7.8	7.9	7.8	7.7	7.7	7.5	
	DO	7.3	7.3	7.5	7.4	7.3	7.2	
	Temp.	24.9	25.4	25.2	25.0	25.4	25.8	
	Cond.	552	556	520	526	536	545	
50 % EFF	pH	7.9	7.9	7.9	7.8	7.7	7.6	
	DO	7.3	7.2	7.5	7.5	7.3	7.2	
	Temp.	24.9	25.4	25.1	25.0	25.4	25.8	
	Cond.	567	578	537	544	551	558	
100 % EFF	pH	8.1	8.2	8.0	8.0	7.9	7.8	
	DO	7.3	7.2	7.4	7.5	7.4	7.2	
	Temp.	24.9	25.4	25.1	25.0	25.3	25.8	
	Cond.	930	947	866	869	881	900	
	Sample #	51115	51115	51124	51124	51130	51130	51130
	Date	9/12/18	9/13/18	9/14/18	9/15/18	9.16.18	9/17/18	
	Initials	KN	KN	KN	KN	KP	KN	

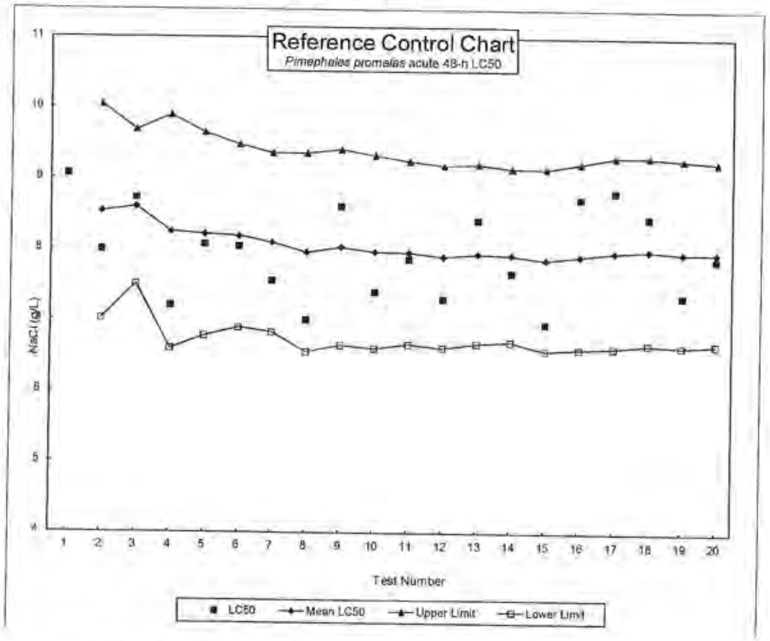
CA

Standard Reference Toxicant Control Chart(s)

***Pimephales promelas* acute survival LC50 Control Chart**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Lower	Source
1	9/13/16-9/15/16	9.06				Aquatic Biosystems
2	10/19-21/2016	7.994	8.53	10.03	7.02	Aquatic Biosystems
3	11/29/16-12/1/16	8.722	8.59	9.68	7.50	Aquatic Biosystems
4	1/10/17-1/12/17	7.204	8.25	9.89	6.60	Aquatic Biosystems
5	2/7/17-2/9/17	8.071	8.21	9.65	6.77	Aquatic Biosystems
6	3/21/17-3/23/17	8.042	8.18	9.47	6.89	Aquatic Biosystems
7	5/2/17-5/4/17	7.561	8.09	9.36	6.82	Aquatic Biosystems
8	7/12/17-7/14/17	7.005	7.96	9.36	6.55	Aquatic Biosystems
9	8/8/17-8/10/17	8.61	8.03	9.41	6.65	Aquatic Biosystems
10	9/12/17-9/14/14	7.403	7.97	9.33	6.60	Aquatic Biosystems
11	10/24/17-10/26/17	7.867	7.96	9.25	6.66	Aquatic Biosystems
12	11/7/17-11/9/17	7.31	7.90	9.19	6.61	Aquatic Biosystems
13	1/25/18-1/27/18	8.42	7.94	9.21	6.68	Aquatic Biosystems
14	2/6/18-2/8/18	7.678	7.92	9.15	6.70	Aquatic Biosystems
15	3/6/18-3/8/18	6.952	7.86	9.14	6.58	Aquatic Biosystems
16	4/3/18-4/5/18	8.722	7.91	9.23	6.60	Aquatic Biosystems
17	6/5/18-6/7/18	8.819	7.97	9.31	6.62	Aquatic Biosystems
18	7/24/18-7/26/18	8.451	7.99	9.32	6.67	Aquatic Biosystems
19	8/14/18-8/16/18	7.35	7.96	9.28	6.64	Aquatic Biosystems
20	9/11/18-9/13/18	7.87	7.96	9.24	6.67	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted.

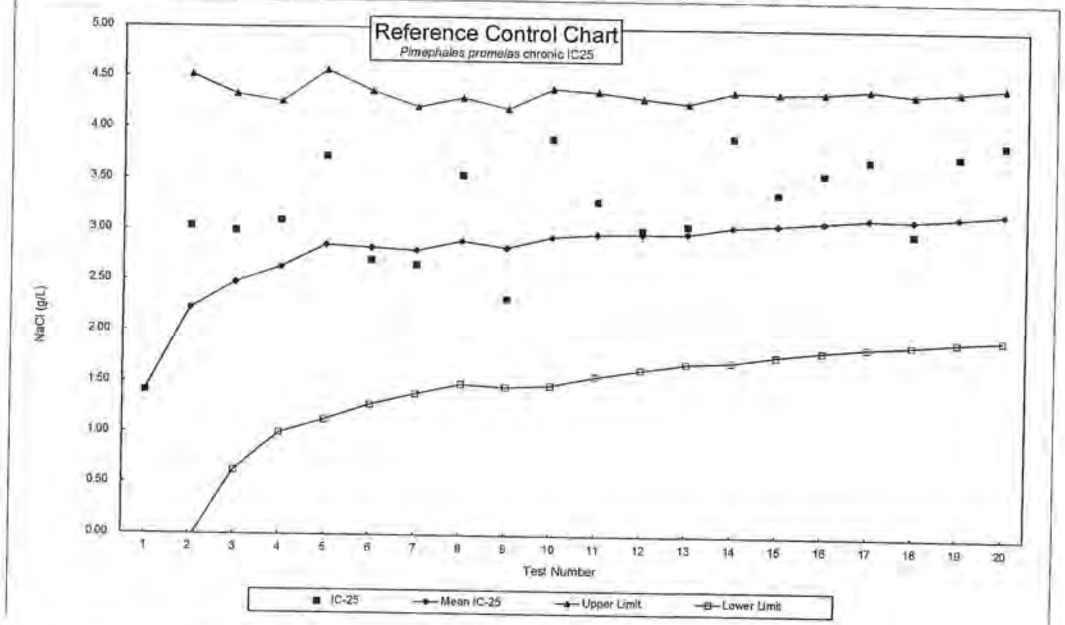


Note: Tests through September of 2016 were as Aquatec Biological Sciences, Inc. SRT tests beginning in October of 2016 were as Aquatec Environmental, Inc.

***Pimephales promelas* chronic IC25 Control Chart based on minnow growth**
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Lower	CV of Avg. IC25	Avg. CV	Growth PMSD (%)	Avg. PMSD (%)	Source
1	9/13/16-9/20/16	1.41	1.41						#DIV/0!	Aquatic Biosystems
2	10/19-26/2016	3.04	2.22	4.52	-0.08	0.52	0.52	18.00	18.00	Aquatic Biosystems
3	11/29/16-12/6/16	2.99	2.48	4.33	0.63	0.37	0.45	20.40	19.20	Aquatic Biosystems
4	1/10/17-1/17/17	3.09	2.63	4.26	1.00	0.31	0.40	11.20	16.53	Aquatic Biosystems
5	2/7/17-2/14/17	3.73	2.85	4.57	1.13	0.30	0.38	7.45	14.26	Aquatic Biosystems
6	3/21/17-3/28/17	2.71	2.83	4.37	1.28	0.27	0.36	14.80	14.37	Aquatic Biosystems
7	5/2/14-5/9/17	2.66	2.80	4.22	1.39	0.25	0.34	15.10	14.49	Aquatic Biosystems
8	7/12/17-7/19/17	3.55	2.90	4.31	1.49	0.24	0.32	12.90	14.26	Aquatic Biosystems
9	8/8/17-8/15/17	2.33	2.83	4.21	1.46	0.24	0.31	only 2 reps	12.48	Aquatic Biosystems
10	9/12/17-9/19/17	3.91	2.94	4.40	1.48	0.25	0.31	19.00	13.21	Aquatic Biosystems
11	10/24/17-10/31/17	3.29	2.97	4.38	1.57	0.24	0.30	22.10	14.10	Aquatic Biosystems
12	11/7/17-11/14/17	3.02	2.98	4.32	1.64	0.22	0.29	27.00	15.27	Aquatic Biosystems
13	1/25/18-2/1/18	3.06	2.98	4.27	1.70	0.21	0.29	15.50	15.29	Aquatic Biosystems
14	2/6/18-2/13/18	3.93	3.05	4.38	1.72	0.22	0.28	14.70	15.24	Aquatic Biosystems
15	3/6/18-3/13/18	3.38	3.07	4.37	1.78	0.21	0.28	19.20	15.53	Aquatic Biosystems
16	4/3/18-4/10/18	3.57	3.10	4.38	1.83	0.21	0.27	13.20	15.37	Aquatic Biosystems
17	6/5/18-6/12/18	3.72	3.14	4.41	1.87	0.20	0.27	12.80	15.21	Aquatic Biosystems
18	7/24/18-7/31/18	2.99	3.13	4.37	1.90	0.20	0.26	20.80	15.54	Aquatic Biosystems
19	8/14/18-8/21/18	3.76	3.17	4.40	1.93	0.19	0.26	9.11	15.18	Aquatic Biosystems
20	9/11/18-9/18/18	3.88	3.20	4.44	1.96	0.19	0.26	12.60	15.05	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted. Test of 8/8/17, insufficient minnows for 4 reps. Tested with 2 reps.

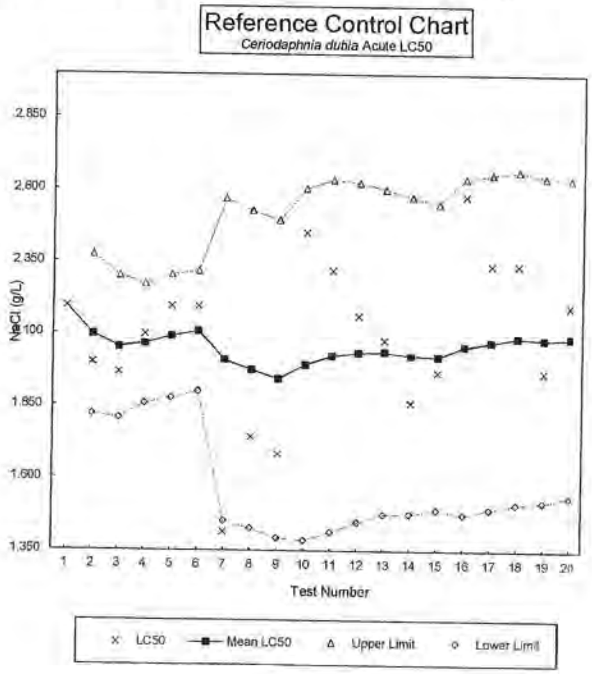


Assessment of test precision and sensitivity: Thev CV of average IC25 values was within the 25th Percentile (0.21) for fathead minnow growth (Table 3-2, EPA 833-R-00-003) indicating high precision (only 25% of labs reported CVs of not more than 0.21). The per-test PMSD values were less than the EPA upper limit of 30% indicating low-to moderate variability (moderate to high sensitivity) for this method. The cumulative average PMSD value of 20 tests (15.0) was near the EPA lower boundary (12%), indicating high statistical sensitivity for this test method. Updated 9/25/18

Ceriodaphnia dubia
Reference Control Chart for NaCl Acute Toxicity

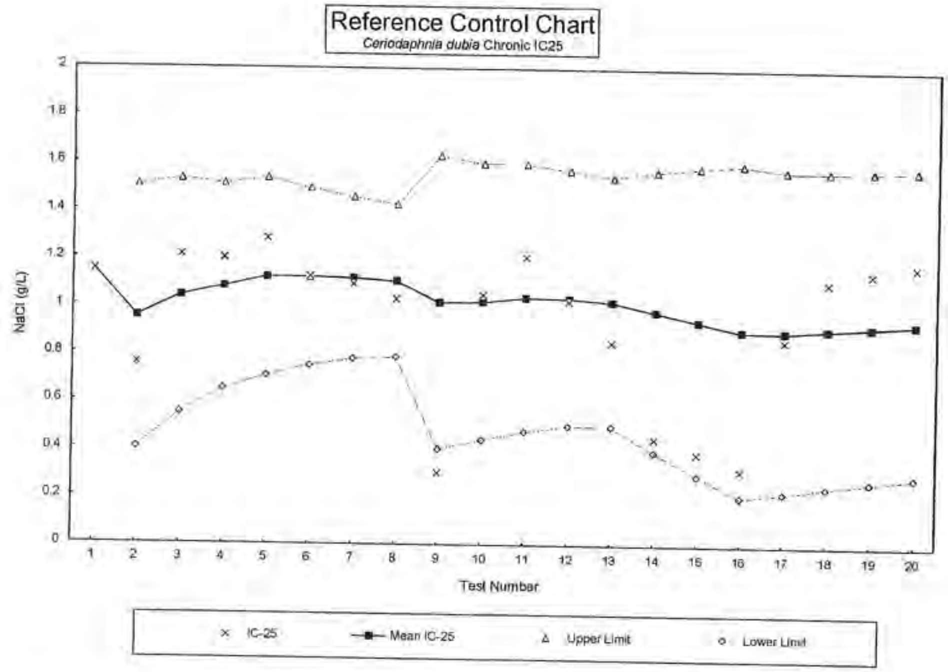
Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower
1	10/18/16-10/20/16	2.195	2.20		
2	11/29/16-12/1/16	2.000	2.10	2.37	1.82
3	1/10/17-1/12/17	1.966	2.05	2.30	1.81
4	2/14/17-2/16/17	2.098	2.06	2.27	1.86
5	3/21/17-3/23/17	2.195	2.09	2.30	1.88
6	5/16/17-5/18/17	2.195	2.11	2.32	1.90
7	7/11/17-7/13/17	1.414	2.01	2.57	1.45
8	8/1/17-8/3/17	1.743	1.98	2.53	1.43
9	9/12/17-9/14/17	1.684	1.94	2.49	1.39
10	9/28/17-9/30/17	2.449	1.99	2.60	1.38
11	10/31/17-11/2/17	2.319	2.02	2.63	1.41
12	11/28/17-11/30/17	2.161	2.03	2.62	1.45
13	1/9/18-1/11/18	2.077	2.04	2.60	1.48
14	2/6/18-2/8/18	1.861	2.03	2.57	1.48
15	3/6/18-3/8/18	1.966	2.02	2.55	1.49
16	4/3/18-4/5/18	2.577	2.06	2.64	1.47
17	5/15/18-5/17/18	2.337	2.07	2.65	1.49
18	6/12/18-6/14/18	2.337	2.09	2.66	1.51
19	7/24/18-7/26/18	1.966	2.08	2.64	1.52
20	8/14/18-8/16/18	2.195	2.09	2.64	1.54

Organisms Sources: Aquatec Environmental, Inc. in-house cultures



Ceriodaphnia dubia
Reference Control Chart for NaCl Chronic Toxicity based on reproduction

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Repro. PMSD (%)	Avg. PMSD (%)
1	10/18/19-10/25/16	1.149	1.15					10.7	
2	11/29/16-12/5/16	0.7583	0.95	1.51	0.40	0.29	0.29	15.8	10.7
3	1/10/17-1/16/17	1.211	1.04	1.53	0.55	0.24	0.26	13.7	13.3
4	2/14/17-2/22/17	1.2	1.08	1.51	0.65	0.20	0.24	33.2	13.4
5	3/21/17-3/28/17	1.282	1.12	1.54	0.70	0.19	0.23	34.9	18.4
6	5/16/17-5/22/17	1.123	1.12	1.49	0.75	0.17	0.22	10.5	21.7
7	7/11/17-7/13/17	1.093	1.12	1.46	0.78	0.15	0.20	6.72	19.8
8	8/1/17-8/7/17	1.03	1.11	1.43	0.79	0.14	0.20	16	17.9
9	9/12/17-9/18/17	0.2996	1.02	1.63	0.40	0.30	0.21	32.1	17.7
10	9/28/17-10/4/17	1.048	1.02	1.60	0.44	0.28	0.22	15.8	19.3
11	10/31/17-11/6/17	1.208	1.04	1.60	0.47	0.27	0.22	9.47	18.9
12	11/28/17-12/4/17	1.023	1.04	1.57	0.50	0.26	0.23	9.72	18.1
13	1/9/18-1/16/18	0.85	1.02	1.54	0.50	0.26	0.23	30.3	17.4
14	2/6/18-2/12/18	0.4474	0.98	1.57	0.39	0.30	0.23	20.6	18.4
15	3/6/18-3/12/18	0.3857	0.94	1.59	0.30	0.34	0.24	13.8	18.5
16	4/3/18-4/10/18	0.315	0.90	1.60	0.20	0.39	0.25	36.3	18.2
17	5/15/18-5/21/18	0.8601	0.90	1.57	0.22	0.38	0.26	17.3	19.4
18	6/12/18-6/18/18	1.105	0.91	1.57	0.25	0.36	0.27	6.82	19.2
19	7/24/18-7/30/19	1.145	0.92	1.58	0.27	0.35	0.27	16.1	18.5
20	8/14/18-8/20/18	1.174	0.94	1.58	0.29	0.35	0.27	11.6	18.1



Assessment of test precision and sensitivity: The cumulative average CV of 0.27 for reproduction was near the 50th Percentile (0.27, Table 3-2 of EPA 833-R-00-003) indicating normal (median) variability. The PMSD values were less than the EPA upper limit of 47% indicating acceptable variability (sensitivity) of test data . The cumulative average PMSD values were slightly above EPA lower boundary (13%), indicating high-to-moderate statistical sensitivity for this test method when averaged for the most recent 20 tests. Updated 09/02/18.

\qaqc\srts\Cd SRT including CV and PMSD

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY SUMMARY REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *10/23/2018 4:45:00 PM* ***Test End:*** *10/30/2018 12:10:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
51157	Keene WWTP (2° Clarifier #2)	100	>100	100	>100

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *10/23/2018 10:55:00 AM* ***Test End:*** *10/31/2018 4:50:00 PM*

		ACUTE %		CHRONIC %	
Number	**Sample Name**	**NOEC**	**LC50**	**NOEC**	**LOEC**
51157	Keene WWTP (2° Clarifier #2)	100	>100	100	>100

SAMPLES RECEIVED:

Number	Sample Name	Date Time and Collected	Type
51157	Keene WWTP (2° Clarifier #2)	10/22/2018 7:08:00 AM	Effluent
51158	Ashuelot River	10/22/2018 9:20:00 AM	Receiving
51159	Soft Water 102218	10/22/2018	Lab Water
51167	Keene WWTP (2° Clarifier #2)	10/24/2018 7:00:00 AM	Effluent
51168	Ashuelot River	10/24/2018 9:25:00 AM	Receiving
51171	Keene WWTP (2° Clarifier #2)	10/26/2018 9:15:00 AM	Effluent
51172	Ashuelot River	10/26/2018 2:30:00 PM	Receiving

Submitted By:

Monday, November 12, 2018

Aquatec Environmental, Inc.

Reviewed by: Date: 11/12/18

SDG: 15440
Project 18017

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

TOXICITY DETAIL REPORT:

Sample ID: 51157 / Keene WWTP (2° Clarifier #2)

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *10/23/2018 4:45:00 PM* ***Test End:*** *10/30/2018 12:10:00 PM*

Response: Survival (%)

		|--------- Concentration % ---------|					
Day	Additional Control	0	12	24	48	50	100
2	100	100	100	100	100	100	100
7	100	100	100	97.5	100	100	100

Response: Growth per Original Number of Larvae (mean dry weight,mg)

		|--------- Concentration % ---------|					
	Additional Control	0	12	24	48	50	100
7	0.503	0.536	0.571	0.515	0.562	0.560	0.586

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *10/23/2018 10:55:00 AM* ***Test End:*** *10/30/2018 4:50:00 PM*

Response: Survival (%)

		|--------- Concentration % ---------|					
Day	Additional Control	0	12	24	48	50	100
2	100	100	100	100	100	100	100
8	100	100	100	100	100	90	100

Response: Reproduction (mean neonates per female)

		|--------- Concentration % ---------|					
	Additional Control	0	12	24	48	50	100
8	16.2	12.7	13.3	22.4	31.5	28	35.5

Submitted By:

Wednesday, November 7, 2018
SDG: 15440
Project 18017

Aquatec Environmental, Inc.
Reviewed by: Date: 11/12/18

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: 10/23/2018 4:45:00 PM **Test End:** 10/30/2018 12:10:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	51157	100	100
7	51157	100	100

Response: Growth per Original Number of Larvae (mean dry weight, mg)

Day	Sample ID	Dilution Control	Additional Control
7	51157	0.536	0.503

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

PMSD Comparison: **PMSD:** 9.5% **PMSD Criteria Range:** 12%-30%

The calculated test PMSD was less than the lower bound indicating test data with low variability and high statistical sensitivity. In determining the C-NOEC, C-LOEC, test concentrations were not considered toxic if the relative difference from the control was less than the lower PMSD bounds.

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, there were no special conditions or qualifiers that relate to the samples in this report, with the following exceptions:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as an additional control.

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Route 32
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Client ID: Keene/Ley **Permit No.** NH0100790

TOXICITY QUALITY ASSURANCE REPORT:

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: 10/23/2018 10:55:00 AM **Test End:** 10/31/2018 4:50:00 PM

Response: Survival (%)

Day	Sample ID	Dilution Control	Additional Control
2	51157	100	100
8	51157	100	100

Response: Reproduction (mean neonates per female)

Day	Sample ID	Dilution Control	Additional Control
8	51157	12.7	16.2

Percent Minimum Significant Difference (PMSD) Sensitivity Determination:

SPECIAL CONDITIONS AND QUALIFIERS:

To the best our knowledge, the following special conditions or qualifiers relate to the samples in this report for this test method:

Reconstituted soft water was the dilution water and statistical control. Receiving water (Ashuelot River) was included in the test array as an additional control.

The laboratory control (soft water used as dilution water) did not met acceptance criteria for average number of neonates per surviving female (<15) when the test was ended on Day 8. Neonate production was high in the effluent concentrations of 24%, 48%, 50%, and 100% effluent with many producing fourth broods. The client was notified that the Lab Control did not meet acceptance criteria and that due to the high reproduction in upper effluent concentrations, the test could provide useful information reflecting no toxicity. The client approved reporting of the test results for informational purposes.

Some neonates were judged to be split broods (neonates from the same brood produced before and after a daily renewal). These are indicated on a copy of the bench sheet with circles around those viewed as split broods. Neonates judged to a fourth brood on Day 7 or Day 8 (also indicated on a copy of the bench sheet) were excluded from the data tabulations and analysis.

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Client ID: Keene/Ley **Permit No.** NH0100790

WHOLE EFFLUENT TOXICITY TEST REPORT CERTIFICATION:

The results reported relate only to the the samples submitted as received.

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 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: November 19, 2018
(Date)

(Authorized signature)

John Williams
Director
Aquatec Environmental, Inc.

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *10/23/2018 4:45:00 PM* ***Test End:*** *10/30/2018 12:10:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Pimephales promelas*	Effluent	Composite

Dilution Water:	Soft Water	
Additional Control:	Ashuelot River	
Effluent Sampling Dates:	October 22, 24, & 26, 2018	
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)	
Effluent Salinity Adjusted?	No	If yes, to what value?
With Sea Salts?		Hypersaline Brine Solution?
Reference Toxicant Date:	October 23-30, 2018	
Reference Toxicant Test Acceptable?	Yes	
Age and Age Range of Test Organisms:	1-day old	
Source of Organisms:	Aquatic BioSystems - Fort Collins, CO	

Aquatec Environmental, Inc.

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *10/23/2018 4:45:00 PM* ***Test End:*** *10/30/2018 12:10:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Growth: 0.536 (mg)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Growth: 0.503 (mg)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Growth (%): 9.49

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Dunnett Multiple Comparison Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

Aquatec Environmental, Inc.

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Client ID: Keene/Ley **Permit No.** NH0100790

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Test Start: *10/23/2018 4:45:00 PM* ***Test End:*** *10/30/2018 12:10:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) met test acceptance criteria. The additional control (receiving water) also met test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was below the boundaries of 12%-30%, indicating test data with low variability and high statistical sensitivity. Chronic values were reported as calculated by the statistical program.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or growth were not detected.

Aquatec Environmental, Inc.

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Williston, VT 05495
Tel: (802) 860 - 2960

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420 Airport Road
Route 32
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E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *10/23/2018 10:55:00 AM* ***Test End:*** *10/31/2018 4:50:00 PM*

TOXICITY TEST SUMMARY SHEET:

Test Type	Test Species	Sample Type	Sampling Method
Modified Chronic	*Ceriodaphnia dubia*	Effluent	Composite

Dilution Water:	Soft Water	
Additional Control:	Ashuelot River	
Effluent Sampling Dates:	October 22, 24, & 26, 2018	
Effluent Concentrations Tested (%):	0, 0, 12, 24, 48*, 50, 100* * Permit Limit: 100% (acute); 48% (chronic)	
Effluent Salinity Adjusted?	No	If yes, to what value?
With Sea Salts?		Hypersaline Brine Solution?
Reference Toxicant Date:	October 2-8, 2018	
Reference Toxicant Test Acceptable?	No	
Age and Age Range of Test Organisms:	<24h collected within an 8h period	
Source of Organisms:	Aquatec Environmental, Inc. - Williston, VT	

Aquatec Environmental, Inc.

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Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *10/23/2018 10:55:00 AM* ***Test End:*** *10/31/2018 4:50:00 PM*

CONTROL RESPONSES:

Test Acceptability Criteria

A. Dilution Water Control: Soft Water
Mean Control Survival: 100 % Mean Control Reproduction: 12.7 (neonates)

B. Additional Control: Ashuelot River
Mean Control Survival: 100 % Mean Control Reproduction: 16.2 (neonates)

C. Lab Control: See A. Above

D. Thiosulfate Control: N/A

Test Variability

Test PMSD: Reproduction (%): 66.3

PERMIT LIMITS AND TEST RESULTS:

LIMITS (%)		RESULTS (%)	
48-Hour LC50:		**48-Hour LC50:**	> 100
		Upper Value:	N/A
		Lower Value:	N/A
		Data Analysis Method(s):	Fisher Exact/Bonferroni-Holm Test, Linear Interpolation (ICPIN), Steel Many-One Rank Sum Test
A-NOEC:	100.0	**A-NOEC:**	100
C-NOEC:	48.0	**C-NOEC:**	100
		C-LOEC:	> 100
IC25:		**IC25:**	> 100

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E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Test Start: *10/23/2018 10:55:00 AM* ***Test End:*** *10/31/2018 4:50:00 PM*

CONTROL ACCEPTANCE AND RESPONSE COMPARISONS:

Control Results:
The laboratory control (soft water used as dilution water and statistical control) did not meet test acceptance criteria. The additional control (receiving water) also did not meet test acceptance criteria.

PMSD Comparison:
The Percent Minimum Significant Difference (PMSD) is a measure of statistical sensitivity. The PMSD was above the boundaries of 13%-47%, indicating test data with high variability and low statistical sensitivity. Although the controls did not meet acceptability criteria, reproduction rates in the upper effluent concentrations, including the 100% effluent were high. The client requested that the data be reported for informational purposes.

Concentration-Response Comparison:
The concentration-response pattern reflected a pattern where significant reductions in survival or reproduction were not detected.

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1810-27611**
Williston, VT 05495	DATE RECEIVED: October 23, 2018
	DATE REPORTED: November 05, 2018
Atten: John Williams	SAMPLER: Not Indicated

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and “N” the Plattsburgh, NY lab under certification ELAP 11892. “Sub” indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. “A” indicates the referenced laboratory is NELAC accredited for the parameter reported. “N” indicates the laboratory is not accredited. “U” indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an “A” meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 11/05/2018

CLIENT: Aquatec Environmental, Inc WORK ORDER: **1810-27611**
PROJECT: Keene NH NPDES DATE RECEIVED: 10/23/2018

001 Site: (51157) Keene WWTP (2nd Clarifier #2) Composite Date Sampled: 10/22/18 Time: 7:08

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	4.5	mg/L	SM 5310C (00)	11/1/18	N JGM	A	
Total Hardness, Total as CaCO3	64	mg/L	EPA 200.7	11/5/18	W FAA	A	
Ammonia as N	0.25	mg/L	EPA 350.1, R.2	11/1/18	N JGM	A	
Solids, Total Dissolved	479	mg/L	SM 2540C-97	10/26/18	W JSS	A	
Total Solids	486	mg/l	SM 2540 B.-97	11/1/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	10/30/18	W SJM	A	
Aluminum, Total	0.18	mg/L	EPA 200.8	10/31/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	10/31/18	W SJM	A	
Calcium, Total	20	mg/L	EPA 200.7	11/5/18	W FAA	A	
Copper, Total	0.0032	mg/L	EPA 200.8	10/31/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	10/31/18	W SJM	A	
Magnesium, Total	3.5	mg/L	EPA 200.7	11/5/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	10/31/18	W SJM	A	
Zinc, Total	0.022	mg/L	EPA 200.8	10/31/18	W SJM	A	

002 Site: (51158) Ashuelot River Grab Date Sampled: 10/22/18 Time: 9:20

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	4.9	mg/L	SM 5310C (00)	11/1/18	N JGM	A	
Total Hardness, Total as CaCO3	8	mg/L	EPA 200.7	11/5/18	W FAA	A	
Ammonia as N	0.15	mg/L	EPA 350.1, R.2	11/1/18	N JGM	A	
Metals Digestion	Digested		EPA 200.7/200.8	10/30/18	W SJM	A	
Aluminum, Total	0.14	mg/L	EPA 200.8	10/31/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	10/31/18	W SJM	A	
Calcium, Total	2.2	mg/L	EPA 200.7	11/5/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	10/31/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	10/31/18	W SJM	A	
Magnesium, Total	0.60	mg/L	EPA 200.7	11/5/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	10/31/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	10/31/18	W SJM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2nd Clarifier #2) (51157)	**10/22/18**	**7:08**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2
			Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice (4C)	1
Ashuelot River (51158)	**10/22/18**	**9:20**	Grab: **X** Composite: **N/A**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1
			Metals: Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Al (0.02); Mg, Ca (0.05)	250mL	Plastic	HNO3	1
			Total Organic Carbon (0.5)	40mL	Glass	H2SO4	2

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	
[signature]	10/23/18	14:30	K. White	10/23/18	14:30	Cooler/Sample Temp.: 5.4 Notes To Lab:
Relinquished by *(signature)*	**DATE**	**TIME**	**Received by: *(signature)***	**DATE**	**TIME**	

1810-27611

1810-27611
Aquatec Environmental, Inc
Keene NH NPDES

Page 1 of 1

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1811-28463**
Williston, VT 05495	DATE RECEIVED: November 02, 2018
	DATE REPORTED: November 16, 2018
Atten: John Williams	SAMPLER: BB, MM

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and “N” the Plattsburgh, NY lab under certification ELAP 11892. “Sub” indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. “A” indicates the referenced laboratory is NELAC accredited for the parameter reported. “N” indicates the laboratory is not accredited. “U” indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an “A” meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report

DATE REPORTED: 11/16/2018

CLIENT: Aquatec Environmental, Inc
PROJECT: Keene NH NPDES

WORK ORDER: **1811-28463**
DATE RECEIVED: 11/02/2018

001 Site: 51167 Keene WWTP 2nd Clarifier #2 Date Sampled: 10/24/18 Time: 7:00

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.09	mg/L	EPA 350.1, R.2	11/15/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	Project Name:	Keene NH NPDES
Address:	273 Commerce Street	Project Number:	18017
City/State/Zip:	Williston, VT 05403	Sampler Name(s):	BB, MM
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2nd Clarifier #2) (51167)	10/24/18	7:00	Grab: N/A Composite: X				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	
[signature]	11/2/18	13:20	[signature]	11/2	@1320	Cooler/Sample Temp.: 6.8 Notes To Lab:
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME	

1811-28463

1811-28463
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Keene NH NPDES
273 Commerce St 101170	WORK ORDER: **1811-28462**
Williston, VT 05495	DATE RECEIVED: November 02, 2018
	DATE REPORTED: November 16, 2018
Atten: John Williams	SAMPLER: Not Indicated

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report

DATE REPORTED: 11/16/2018

CLIENT: Aquatec Environmental, Inc
PROJECT: Keene NH NPDES

WORK ORDER: **1811-28462**
DATE RECEIVED: 11/02/2018

001 Site: 51171 Keene WWTP 2`Clarifier #2 Composite Date Sampled: 10/26/18 Time: 9:15

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Ammonia as N	0.14	mg/L	EPA 350.1, R.2	11/15/18	N JGM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Keene NH NPDES
Address:	273 Commerce Street	**Project Number:**	18017
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	BOTTLE/CONTAINER SIZE	TYPE	PRESERVATIVE	NUMBER
Keene WWTP (2° Clarifier #2) (51171)	**10/26/18**	**9:15**	Grab: **N/A** Composite: **X**				
			Ammonia (0.1)	500mL	Plastic	H2SO4	1

Relinquished by *(signature)*	DATE	TIME	Received by: *(signature)*	DATE	TIME	Cooler/Sample Temp.: 6.8 Notes To Lab:
[signature]	11/2/18	13:20	EToomey	11/2	1320	
Relinquished by *(signature)*	**DATE**	**TIME**	**Received by: *(signature)***	**DATE**	**TIME**	

1811-28462

1811-28462
Aquatec Environmental, Inc
Keene NH NPDES

ENDYNE Inc.
Environmental Laboratories

Aquatec Environmental, Inc	PROJECT: Tox Lab QC
273 Commerce St 101170	WORK ORDER: **1808-19923**
Williston, VT 05495	DATE RECEIVED: August 09, 2018
	DATE REPORTED: August 29, 2018
Atten: John Williams	SAMPLER: EB

Laboratory Report

Enclosed please find the results of the analyses performed for the samples referenced on the attached chain of custody. All required method quality control elements including instrument calibration were performed in accordance with method requirements and determined to be acceptable unless otherwise noted.

The column labeled Lab/Tech in the accompanying report denotes the laboratory facility where the testing was performed and the technician who conducted the assay. A "W" designates the Williston, VT lab under NELAC certification ELAP 11263; "R" designates the Lebanon, NH facility under certification NH 2037 and "N" the Plattsburgh, NY lab under certification ELAP 11892. "Sub" indicates the testing was performed by a subcontracted laboratory. The accreditation status of the subcontracted lab is referenced in the corresponding NELAC and Qual fields.

The NELAC column also denotes the accreditation status of each laboratory for each reported parameter. "A" indicates the referenced laboratory is NELAC accredited for the parameter reported. "N" indicates the laboratory is not accredited. "U" indicates that NELAC does not offer accreditation for that parameter in that specific matrix. Test results denoted with an "A" meet all National Environmental Laboratory Accreditation Program requirements except where denoted by pertinent data qualifiers. Test results are representative of the samples as they were received at the laboratory

Endyne, Inc. warrants, to the best of its knowledge and belief, the accuracy of the analytical test results contained in this report, but makes no other warranty, expressed or implied, especially no warranties of merchantability or fitness for a particular purpose.

Reviewed by:

Harry B. Locker, Ph.D.
Laboratory Director

Laboratory Report DATE REPORTED: 08/29/2018

CLIENT: Aquatec Environmental, Inc   WORK ORDER: **1808-19923**
PROJECT: Tox Lab QC   DATE RECEIVED: 08/09/2018

001 Site: (51058) 080518 Soft   Date Sampled: 8/7/18   Time: 16:20

Parameter	Result	Units	Method	Analysis Date/Time	Lab/Tech	NELAC	Qual.
Total Organic Carbon	< 0.5	mg/L	SM 5310C (00)	8/16/18	N CAL	A	
Total Hardness, Total as CaCO3	53	mg/L	EPA 200.7	8/27/18	W FAA	A	
Ammonia as N	< 0.05	mg/L	EPA 350.1, R.2	8/21/18	N CAL	A	
Solids, Total Dissolved	111	mg/L	SM 2540C-97	8/10/18	W JSS	A	
Total Solids	94	mg/L	SM 2540 B.-97	8/10/18	W JSS	A	
Metals Digestion	Digested		EPA 200.7/200.8	8/20/18	W SJM	A	
Aluminum, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	
Cadmium, Total	< 0.0002	mg/L	EPA 200.8	8/21/18	W SJM	A	
Calcium, Total	10	mg/L	EPA 200.7	8/27/18	W FAA	A	
Copper, Total	< 0.0020	mg/L	EPA 200.8	8/21/18	W SJM	A	
Lead, Total	< 0.0010	mg/L	EPA 200.8	8/21/18	W SJM	A	
Magnesium, Total	6.8	mg/L	EPA 200.7	8/27/18	W FAA	A	
Nickel, Total	< 0.0050	mg/L	EPA 200.8	8/21/18	W SJM	A	
Zinc, Total	< 0.020	mg/L	EPA 200.8	8/21/18	W SJM	A	

Aquatec Environmental, Inc.

Chain-of-Custody Record

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 - 2960
Attn. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
Name:	Aquatec Environmental, Inc.	**Project Name:**	Tox Lab QC
Address:	273 Commerce Street	**Project Number:**	18000
City/State/Zip:	Williston, VT 05403	**Sampler Name(s):**	EB
Telephone:	(802) 860 - 2960		
Contact Name:	John Williams		

SAMPLE IDENTIFICATION	COLLECTION DATE	COLLECTION TIME	ANALYSIS (Detection Limit, mg/L)	SIZE	TYPE	PRESERVATIVE	NUMBER
080518SOFT (51058)	**08/07/18**	**16:20**	Grab: **X** Composite: **N/A**				
			Ammonia-Nitrogen(0.1)	250mL	Plastic	H2SO4	1
			Metals: Al (0.02); Cd, Pb (0.0005); Cu (0.003); Zn, Ni (0.005); Ca, Mg (0.05)	250mL	Plastic	HNO3	1
			TOC - Total Organic Carbon(0.5)	40mL	Glass	H2SO4	2
			TS/TDS-Total Solids/Total Dissolved Solids	1/2gal	Plastic	Ice(4C)	1

Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME
Ellen Bouffard	8/9/18	11:35	Eileen Twomey	8/9	11:35
Relinquished by (signature)	DATE	TIME	Received by: (signature)	DATE	TIME

Cooler/Sample Temp.: 3.7

Notes To Lab:

1808-19923

1808-19923

Aquatec Environmental, Inc
Tox Lab QC

Supportive Documentation

Chain-Of-Custody

Toxicity Test Methods

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

Standard Reference Toxicant Control Charts

Chain-Of-Custody(s)

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION	PROJECT INFORMATION
NAME: Keene, NH	PROJECT: Keene NH/Ley
ADDRESS: 420 Airport Road	*(1st Sample Ship Monday)*
Swanzey, NH 03446	PROJECT #: 18017
TEL: (603) 357 – 9836 [x6502]	SAMPLERS NAME(S): Darren Condillo
CONTACT: Mary Ley	Mike Martell
E-MAIL: mley@ci.keene.nh.us	PERMIT NUMBER: NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Comp 10/21-10/22 Keene WWTP (2° Clarifier #2)	10/22/18	708		X	Effluent	2	1	1	1	1	2		
Ashuelot River	10/22/18	920	X		Receiving	1	1			1	2		

ANALYSIS (TEST/DETECTION LIMITS) – TOX: 1000.0 & 1002.0 (*P. promelas* & *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

Aquatec

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	10/22/18	1000	Priority Express
RELINQUISHED BY: (Signature or carrier) Priority Express	DATE: 10/22/18	TIME: 14:30	RECEIVED BY: (Signature) At Aquatec
RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature)

TEMPERATURE ON DELIVERY (°C): 5.2 °C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Other 'ChemSub' only if ≥50% mortality on renewal samples

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Page: 1 of 1

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		(2nd Sample Ship Wednesday)
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	Bob Bishop
CONTACT:	Mary Ley		Mike Martell
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/PRESERVATIVE — NUMBER OF CONTAINERS

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
Comp 10-23/18-10/24/18 Keene WWTP (2° Clarifier #2)	10/24	700		X	Effluent	2	1*	1		1			
Ashuelot River	10/24/18	925	X		Receiving	1							

ANALYSIS (TEST/DETECTION LIMITS) – **TOX:** Renewal (*P. promelas* and *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary Ley	10/24/18	1000	~~Priority Express~~ [signature]
RELINQUISHED BY: (Signature or carrier)	DATE:	TIME:	RECEIVED BY: (Signature)
~~Priority Express~~ [signature]	10-24-18	14:00	Aquatec Environmental
RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature)

TEMPERATURE ON DELIVERY (°C): 5.6°C

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Metals analysis only if ≥50% mortality.

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

Chain-of-Custody

273 Commerce Street
Williston, VT 05495
TEL: (802) 860 – 2960
ATTN. John Williams

COMPANY INFORMATION		PROJECT INFORMATION	
NAME:	Keene, NH	PROJECT:	Keene NH/Ley
ADDRESS:	420 Airport Road		*(3rd Sample Ship Friday)*
	Swanzey, NH 03446	PROJECT #:	18017
TEL:	(603) 357 – 9836 [x6502]	SAMPLERS NAME(S):	
CONTACT:	Mary Ley		
E-MAIL:	mley@ci.keene.nh.us	PERMIT NUMBER:	NH0100790

VOLUME/CONTAINER TYPE/ PRESERVATIVE

SAMPLE IDENTIFICATION	FINAL COLLECTION DATE	FINAL COLLECTION TIME	GRAB	COMPOSITE	MATRIX	TOX: 1 Gallon | Plastic | 4°C	METALS: 250mL | Plastic | HNO_3	TRC: 40mL | Glass | 4°C	TS/TDS: ½ Gallon | Plastic | 4°C	AMMONIA: 250mL | Plastic | H_2SO_4	TOC: 40mL | Glass | H_2SO_4		
						NUMBER OF CONTAINERS							
10/25-10/26/18 Keene WWTP (2° Clarifier #2)	10/26/18	700		X	Effluent	3	1*	1		1			
Ashuelot River	10/26/18	830	X		Receiving	2							

ANALYSIS (TEST/DETECTION LIMITS) – TOX: Renewal (*P. promelas* and *C. dubia* chronic toxicity; %) – **METALS:** Cd & Pb (0.0005mg/L); Cu (0.003mg/L); Zn, & Ni (0.005mg/L); Al (0.02mg/L); Mg & Ca (0.05mg/L) – **TRC:** Total Residual Chlorine (0.02mg/L) – **TS/TDS:** Total Solids / Total Dissolved Solids – **AMMONIA:** (0.1mg/L) – **TOC:** Total Organic Carbon (0.5mg/L)

RELINQUISHED BY: (Signature)	DATE:	TIME:	RECEIVED BY: (Signature or carrier)
Mary L	10/26/18	915	Aquatec ~~Priority Express~~
RELINQUISHED BY: (Signature or carrier)	**DATE:**	**TIME:**	**RECEIVED BY: (Signature)**
~~Priority Express~~	10/26/18	14:30	
RELINQUISHED BY: (Signature)	**DATE:**	**TIME:**	**RECEIVED BY: (Signature)**

TEMPERATURE ON DELIVERY (°C): 6.0

NOTES: Aquatec delivers chemistry sub-samples to a NELAC-Accredited analytical lab (Endyne, Inc.); Ammonia and TRC are required on each new effluent sample; *Metals analysis of renewal samples only if ≥50% mortality.

SAMPLE ACCEPTANCE POLICY: Chain-of-Custody completed. Sample bottle labels should be completed and covered with waterproof tape. Sample should be received at 0-6°C and/or within 6-hours of collection. Samples should be received within specified holding times based on controlling regulations (e.g., <36-hours for effluent samples under NPDES regulation). ***Samples NOT meeting the above conditions (per applicable regulatory protocols) will be qualified in the report.***

Aquatec Environmental, Inc.

273 Commerce Street
Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

SAMPLE PREPARATION:

	Initial Sample		Second Sample		Third Sample		
	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	EFFLUENT	RECEIVING	LAB CONTROL
Sample No.	51157	51158	51167	51168	51171	51172	51159
Filtration	60 Micron ✓	60 Micron ✓	60 Micron ✓	60 Micron ✓	60 Micron ✓	60 Micron ✓	N / A
Chlorine (1)	ND	–	ND	–	ND	/	N / A
Chlorine (2)	/	–	/	–	/	/	N / A
NaThio Lot No.	/	–	/	–	/	/	N / A
Original / Final Salinity:	N / A	N / A	N / A	N / A	N / A	N / A	N / A
FF Lot No.	N / A	N / A	N / A	N / A	N / A	N / A	N / A
Date / Initials:	JW 10/22/18		EB 10/24/18		10.26.18 KP		

(1) Record vol. 0.025 N sodium thiosulfate to dechlorinate 100mL sample or record "ND" (Not Detected)

(2) Dechlorination required if detected. Record vol. 0.25 N sodium thiosulfate added per gallon effluent.

Aquatec Environmental, Inc.

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Williston, VT 05495
Tel: (802) 860 - 2960

City of Keene NH
420 Airport Road
Route 32
Swanzey, NH 03446

Tel: (603) 357-9836
E-Mail: mley@ci.keene.nh.us

Client ID: Keene/Ley

Permit No. NH0100790

ALKALINITY, HARDNESS, AND TRC REPORT:

Sample ID:	Analysis Date:	Alkalinity: (mg/L)	Hardness: (mg/L)	TRC: (mg/L)
51157 - Keene WWTP (2° Clarifier #2)	10/22/2018	68.0	68.0	0.00
51158 - Ashuelot River	10/22/2018	12.0	14.0	---
51159 - Soft Water 102218	10/24/2018	36.0	52.0	---
51167 - Keene WWTP (2° Clarifier #2)	10/24/2018	84.0	72.0	0.02
51168 - Ashuelot River	10/24/2018	12.0	16.0	---
51171 - Keene WWTP (2° Clarifier #2)	10/26/2018	60.0	76.0	0.01
51172 - Ashuelot River	10/26/2018	8.0	12.0	---

INF: Interference. The color endpoint was reached immediately

Toxicity Test Method(s)

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25 +/- 1C; Test temperatures must not deviate (i.e. maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s or 50-100ft-c (ambient laboratory levels)
5	Photoperiod:	16h light, 8h dark
6	Test chamber size:	30mL
7	Test solution volume	Nominal 15mL
8	renewal of test solutions:	Daily
9	Age of test organisms:	Less than 24h; and all released within a 8h period
10	No. neonates per test chamber:	1
11	No. replicate test chambers per concentration:	10
12	No. neonates per test concentration:	10
13	Feeding regime:	Feed 0.1mL each of YCT and algal suspension per test chamber daily
14	Cleaning:	Use new plastic cups daily
15	Aeration:	None
16	Dilution water:	Soft Water
17	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
18	Additional control:	Ashuelot River
19	Test duration:	Until 60% or more of surviving control females have three broods (maximum test duration 8 days)
20	Endpoints:	Survival and reproduction
21	Test acceptability criteria:	80% or greater survival of all control organisms and an average of 15 or more young per surviving female in the control solutions. 60% of surviving control females must produce three broods
22	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
23	Sample volume required:	1L/day

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Project: Keene NH NPDES

1	Test type:	Static renewal
2	Temperature:	25+/- 1C, Test temperatures must not deviate (i.e., maximum minus minimum temperature) by more than 3C during the test
3	Light quality:	Ambient laboratory illumination
4	Light intensity:	10-20uE/m^2/s (50-100ft-c) (ambient laboratory levels)
5	Photoperiod:	16h light/8h dark
6	Test chamber size:	300mL disposable plastic or 600mL glass
7	Test solution volume:	Nominal 250mL
8	Test solution renewal:	Daily
9	Age of test organisms:	Newly hatched larvae less than 24h old. If shipped, not more than 48h old, 24h range in age
10	No. larvae per test chamber:	10
11	No. replicate chambers per concentration:	4
12	No. larvae per concentration:	40
13	Source of food:	Newly hatched Artemia nauplii (< 24h old)
14	Feeding regime:	On days 0-6, feed 0.1g newly hatched (less than 24h old) brine shrimp nauplii three times daily at 4h intervals or, as a minimum, 0.15g twice daily at 6h intervals. Sufficient nauplii are added to provide an excess.
15	Cleaning:	Siphon daily, immediately before test solution renewal
16	Aeration:	None: unless DO concentration falls below 4.0mg/L.
17	Dilution water:	Soft Water
18	Test concentrations (%):	0, 0, 12, 24, 48*, 50, 100*
19	Additional control:	Ashuelot River
20	Test duration:	7 days
21	Endpoints:	Survival and growth (weight)
22	Test acceptability criteria:	80% or greater survival in controls; average dry weight per surviving organism in control chambers equals or exceeds 0.25mg
23	Sampling requirements:	For off-site tests, a minimum of three samples (e.g., collected on days one, three, and five) with a maximum holding time of 36h before first use
24	Sample volume required:	2.5L/day

1000.0 - Fathead Minnow, P. promelas, Survival and Growth Test

CETIS Summary Report

Report Date: 07 Nov-18 15:10 (p 1 of 2)
Test Code: 81605 | 14-7271-6203

Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Batch ID:	19-8492-9331	**Test Type:**	Growth-Survival (7d)	**Analyst:**	Kaitlyn Priest
Start Date:	23 Oct-18 16:45	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	30 Oct-18 12:10	**Species:**	Pimephales promelas	**Brine:**	Not Applicable
Duration:	6d 19h	**Source:**	Aquatic Biosystems, CO	**Age:**	1d

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
01-7452-1656	2d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	n/a
02-2980-9698	7d Survival Rate	Steel Many-One Rank Sum Test	100	> 100	n/a	1	4.57%
07-1655-0701	Mean Dry Biomass-mg	Dunnett Multiple Comparison Test	100	> 100	n/a	1	9.49%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
08-3563-4331	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
17-1377-0398	Mean Dry Biomass-mg	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		4	0.9750	0.8954	1.0000	0.9000	1.0000	0.0250	0.0500	5.13%	2.50%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	4	0.5025	0.4617	0.5433	0.471	0.533	0.01282	0.02565	5.10%	0.00%
0	L	4	0.536	0.5232	0.5488	0.528	0.547	0.004021	0.008042	1.50%	-6.67%
12		4	0.5713	0.5386	0.6039	0.541	0.586	0.01025	0.0205	3.59%	-13.68%
24		4	0.5147	0.4504	0.5791	0.464	0.555	0.0202	0.04041	7.85%	-2.44%
48		4	0.5617	0.4768	0.6467	0.507	0.61	0.02669	0.05338	9.50%	-11.79%
50		4	0.56	0.5332	0.5868	0.543	0.579	0.008426	0.01685	3.01%	-11.44%
100		4	0.5855	0.569	0.602	0.573	0.594	0.005172	0.01034	1.77%	-16.52%

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	R	1.0000	1.0000	1.0000	1.0000
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	R	1.0000	1.0000	1.0000	1.0000
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	0.9000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	R	0.508	0.471	0.533	0.498
0	L	0.547	0.528	0.536	0.533
12		0.577	0.541	0.581	0.586
24		0.555	0.502	0.464	0.538
48		0.61	0.605	0.525	0.507
50		0.543	0.579	0.549	0.569
100		0.594	0.573	0.581	0.594

CETIS Analytical Report

Report Date: 07 Nov-18 15:10 (p 1 of 2)
Test Code: 81605 | 14-7271-6203

Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Analysis ID:	08-3563-4331	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	34h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	54262	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

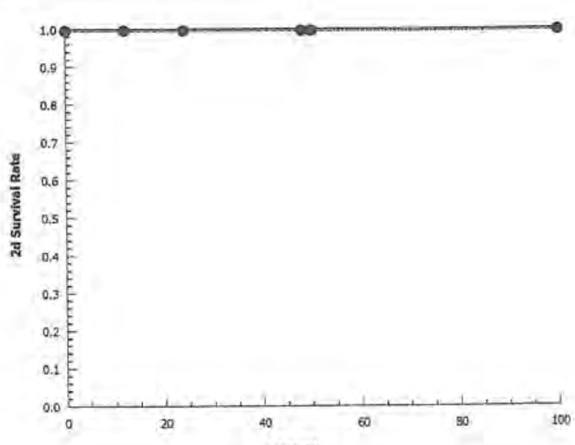
2d Survival Rate Summary

			Calculated Variate(A/B)								
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
12		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
24		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
48		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
50		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40
100		4	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	40	40

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	17-1377-0398	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	34h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	138928	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

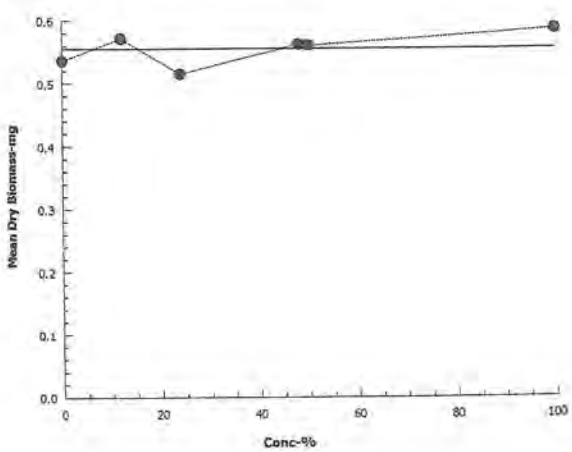
Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Calculated Variate						
			Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	4	0.536	0.528	0.547	0.004021	0.008042	1.50%	0.0%
12		4	0.5713	0.541	0.586	0.01025	0.0205	3.59%	-6.58%
24		4	0.5147	0.464	0.555	0.0202	0.04041	7.85%	3.97%
48		4	0.5617	0.507	0.61	0.02669	0.05338	9.50%	-4.8%
50		4	0.56	0.543	0.579	0.008426	0.01685	3.01%	-4.48%
100		4	0.5855	0.573	0.594	0.005172	0.01034	1.77%	-9.24%

Mean Dry Biomass-mg Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.547	0.528	0.536	0.533
12		0.577	0.541	0.581	0.586
24		0.555	0.502	0.464	0.538
48		0.61	0.605	0.525	0.507
50		0.543	0.579	0.549	0.569
100		0.594	0.573	0.581	0.594

Graphics



Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	01-7452-1656	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	34h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Angular (Corrected)	C > T	100	> 100	n/a	1

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		48	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		100	18	10	1	6	Asymp	0.8333	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0	0	5	65540	<1.0E-37	Significant Effect
Error	0	0	18			
Total	0		23			

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
24		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
48		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

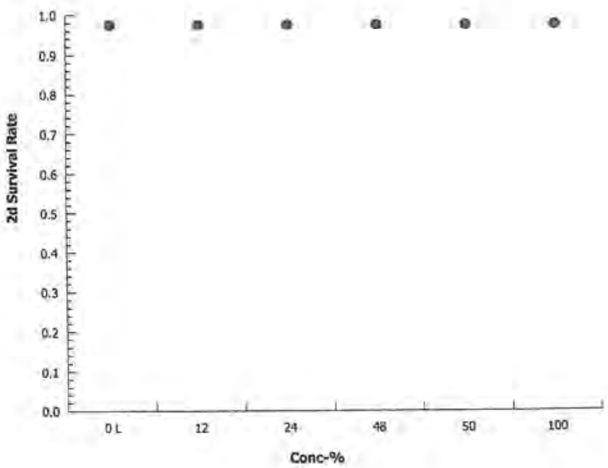
Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

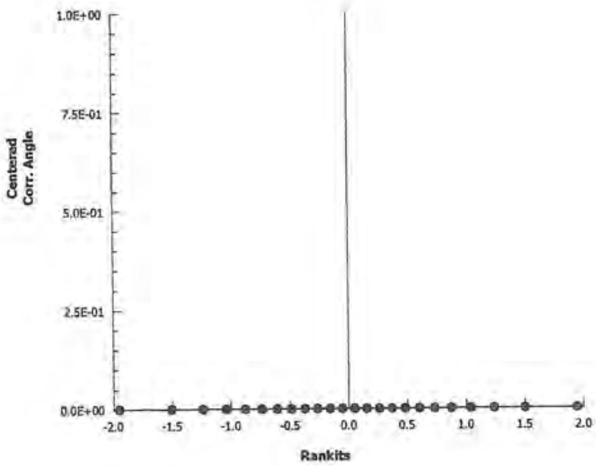
Analysis ID:	01-7452-1656	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.412	1.412	1.412
48		1.412	1.412	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Analyst: [signature] QA: 11/10/18

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	02-2980-9698	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	34h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Angular (Corrected)	C > T	100	> 100	n/a	1	4.57%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		24	16	10	1	6	Asymp	0.6105	Non-Significant Effect
		48	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		50	18	10	1	6	Asymp	0.8333	Non-Significant Effect
		100	18	10	1	6	Asymp	0.8333	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0055332	0.0011066	5	1	0.4457	Non-Significant Effect
Error	0.0199195	0.0011066	18			
Total	0.0254527		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Levene Equality of Variance Test	9	4.248	2.0E-04	Unequal Variances
Variances	Mod Levene Equality of Variance Test	1	4.248	0.4457	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.4634	0.884	2.5E-08	Non-Normal Distribution

7d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
12		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
24		4	0.9750	0.8954	1.0000	1.0000	0.9000	1.0000	0.0250	5.13%	2.50%
48		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
50		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%
100		4	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.00%	0.00%

Angular (Corrected) Transformed Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
12		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
24		4	1.371	1.242	1.501	1.412	1.249	1.412	0.04074	5.94%	2.89%
48		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
50		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%
100		4	1.412	1.412	1.412	1.412	1.412	1.412	0	0.00%	0.00%

7d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000
24		1.0000	0.9000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000

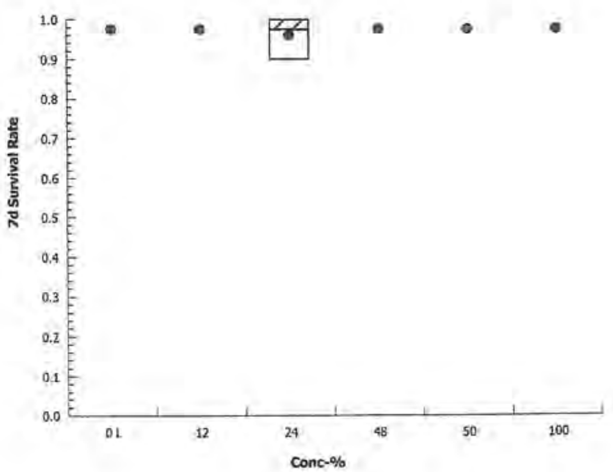
Fathead Minnow 7-d Larval Survival and Growth Test **Aquatec Environmental, Inc.**

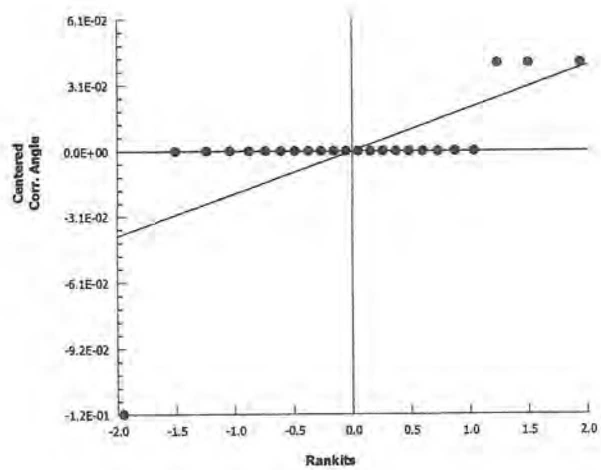
Analysis ID:	02-2980-9698	**Endpoint:**	7d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Angular (Corrected) Transformed Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	1.412	1.412	1.412	1.412
12		1.412	1.412	1.412	1.412
24		1.412	1.249	1.412	1.412
48		1.412	1.412	1.412	1.412
50		1.412	1.412	1.412	1.412
100		1.412	1.412	1.412	1.412

Graphics





Analyst: [signature] QA: 11/15/18

Fathead Minnow 7-d Larval Survival and Growth Test — Aquatec Environmental, Inc.

Analysis ID:	07-1655-0701	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	34h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	9.49%

Dunnett Multiple Comparison Test

Control	vs	Conc-%	Test Stat	Critical	MSD	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	-1.668	2.407	0.051	6	CDF	0.9975	Non-Significant Effect
		24	1.006	2.407	0.051	6	CDF	0.4194	Non-Significant Effect
		48	-1.219	2.407	0.051	6	CDF	0.9906	Non-Significant Effect
		50	-1.136	2.407	0.051	6	CDF	0.9881	Non-Significant Effect
		100	-2.343	2.407	0.051	6	CDF	0.9997	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	0.0129834	0.0025967	5	2.908	0.0427	Significant Effect
Error	0.0160733	0.000893	18			
Total	0.0290567		23			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	12.97	15.09	0.0237	Equal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9675	0.884	0.6057	Normal Distribution

Mean Dry Biomass-mg Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	4	0.536	0.5232	0.5488	0.5345	0.528	0.547	0.004021	1.50%	0.00%
12		4	0.5713	0.5386	0.6039	0.579	0.541	0.586	0.01025	3.59%	-6.58%
24		4	0.5147	0.4504	0.5791	0.52	0.464	0.555	0.0202	7.85%	3.96%
48		4	0.5617	0.4768	0.6467	0.565	0.507	0.61	0.02669	9.50%	-4.80%
50		4	0.56	0.5332	0.5868	0.559	0.543	0.579	0.008426	3.01%	-4.48%
100		4	0.5855	0.569	0.602	0.5875	0.573	0.594	0.005172	1.77%	-9.24%

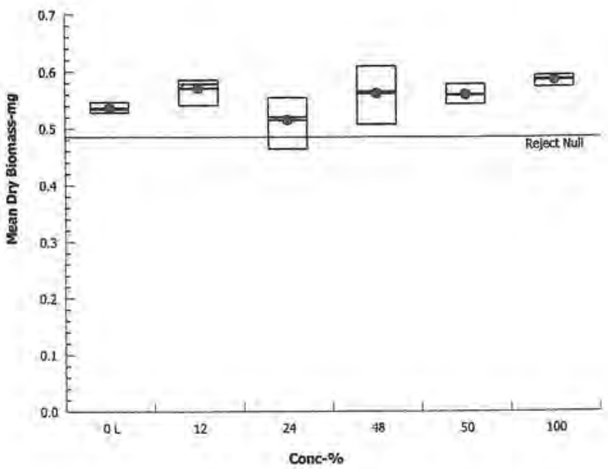
Mean Dry Biomass-mg Detail

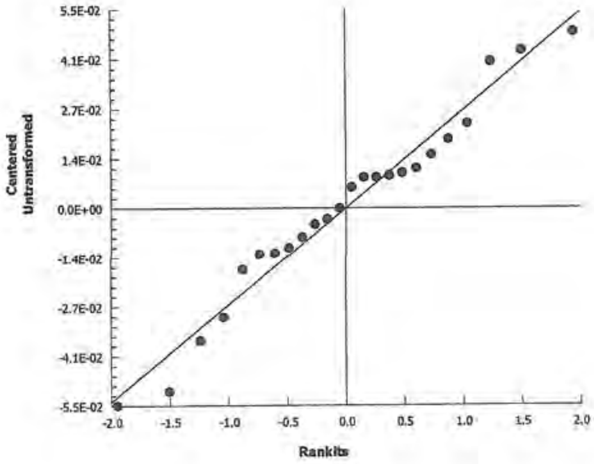
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4
0	L	0.547	0.528	0.536	0.533
12		0.577	0.541	0.581	0.586
24		0.555	0.502	0.464	0.538
48		0.61	0.605	0.525	0.507
50		0.543	0.579	0.549	0.569
100		0.594	0.573	0.581	0.594

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Analysis ID:	07-1655-0701	**Endpoint:**	Mean Dry Biomass-mg	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:09	**Analysis:**	Parametric-Control vs Treatments	**Official Results:**	Yes

Graphics





Analyst: [signature] QA: 11/10/18

CETIS Test Data Worksheet

Report Date: 07 Nov-18 15:08 (p 1 of 1)
Test Code/ID: 14-7271-6203/81605

Fathead Minnow 7-d Larval Survival and Growth Test — **Aquatec Environmental, Inc.**

Start Date: 23 Oct-18 16:45 **Species:** Pimephales promelas **Sample Code:** 15440
End Date: 30 Oct-18 12:10 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 22 Oct-18 07:08 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Survival	2d Survival	3d Survival	4d Survival	5d Survival	6d Survival	7d Survival	Total Weight-mg	Tare Weight-mg	Pan Count	Notes
0	L	1	9	10		10					10	26.33	20.86	10	
0	L	2	7	10		10					10	27.73	22.45	10	
0	L	3	2	10		10					10	26.92	21.56	10	
0	L	4	6	10		10					10	26.99	21.66	10	
0	R	1	3	10		10					10	26.73	21.65	10	
0	R	2	23	10		10					10	26.31	21.6	10	
0	R	3	13	10		10					10	26.72	21.39	10	
0	R	4	8	10		10					10	26.1	21.12	10	
12		1	17	10		10					10	28	22.23	10	
12		2	20	10		10					10	26.17	20.76	10	
12		3	21	10		10					10	27.6	21.79	10	
12		4	16	10		10					10	27.69	21.83	10	
24		1	22	10		10					10	27.22	21.67	10	
24		2	25	10		10					9	27.3	22.28	9	
24		3	15	10		10					10	26.66	22.02	10	
24		4	5	10		10					10	26.34	20.96	10	
48		1	12	10		10					10	27.21	21.11	10	
48		2	27	10		10					10	27.65	21.6	10	
48		3	18	10		10					10	26.46	21.21	10	
48		4	10	10		10					10	26.57	21.5	10	
50		1	11	10		10					10	27.13	21.7	10	
50		2	28	10		10					10	27.29	21.5	10	
50		3	26	10		10					10	26.56	21.07	10	
50		4	4	10		10					10	26.84	21.15	10	
100		1	14	10		10					10	26.16	20.22	10	
100		2	1	10		10					10	27.95	22.22	10	
100		3	24	10		10					10	27.23	21.42	10	
100		4	19	10		10					10	27.65	21.71	10	

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81605

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	No. weighed [1]	Initial Pan Weight	Final Pan Weight
DW 0 % SOFT CTRL	A	10	10	10	10	10	10	10	10	10	20.86	26.33
	B	10	10	10	10	10	10	10	10	10	22.45	27.73
	C	10	10	10	10	10	10	10	10	10	21.56	26.92
	D	10	10	10	10	10	10	10	10	10	21.66	26.99
0 % RW	A	10	10	10	10	10	10	10	10	10	21.65	26.73
	B	10	10	10	10	10	10	10	10	10	21.60	26.31
	C	10	10	10	10	10	10	10	10	10	21.39	26.72
	D	10	10	10	10	10	10	10	10	10	21.12	26.10
12 % EFF	A	10	10	10	10	10	10	10	10	10	22.23	28.00
	B	10	10	10	10	10	10	10	10	10	20.76	26.17
	C	10	10	10	10	10	10	10	10	10	21.79	27.60
	D	10	10	10	10	10	10	10	10	10	21.83	27.69
24 % EFF	A	10	10	10	10	10	10	10	10	10	21.67	27.22
	B	10	10	10	10	10	9	9	9	9	22.28	27.30
	C	10	10	10	10	10	10	10	10	10	22.02	26.66
	D	10	10	10	10	10	10	10	10	10	20.96	26.34
48 % EFF	A	10	10	10	10	10	10	10	10	10	21.11	27.21
	B	10	10	10	10	10	10	10	10	10	21.60	27.65
	C	10	10	10	10	10	10	10	10	10	21.21	26.46
	D	10	10	10	10	10	10	10	10	10	21.50	26.57
50 % EFF	A	10	10	10	10	10	10	10	10	10	21.70	27.13
	B	10	10	10	10	10	10	10	10	10	21.50	27.29
	C	10	10	10	10	10	10	10	10	10	21.07	26.56
	D	10	10	10	10	10	10	10	10	10	21.15	26.84
100 % EFF	A	10	10	10	10	10	10	10	10	10	20.22	26.16
	B	10	10	10	10	10	10	10	10	10	22.22	27.95
	C	10	10	10	10	10	10	10	10	10	21.42	27.23
	D	10	10	10	10	10	10	10	10	10	21.71	27.65

	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Test End
Sample #	51157	51157	51167	51167	51171	51171	51171	
Fed AM / Init.	------	0900 KP	0915 EB	0920 KP	0900 KP	08:30	0930 EB	------
Fed PM / Init.	1800 EB	1555 KP	1725 EB	1655 KP	1600 KP	15:50	17:55	------
Renewal (D / T / I)	10-23-18 1645 EB	10-24-18 1350 KP	10-25-18 1655 EB	10-26-18 1410 KP	10-27-18 1325 KP	10/28/18 14:10	10-29-18 1335 EB	10-30-18 1210 EB

Date/Init (Initial Pan Weights): 10-27-18 KP

IN (Date/Time/Temp/Init): 10-30-18 1201 10.2°C EB

OUT (Date/Time/Temp/Init): 10/31/18 8:30 10.2°C KP

Brine Shrimp Lot #: 251235-1

1 The number weighed = the number actually weighed. For statistical purposes, the number weighed = original number of organisms on Day 0.

Aquatec Environmental, Inc.

Reviewed by: ______ Date: 11/10/18

SDG: 15440

Project 18017

Pp

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

Test ID 81605

INITIAL CHEMISTRY DATA:

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
DW 0 % SOFT CTRL	pH	7.5	7.5	7.6	7.6	7.5	7.6	7.5
	DO	7.7	8.1	7.9	7.7	7.6	8.1	7.2
	Temp.	25.0	24.7	24.7	24.6	25.8	24.7	25.9
	Cond.	178	189	186	188	186	177	181
0 % RW	pH	6.9	7.5	6.8	7.3	7.6	7.1	7.1
	DO	7.7	8.1	9.3	8.1	7.8	8.0	7.3
	Temp.	25.7	25.9	25.3	25.5	24.5	24.9	25.3
	Cond.	66	73	73	73	68	68	67
12 % EFF	pH	7.5	7.5	7.6	7.6	7.5	7.5	7.6
	DO	7.7	7.9	8.0	7.7	7.5	7.9	7.2
	Temp.	24.7	24.6	24.4	24.7	25.6	24.7	25.7
	Cond.	256	276	273	277	281	268	274
24 % EFF	pH	7.6	7.5	7.7	7.6	7.6	7.6	7.7
	DO	7.6	8.1	7.9	7.6	7.6	7.8	7.2
	Temp.	24.8	24.7	24.4	24.7	25.5	24.7	25.6
	Cond.	337	361	360	365	378	360	370
48 % EFF	pH	7.6	7.4	7.8	7.6	7.6	7.7	7.8
	DO	7.6	8.4	7.8	7.8	7.6	7.9	7.2
	Temp.	24.7	24.8	24.6	24.8	25.4	24.8	25.6
	Cond.	487	522	529	535	555	538	551
50 % EFF	pH	7.6	7.4	7.9	7.6	7.6	7.7	7.8
	DO	7.7	8.5	7.8	7.7	7.6	7.9	7.3
	Temp.	24.7	24.9	① ~~24.4~~ 24.6	24.9	25.3	24.8	25.5
	Cond.	502	537	547	552	569	558	568
100 % EFF	pH	7.6	7.3	7.9	7.5	7.5	7.8	7.9
	DO	7.8	9.0	7.7	7.9	7.8	8.0	7.3
	Temp.	24.8	25.1	25.2	25.2	25.0	25.4	25.9
	Cond.	812	869	878	898	924	923	923
	Sample #	51157	51157	51167	51167	51171	51171	51171
	Date	10-23-18	10.~~23~~ 24.18	10-25-18	10-26-18	10.27.18	10/28/18	10-29-18
	Initials	EB	KP	EB	KP	KP	[illegible]	EB

① Recording error EB 10-25-18

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

AQUATIC BIO SYSTEMS
ABS
INC.

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

ORGANISM HISTORY

DATE: 10/22/2018

SPECIES: *Pimephales promelas*

AGE: N/A

LIFE STAGE: Embryo

HATCH DATE: 10/22/2018

BEGAN FEEDING: N/A

FOOD: N/A

Received 10-23-18
10:00 AM
EB

Temp 23.8
Cond 411
DO 11.0
pH 7.6
Condition Normal active

Added Soft water

Water Chemistry Record:	**Current**	**Range**
TEMPERATURE:	25°C	--
SALINITY/CONDUCTIVITY:	--	--
TOTAL HARDNESS (as $CaCO_3$):	124 mg/l	--
TOTAL ALKALINITY (as $CaCO_3$):	90 mg/l	--
pH:	8.35	--

Comments:

Facility Supervisor

11/10/18

1000.0 Fathead Minnow, P. promelas, Survival and Growth Test

Species: *Pimephales promelas* Reference: EPA-821-R-02-013 SOP: WET-A-001

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

Test ID 81605

FINAL CHEMISTRY DATA:

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
0 % SOFT CTRL	pH	7.4	7.3	7.5	7.3	7.3	7.2	7.2
	DO	7.0	6.8	6.7	6.1	~~7.8~~ 6.4	5.9	6.4
	Temp.	24.9	25.7	24.8	24.8	24.0	25.9	25.8
	Cond.	192	196	197	197	185	189	179
0 % RW	pH	7.0	6.8	6.8	6.8	7.2	6.7	6.7
	DO	6.9	6.7	6.6	6.2	6.3	5.8	6.3
	Temp.	24.7	25.9	25.3	25.0	24.1	25.9	25.8
	Cond.	78	74	76	76	73	73	70
12 % EFF	pH	7.4	7.2	7.5	7.3	7.2	7.2	7.2
	DO	6.9	6.7	6.5	6.2	6.3	6.0	6.6
	Temp.	24.6	25.8	25.4	25.0	23.9	26.0	25.6
	Cond.	274	282	284	287	267	282	268
24 % EFF	pH	7.4	7.4	7.5	7.3	7.2	7.4	7.3
	DO	6.8	6.4	6.5	6.2	6.3	5.8	6.7
	Temp.	24.7	25.6	25.5	25.0	24.0	25.7	25.7
	Cond.	351	372	370	374	363	378	358
48 % EFF	pH	7.5	7.5	7.6	7.4	7.3	7.5	7.4
	DO	6.6	7.1	6.4	5.9	6.3	5.8	6.6
	Temp.	24.5	25.3	25.4	25.0	23.9	25.7	25.7
	Cond.	508	541	541	545	540	560	532
50 % EFF	pH	7.6	7.5	7.6	7.5	7.4	7.4	7.5
	DO	6.8	6.7	6.5	6.0	6.3	5.7	6.5
	Temp.	24.6	25.9	25.2	24.9	24.0	25.8	25.3
	Cond.	520	551	557	564	563	578	550
100 % EFF	pH	7.6	7.6	7.7	7.7	7.~~8~~6	7.6	7.6
	DO	6.6	6.4	6.7	6.2	6.4	5.8	6.5
	Temp.	24.6	25.8	24.9	24.6	24.0	26.0	25.8
	Cond.	821	900	903	925	902	946	899
	Sample #	51157	51157	51167	51167	51171	51171	51171
	Date	10.24.18	10-25-18	10.26.18	10.27.18	10/28/18	10-29-18	10-30-18
	Initials	KP	EB	KP	KP	[illegible]	EB	EB

1002.0 - Daphnid, C. dubia, Survival and Reproduction Test

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Batch ID:	16-3767-9415	**Test Type:**	Reproduction-Survival (2-8d)	**Analyst:**	Kaitlyn Priest
Start Date:	23 Oct-18 10:55	**Protocol:**	EPA/821/R-02-013 (2002)	**Diluent:**	Soft Synthetic Water
Ending Date:	31 Oct-18 16:50	**Species:**	Ceriodaphnia dubia	**Brine:**	Not Applicable
Duration:	8d 6h	**Source:**	In-House Culture	**Age:**	<24h

Multiple Comparison Summary

Analysis ID	Endpoint	Comparison Method	NOEL	LOEL	TOEL	TU	PMSD ✓
19-5730-9535	2d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
07-3951-8497	8d Survival Rate	Fisher Exact/Bonferroni-Holm Test	100	> 100	n/a	1	n/a
19-3461-2593	Reproduction	Steel Many-One Rank Sum Test	100	> 100	n/a	1	66.3%

Point Estimate Summary

Analysis ID	Endpoint	Point Estimate Method	Level	%	95% LCL	95% UCL	TU	✓
11-7941-8768	2d Survival Rate	Linear Interpolation (ICPIN)	EC5	>100	n/a	n/a	<1	✓
			EC10	>100	n/a	n/a	<1	✓
			EC15	>100	n/a	n/a	<1	✓
			EC20	>100	n/a	n/a	<1	✓
			EC25	>100	n/a	n/a	<1	✓
			EC40	>100	n/a	n/a	<1	✓
			EC50	>100	n/a	n/a	<1	✓
01-2160-2005	Reproduction	Linear Interpolation (ICPIN)	IC5	>100	n/a	n/a	<1	✓
			IC10	>100	n/a	n/a	<1	✓
			IC15	>100	n/a	n/a	<1	✓
			IC20	>100	n/a	n/a	<1	✓
			IC25	>100	n/a	n/a	<1	✓
			IC40	>100	n/a	n/a	<1	✓
			IC50	>100	n/a	n/a	<1	✓

2d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

8d Survival Rate Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
0	L	10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
12		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
24		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
48		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%
50		10	0.9000	0.6738	1.0000	0.0000	1.0000	0.1000	0.3162	35.14%	10.00%
100		10	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.00%

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Min	Max	Std Err	Std Dev	CV%	%Effect
0	R	10	16.2	10.07	22.33	4	28	2.711	8.574	52.93%	0.00%
0	L	10	12.7	8.474	16.93	4	23	1.868	5.908	46.52%	21.60%
12		10	13.3	9.225	17.38	6	22	1.802	5.697	42.83%	17.90%
24		10	22.4	15.85	28.95	9	38	2.895	9.155	40.87%	-38.27%
48		10	31.5	24.76	38.24	9	40	2.979	9.419	29.90%	-94.44%
50		10	28	19.15	36.85	0	40	3.913	12.37	44.19%	-72.84%
100		10	35.5	32.95	38.05	30	41	1.128	3.567	10.05%	-119.14%

Ceriodaphnia 7-d Survival and Reproduction Test — Aquatec Environmental, Inc.

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	R	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

8d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	R	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	R	17	23	18	23	23	5	6	28	4	15
0	L	12	15	9	23	13	17	4	17	13	4
12		6	11	20	14	22	6	17	15	15	7
24		14	34	16	21	27	28	19	9	38	18
48		34	29	38	39	25	28	9	38	40	35
50		13	32	35	34	34	34	24	34	0	40
100		33	30	35	35	39	41	37	35	31	39

CETIS Analytical Report

Report Date: 07 Nov-18 15:24 (p 1 of 2)
Test Code: 81606 | 00-0320-8903

Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID: 19-5730-9535 **Endpoint:** 2d Survival Rate **CETIS Version:** CETISv1.9.2
Analyzed: 07 Nov-18 15:24 **Analysis:** STP 2xK Contingency Tables **Official Results:** Yes

Sample ID: 10-7643-0565 **Code:** 15440 **Client:** Keene WWTP
Sample Date: 22 Oct-18 07:08 **Material:** POTW Effluent **Project:** Special Studies
Receipt Date: 22 Oct-18 14:30 **Source:** Permit # NH0100790 (KEENE NH)
Sample Age: 28h **Station:** Keene WWTP

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water	12	1.0000	Exact	1.0000	Non-Significant Effect
	24	1.0000	Exact	1.0000	Non-Significant Effect
	48	1.0000	Exact	1.0000	Non-Significant Effect
	50	1.0000	Exact	1.0000	Non-Significant Effect
	100	1.0000	Exact	1.0000	Non-Significant Effect

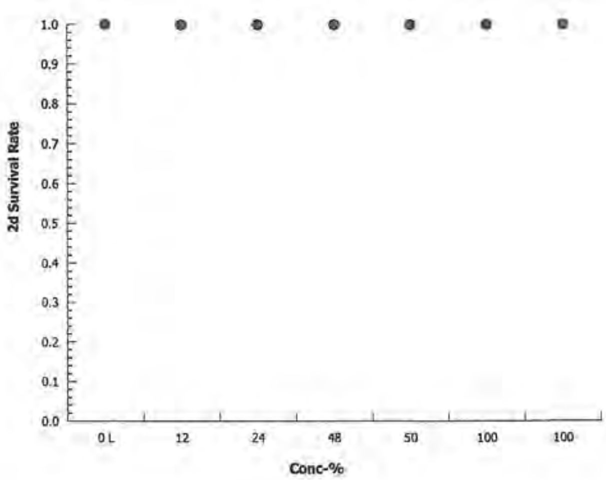
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		10	0	10	1	0	0.0%
100		10	0	10	1	0	0.0%

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test **Aquatec Environmental, Inc.**

Analysis ID:	07-3951-8497	**Endpoint:**	8d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:24	**Analysis:**	STP 2xK Contingency Tables	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	28h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU
Untransformed	C > T	100	> 100	n/a	1

Fisher Exact/Bonferroni-Holm Test

Control	vs	Group	Test Stat	P-Type	P-Value	Decision(α:5%)
Lab Water		12	1.0000	Exact	1.0000	Non-Significant Effect
		24	1.0000	Exact	1.0000	Non-Significant Effect
		48	1.0000	Exact	1.0000	Non-Significant Effect
		50	0.5000	Exact	1.0000	Non-Significant Effect
		100	1.0000	Exact	1.0000	Non-Significant Effect

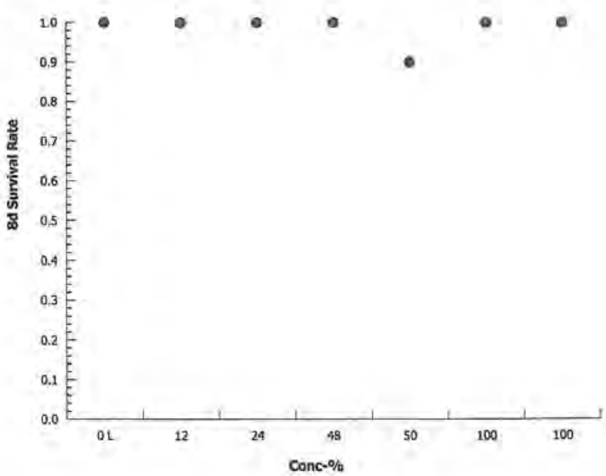
Data Summary

Conc-%	Code	NR	R	NR + R	Prop NR	Prop R	%Effect
0	L	10	0	10	1	0	0.0%
12		10	0	10	1	0	0.0%
24		10	0	10	1	0	0.0%
48		10	0	10	1	0	0.0%
50		9	1	10	0.9	0.1	10.0%
100		10	0	10	1	0	0.0%

8d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	0.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	11-7941-8768	**Endpoint:**	2d Survival Rate	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:24	**Analysis:**	Linear Interpolation (ICPIN)	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	28h	**Station:**	Keene WWTP		

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	866048	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
EC5	>100	n/a	n/a	<1	n/a	n/a
EC10	>100	n/a	n/a	<1	n/a	n/a
EC15	>100	n/a	n/a	<1	n/a	n/a
EC20	>100	n/a	n/a	<1	n/a	n/a
EC25	>100	n/a	n/a	<1	n/a	n/a
EC40	>100	n/a	n/a	<1	n/a	n/a
EC50	>100	n/a	n/a	<1	n/a	n/a

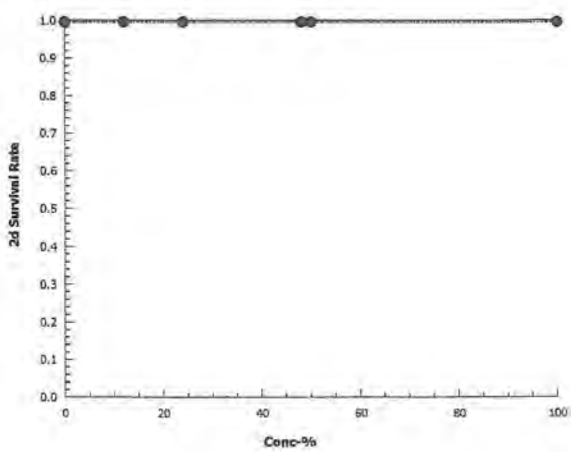
2d Survival Rate Summary

Conc-%	Code	Count	Calculated Variate(A/B) Mean	Min	Max	Std Err	Std Dev	CV%	%Effect	A	B
0	L	10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
12		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
24		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
48		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
50		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10
100		10	1.0000	1.0000	1.0000	0.0000	0.0000	0.00%	0.0%	10	10

2d Survival Rate Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
12		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
24		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
48		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
50		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
100		1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID: 01-2160-2005 **Endpoint:** Reproduction **CETIS Version:** CETISv1.9.2
Analyzed: 07 Nov-18 15:24 **Analysis:** Linear Interpolation (ICPIN) **Official Results:** Yes

Sample ID: 10-7643-0565 **Code:** 15440 **Client:** Keene WWTP
Sample Date: 22 Oct-18 07:08 **Material:** POTW Effluent **Project:** Special Studies
Receipt Date: 22 Oct-18 14:30 **Source:** Permit # NH0100790 (KEENE NH)
Sample Age: 28h **Station:** Keene WWTP

Linear Interpolation Options

X Transform	Y Transform	Seed	Resamples	Exp 95% CL	Method
Linear	Linear	1371373	200	Yes	Two-Point Interpolation

Point Estimates

Level	%	95% LCL	95% UCL	TU	95% LCL	95% UCL
IC5	>100	n/a	n/a	<1	n/a	n/a
IC10	>100	n/a	n/a	<1	n/a	n/a
IC15	>100	n/a	n/a	<1	n/a	n/a
IC20	>100	n/a	n/a	<1	n/a	n/a
IC25	>100	n/a	n/a	<1	n/a	n/a
IC40	>100	n/a	n/a	<1	n/a	n/a
IC50	>100	n/a	n/a	<1	n/a	n/a

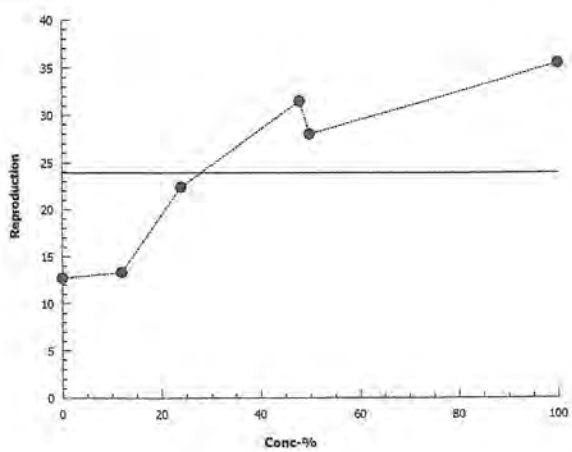
Reproduction Summary

			Calculated Variate						
Conc-%	Code	Count	Mean	Min	Max	Std Err	Std Dev	CV%	%Effect
0	L	10	12.7	4	23	1.868	5.908	46.52%	0.0%
12		10	13.3	6	22	1.802	5.697	42.83%	-4.72%
24		10	22.4	9	38	2.895	9.155	40.87%	-76.38%
48		10	31.5	9	40	2.979	9.419	29.90%	-148.0%
50		10	28	0	40	3.913	12.37	44.19%	-120.5%
100		10	35.5	30	41	1.128	3.567	10.05%	-179.5%

Reproduction Detail

Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	12	15	9	23	13	17	4	17	13	4
12		6	11	20	14	22	6	17	15	15	7
24		14	34	16	21	27	28	19	9	38	18
48		34	29	38	39	25	28	9	38	40	35
50		13	32	35	34	34	34	24	34	0	40
100		33	30	35	35	39	41	37	35	31	39

Graphics



Ceriodaphnia 7-d Survival and Reproduction Test — **Aquatec Environmental, Inc.**

Analysis ID:	19-3461-2593	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:24	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Sample ID:	10-7643-0565	**Code:**	15440	**Client:**	Keene WWTP
Sample Date:	22 Oct-18 07:08	**Material:**	POTW Effluent	**Project:**	Special Studies
Receipt Date:	22 Oct-18 14:30	**Source:**	Permit # NH0100790 (KEENE NH)		
Sample Age:	28h	**Station:**	Keene WWTP		

Data Transform	Alt Hyp	NOEL	LOEL	TOEL	TU	PMSD
Untransformed	C > T	100	> 100	n/a	1	66.29%

Steel Many-One Rank Sum Test

Control	vs	Conc-%	Test Stat	Critical	Ties	DF	P-Type	P-Value	Decision(α:5%)
Lab Water		12	109	75	2	18	Asymp	0.9082	Non-Significant Effect
		24	137.5	75	1	18	Asymp	1.0000	Non-Significant Effect
		48	147.5	75	1	18	Asymp	1.0000	Non-Significant Effect
		50	140	75	1	18	Asymp	1.0000	Non-Significant Effect
		100	155	75	0	18	Asymp	1.0000	Non-Significant Effect

ANOVA Table

Source	Sum Squares	Mean Square	DF	F Stat	P-Value	Decision(α:5%)
Between	4491.8	898.36	5	13.28	<1.0E-37	Significant Effect
Error	3651.6	67.6222	54			
Total	8143.4		59			

Distributional Tests

Attribute	Test	Test Stat	Critical	P-Value	Decision(α:1%)
Variances	Bartlett Equality of Variance Test	15.21	15.09	0.0095	Unequal Variances
Distribution	Shapiro-Wilk W Normality Test	0.9376	0.9459	0.0042	Non-Normal Distribution

Reproduction Summary

Conc-%	Code	Count	Mean	95% LCL	95% UCL	Median	Min	Max	Std Err	CV%	%Effect
0	L	10	12.7	8.474	16.93	13	4	23	1.868	46.52%	0.00%
12		10	13.3	9.225	17.38	14.5	6	22	1.802	42.83%	-4.72%
24		10	22.4	15.85	28.95	20	9	38	2.895	40.87%	-76.38%
48		10	31.5	24.76	38.24	34.5	9	40	2.979	29.90%	-148.03%
50		10	28	19.15	36.85	34	0	40	3.913	44.19%	-120.47%
100		10	35.5	32.95	38.05	35	30	41	1.128	10.05%	-179.53%

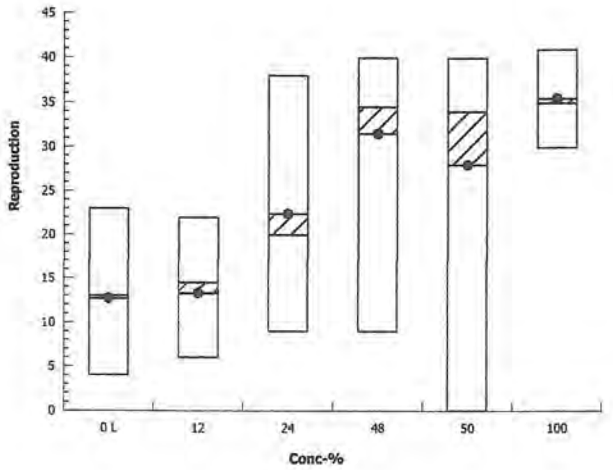
Reproduction Detail

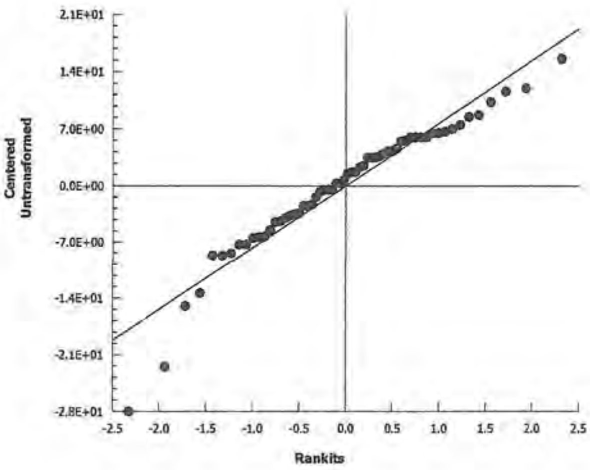
Conc-%	Code	Rep 1	Rep 2	Rep 3	Rep 4	Rep 5	Rep 6	Rep 7	Rep 8	Rep 9	Rep 10
0	L	12	15	9	23	13	17	4	17	13	4
12		6	11	20	14	22	6	17	15	15	7
24		14	34	16	21	27	28	19	9	38	18
48		34	29	38	39	25	28	9	38	40	35
50		13	32	35	34	34	34	24	34	0	40
100		33	30	35	35	39	41	37	35	31	39

Ceriodaphnia 7-d Survival and Reproduction Test | **Aquatec Environmental, Inc.**

Analysis ID:	19-3461-2593	**Endpoint:**	Reproduction	**CETIS Version:**	CETISv1.9.2
Analyzed:	07 Nov-18 15:24	**Analysis:**	Nonparametric-Control vs Treatments	**Official Results:**	Yes

Graphics





CETIS Test Data Worksheet

Report Date: 07 Nov-18 15:23 (p 1 of 2)
Test Code/ID: 00-0320-8903/81606

Ceriodaphnia 7-d Survival and Reproduction Test | **Aquatec Environmental, Inc.**

Start Date: 23 Oct-18 10:55 **Species:** Ceriodaphnia dubia **Sample Code:** 15440
End Date: 31 Oct-18 16:50 **Protocol:** EPA/821/R-02-013 (2002) **Sample Source:** Permit # NH0100790
Sample Date: 22 Oct-18 07:08 **Material:** POTW Effluent **Sample Station:** Keene WWTP

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
0	L	1	21	1		1						1		0	3	9	0	0	0	0	
0	L	2	59	1		1						1		0	5	10	0	0	0	0	
0	L	3	66	1		1						1		0	6	2	1	0	0	0	
0	L	4	20	1		1						1		0	7	14	2	0	0	0	
0	L	5	49	1		1						1		0	6	4	0	0	3	0	
0	L	6	27	1		1						1		0	5	10	2	0	0	0	
0	L	7	46	1		1						1		0	4	0	0	0	0	0	
0	L	8	29	1		1						1		0	6	6	1	0	4	0	
0	L	9	47	1		1						1		7	0	4	1	1	0	0	
0	L	10	45	1		1						1		0	3	0	1	0	0	0	
0	R	1	12	1		1						1		0	3	13	0	1	0	0	
0	R	2	67	1		1						1		0	6	14	0	0	3	0	
0	R	3	60	1		1						1		0	4	10	0	4	0	0	
0	R	4	44	1		1						1		0	5	12	5	1	0	0	
0	R	5	23	1		1						1		0	6	16	1	0	0	0	
0	R	6	37	1		1						1		0	4	0	1	0	0	0	
0	R	7	14	1		1						1		0	5	0	0	1	0	0	
0	R	8	24	1		1						1		0	5	9	14	0		0	
0	R	9	26	1		1						1		0	0	1	1	2	0	0	
0	R	10	64	1		1						1		0	3	0	5	0	7	0	
12		1	34	1		1						1		0	4	0	0	0	2	0	
12		2	9	1		1						1		0	4	7	0	0	0	0	
12		3	68	1		1						1		0	6	11	3	0		0	
12		4	28	1		1						1		0	5	9	0	0	0	0	
12		5	1	1		1						1		0	7	9	1	0	5	0	
12		6	22	1		1						1		0	4	0	2	0	0	0	
12		7	63	1		1						1		0	6	11	0	0	0	0	
12		8	30	1		1						1		0	7	6	0	0	2	0	
12		9	53	1		1						1		5	0	10	0	0	0	0	
12		10	5	1		1						1		0	4	0	3	0	0	0	
24		1	32	1		1						1		4	0	9	0	1	0	0	
24		2	57	1		1						1		6	0	11	16	1	0	0	
24		3	55	1		1						1		0	4	6	6	0	0	0	
24		4	38	1		1						1		0	7	14	0	0	0	0	
24		5	65	1		1						1		0	6	9	12	0		0	
24		6	42	1		1						1		6	0	10	12	0		0	
24		7	62	1		1						1		5	0	12	0	0	2	0	
24		8	50	1		1						1		0	4	4	1	0	0	0	
24		9	69	1		1						1		5	0	14	19			0	
24		10	61	1		1						1		0	3	0	15	0	0	0	
48		1	56	1		1						1		6	0	10	18		0	0	
48		2	19	1		1						1		5	0	9	15		0	0	
48		3	4	1		1						1		6	0	12	20			0	
48		4	3	1		1						1		7	0	14	18	0		0	
48		5	18	1		1						1		3	0	11	11	0		0	

CETIS Test Data Worksheet

Report Date: 07 Nov-18 15:24 (p 2 of 2)
Test Code/ID: 00-0320-8903/81606

Conc-%	Code	Rep	Pos	# Exposed	1d Surv	2d Surv	3d Surv	4d Surv	5d Surv	6d Surv	7d Surv	8d Surv	2d Neo	3d Neo	4d Neo	5d Neo	6d Neo	7d Neo	8d Neo	Male	Notes
48		6	43	1		1						1		0	7	13	8	0		0	
48		7	39	1		1						1		6	0	0	0	3	0	0	
48		8	48	1		1						1		0	7	14	17	0		0	
48		9	13	1		1						1		6	0	13	21		0	0	
48		10	40	1		1						1		5	0	13	17		0	0	
50		1	8	1		1						1		5	0	8	0	0	0	0	
50		2	52	1		1						1		6	0	10	16		0	0	
50		3	7	1		1						1		0	6	13	16	0		0	
50		4	6	1		1						1		6	0	12	16		0	0	
50		5	17	1		1						1		0	5	11	18		0	0	
50		6	33	1		1						1		0	6	15	13	0		0	
50		7	35	1		1						1		0	5	12	7	0		0	
50		8	15	1		1						1		6	0	14	1	0	13	0	
50		9	58	1		1						0		0	0	0	0	0	0	0	
50		10	11	1		1						1		6	0	12	22		0	0	
100		1	36	1		1						1		5	0	10	18		0	0	
100		2	51	1		1						1		5	0	10	15		0	0	
100		3	54	1		1						1		0	6	14	15	0		0	
100		4	25	1		1						1		6	0	11	18		0	0	
100		5	41	1		1						1		8	0	14	17		0	0	
100		6	10	1		1						1		7	0	15	19			0	
100		7	16	1		1						1		7	0	13	16	1		0	
100		8	70	1		1						1		5	0	11	19			0	
100		9	2	1		1						1		5	0	13	13		0	0	
100		10	31	1		1						1		6	0	12	21		0	0	

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA: **Test ID** 81606

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	DAY 8
DW 0 % SOFT CTRL	1	0	0	0	0	3	9	0	0	0
	2	0	0	0	0	5	10	0	0	0
	3	0	0	0	0	6	2	1	0	0
	4	0	0	0	0	7	14	2	0	0
	5	0	0	0	0	6	4	0	0	3
	6	0	0	0	0	5	10	2	0	0
	7	0	0	0	0	4	0	0	0	0
	8	0	0	0	0	6	6	1	0	4
	9	0	0	0	7	0	4	1	1	0
	10	0	0	0	0	3	0	1	0	0
0 % RW	1	0	0	0	0	3	13	0	1	0
	2	0	0	0	0	6	14	0	0	3
	3	0	0	0	0	4	10	0	4	0
	4	0	0	0	0	5	12	5	1	0
	5	0	0	0	0	6	16	1	0	0
	6	0	0	0	0	4	0	1	0	0
	7	0	0	0	0	5	0	0	1	0
	8	0	0	0	0	5	9	14	0	20
	9	0	0	0	0	0	1	1	2	0
	10	0	0	0	0	3	0	5	0	7
12 % EFF	1	0	0	0	0	4	0	0	0	2
	2	0	0	0	0	4	7	0	0	0
	3	0	0	0	0	6	11	3	0	1
	4	0	0	0	0	5	9	0	0	0
	5	0	0	0	0	7	9	1	0	5
	6	0	0	0	0	4	0	2	0	0
	7	0	0	0	0	6	11	0	0	0
	8	0	0	0	0	7	6	0	0	2
	9	0	0	0	5	0	10	0	0	0
	10	0	0	0	0	4	0	3	0	0
24 % EFF	1	0	0	0	4	0	9	0	1	0
	2	0	0	0	6	0	11	16	1	0
	3	0	0	0	0	4	6	6	0	0
	4	0	0	0	0	7	14	0	0	0
	5	0	0	0	0	6	9	12	0	16
	6	0	0	0	6	0	10	12	0	2
	7	0	0	0	5	0	12	0	0	2
	8	0	0	0	0	4	4	1	0	0
	9	0	0	0	5	0	14	19	2	4
	10	0	0	0	0	3	0	15	0	0

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

Aquatec Environmental, Inc.

Reviewed by: [signature] Date: 11/10/18

SDG: 15440

Project 18017

Cd

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

TOXICITY TEST DATA:

Test ID 81606

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
48 % EFF	1	0	0	0	6	0	10	18	3	0
	2	0	0	0	5	0	9	15	16	0
	3	0	0	0	6	0	12	20	15	3
	4	0	0	0	7	0	14	18	0	4
	5	0	0	0	3	0	11	11	0	26
	6	0	0	0	0	7	13	8	0	6
	7	0	0	0	6	0	0	0	3	0
	8	0	0	0	0	7	14	17	0	16
	9	0	0	0	6	0	13	21	17	0
	10	0	0	0	5	0	13	17	17	0
50 % EFF	1	0	0	0	5	0	8	0	0	0
	2	0	0	0	6	0	10	16	15	0
	3	0	0	0	0	6	13	16	0	17
	4	0	0	0	6	0	12	16	17	0
	5	0	0	0	0	5	11	18	16	0
	6	0	0	0	0	6	15	13	0	2
	7	0	0	0	0	5	12	7	0	13
	8	0	0	0	6	0	14	1	0	13
	9	0	0	0	D/0	—	—	—	—	—
	10	0	0	0	6	0	12	22	16	0
100 % EFF	1	0	0	0	5	0	10	18	17	0
	2	0	0	0	5	0	10	15	12	0
	3	0	0	0	0	6	14	15	0	13
	4	0	0	0	6	0	11	18	16	0
	5	0	0	0	8	0	14	17	14	0
	6	0	0	0	7	0	15	19	15	6
	7	0	0	0	7	0	13	16	1	19
	8	0	0	0	5	0	11	19	19	3
	9	0	0	0	5	0	13	13	16	0
	10	0	0	0	6	0	12	21	19	0

Sample #	51157	51157	51167	51167	51171	51171	51171	51171	
Fed	✓	✓	✓	✓	✓	✓	✓	✓	—
Renewal (D / T / I)	10-23-18 10:55 EB	10.24.18 1130 KP	10-25-18 1235 EB	10.26.18 1320 KP	10.27.18 1145 KP	10/28/18 13:06	10-29-18 17:30 EB	10/30/18 16:15	10/31/18 16:50 KN

YCT Lot Number: 081018-YCT Selenastrum Lot Number: 101018-SEL

10/30/18 - 100 μL sel/YCT (14:00) each cup.

0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality

Aquatec Environmental, Inc.

Reviewed by: [signature] Date: 11/10/18

SDG: 15440
Project 18017

Cd

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

Test ID 81606

TOXICITY TEST DATA:

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	DAY 8
DW 0 % SOFT CTRL	1	0	0	0	0	3	9	0	0	0
	2	0	0	0	0	5	10	0	0	0
	3	0	0	0	0	6	2	1	0	0
	4	0	0	0	0	7	14	2	0	
	5	0	0	0	0	6	4	0	0	3
	6	0	0	0	0	5	10	2	0	0
	7	0	0	0	0	4	0	0 (1.)	0	0
	8	0	0	0	0	6	6	1	0	5
	9	0	0	0	7	0	4	1	1	0
	10	0	0	0	0	3	0	1	0	0
0 % RW	1	0	0	0	0	3	13	0	1	0
	2	0	0	0	0	6	14	0	0	3
	3	0	0	0	0	4	10	0	4	0
	4	0	0	0	0	5	12	5	1	0
	5	0	0	0	0	6	16	1	0	0
	6	0	0	0	0	4	0	1	0	0 (2.)
	7	0	0	0	0	5	0	0	1	0
	8	0	0	0	0	5	9	14	0	20 e
	9	0	0	0	0	0	1	1	2	0
	10	0	0	0	0	3	0	5	0	7
12 % EFF	1	0	0	0	0	4	0	0	0	2
	2	0	0	0	0	4	7	0	0	0
	3	0	0	0	0	6	11	3	0	1 e
	4	0	0	0	0	5	9	0	0	0
	5	0	0	0	0	7	9	1	0	5
	6	0	0	0	0	4	0	2	0	0
	7	0	0	0	0	6	11	0	0	0
	8	0	0	0	0	7	6	0	0	2
	9	0	0	0	5	0	10	0	0	0
	10	0	0	0	0	4	0	3	0	0
24 % EFF	1	0	0	0	4	0	9	0	1	0
	2	0	0	0	6	0	11	16	1	0
	3	0	0	0	0	4	6	6	0	0
	4	0	0	0	0	7	14	0	0	0
	5	0	0	0	0	6	9	12	0	16 e
	6	0	0	0	6	0	10	12	0	2 e
	7	0	0	0	5	0	12	0	0	2
	8	0	0	0	0	4	4	1	0	0
	9	0	0	0	5	0	14	19	2 e	4 e
	10	0	0	0	0	3	0	15	0	0

COPY OF BENCH SHEET

(1.) Circled #s of neonates were viewed as split broods

(2.) Circled with flag neonates were fourth broods excluded from data tabulations and analysis. 20 e

*0 = Original organism surviving, No young; D = Original organism dead; # = Number young released; * = Lab-induced mortality*

SDG: 15440

Project 18017

Aquatec Environmental, Inc.

Reviewed by: JV Date: 11/10/18

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

Test ID 81606

TOXICITY TEST DATA:

% Effluent	Rep.	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	
48 % EFF	1	0	0	0	6	0	10	18	3	0
	2	0	0	0	5	0	9	15	16	0
	3	0	0	0	6	0	12	20	15	3 4
	4	0	0	0	7	0	14	18	0	20
	5	0	0	0	3	0	11	11	0	16
	6	0	0	0	0	7	13	8	0	0
	7	0	0	0	6	0	0	0	3	16
	8	0	0	0	0	7	14	17	0	0
	9	0	0	0	6	0	13	21	17	0
	10	0	0	0	5	0	13	17	17	0
50 % EFF	1	0	0	0	5	0	8	0	0	0
	2	0	0	0	6	0	10	16	5	17
	3	0	0	0	0	6	13	16	0	0
	4	0	0	0	6	0	12	16	17	0
	5	0	0	0	0	5	11	18	16	0
	6	0	0	0	0	6	15	13	0	2
	7	0	0	0	0	5	12	7	0	18
	8	0	0	0	6	0	14	1	0	13
	9	0	0	0	D/0	—	—	—	—	—
	10	0	0	0	6	0	12	22	16	0
100 % EFF	1	0	0	0	5	0	10	18	17	0
	2	0	0	0	5	0	10	15	12	0
	3	0	0	0	0	6	14	15	0	13
	4	0	0	0	6	0	11	18	16	0
	5	0	0	0	8	0	14	17	14	0
	6	0	0	0	7	0	15	19	15	16
	7	0	0	0	7	0	13	16	0	19
	8	0	0	0	5	0	11	17	19	3
	9	0	0	0	5	0	13	13	16	0
	10	0	0	0	6	0	12	21	19	0
	Sample #	51157	51157	51167	51167	51171	51171	51171	51171	
	Fed	✓	✓	✓	✓	✓	✓	✓	✓	—
	Renewal (D / T / I)	10-23-18 10:55 EB	10-24-18 1130 KP	10-25-18 1235 EB	10-26-18 1320 KP	10-27-18 1145 KP	10/28/18 13:06	10-29-18 17:30 EB	10/30/18 16:15	10/31/18 16:50 KN

YCT Lot Number: 081018-YCT Selenastrum Lot Number: 101018-SEL

10/30/18 - 100 µL sel/yct 14:00 each cup

Copy of Bench Sheet
indicating split broods
and fourth broods (excluded) 0

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

INITIAL CHEMISTRY DATA:

Test ID 81606

% Effluent	Analysis	Day 0	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7
DW 0 % SOFT CTRL	pH								7.4
	DO								7.3
	Temp.								25.3
	Cond.								178
0 % RW	pH								6.9
	DO								7.3
	Temp.								24.9
	Cond.								66
12 % EFF	pH								7.5
	DO								7.3
	Temp.								25.1
	Cond.								269
24 % EFF	pH								7.6
	DO								7.3
	Temp.								25.0
	Cond.								362
48 % EFF	pH								7.8
	DO								7.3
	Temp.								24.7
	Cond.								538
50 % EFF	pH								7.8
	DO								7.3
	Temp.								24.7
	Cond.								557
100 % EFF	pH								7.9
	DO								7.4
	Temp.								24.4
	Cond.								892
	Sample #	51157	51157						51171
	Date								10-30-18
	Initials								EB

See P. promelas initial chem. Data are common to both tests
D

Cd

Aquatec Environmental, Inc.
Reviewed by: D Date: 11/10/18.

SDG: 15440
Project 18017

1002.0 Daphnid, C. dubia, Survival and Reproduction Test

Species: *Ceriodaphnia dubia* Reference: EPA-821-R-02-013 SOP: WET-A-002

Client ID: Keene/Ley **Permit No.** NH0100790 **Pipe No.** 1

Test ID 81606

FINAL CHEMISTRY DATA:

% Effluent	Analysis	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6	Day 7	↓	Day 8
DW ~~0 %~~ Soft CTRL	pH	7.5	7.6	7.5	7.6	7.3	7.3	7.2 (1)	7.2	7.2
	DO	7.8	7.4	7.5	7.6	7.7	7.1	6.4	7.0	7.4
	Temp.	24.1	25.5	25.1	25.0	24.3	25.8	25.8	23.3	26.0
	Cond.	194	196	194	197	186	190	179	189	199
0 % RW	pH	7.0	7.1	7.2	7.1	7.0	6.9	6.7	6.8	6.9
	DO	7.8	7.4	7.4	7.4	7.7	7.0	6.3	7.0	7.4
	Temp.	24.2	25.6	25.3	25.3	24.6	25.9	25.8	23.5	26.1
	Cond.	82	76	79	79	82	76	70	81	80
12 % EFF	pH	7.4	7.6	7.6	7.6	7.3	7.4	7.2	7.1	7.2
	DO	7.8	7.6	7.5	7.3	7.7	7.1	6.6	7.0	7.3
	Temp.	24.3	25.6	25.3	25.4	24.6	25.9	25.6	23.8	26.2
	Cond.	273	281	278	282	269	279	268	255	291
24 % EFF	pH	7.6	7.7	7.7	7.7	7.5	7.5	7.3	7.4	7.3
	DO	7.7	7.5	7.5	7.4	7.7	7.1	6.7	7.1	7.3
	Temp.	24.3	25.6	25.4	25.5	24.6	25.8	25.7	24.0	26.0
	Cond.	354	362	368	369	358	371	358	364	384
48 % EFF	pH	7.7	7.8	7.8	7.8	7.6	7.7	7.4	7.5	7.5
	DO	7.7	7.6	7.4	7.4	7.7	7.1	6.6	6.9	7.3
	Temp.	24.3	25.6	25.3	25.5	24.6	25.7	25.7	24.2	26.0
	Cond.	508	522	527	533	527	556	532	539	566
50 % EFF	pH	7.7	7.8	7.8	7.8	7.8	7.7	7.5	7.6	7.5
	DO	7.7	7.6	7.5	7.3	7.7	7.1	6.5	7.0	7.3
	Temp.	24.3	25.6	25.3	25.4	24.4	25.9	25.3	24.2	26.0
	Cond.	521	535	539	542	544	567	550	544	582
100 % EFF	pH	7.8	7.9	7.9	8.0	7.9	7.9	7.6	7.8	7.7
	DO	7.7	7.6	7.5	7.4	7.8	7.2	6.5	7.1	7.3
	Temp.	24.2	25.6	25.3	25.1	24.5	25.8	25.8	24.2	26.0
	Cond.	837	859	873	881	868	935	899	898	948
	Sample #	51157	51157	51167	51167	51171	51171			
	Date	10.24.18	10.25.18	10.26.18	10.27.18	10/28/18	10.29.18	10.30.18	10/30/18	10/31/18
	Initials	KP	EB	KP	KP	[illegible]	EB	EB	[illegible]/EB	KN

(1) Recording error, Pp Final chem data recorded on Cd sheet. Transcribed Pp data on correct sheet. EB 10-30-18

Aquatec Environmental, Inc.

Reviewed by: [illegible] Date: 11/6/18

SDG: 15440

Project 18017

Cd

Documentation of Collection

Species:	*Ceriodaphnia dubia*	Client/Project:	KEENE
Source:	In-House Cultures	Testing Date:	10 / 23 / 18

Acclimation/Holding Procedures: Transfer culture cups collected within 8-hour intervals to the top of the brood board, group each collection by collection time or Collect neonates into a small Carolina bowl of <24-hour pooled neonates. Acclimate/Hold at appropriate testing temperature.

Feeding: Feed 200µL 1:1 Mix of *Pseudokirschneriella subcapitata* formally *Selenastrum capricornutum* (Lot #: 101018-SEL) and YTC (Lot #: ~~[illegible]~~ 81018-YCT) to each culture cup or ~3mL 1:1 Mix to a small Carolina bowl of pooled neonates.

Culture ID	Date / Time / Init Cleared of Neonates	Date / Time / Init Neonate Collection	Number of Cups Collected*	Fed (✓)
101418-cd	10-22-18/11:30/EB	10/22/18 18:35	14	✓
101518-cd	10-22-18/11:05/EB	10/22/18 18:20	20	✓

* *Neonates collected must number at least eight per cup, and be from a healthy adult female*

Aquatec Environmental, Inc.
DAPHNID COLLECTION FORM

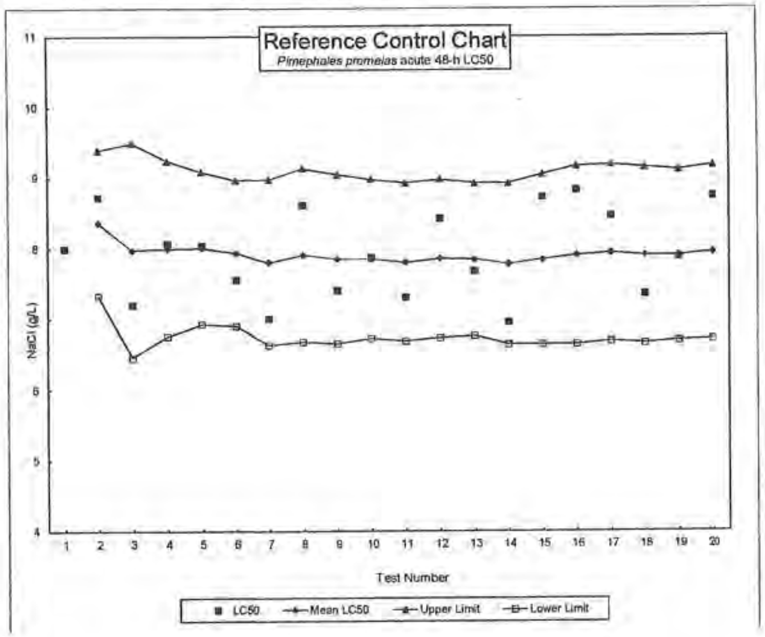
11/10/18

Standard Reference Toxicant Control Chart(s)

Pimephales promelas acute survival LC50 Control Chart
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower	Source
1	10/19-21/2016	7.994				Aquatic Biosystems
2	11/29/16-12/1/16	8.722	8.36	9.39	7.33	Aquatic Biosystems
3	1/10/17-1/12/17	7.204	7.97	9.49	6.45	Aquatic Biosystems
4	2/7/17-2/9/17	8.071	8.00	9.24	6.75	Aquatic Biosystems
5	3/21/17-3/23/17	8.042	8.01	9.08	6.93	Aquatic Biosystems
6	5/2/17-5/4/17	7.561	7.93	8.96	6.90	Aquatic Biosystems
7	7/12/17-7/14/17	7.005	7.80	8.97	6.63	Aquatic Biosystems
8	8/8/17-8/10/17	8.61	7.90	9.13	6.67	Aquatic Biosystems
9	9/12/17-9/14/14	7.403	7.85	9.04	6.65	Aquatic Biosystems
10	10/24/17-10/26/17	7.867	7.85	8.98	6.72	Aquatic Biosystems
11	11/7/17-11/9/17	7.31	7.80	8.92	6.68	Aquatic Biosystems
12	1/25/18-1/27/18	8.42	7.85	8.98	6.73	Aquatic Biosystems
13	2/6/18-2/8/18	7.678	7.84	8.92	6.76	Aquatic Biosystems
14	3/6/18-3/8/18	6.952	7.77	8.92	6.63	Aquatic Biosystems
15	4/3/18-4/5/18	8.722	7.84	9.04	6.63	Aquatic Biosystems
16	6/5/18-6/7/18	8.819	7.90	9.16	6.64	Aquatic Biosystems
17	7/24/18-7/26/18	8.451	7.93	9.18	6.68	Aquatic Biosystems
18	8/14/18-8/16/18	7.35	7.90	9.14	6.65	Aquatic Biosystems
19	9/11/18-9/13/18	7.87	7.90	9.11	6.69	Aquatic Biosystems
20	10/23/18-10/25/18	8.729	7.94	9.17	6.70	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted.

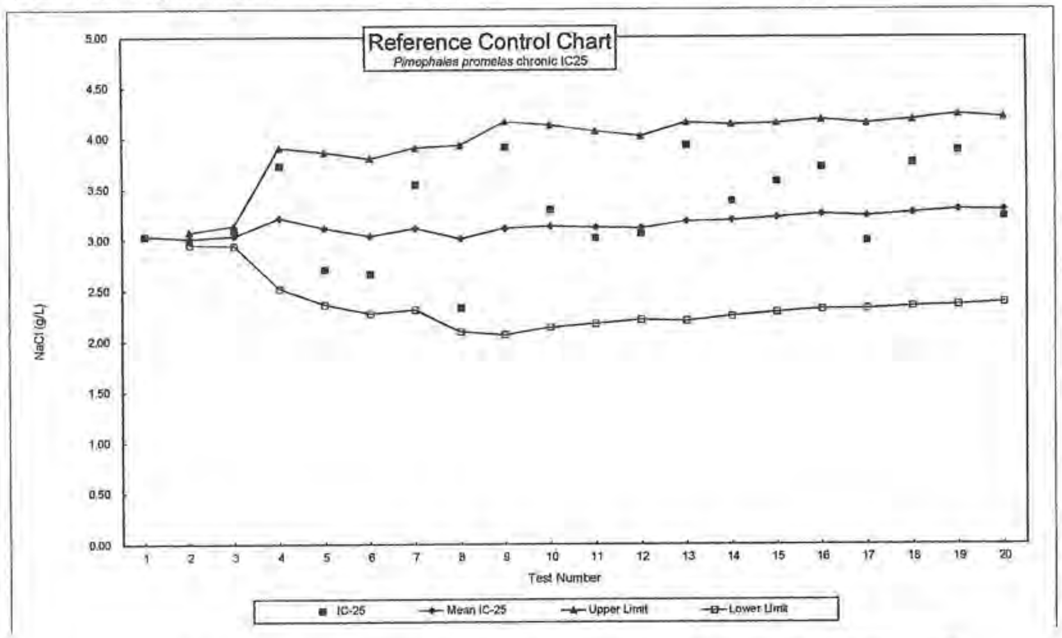


Note: Tests through September of 2016 were as Aquatec Biological Sciences, Inc. SRT tests beginning in October of 2016 were as Aquatec Environmental, Inc.

Pimephales promelas chronic IC25 Control Chart based on minnow growth
Reference toxicant: sodium chloride (g/L)

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Growth PMSD (%)	Avg. PMSD (%)	Source
1	10/19-26/2016	3.04	3.04					18.00	18.00	Aquatic Biosystems
2	11/29/16-12/6/16	2.99	3.01	3.08	2.95	0.01	0.01	20.40	19.20	Aquatic Biosystems
3	1/10/17-1/17/17	3.09	3.04	3.14	2.94	0.02	0.01	11.20	15.80	Aquatic Biosystems
4	2/7/17-2/14/17	3.73	3.21	3.91	2.52	0.11	0.04	7.45	14.26	Aquatic Biosystems
5	3/21/17-3/28/17	2.71	3.11	3.86	2.36	0.12	0.06	14.80	14.37	Aquatic Biosystems
6	5/2/14-5/9/17	2.66	3.04	3.80	2.27	0.13	0.08	15.10	14.49	Aquatic Biosystems
7	7/12/17-7/19/17	3.55	3.11	3.91	2.31	0.13	0.08	12.90	14.26	Aquatic Biosystems
8	8/8/17-8/15/17	2.33	3.01	3.93	2.09	0.15	0.09	only 2 reps	12.48	Aquatic Biosystems
9	9/12/17-9/19/17	3.91	3.11	4.16	2.06	0.17	0.10	19.00	13.21	Aquatic Biosystems
10	10/24/17-10/31/17	3.29	3.13	4.13	2.13	0.16	0.11	22.10	14.10	Aquatic Biosystems
11	11/7/17-11/14/17	3.02	3.12	4.07	2.17	0.15	0.11	27.00	15.27	Aquatic Biosystems
12	1/25/18-2/1/18	3.06	3.11	4.02	2.21	0.15	0.12	15.50	15.29	Aquatic Biosystems
13	2/6/18-2/13/18	3.93	3.18	4.15	2.20	0.15	0.12	14.70	15.24	Aquatic Biosystems
14	3/6/18-3/13/18	3.38	3.19	4.14	2.25	0.15	0.12	19.20	15.53	Aquatic Biosystems
15	4/3/18-4/10/18	3.57	3.22	4.15	2.29	0.14	0.12	13.20	15.37	Aquatic Biosystems
16	6/5/18-6/12/18	3.72	3.25	4.18	2.31	0.14	0.13	12.80	15.21	Aquatic Biosystems
17	7/24/18-7/31/18	2.99	3.23	4.15	2.32	0.14	0.13	20.80	15.54	Aquatic Biosystems
18	8/14/18-8/21/18	3.76	3.26	4.18	2.34	0.14	0.13	9.11	15.02	Aquatic Biosystems
19	9/11/18-9/18/18	3.88	3.30	4.23	2.36	0.14	0.13	12.60	15.05	Aquatic Biosystems
20	10/23/18-10/30/18	3.23	3.29	4.20	2.38	0.14	0.13	9.04	14.75	Aquatic Biosystems

Larval minnows ~1-day old unless otherwise noted. Test of 8/8/17, insufficient minnows for 4 reps. Tested with 2 reps.



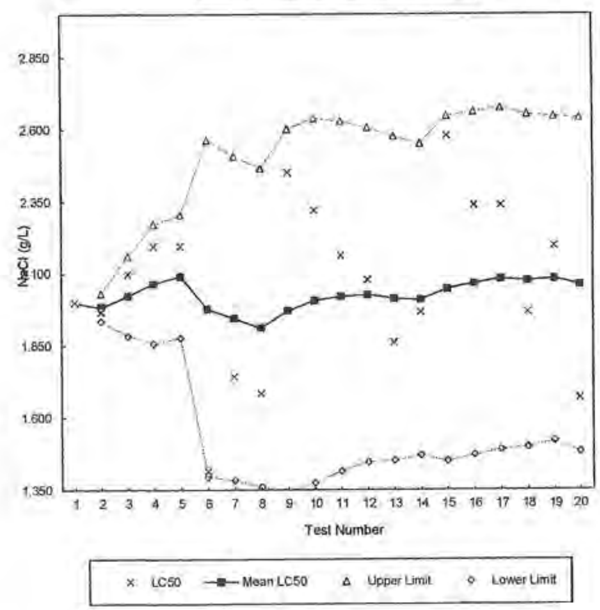
Assessment of test precision and sensitivity: Thev CV of average IC25 values was within the 25th Percentile (0.21) for fathead minnow growth (Table 3-2, EPA 833-R-00-003) indicating high precision (only 25% of labs reported CVs of not more than 0.21). The per-test PMSD values were less than the EPA upper limit of 30% indicating low-to moderate variability (moderate to high sensitivity) for this method. The cumulative average PMSD value of 20 tests (15.0) was near the EPA lower boundary (12%), indicating high statistical sensitivity for this test method. Updated 9/25/18

Ceriodaphnia dubia
Reference Control Chart for NaCl Acute Toxicity

Test Number	Test Date	LC50 (g/L)	Mean LC50	Calculated limits Upper	Calculated limits Lower
1	11/29/16-12/1/16	2.000	2.00		
2	1/10/17-1/12/17	1.966	1.98	2.03	1.93
3	2/14/17-2/16/17	2.098	2.02	2.16	1.88
4	3/21/17-3/23/17	2.195	2.06	2.27	1.86
5	5/16/17-5/18/17	2.195	2.09	2.30	1.88
6	7/11/17-7/13/17	1.414	1.98	2.56	1.39
7	8/1/17-8/3/17	1.743	1.94	2.51	1.38
8	9/12/17-9/14/17	1.684	1.91	2.46	1.36
9	9/28/17-9/30/17	2.449	1.97	2.60	1.34
10	10/31/17-11/2/17	2.319	2.01	2.64	1.37
11	11/28/17-11/30/17	2.161	2.02	2.63	1.41
12	1/9/18-1/11/18	2.077	2.03	2.60	1.45
13	2/6/18-2/8/18	1.861	2.01	2.57	1.45
14	3/6/18-3/8/18	1.966	2.01	2.55	1.47
15	4/3/18-4/5/18	2.577	2.05	2.64	1.45
16	5/15/18-5/17/18	2.337	2.07	2.66	1.47
17	6/12/18-6/14/18	2.337	2.08	2.67	1.49
18	7/24/18-7/26/18	1.966	2.07	2.65	1.50
19	8/14/18-8/16/18	2.195	2.08	2.64	1.52
20	10/2/18-10/4/18	1.668	2.06	2.64	1.48

Organisms Sources: Aquatec Environmental, Inc. in-house cultures

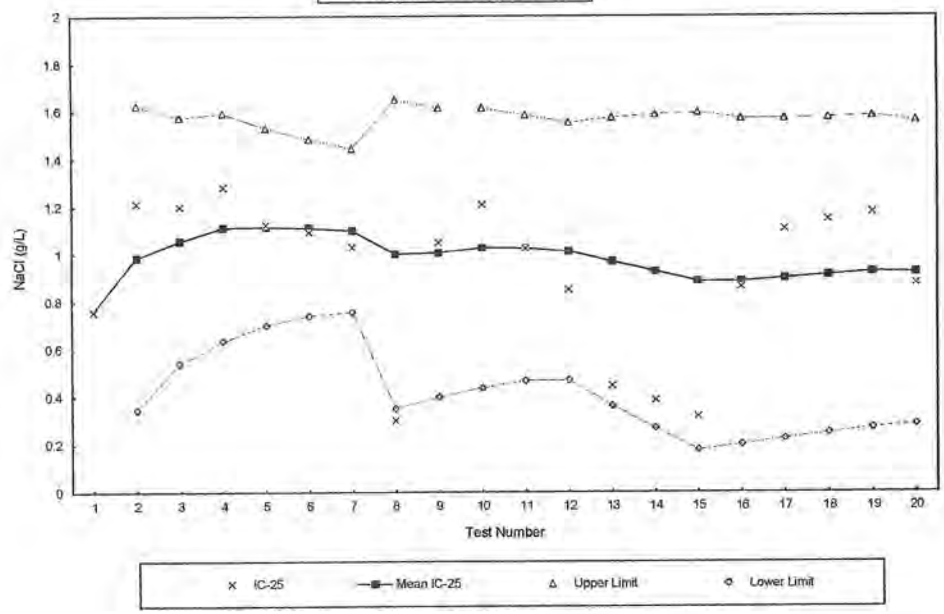
Reference Control Chart
Ceriodaphnia dubia Acute LC50



Ceriodaphnia dubia
Reference Control Chart for NaCl Chronic Toxicity based on reproduction

Test Number	Test Date	IC-25 (g/L)	Mean IC-25	Calculated limits Upper	Calculated limits Lower	CV of Avg. IC25	Avg. CV	Repro. PMSD (%)	Avg. PMSD (%)
1	11/29/16-12/5/16	0.7583	0.76					15.8	
2	1/10/17-1/16/17	1.211	0.98	1.62	0.34	0.33	0.33	13.7	15.8
3	2/14/17-2/22/17	1.2	1.06	1.57	0.54	0.24	0.28	33.2	14.8
4	3/21/17-3/28/17	1.282	1.11	1.59	0.63	0.21	0.26	34.9	20.9
5	5/16/17-5/22/17	1.123	1.11	1.53	0.70	0.19	0.24	10.5	24.4
6	7/11/17-7/13/17	1.093	1.11	1.48	0.74	0.17	0.23	6.72	21.6
7	8/1/17-8/7/17	1.03	1.10	1.44	0.76	0.16	0.22	16	19.1
8	9/12/17-9/18/17	0.2996	1.00	1.65	0.35	0.32	0.23	32.1	18.7
9	9/28/17-10/4/17	1.048	1.00	1.61	0.40	0.30	0.24	15.8	20.4
10	10/31/17-11/6/17	1.208	1.03	1.61	0.44	0.29	0.25	9.47	19.9
11	11/28/17-12/4/17	1.023	1.03	1.58	0.47	0.27	0.25	9.72	18.8
12	1/9/18-1/16/18	0.85	1.01	1.55	0.47	0.27	0.25	30.3	18.0
13	2/6/18-2/12/18	0.4474	0.97	1.57	0.36	0.31	0.25	20.6	19.0
14	3/6/18-3/12/18	0.3857	0.93	1.58	0.27	0.36	0.26	13.8	19.1
15	4/3/18-4/10/18	0.315	0.88	1.59	0.18	0.40	0.27	36.3	18.8
16	5/15/18-5/21/18	0.8601	0.88	1.57	0.20	0.39	0.28	17.3	19.9
17	6/12/18-6/18/18	1.105	0.90	1.57	0.22	0.37	0.29	6.82	19.8
18	7/24/18-7/30/19	1.145	0.91	1.57	0.25	0.36	0.29	16.1	19.0
19	8/14/18-8/20/18	1.174	0.92	1.58	0.27	0.35	0.29	11.6	18.8
20	10/2/18-10/8/18	0.875	0.92	1.56	0.28	0.35	0.30	24.1	18.7

Reference Control Chart
Ceriodaphnia dubia Chronic IC25



Assessment of test precision and sensitivity: The cumulative average CV of 0.27 for reproduction was near the 50th Percentile (0.27, Table 3-2 of EPA 833-R-00-003) indicating normal (median) variability. The PMSD values were less than the EPA upper limit of 47% indicating acceptable variability (sensitivity) of test data . The cumulative average PMSD values were slightly above EPA lower boundary (13%), indicating high-to-moderate statistical sensitivity for this test method when averaged for the most recent 20 tests. Updated 09/02/18.

\qaqc\srts\Cd SRT including CV and PMSD

APPENDIX D

VRAP Annual Reports

New Hampshire Volunteer River Assessment Program
2007 Ashuelot River Watershed Water Quality Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

February 2008

NHDES R-WD-08-1B

New Hampshire Volunteer River Assessment Program 2007 Ashuelot River Watershed Water Quality Report

State of New Hampshire
Department of Environmental Services
Water Division
Watershed Management Bureau
P.O. Box 95
29 Hazen Drive
Concord, New Hampshire 03302-0095
www.des.nh.gov

Thomas S. Burack
Commissioner

Harry T. Stewart
Water Division Director

Prepared By:

Ted Walsh, VRAP Program Manager

Jen Drociak, VRAP Coordinator

Chelsea Martin, VRAP Assistant

February 2008

Cover Photo: Ashuleot River, 15-ASH, West Swanzey

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ACKNOWLEDGEMENTS

The New Hampshire Department of Environmental Services Volunteer River Assessment Program extends sincere thanks to the volunteers of the Ashuelot River Local Advisory Committee for their efforts during 2007. This report was created solely from the data collected by the volunteers listed below. Their time and dedication is an expression of their genuine concern for local water resources and has significantly contributed to our knowledge of river and stream water quality in New Hampshire.

2007 Ashuelot River Volunteers

Barbara Skuly, Coordinator

Paul Daniello

Pat Eggleston
Penny Eggleston
Jim Holley
Brad Hutchinson
Bob Lamoy
Carolyn MacDonald
Malcom MacDonald
Mike Morrison
Bill Patnode
Barbara Richter
Steve Stepenuck
Ann Sweet
Roger Sweet
Sigrid Scholz-Karabakakis
Bob Thompson

1.0 INTRODUCTION

1.1. Purpose of Report

Each year the New Hampshire Volunteer River Assessment Program (VRAP) prepares and distributes a water quality report for each volunteer river monitoring group that is based solely on the water quality data collected by that group during a specific year. The reports summarize and interpret the data, particularly as they relate to New Hampshire's surface water quality standards, and serve as a teaching tool and guidance document for future monitoring activities by the individual volunteer groups.

1.2. Report Format

Each report includes the following:

- **Volunteer River Assessment Program Overview**

  This section includes a description of the history of VRAP, the technical support, training and guidance provided by NHDES, and how data is transmitted to the volunteers and used in surface water quality assessments.

- **Monitoring Program Description**

  This section provides a description of the volunteer group's monitoring program including monitoring objectives as well as a table and map showing sample station locations.

- **Results and Recommendations**

  Water quality data collected during the year are summarized on a parameter-by-parameter basis using: (1) a data summary table, which includes the number of samples collected, data ranges, the number of samples meeting New Hampshire water quality standards, and the number of samples adequate for water quality assessments at each station; (2) a discussion of the data; (3) a river graph showing the range of measured values at each station; and (4) a list of applicable recommendations.

  Sample results reported as less than the detection limit were assumed equal to one-half the detection limit on the river graphs. This approach simplifies the understanding of the parameter of interest, and specifically helps one to visualize how the river or watershed is functioning from upstream to downstream. In addition, this format allows the reader to better understand potential pollution areas and target those areas for additional sampling or environmental enhancements. Where applicable, the river graph also shows New Hampshire surface water quality standards or levels of concern for comparison purposes.

- **Appendix A – Water Quality Data**

  This appendix includes a spreadsheet detailing the data results and additional information such as data results which do not meet New Hampshire surface water quality standards, and data that is unusable for assessment purposes due to quality control requirements.

- **Appendix B – Interpreting VRAP Water Quality Parameters**

  This appendix provides a brief description of water quality parameters typically sampled by VRAP volunteers and their importance, as well as applicable state water quality criteria or levels of concern.

- **Appendix C – VRAP Volunteer Monitor Field Sampling Procedures Assessment *(Field Audits)***

  This appendix provides an overview of the VRAP Volunteer Monitor Field Sampling Procedures Assessment (field audit) process with respect to programmatic quality assurance/quality control (QA/QC) guidelines.

- **Appendix D – The New Hampshire Surface Water Quality Assessment Process**

  This appendix provides an overview of how data collected by VRAP volunteers, which meets QA/QC criteria, is used in the state assessment process of New Hampshire's rivers and streams.

- **Appendix E - Programs, Publications, & Links of Interest**

  This appendix lists NHDES Watershed Management Bureau programs, publications, and links of interest with respect to water quality, chemistry, biology, and watershed protection.

2.0 PROGRAM OVERVIEW

2.1 What is VRAP?

In 1998, the New Hampshire Volunteer River Assessment Program was established to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources.

Today, VRAP loans water quality monitoring equipment, provides technical support, and facilitates educational programs to volunteer groups on numerous rivers and watersheds throughout the state. VRAP volunteers conduct water quality monitoring on an ongoing basis and increase the amount of river water quality information available to local, state and federal governments, which allows for better watershed planning.

2.2 Why is VRAP Important?

VRAP establishes a regular volunteer-driven water sampling program to assist NHDES in evaluating water quality throughout the state. VRAP empowers volunteers with information about the health of New Hampshire's rivers and streams. Regular collection of water quality data allows for early detection of water quality changes allowing NHDES to trace potential problems to their source. Data collected by VRAP volunteers are directly contributing to New Hampshire's obligations under the Clean Water Act. Measurements taken by volunteers are used in assessing the water quality of New Hampshire's river and streams, and are included in reporting to the US Environmental Protection Agency.

2.3 How Does VRAP Work?

VRAP is a cooperative program between NHDES, river groups, local advisory committees, watershed associations, and individuals working to protect New Hampshire's rivers and streams. Volunteers are trained by VRAP staff in the use of water quality monitoring equipment at an annual training workshop. VRAP works with each group to establish monitoring stations and develop a sampling plan.

During the summer months, VRAP receives water quality data from trained volunteers. The data are reviewed for quality assurance, and are entered into the environmental monitoring database at NHDES. During the off-season, VRAP interprets the data and compiles the results into an annual report for each river. VRAP volunteers can use the data as a means of understanding the details of water quality, as well as guide future sampling efforts. NHDES can use the data for making surface water quality assessments, provided that the data met certain quality assurance/quality control guidelines.

2.4 Equipment and Sampling Schedule

VRAP frequently lends and maintains water quality monitoring equipment kits to VRAP groups throughout the state. The kits contain meters and supplies for routine water quality parameter measurements of turbidity, pH, dissolved oxygen, water temperature and specific conductance (conductivity). Other parameters such as nutrients, metals, and *E. coli* can also be studied, although VRAP does not always provide funds to cover laboratory analysis costs. Thus, VRAP encourages groups to pursue other fundraising activities such as association membership fees, special events, in-kind services (non-monetary contributions from individuals and organizations), and grant writing.

Each year, volunteers design and arrange a sampling schedule in cooperation with VRAP staff. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency. VRAP typically recommends sampling every other week from May through September, and VRAP groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions.

2.5 Training and Technical Support

Each VRAP volunteer attends an annual training workshop to receive a demonstration of monitoring protocols and sampling techniques and the calibration and use of water quality monitoring equipment. During the training, volunteers have an opportunity for hands-on use of the equipment and receive instruction in the collection of samples for laboratory analysis.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols (see Appendix C). If necessary, volunteers are re-trained during the visit, and the group's monitoring coordinator is notified of the result of the verification visit. VRAP groups forward water quality results to NHDES for incorporation into an annual report and state water quality assessment activities.

2.6 Data Usage

Annual Water Quality Reports

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. All data collected by volunteers are summarized in water quality reports that are prepared and distributed after the conclusion of the sampling period. VRAP groups can use the reports and data as a means of understanding the details of water quality, guiding future sampling efforts, or determining restoration activities.

New Hampshire Surface Water Quality Assessments

Along with data collected from other water quality programs, specifically the State Ambient River Monitoring Program, applicable volunteer data are used to support periodic NHDES surface water quality assessments. VRAP data are entered into NHDES's environmental monitoring database and are ultimately uploaded to the EPA database. Assessment results and the methodology used to assess surface waters are published by NHDES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act. The reader is encouraged to log on to the NHDES web page to review the assessment methodology and list of impaired waters www.des.nh.gov/wmb/swqa/.

2.7 Quality Assurance/Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The VRAP QAPP was approved by NHDES and reviewed by EPA in the summer of 2003. The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP quality assurance/quality control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.
- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.
- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.
- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.
- **DI (De-Ionized) Turbidity Blank**: A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

2.7.1 Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables with an explanation of why the data was unusable. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1. Relative Percent Difference)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O_2 Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	RPD < 10% or Absolute Difference <0.3 pH units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (Zero Air Reading)	± 5.0 µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <0.5 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

3.0 METHODS

In 2001, volunteers from the Ashuelot River Local Advisory Committee began monitoring water quality on the Ashuelot River. The goal of this effort was to provide water quality data from the Ashuelot River relative to surface water quality standards and to allow for the assessment of the river for support of aquatic life and primary contact recreation (swimming). The establishment of a long-term monitoring program allows for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, equipment, financial assistance for laboratory costs, and technical assistance.

During 2007, trained volunteers from the Ashuelot River Local Advisory Committee monitored water quality at 10 stations on the mainstem of the Ashuelot River from its upper limits in Washington to just upstream of its confluence with the Connecticut River in Hinsdale (Figure 1, Table 2). One station was also monitored on the South Branch of the Ashuelot River in Swanzey. In addition, eight stations in the Ashuelot River watershed were monitored by VRAP staff using submersible dataloggers.

Stations IDs are designated using a three-letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed. All stations monitored in 2007 are designated as Class B waters. This classification is used to apply the appropriate water quality standard.

Water quality monitoring was conducted monthly from May to September. In-situ measurements of water temperature, air temperature, dissolved oxygen, pH, and specific conductance were taken using handheld meters. Turbidity samples were collected in the field, brought to a central location and measured the same day. Samples for *E.coli* and total phosphorous were taken using sterile and/or preserved bottles and were stored on ice during transport from the field to the NHDES laboratory or the Keene Wastewater Treatment Facility. Table 3 summarizes the parameters measured, laboratory standard methods, and equipment used.

Table 2. Sampling Stations for the Ashuelot River, NHDES VRAP, 2007

Station ID	Location	Town	Elevation*
28-ASH	Route 31	Washington	1600
27-ASH	Mountain Road	Lempster	1500
04-GSB	Grassy Brook at Route 123 Bridge	Marlow	1100
24A-ASH	Route 10	Marlow	1100
01-DTB	Dart Brook at Surry Road	Gilsum	800
23-ASH	Route 10	Gilsum	800
21P-ASH	Gilsum/Surry Road	Surry	600
02-OTB	Otter Brook at Granite Gorge	Roxbury	900
20A-ASH	Stone Arch Bridge	Keene	500
18-ASH	Route 101	Keene	500
16-ASH	Cresson Bridge	Swanzey	500
16B-ASH	D/S of WWTF, U/S of SBA River	Swanzey	500
02-SBA	Rt 32 Bridge Near Swanzey Schools	Swanzey	500
15-ASH	Denman Thompson Bridge	West Swanzey	400
07-ASH	Route 119	Winchester	400
14T-ASH	U/S of Deniman Thompson Highway Bridge	Swanzey	400
01-ASH	147 River Street	Hinsdale	200

*Elevations have been rounded off to 100-foot increments for calibration of dissolved oxygen meter

Table 3. Sampling and Analysis Methods

Parameter	Sample Type	Standard Method	Equipment Used	Laboratory
Temperature	In-Situ	SM 2550	YSI 85	------
	Datalogger	SM 2550	In Situ Multiparameter Series Troll 9500	------
Dissolved Oxygen	In-Situ	SM 4500 O G	YSI 85	------
	Datalogger	SM 2550	In Situ Multiparameter Series Troll 9500	------
pH	In-Situ	SM 4500 H+	Oakton pH 11	------
Turbidity	In-Situ	EPA 180.1	LaMotte 2020 e	
Specific Conductance	In-Situ	SM 2510	YSI 85	------
	Datalogger	SM 2550	In Situ Multiparameter Series Troll 9500	------
E.coli	Bottle (Sterile)	EPA 1103.1	------	NHDES
Total Phosphorus	Bottle (w/ Preservative)	EPA 365.3	------	NHDES

RESULTS AND RECOMMENDATIONS

Results and recommendations for each monitored parameter are presented in the following sections. For a description of the importance of each parameter and pertinent water quality criteria for these and other parameters, please see Appendix B, *"Interpreting VRAP Water Quality Parameters."*

4.1 Dissolved Oxygen

Five measurements were taken in the field for dissolved oxygen concentration at 10 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 4). VRAP staff also deployed submersible dataloggers to record dissolved oxygen at eight stations in the Ashuelot River watershed. Of the 59 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

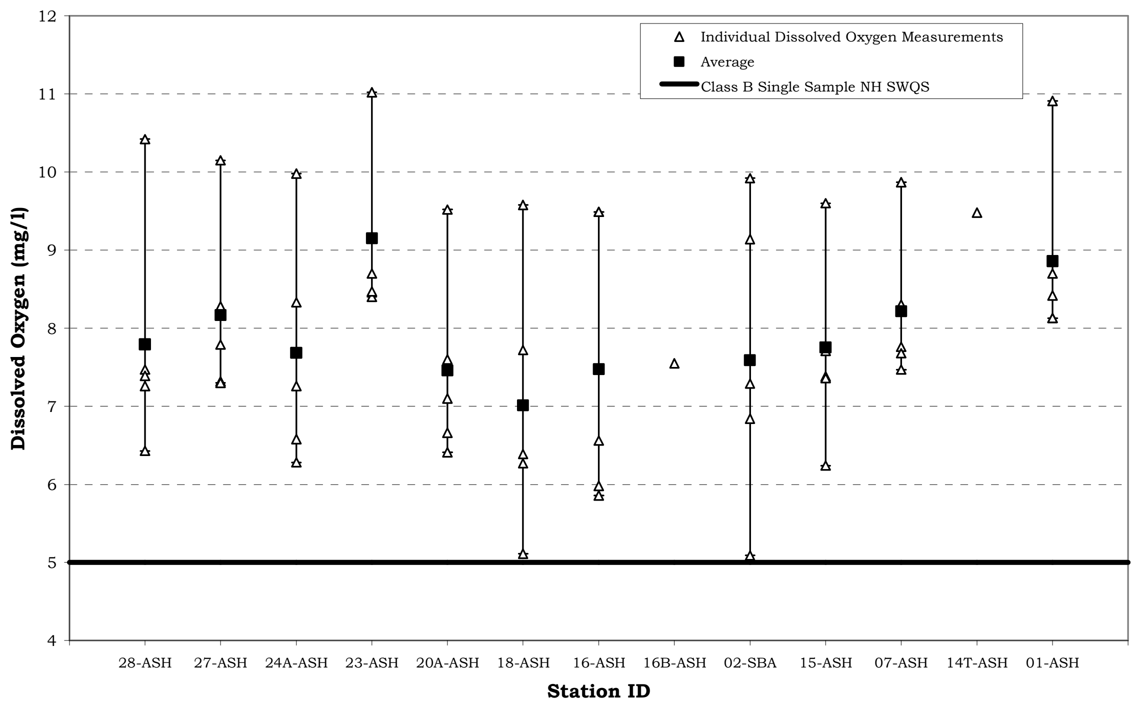
The Class B New Hampshire surface water quality standard for dissolved oxygen includes a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 percent of saturation. In other words, there are criteria for both concentration and saturation that must be met before the river can be assessed as meeting dissolved oxygen standards. Table 4 reports only dissolved oxygen concentration as more detailed analysis is required to determine if instantaneous dissolved oxygen saturation measurements are above or below water quality standards.

Table 4. Dissolved Oxygen Concentration (mg/L) Summary – Ashuelot River, 2007

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	5	6.43 - 10.42	0	5
27-ASH	5	7.30 - 10.15	0	5
24A-ASH	5	6.28 - 9.98	0	5
23-ASH	5	8.40 - 11.02	0	5
20A-ASH	5	6.41 - 9.52	0	5
18-ASH	5	5.11 - 9.58	0	5
16-ASH	5	5.86 - 9.49	0	5
16B-ASH	1	7.55	0	1
02-SBA	6	5.09-9.92	0	6
15-ASH	6	6.24 - 9.60	0	6
07-ASH	5	7.47 - 9.87	0	5
14T-ASH	1	9.48	0	1
01-ASH	5	8.13 - 10.91	0	5
Total	**59**	_____	**0**	**59**

Dissolved oxygen concentration levels were above the New Hampshire Class B surface water quality standard at all stations and on all occasions with the average ranging from 7.01 mg/L to 9.15 mg/L (Figure 1). Levels of dissolved oxygen sustained above the standards are considered adequate for the support of aquatic life and other desirable water quality conditions.

Figure 1. Dissolved Oxygen Concentration Statistics for the Ashuelot River May 19 - September 11, 2007, NHDES VRAP



Figures 2 though 5 illustrate the results of dissolved oxygen concentration and saturation levels obtained at six stations in the Ashuelot River watershed using submersible multiparameter dataloggers deployed on two separate occasions. On each occasion, the meters were programmed to take dissolved oxygen readings every 15 minutes over a multiple day period. In general the daily minimum is used to determine if the waterbodies are meeting the surface water quality standard for dissolved oxygen concentration (mg/L) and the 24 hour average is analyzed for % saturation of dissovled oxygen.

During the first deployment (June 28 through July 3) three dataloggers were deployed in the mainstem of the Ashuelot River (16B-ASH, 15-ASH, and 14T-ASH) and one in the South Branch of the Ashuelot River (02-SBA). During the deployment four full 24-hour periods were measured. Stations 15-ASH and 14T-ASH were measured to gather baseline data upstream and downstream of the Homestead Woolen Mills Dam which is currently under consideration for removal. The datalogger deployed at station 16B-ASH failed post deployment QA/QC checks and is not included in the graphs.

Dissolved oxygen concentration levels were above the Class B surface water quality standard of 5.0 mg/L at all three stations on all occasions (Figure 2). The daily average of dissolved oxygen % saturation was also above the Class B surface water quality standard of 75% at all three stations on all days (Figure 3).

During the second deployment (September 17 through September 25) one datalogger was deployed in the mainstem of the Ashuelot River (21P-ASH) and three in tributaries of the Ashuelot River: Grassy Brook (04-GSB, Dart Brook (01-DTB and Otter Brook (02-OTB). This deployment was conducted to help identify river segments and tributaries with very high water quality. Seven full 24-hour periods were measured. The datalogger deployed in Grassy Brook (02-GSB) failed post deployment QA/QC checks and is not included in the graphs.

Dissolved oxygen concentration levels were above the Class B surface water quality standard of 5.0 mg/L at all three stations on all occasions (Figure 4). The daily average of dissolved oxygen % saturation was also above the Class B surface water quality standard of 75% at all three stations on all days (Figure 5).

Figures 2 through 5 also depict the typical cyclical variations in dissolved oxygen measurements one would expect to see during a 24-hour period in the summer. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.

Figure 2. Dissolved Oxygen Concentration Statistics for Ashuelot River Watershed June 28 - July 3 2007, NHDES VRAP

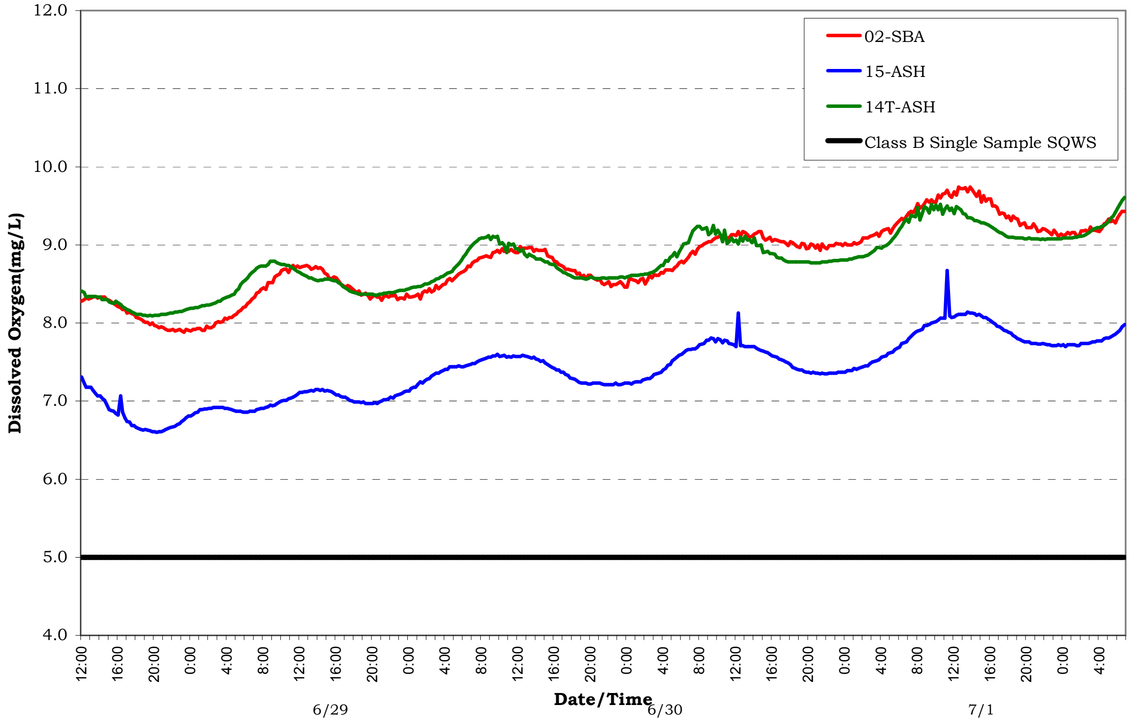


Figure 3. Dissolved Oxygen Saturation Statistics for the Ashuelot River Watershed June 28- July 3 2007, NHDES VRAP

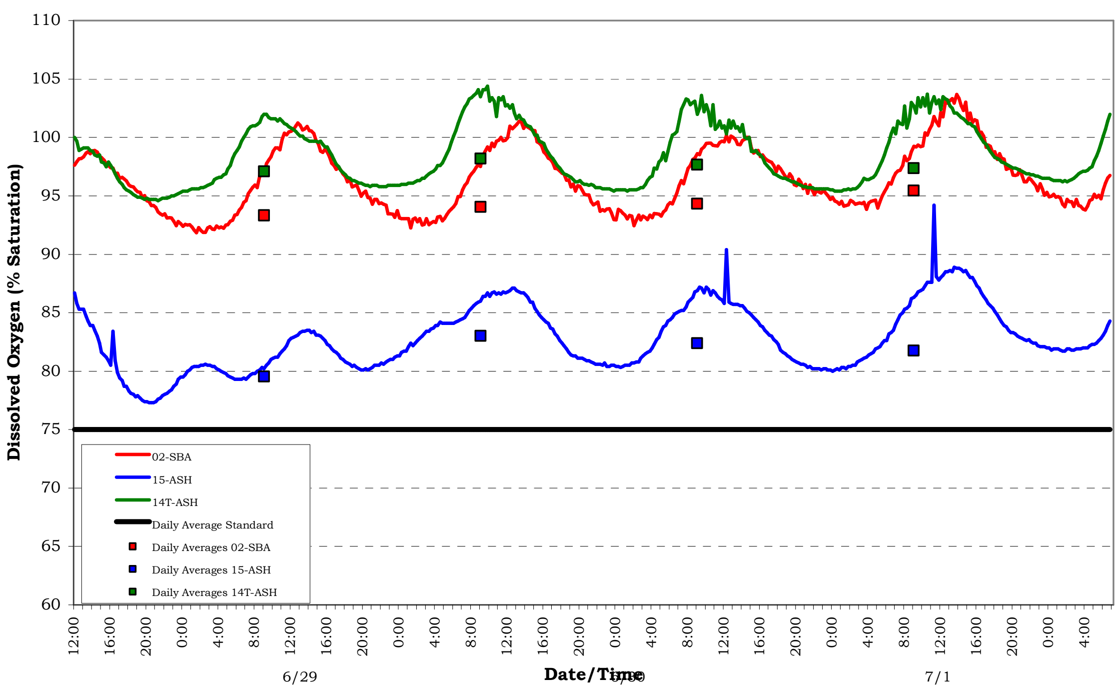


Figure 4. Dissolved Oxygen Concentration Statistics for the Ashuelot River Watershed September 17-25, 2007, NHDES VRAP

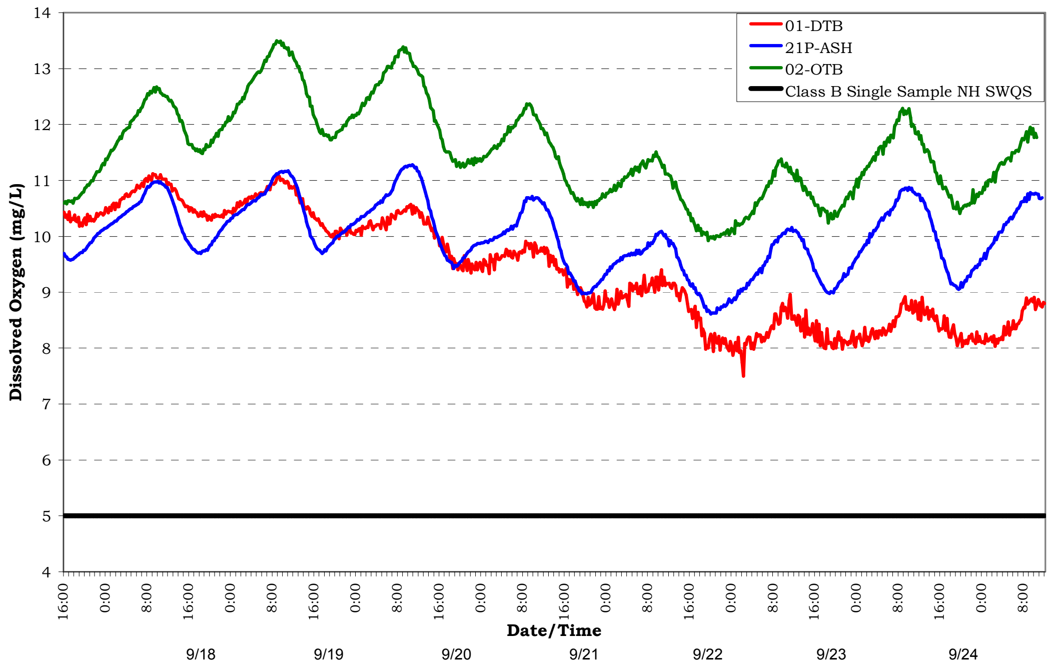
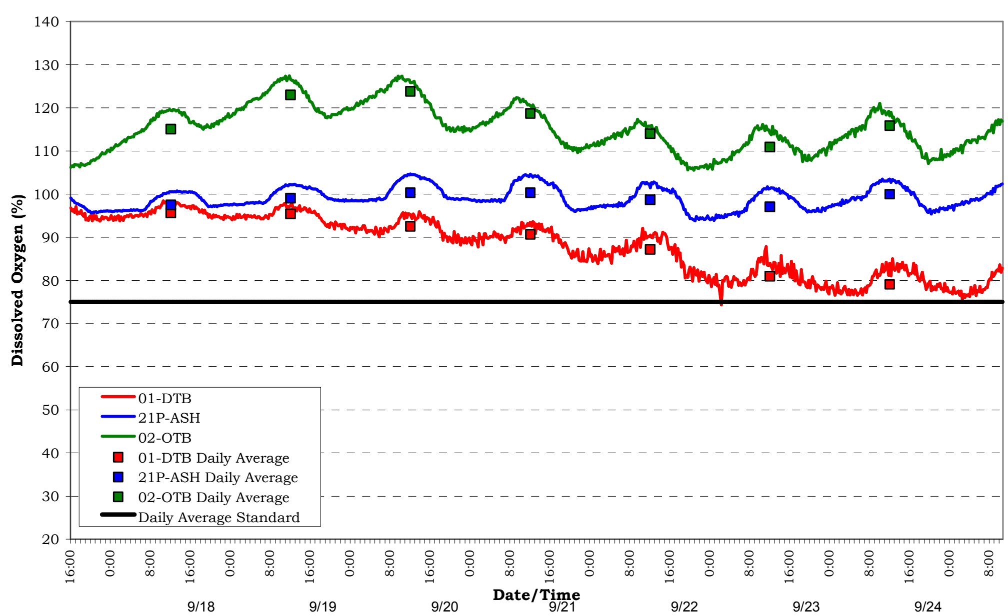


Figure 5. Dissolved Oxygen Saturation Statistics for the Ashuelot River Watershed September 17-25, 2007, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- If possible, take measurements between 5 a.m. and 10 a.m., which is when dissolved oxygen is usually the lowest, and between 2 p.m. and 7 p.m. when dissolved oxygen is usually the highest. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.

- Continue to incorporate the use of in-situ dataloggers to automatically record dissolved oxygen saturation levels during a period of several days. The use of these instruments is dependent upon availability, and requires coordination with NHDES.

4.2 pH

Between one and five measurements were taken in the field for pH at 13 stations in the Ashuelot River watershed from Washington to Hinsdale. VRAP staff also deployed submersible dataloggers to record pH at eight stations in the Ashuelot River watershed [Table 5]. Of the 59 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard is 6.5 - 8.0, unless naturally occurring.

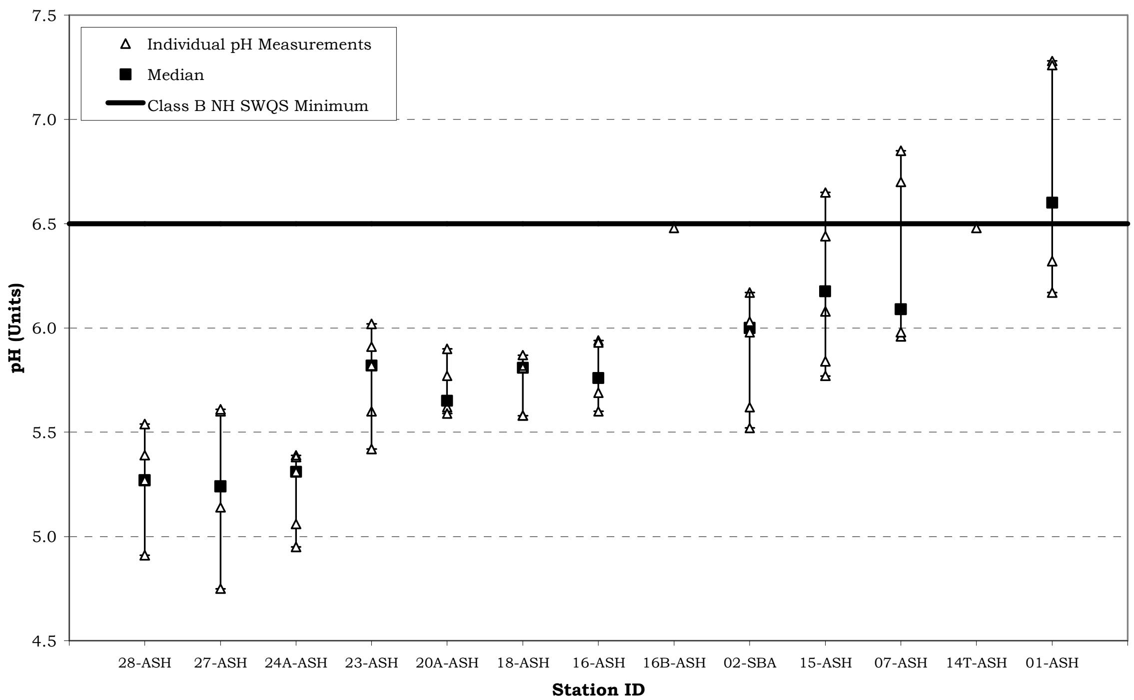
Table 5. pH Data Summary – Ashuelot River, 2007

Station ID	Samples Collected	Data Range (standard units)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	5	4.91 - 5.54	5	5
27-ASH	5	4.75 - 5.61	5	5
24A-ASH	5	4.95 - 5.39	5	5
23-ASH	5	5.42 - 6.02	5	5
20A-ASH	5	5.59 - 5.9	5	5
18-ASH	5	5.58 - 5.87	5	5
16-ASH	5	5.60 - 5.94	5	5
16B-ASH	1	6.48	1	1
02-SBA	6	5.52 - 6.17	6	6
15-ASH	6	5.77 - 6.65	5	6
07-ASH	5	5.96 - 6.85	3	5
14T-ASH	1	6.48	1	1
01-ASH	5	6.17 - 7.28	2	5
Total	**59**	_____	**53**	**59**

A majority of the pH measurements were below the New Hampshire surface water quality standard minimum (Figure 6). In general, stations in the upper portions of the watershed had lower pH measurements than stations in the lower portions of the watershed.

Lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area. Rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels; after the spring melt or significant rain events, surface waters will generally have a lower pH.

Figure 6. pH Statistics for the Ashuelot River
May 19 - September 11, 2007, NHDES VRAP



Figures 7 and 8 illustrate the results of pH measurements obtained at seven stations in the Ashuelot River watershed using submersible multiparameter dataloggers deployed on two separate occasions. On each occasion, the meters were programmed to take pH measurements every 15 minutes over a multiple day period. In general the daily minimum is used to determine if the waterbodies are meeting the surface water quality standard for pH.

During the first deployment (June 28 through July 3) three dataloggers were deployed in the mainstem of the Ashuelot River (16B-ASH, 15-ASH, and 14T-ASH) and one in the South Branch of the Ashuelot River (02-SBA). pH measurements at station15-ASH were below the minimum standard on all occasions. Stations 16B-ASH and 14-ASH had daily minimums below the minimum standard on all days that were measured though both stations did have some pH readings that were above the minimum standard. The datalogger deployed in the South Branch Ashuelot River (02-SBA) failed post deployment QA/QC checks and is not included in the graphs (Figure 7).

During the second deployment (September 17 through September 25) one datalogger was deployed in the mainstem of the Ashuelot River (21P-ASH) and three in tributaries of the Ashuelot River: Grassy Brook (04-GSB, Dart Brook (01-DTB and Otter Brook (02-OTB). This deployment was done to help identify river segments and tributaries with very high water quality. Seven full 24-hour periods were measured. pH measurements from stations 21P-ASH and 01-DTB met the state of New Hampshire surface water quality standard on all occasions while measurements from station 02-OTB were both above and below the standard with daily variations. Station 04-GRB failed to meet the standard on all occasions (Figure 8).

Figures 7 and 8 also depicts the typical cyclical variations in pH measurements one would expect to see during a 24-hour period in the summer. In general, pH levels are lowest (more acidic) in the early morning when there is low photosynthetic activity, low dissolved oxygen levels, and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Higher (more basic/alkaline) pH levels occur when photosynthetic activity is at its peak.

Figure 7. pH statistics for the Ashuelot River Watershed
June 28- July 3, 2007, NHDES VRAP

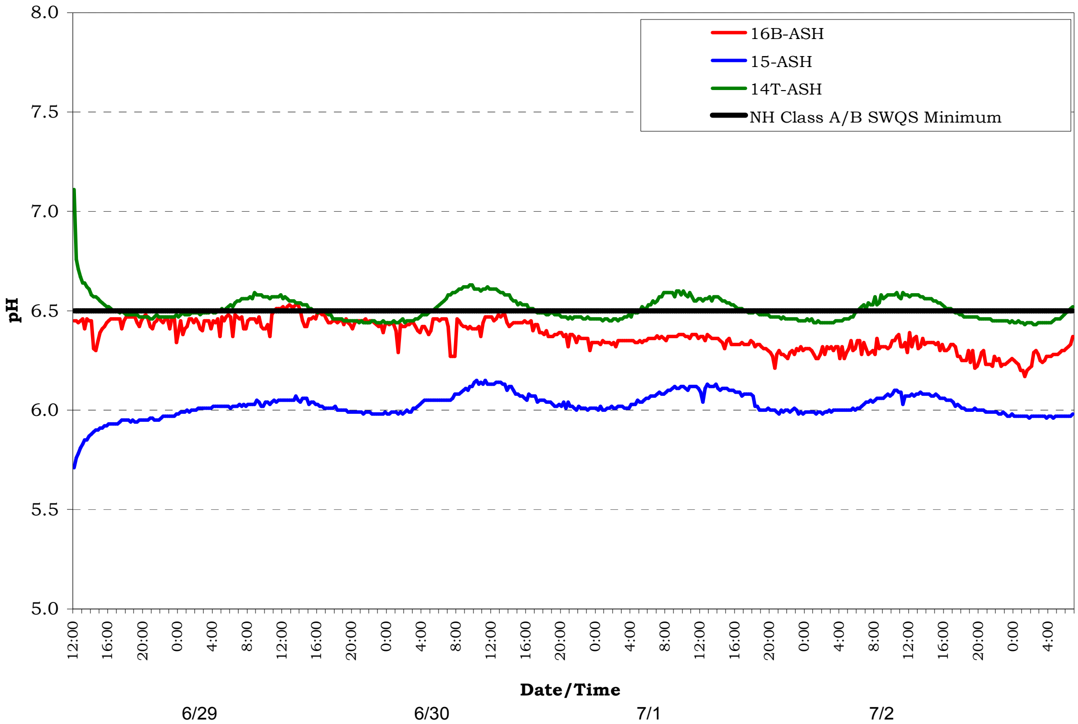
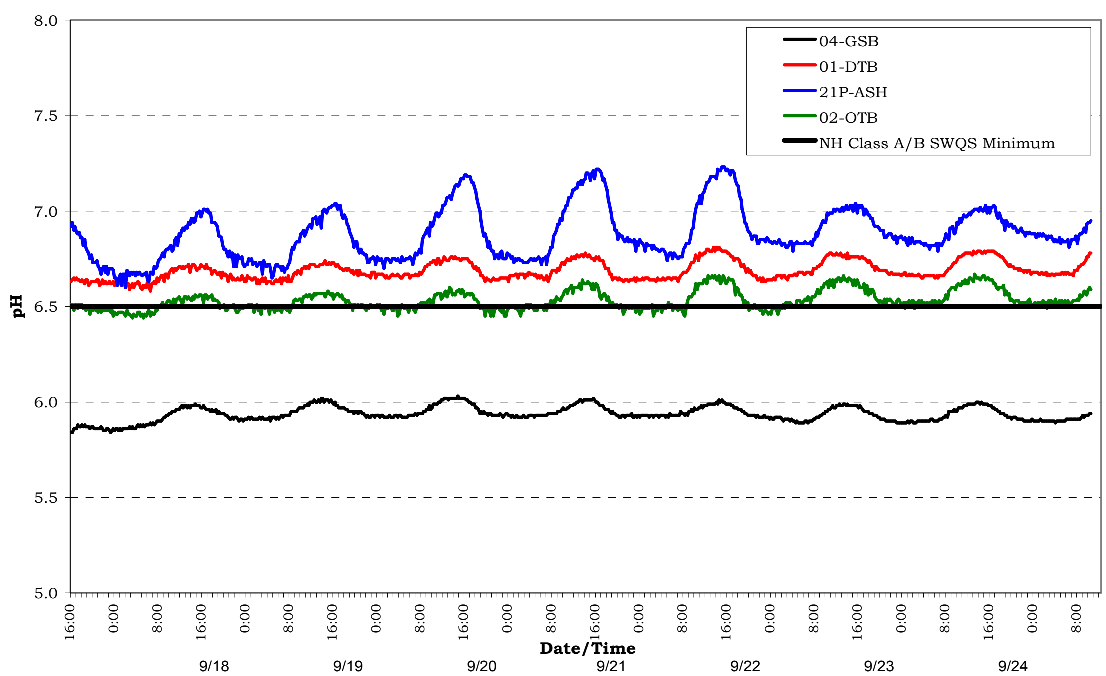


Figure 8. pH Statistics for the Ashuelot River Watershed
September 17-25, 2007, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Consider sampling for pH in some of the tributaries and wetland areas that are influencing the pH of stations with measurements below state standards. Site conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands or other natural conditions, then the low pH measurements are not considered a violation of water quality standards. It is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life. In this case, additional information about factors influencing pH levels is needed.

4.3 Turbidity

Five measurements were taken in the field for turbidity at 10 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 6]. Of the 54 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

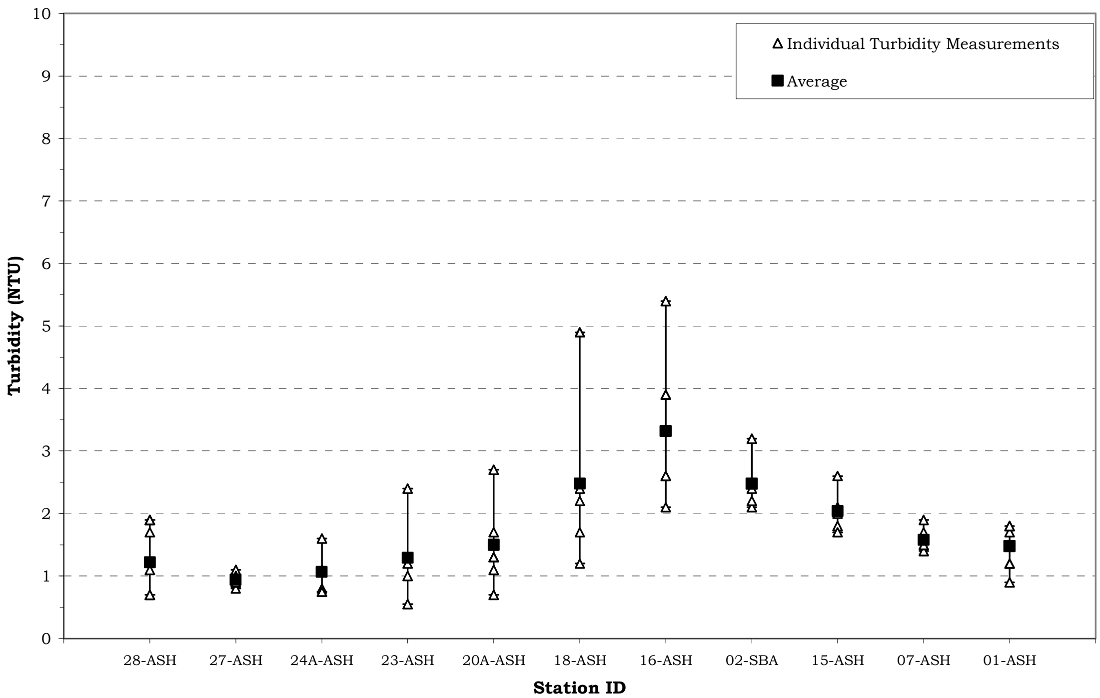
The Class B New Hampshire surface water quality standard for turbidity is less than 10 NTU above natural background.

Table 6. Turbidity Data Summary – Ashuelot River, 2007

Station ID	Samples Collected	Data Range (NTU)	Acceptable Samples Potentially Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	5	0.7 - 1.9	0	5
27-ASH	5	0.8 - 1.1	0	5
24A-ASH	5	0.75 - 1.6	0	5
23-ASH	5	0.55 - 2.4	0	5
20A-ASH	5	0.7 - 2.7	0	5
18-ASH	5	1.2 - 4.9	0	5
16-ASH	5	2.1 - 5.4	0	5
02-SBA	4	2.1 - 3.2	0	4
15-ASH	5	1.7 - 2.6	0	5
07-ASH	5	1.4 - 1.9	0	5
01-ASH	5	0.9 - 1.8	0	5
Total	**54**	_____	**0**	**54**

Turbidity levels were low with the average ranging from 0.90 NTU to 3.30 NTU (Figure 9). In general, turbidity levels tended to increase in the middle portions of the watershed and then decrease again in the lower portions of the watershed. Although clean waters are associated with low turbidity there is a high degree of natural variability involved. Precipitation often contributes to increased turbidity by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. However, human activities such as removal of vegetation near surface waters and disruption of nearby soils can lead to dramatic increases in turbidity levels. In general it is typical to see a rise in turbidity in more developed areas due to increased runoff.

Figure 9. Turbidity Statistics for the Ashuelot River
May 19 - September 11, 2007, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Collect samples during wet weather. This will help us to understand how the river responds to runoff and sedimentation.

- If a higher than normal turbidity measurement occurs, volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated turbidity levels. In addition, take good field notes and photographs. If human activity is suspected or verified as the source of elevated turbidity levels, volunteers should contact NHDES.

4.4 Specific Conductance

Between one and six measurements were taken in the field for specific conductance at 17 stations in the Ashuelot River watershed from Washington to Hinsdale. VRAP staff also deployed submersible dataloggers to record specific conductance at eight stations in the Ashuelot River watershed [Table 7]. Of the 67 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

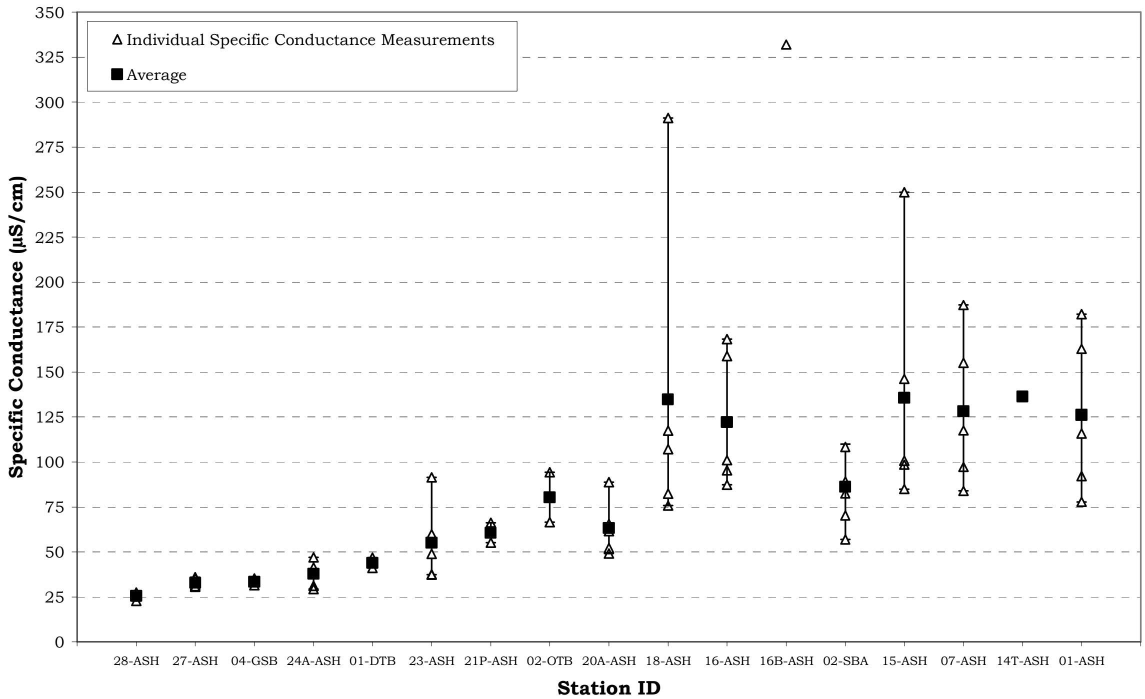
New Hampshire surface water quality standards do not contain numeric limits for specific conductance.

Table 7. Specific Conductance Data Summary – Ashuelot River, 2007

Station ID	Samples Collected	Data Range (µS/cm)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	5	22.8 - 27.5	Not Applicable	5
27-ASH	5	30.7 - 36.0	N/A	5
04-GSB	2	31.5 - 35.2	N/A	2
24A-ASH	5	29.4 - 47.1	N/A	5
01-DTB	2	41.2 - 46.9	N/A	2
23-ASH	5	37.4 - 91.5	N/A	5
21P-ASH	2	55.2 - 66.3	N/A	2
02-OTB	2	66.6 - 94.3	N/A	2
20A-ASH	5	49.1 - 88.8	N/A	5
18-ASH	5	75.8 - 291.2	N/A	5
16-ASH	5	87.3 - 168.4	N/A	5
16B-ASH	1	332.0	N/A	1
02-SBA	6	57.0 - 110.0	N/A	6
15-ASH	6	85.0 - 249.9	N/A	6
07-ASH	5	83.9 - 187.2	N/A	5
14T-ASH	1	136.3	N/A	1
01-ASH	5	77.9 - 182.2	N/A	5
Total	**67**	_____	**N/A**	**67**

Specific conductance levels were variable with the average ranging from 25.7 µS/cm to 136.1 µS/cm (Figure 10). Specific conductance measurements tended to be higher in the lower portion of the watershed. Higher specific conductance levels can be indicative of pollution from sources such as urban/agricultural runoff, road salt, failed septic systems, or groundwater pollution. The variable specific conductance levels generally indicate low pollutant levels at some stations and higher levels at others.

Figure 10. Specific Conductance Statistics for the Ashuelot River
May 19 - September 11, 2007, NHDES VRAP



Figures 11 and 12 illustrate the results of specific conductance measurements obtained at eight stations in the Ashuelot River watershed using submersible multiparameter dataloggers deployed on two separate occasions. On each occasion, the meters were programmed to take specific conductance measurements every 15 minutes over a multiple day period.

During the first deployment (June 28 through July 3) three dataloggers were deployed in the mainstem of the Ashuelot River (16B-ASH, 15-ASH, and 14T-ASH) and one in the South Branch of the Ashuelot River (02-SBA). Stations 15-ASH and 14T-ASH were measured to gather baseline data upstream and downstream of the Homestead Mill Woolen Dam which is currently under consideration for removal. Specific conductance measurements were highest at station 16B-ASH. Specific conductance levels at the stations upstream (15-ASH) and downstream (14T-ASH) of the Homestead Mill Woolen Dam were nearly identical. Station 01-SBA has the lowest levels. (Figure 11).

During the second deployment (September 17 through September 25) one datalogger was deployed in the mainstem of the Ashuelot River (21P-ASH) and three in tributaries of the Ashuelot River: Grassy Brook (04-GSB, Dart Brook (01-DTB and Otter Brook (02-OTB). This deployment was done to help identify river segments and tributaries with very high water quality. Specific conductance measurements remained low, and stable at all four stations. Station 04-GRB and had the lowest measurements and station 02-OTB had the highest, though all measurements were below 100 µS/cm (Figure 12).

Figure 11. Specific Conductivity Statisitcs for the Ashuelot River Watershed June 28-July 3, 2007, NHDES VRAP

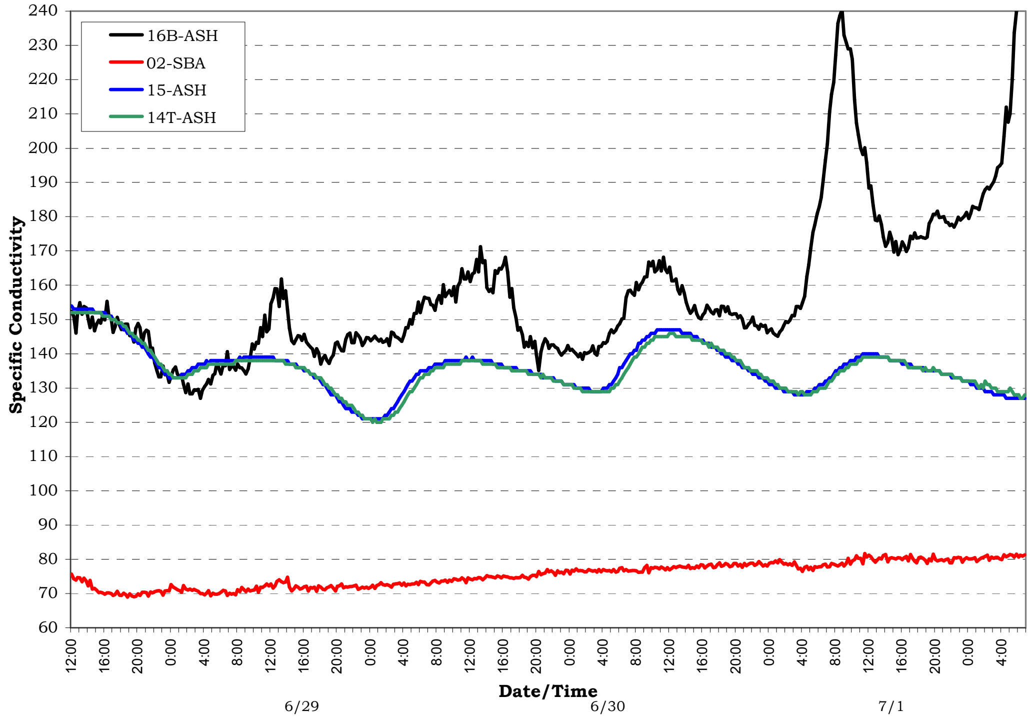
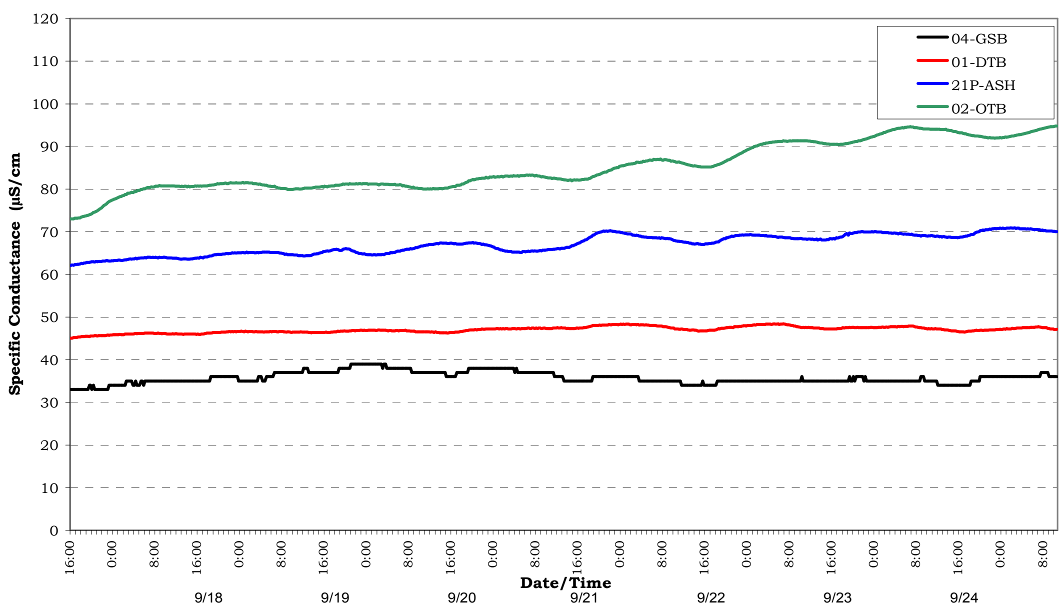


Figure 12. Specific Conductance Statistics for the Ashuelot River Watershed September 17-25, 2007, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Consider collecting chloride samples at the same time that specific conductance is measured. During the late winter/early spring snowmelt, higher specific conductance levels are often seen due to elevated concentrations of chloride in the runoff. Specific conductance levels are very closely correlated to chloride levels. Simultaneously measuring chloride and specific conductance will allow for a better understanding of their relationship.

- Continue to incorporate the use of in-situ dataloggers to automatically determine specific conductance levels during rain events, snowmelt, and baseline dry weather conditions. The use of these instruments is dependent upon availability, and requires coordination with NHDES.

4.5 Water Temperature

Between one and six measurements were taken in the field for water temperature at 17 stations in the Ashuelot River watershed from Washington to Hinsdale. VRAP staff also deployed submersible dataloggers to record water temperature at eight stations in the Ashuelot River watershed [Table 8]. Of the 67 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Table 8. Water Temperature Data Summary – Ashuelot River, 2007

Station ID	Samples Collected	Data Range (°C)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	5	10.3 - 21.7	Not Applicable	5
27-ASH	5	9.4 - 19.8	N/A	5
04-GSB	2	13.6 - 15.5	N/A	2
24A-ASH	5	10.8 - 23.1	N/A	5
01-DTB	2	10.7 - 13.1	N/A	2
23-ASH	5	10.7 - 19.9	N/A	5
21P-ASH	2	12.5 - 13.3	N/A	2
02-OTB	2	11.5 - 13.6	N/A	2
20A-ASH	5	12.3 - 22.1	N/A	5
18-ASH	5	12.4 - 22.1	N/A	5
16-ASH	5	11.5 - 21.6	N/A	5
16B-ASH	1	17.4	N/A	1
02-SBA	6	9.8 - 22.0	N/A	6
15-ASH	6	11.5 - 23.2	N/A	6
07-ASH	5	11.6 - 22.7	N/A	5
14T-ASH	1	19.8	N/A	1
01-ASH	5	11.5 - 21.9	N/A	5
Total	**67**	_____	**N/A**	**67**

Figure 13 shows the results of instantaneous water temperature measurements taken at 17 stations in the Ashuelot River watershed. The average water temperature varied from 11.9 °C. to 19.1 °C. Figures 14 and 15 illustrate the results of water temperature measurements obtained at eight stations in the Ashuelot River watershed using submersible multiparameter dataloggers deployed

on two separate occasions. On each occasion, the meters were programmed to take water temperature readings every 15 minutes over a multiple day period.
Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and the activity of bacteria in the water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation along the shoreline, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and the influence of groundwater.

Figure 13. Water Temperature Statistics for the Ashuelot River
May 19 - September 11, 2007, NHDES VRAP

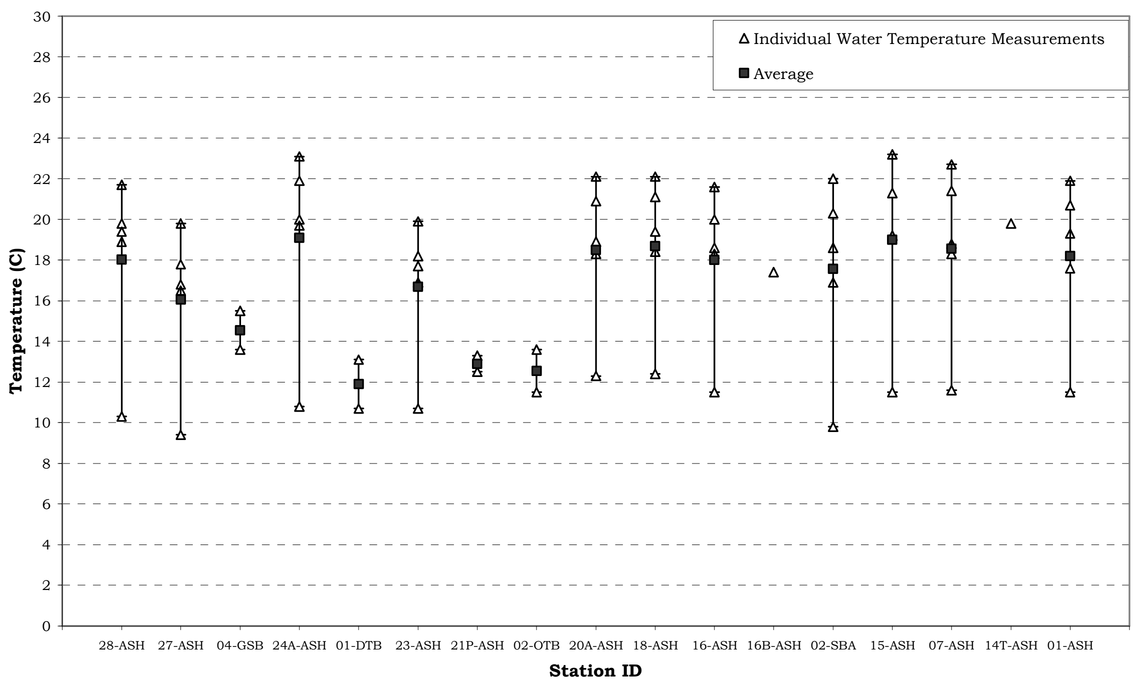


Figure 14. Temperature Statistics for the Ashuelot River Watershed
June 28- July 3 2007, NHDES VRAP

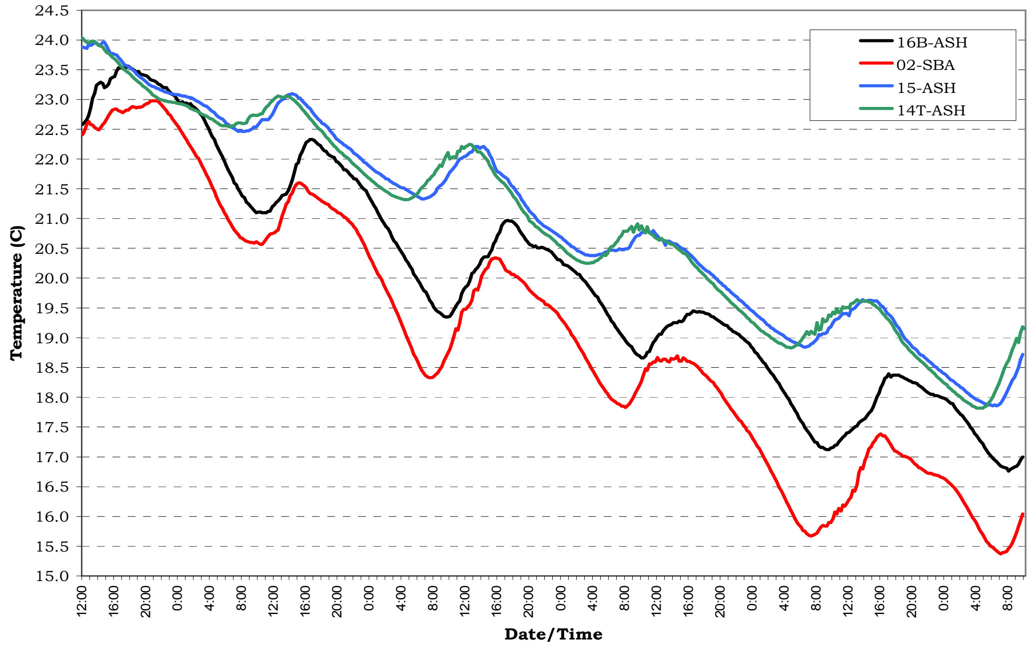
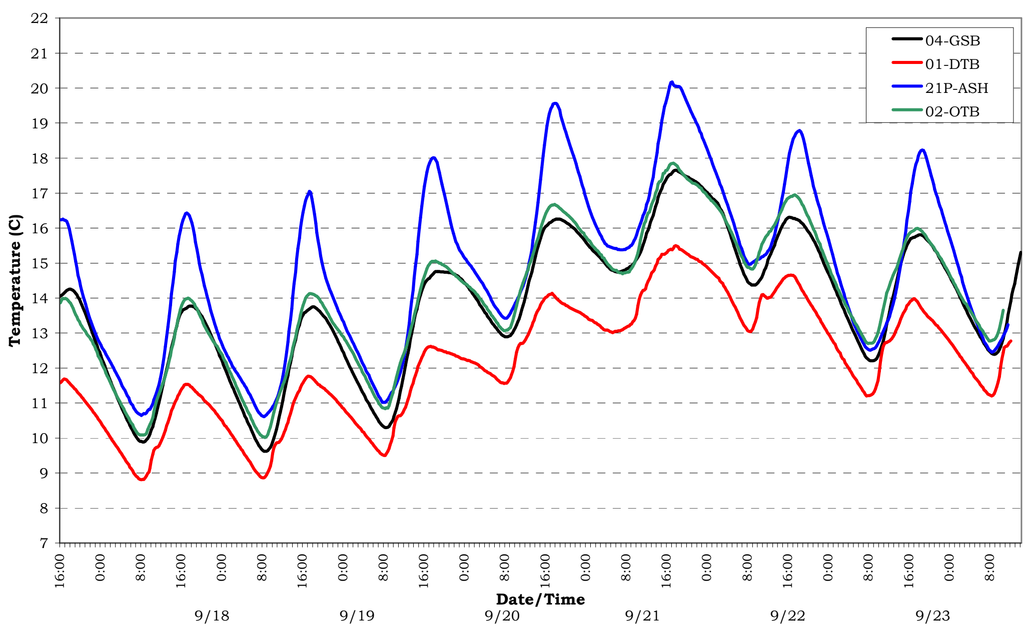


Figure 15. Water Temperature Statistics for the Ashuelot River Watershed
September 17-25, 2007, NHDES VRAP



Recommendations

- Continue collecting water temperature data via both instantaneous reading and long-term deployment of dataloggers.

4.6 *Escherichia coli*/Bacteria

Three samples were taken for *Escherichia coli* (*E. coli*) at 10 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 9). Of the 33 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

Class B New Hampshire surface water quality standards for *E.coli* are as follows:

> ≤406 cts/100 ml, based on any single sample or
> ≤126 cts/100 ml, based on a geometric mean calculated from three samples collected within a 60-day period.

Table 9. *E.coli* Data Summary – Ashuelot River, 2007

Station ID	Samples Collected	Data Range (cts/100ml)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	3	1 - 5	0	3
27-ASH	3	3 - 27	0	3
24A-ASH	3	20 - 58	0	3
23-ASH	3	6 - 76	0	3
20A-ASH	3	13 - 411	1	3
18-ASH	3	80 - 517	1	3
16-ASH	3	172 - 687	1	3
02-SBA	3	81-261	0	3
15-ASH	3	38 - 166	0	3
07-ASH	3	42 - 96	0	3
01-ASH	3	21 - 219	0	3
Total	**33**	_____	**3**	**33**

E.coli measurements met the state of New Hampshire Class B surface water quality standards on all but three occasions. Stations 20A-ASH, 18-ASH, and 16-ASH in the middle portion of the watershed failed to meet the standard on 9/11/2007. (Figure 16) In order to fully determine whether a waterbody is meeting surface water standards for *E.coli* a geometric mean must be calculated. A geometric mean is calculated using three samples collected within a 60-day period. At all stations one geometric mean was calculated. Of the 11 geometric means calculated all but three stations (18-ASH, 16-ASH, 02-SBA) met the state of New Hampshire Class B geometric mean standard of 126 cts/100ml (Table 10).

Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife (e.g., birds), and the presence of septic systems along the river

Figure 16. *Escherichia coli* Statistics for the Ashuelot River
July 17 - September 11 2007, NHDES VRAP

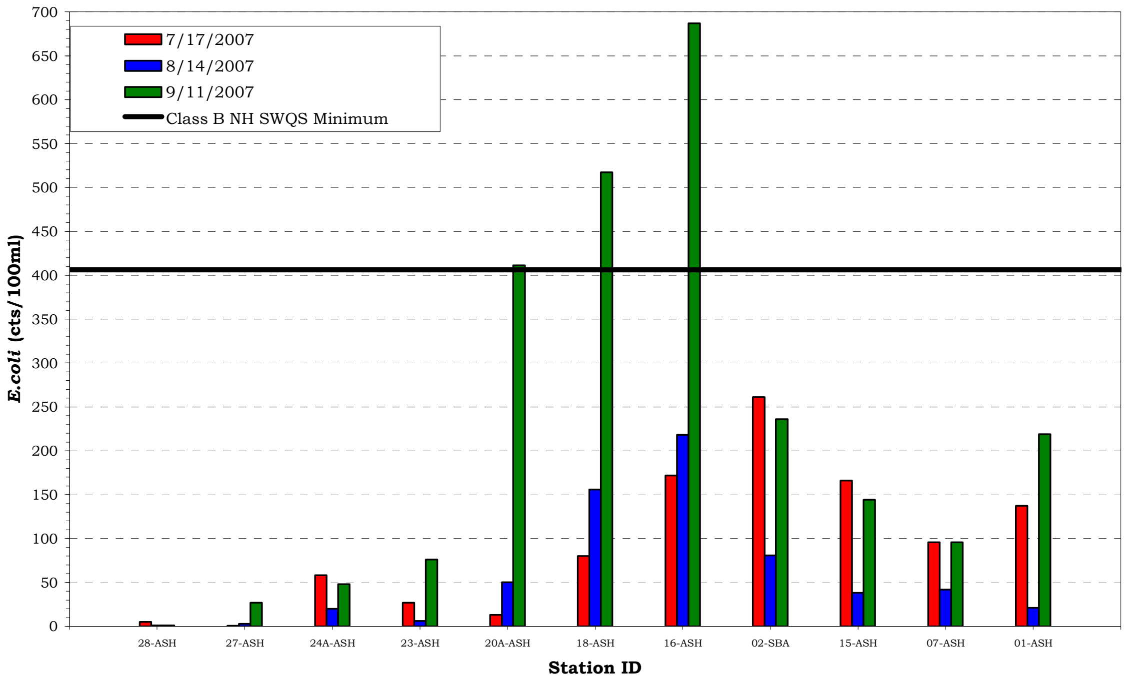


Table 10. *E. coli* Geometric Mean Data Summary – Ashuelot River, 2007

Station ID	Geometric Means Calculated	Geometric Mean 7/17/07 - 9/11/07	Geometric Means Not Meeting NH Class B Standards	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	1	2	0	1
27-ASH	1	9	0	1
24A-ASH	1	38	0	1
23-ASH	1	23	0	1
20A-ASH	1	64	0	1
18-ASH	1	186	1	1
16-ASH	1	295	1	1
02-SBA	1	171	1	1
15-ASH	1	97	0	1
07-ASH	1	76	0	1
01-ASH	1	86	0	1
Total	**11**	____	**3**	**11**

Recommendations

- Continue collecting three samples within any 60-day period during the summer to allow for determination of geometric means. Samples need only be collected during the critical period of May 24 to September 15 for assessment purposes. This coincides with the peak contact recreation season.

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling).

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling).At stations with particularly high bacteria levels volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated bacteria levels. Those sampling should also look for any potential sources of bacteria such as emission pipes, failed septic systems, farm animals, pet waste, wildlife and waterfowl.

4.7 Total Phosphorus

Three measurements were taken for total phosphorus at 10 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 11). Of the 33 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2008 surface water quality report to the US Environmental Protection Agency.

There is no numeric standard for total phosphorus for Class B waters. The narrative standard states that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses." The NHDES "level of concern" for total phosphorous is 0.05 mg/L.

Table 11. Total Phosphorus Data Summary – Ashuelot River, 2007

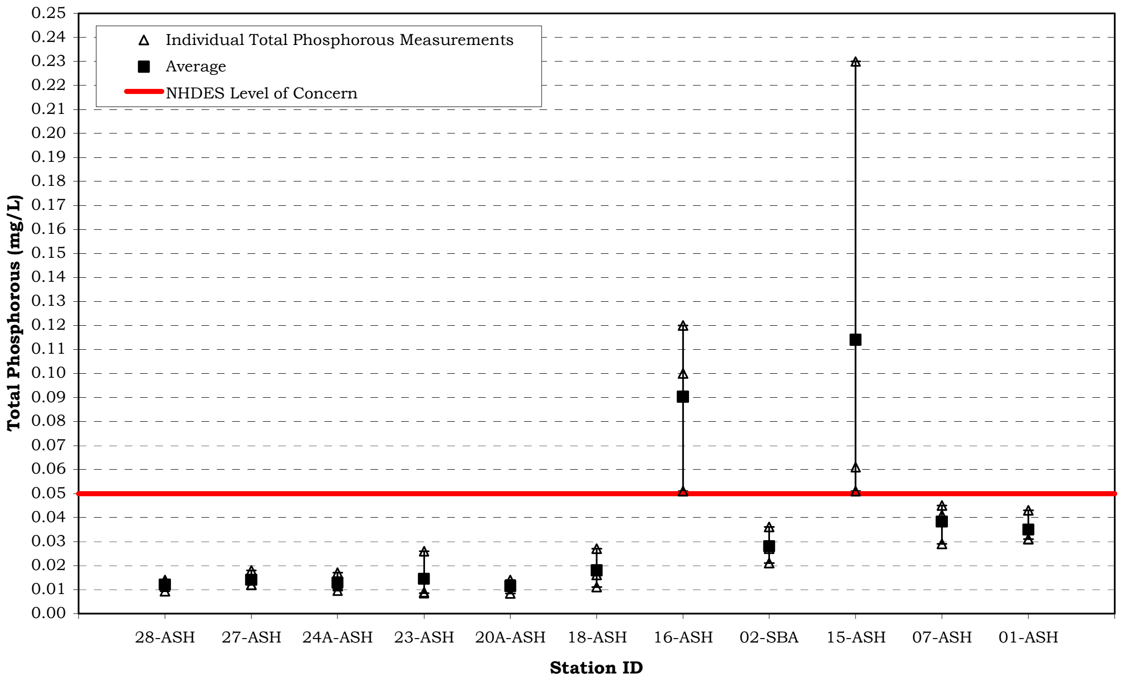
+

Station ID	Samples Collected	Data Range (mg/L)	Acceptable Samples Exceeding NHDES Level of Concern	Number of Usable Samples for 2008 NH Surface Water Quality Assessment
28-ASH	3	0.010 - 0.014	0	3
27-ASH	3	0.012 - 0.018	0	3
24A-ASH	3	0.010 - 0.017	0	3
23-ASH	3	0.009 - 0.026	0	3
20A-ASH	3	0.008 - 0.014	0	3
18-ASH	3	0.011 - 0.027	0	3
16-ASH	3	0.051 - 0.120	3	3
02-SBA	3	0.021 - 0.036	0	3
15-ASH	3	0.051 - 0.230	3	3
07-ASH	3	0.029 - 0.045	0	3
01-ASH	3	0.031 - 0.043	0	3
Total	**33**	_____	**6**	**33**

Nine of the eleven stations had total phosphorous levels that were always below the NHDES "level of concern" (Figure 17). All three measurements taken at stations 16-ASH and 15-ASH were above the NHDES "level of concern". Under undisturbed natural conditions phosphorus is at very low levels in aquatic ecosystems. Of the three nutrients critical for aquatic plant growth; potassium, nitrogen, and phosphorus, it is usually phosphorous that is the limiting factor to plant growth. When the supply of phosphorus is increased due to human activity, algae respond with significant growth.

A major source of excessive phosphorus concentrations in aquatic ecosystems can be wastewater treatment facilities, as sewage typically contains relatively high levels of phosphorus detergents. However, fertilizers used on lawns and agricultural areas can also contribute significant amounts of phosphorus.

Figure 17. Total Phosphorous Statistics for the Ashuelot River
July 17 - September 11, 2007, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

APPENDIX A

2006 Ashuelot River Watershed Water Quality Data

2007 ASHUELOT RIVER WATERSHED VRAP DATA

Measurements not meeting New Hampshire surface water quality standards
Total Phosphorous measurements exceeding NHDES level of concern
Measurements not meeting NHDES quality assurance/quality control standards

[A] QA/QC Sample collected during datalogger deployment/retreival

28-ASH, Route 31, Washington

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**NA**	**NA**	**<406**	**<126**	**NA**
5/19/2007	08:10	10.42	92.4	4.91	1.1	25.7	10.3	10.0			
6/16/2007	07:38	7.47	83.3	5.54	1.7	22.8	19.8	19.0			
7/17/2007	07:25	7.26	80.3	5.27	0.7	25.9	21.7	19.8	5		0.014
8/14/2007	07:30	6.43	71.1	5.27	0.7	26.8	19.4	17.8	1		0.009
9/11/2007	07:30	7.39	81.1	5.39	1.9	27.5	18.9	17.5	1	2	0.013

27-ASH, Mountain Road, Lempster

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**NA**	**NA**	**<406**	**<126**	**NA**
5/19/2007	08:55	10.15	94.2	4.75	0.9	31.6	9.4	10.2			
6/16/2007	08:21	8.28	87.3	5.14	1.1	31.0	17.8	17.2			
7/17/2007	08:07	7.32	86.0	5.24	0.8	30.7	19.8	18.3	<1		0.018
8/14/2007	08:13	7.30	76.0	5.60	1.0	36.0	16.8	16.0	3		0.012
9/11/2007	08:00	7.79	82.0	5.61	0.9	35.2	16.5	16.4	27	9	0.012

04-GSB, Grassy Brook at Route 123 Bridge, Marlow

Date	Time of Sample	Specific Conductance (uS/cm)	Water Temp. (°C)
Standard	**NA**	**NA**	**NA**
9/17/2007[A]	12:25	31.5	13.6
9/25/2007[A]	14:12	35.2	15.5

24A-ASH, Route 10, Marlow

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**NA**	**NA**	**NA**	**<406**	**<126**	**NA**
5/19/2007	09:59	9.98	96.9	4.95	1.1	29.4	10.8	10.5			
6/16/2007	09:02	8.33	91.8	5.06	1.6	31.2	20.0	18.8			
7/17/2007	09:10	7.26	84.0	5.39	1.1	40.6	23.1	21.6	58		0.017
8/14/2007	08:52	6.28	77.5	5.31	0.8	41.5	21.9	18.6	20		0.010
9/11/2007	08:40	6.58	72.7	5.38	0.8	47.1	19.7	18.1	48	38	0.012

01-DTB, Dart Brook at Surry Road, Surry

Date	Time of Sample	Specific Conductance (uS/cm)	Water Temp. (°C)
Standard	**NA**	**NA**	**NA**
9/17/2007[A]	12:25	41.2	10.7
9/25/2007[A]	12:05	46.9	13.1

23-ASH, Route 10, Gilsum

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	10:20	11.02	99.0	5.42	1.0	37.6	10.7	10.3			
6/16/2007	09:48	9.17	97.3	5.82	1.2	37.4	18.2	18.2			
7/17/2007	09:38	8.40	93.0	5.60	2.4	49.0	19.9	19.9	27		0.026
8/14/2007	09:20	8.70	86.0	6.02	0.6	59.9	17.7	21.8	6		0.009
9/11/2007	09:15	8.47	87.8	5.91	1.3	91.5	16.9	17.0	76	23	0.009

21P-ASH, Gilsum/Surry Road, Surry

Date	Time of Sample	Specific Conductance (uS/cm)	Water Temp. (°C)
Standard	NA	NA	NA
9/17/2007[A]	12:00	55.2	12.5
9/25/2007[A]	11:38	66.3	13.3

02-OTB, Otter Brook at Granite Gorge, Roxbury

Date	Time of Sample	Specific Conductance (uS/cm)	Water Temp. (°C)
Standard	NA	NA	NA
9/17/2007[A]	10:55	66.6	11.5
9/25/2007[A]	10:40	94.3	13.6

20A-ASH, Stone Arch Bridge, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	08:00	9.52	88.9	5.62	2.7	52.2	12.3	10.9			
6/16/2007	07:55	7.60	81.9	5.59	1.7	49.1	18.9	16.2			
7/17/2007	07:30	6.66	~~73.8~~	5.65	1.1	61.5	22.1	19.2	13		0.014
8/14/2007	09:55	7.10	99.1	5.77	0.7	65.5	20.9	20.5	50		0.008
9/11/2007	10:10	6.41	70.7	5.90	1.3	88.8	18.3	17.9	411	64	0.012

18-ASH, Route 101, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	09:05	9.58	89.7	5.58	2.4	82.4	12.4	11.1			
6/16/2007	08:35	7.72	84.5	5.58	2.2	75.8	19.4	18.8			
7/17/2007	08:15	6.39	~~74.5~~	5.82	1.7	117.5	22.1	20.7	80		0.016
8/14/2007	08:20	6.27	72.2	5.81	1.2	107.2	21.1	19.6	156		0.011
9/11/2007	09:05	5.11	54.3	5.87	4.9	291.2	18.4	17.8	517	186	0.027

16-ASH, Cresson Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	10:05	9.49	87.1	5.60	2.6	87.3	11.5	10.8			
6/16/2007	09:26	9.49	83.5	5.69	2.1	95.4	18.6	18.1			
7/17/2007	09:39	6.56	~~74.8~~	5.76	2.6	101.0	21.6	21.4	172		0.051
8/14/2007	07:25	5.98	67.5	5.94	5.4	168.4	20.0	6.0	218		0.100
9/11/2007	07:45	5.86	60.9	5.93	3.9	158.9	18.3	17.9	687	295	0.120

16B-ASH, D/S of WWTF, U/S of South Branch Ashuelot River, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Specific Conductance (uS/cm)	Water Temp. (°C)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	NA	NA
7/3/2007[A]	9:55	7.55	79.4	6.48	332.0	17.4

02-SBA, Route 132 Bridge Near Swanzey Schools, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	9:38	9.92	87.8	5.52	2.1	57.0	9.8	9.9			
6/28/2007[A]	12:30	5.09	59.1	6.03		82.5	22.0				
7/3/2007[A]	11:00	9.14	94.1	6.17		89.2	16.9				
7/17/2007	9:00	6.84	78.7	5.62	3.2	70.3	20.3	19.9	261		0.036
8/14/2007	8:20	7.29	75.9	5.98	2.2	108.3	18.6	17.7	81		0.021
9/11/2007	8:20	7.25	73.8	6.02	2.4	110.0	17.8	17.7	236	171	0.027

15-ASH, Deniman Thompson Bridge, West Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	11:00	9.60	88.0	5.77	2.0	85.0	11.5	10.6			
6/16/2007	09:13	7.38	79.2	5.84	1.8	98.5	19.2	18.9			
7/3/2007[A]	12:10	8.22	89.4	6.27		134.5	19.6				
7/17/2007	11:35	7.36	86.1	6.08	2.6	100.8	23.2	23.2	166		0.051
8/14/2007	09:30	7.71	87.1	6.65	1.7	146.2	21.3	18.4	38		0.061
9/11/2007	11:20	6.24	67.5	6.44	2.1	249.9	19.2	17.7	144	97	0.230

07-ASH, Route 119, Winchester

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Water Temp. (°C)	Air Temp. (°C)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	10:01	9.87	91.2	5.96	1.9	11.6	11.5	83.9			
6/16/2007	08:50	7.76	83.2	5.98	1.7	18.3	18.9	97.2			
7/17/2007	10:50	7.68	89.4	6.09	1.4	22.7	22.8	117.6	96		0.045
8/14/2007	08:50	7.47	84.6	6.85	1.4	21.4	19.8	155.2	42		0.029
9/11/2007	10:20	8.30	89.1	6.70	1.5	18.8	18.2	187.2	96	73	0.041

14T-ASH, U/S of Deniman Thompson Highway Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Specific Conductance (uS/cm)	Water Temp. (°C)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	NA	NA
7/3/2007[A]	13:18	9.48	104.0	6.48	136.3	19.8

01-ASH, 147 River Street, Hinsdale

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	Air Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	NA	NA	NA	<406	<126	NA
5/19/2007	08:45	10.91	96.5	6.17	1.8	77.9	11.5	10.1			
6/16/2007	08:05	8.70	90.8	6.32	1.7	92.2	17.6	17.2			
7/17/2007	09:05	8.13	93.2	6.60	1.8	115.8	21.9	20.8	137		0.043
8/14/2007	08:00	8.13	91.1	7.28	0.9	162.9	20.7	19.0	21		0.031
9/11/2007	09:01	8.42	91.5	7.26	1.2	182.2	19.3	18.5	219	86	0.031

APPENDIX B:
Interpreting VRAP Water Quality Monitoring Parameters

Chemical Parameters

Dissolved Oxygen (DO)

- **Unit of Measurement:** concentration (milligrams per liter) and saturation (percent); (abbreviated as mg/L and %, respectively).
- **Description:** A measure of the amount of oxygen in the water: Concentration is a measure of the amount of oxygen in a volume of water; saturation is a measurement of the amount of oxygen in the water compared to the amount of oxygen the water can actually hold at full saturation. Both of these measurements are necessary to accurately determine whether New Hampshire surface water quality standards are met.
- **Importance**: Oxygen is dissolved into the water from the atmosphere, aided by wind and wave action, or from rocky, steep, or uneven stream beds. The presence of dissolved oxygen is vital to bottom-dwelling organisms as well as fish and amphibians. Aquatic plants and algae produce oxygen in the water during the day, but consume oxygen during the night. Bacteria utilize oxygen (day and night) as they process organic matter deposited in the river into smaller and smaller particles.

Class A NH Surface Water Quality Standard: 6 mg/L at any place or time, or 75% minimum daily average – (unless naturally occurring).

Class B NH Surface Water Quality Standard: 5 mg/L at any place or time or 75% minimum daily average – (unless naturally occurring).

Several measurements of oxygen saturation taken in a 24-hour period must be averaged to compare to the 75 percent daily average saturation standard. The concentration of dissolved oxygen is dependent on many factors including temperature and sunlight, and tends to fluctuate throughout the day. Saturation values are averaged because a reading taken in the morning may be low due to respiration, while a measurement that afternoon may show that the saturation has recovered to acceptable levels. Water can become saturated with more than 100 percent dissolved oxygen.

pH

- **Unit of Measurement:** units (no abbreviation).
- **Description:** A measure of hydrogen ion activity in water, or, in general terms, the acidity of water. pH is measured on a logarithmic scale of 0 to 14 with 7 being neutral. A high pH is indicative of an alkaline or basic environment and a low pH is indicative of an acidic environment. pH is influenced by geology and soils, organic acids (decaying leaves and other matter), and human-induced acids from acid rain (which typically has a pH of 3.5 to 5.5).
- **Importance:** pH affects many chemical and biological processes in the water and this is important to the survival and reproduction of fish and other aquatic life. Different organisms flourish within different ranges of pH. Measurements outside of this preferred range can potentially stress the physiological systems of organisms and can limit their growth and reproduction. Low pH can also affect the toxicity of aquatic compounds such as ammonia and certain metals. Lower pH levels can make these toxic compounds more "available" for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life.

Class A NH Surface Water Quality Standard: Between 6.5 and 8.0 (unless naturally occurring).

Class B NH Surface Water Quality Standard: Between 6.5 and 8.0 (unless naturally occurring).

Sometimes, readings that fall below this range are determined to be naturally occurring, perhaps because of the influence of wetlands near the sample station. This is due to the presence or release of tannic and humic acids by decaying plants, which can create more acidic waters in areas influenced by wetlands.

pH Units	Category
<5.0	High Impact
5.0 – 5.9	Moderate to High Impact
6.0 – 6.4	Normal; Low Impact
6.5 – 8.0	Normal;
6.1 – 8.0	Satisfactory

Specific Conductance or Conductivity

- **Unit of Measurement:** micromhos per centimeter or microsiemens per centimeter (abbreviated as umhos/cm or uS/cm, respectively).
- **Description:** The numerical expression of the ability of water to carry an electrical current at 25^{o} C and is a measurement of free ion (charged particles) content in the water. These ions can come from natural sources such as bedrock, or human sources such as stormwater runoff. Specific conductance can be used to indicate the presence of chlorides, nitrates, sulfates, phosphates, sodium, magnesium, calcium, iron, and aluminum ions. The difference between conductivity and specific conductance is specific conductance accounts for the actual water temperature rather than 25^{o}C. The term “specific conductance” is used in the VRAP because the actual measurement is of the *conductivity* (or electric current) at a *specific* water temperature. In some studies and programs, the term “conductivity” is used. This term should only be used when the measurement *does not* adjust to a specific temperature.
- **Importance:** Discharges to streams can change the conductivity depending on their make-up. Specific conductance readings are useful in locating potential pollution sources because they usually have higher specific conductance than unimpaired surface waters. High specific conductance values may indicate pollution from sources such as road salting, septic systems, wastewater treatment plants, or urban/agricultural runoff. Specific conductance can also be related to geology. In rivers and streams not impacted by pollutants, geology and the associated groundwater are the primary influcences on specific conductance levels.

Class A NH Surface Water Quality Standard: No numeric standard.

Class B NH Surface Water Quality Standard: No numeric standard.

Although there is no formal standard for specific conductance, data collect by VRAP groups and NHDES indicated a very close relationship between specific conductance levels. In some cases NHDES can use specific conductance measurements as a surrogate for chloride levels. The data collected by NHDES indicate that the chronic chloride standard is correlated with a specific conductance level of approximately 850 µS/cm.

Unit	Category
0 – 100	Normal
101 – 200	Low Impact
201 – 500	Moderate Impact
> 501	High Impact
> 850	Likely exceeding chronic chloride standard

Turbidity

- **Unit of Measurement:** Nephelometric Turbidity Units (abbreviated at NTU).
- **Description:** A measurement of the amount of suspended material in the water, such as clay, silt, algae, suspended sediment, and decaying plant material, that cause light to be scattered and absorbed, not transmitted in straight lines through the water.
- **Importance:** Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces the concentration of dissolved oxygen (DO) because warm water holds less DO than cold. Higher turbidity also reduces the amount of light penetrating the water, which reduces photosynthesis and the production of DO. Suspended materials can clog fish gills, reducing resistance to disease in fish, lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates. Clean waters are generally associated with low turbidity, but there is a high degree of natural variability involved. Rain events often contribute turbidity to surface waters by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. Human activities such as removal of vegetation near surface waters and disruption of nearby soils can lead to dramatic increases in turbidity levels.

Class A NH Surface Water Quality Standard: As naturally occurs.

Class B NH Surface Water Quality Standard: Shall not exceed naturally occurring conditions bv more than 10 NTU.

Physical Parameters

Temperature

- **Unit of Measurement:** $^{\circ}$ Celsius

Importance: Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and the activity of bacteria in the water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation along the shoreline, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and the influence of groundwater.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard

Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Nutrient Parameters

Chlorophyll-a (Chlor a)

- **Unit of Measurement:** Milligrams per liter (abbreviated as mg/L).
- **Description:** An indicator of the biomass, or abundance, of planktonic algae in the river. The technical term “biomass” is used to represent “amount by weight.” Chlorophyll-a can be strongly influenced by phosphorus, which is derived by natural and human activities.
- **Importance:** Because algae is a plant and contains the green pigment chlorophyll-a, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae. If the chlorophyll-a concentration increases, this indicates an increase in the algal population.

Class A NH Surface Water Quality Standard: No numeric standard.

Class B NH Surface Water Quality Standard: No numeric standard.

Unit	Category
< 3	Excellent
3 – 7	Good
7 – 15	Less than desirable
> 15	Nuisance

Total Phosphorus (TP)

- **Unit of Measurement:** Milligrams per liter (abbreviated as mg/L).
- **Description:** A measure of all forms of phosphorus in the water, including inorganic and organic forms. There are many sources of phosphorus, both natural and human. These include soil and rocks, sewage, animal manure, fertilizer, erosion, and other types of contamination.
- **Importance:** Phosphorus is a nutrient that is essential to plants and animals, however, in excess amounts can cause rapid increases in the biological activity in water. Phosphorus is usually the “limiting nutrient” in freshwater streams, which means relatively small amounts can increase the amount of algae and chlorophyll-a levels in the river. Algal blooms and/or excessive aquatic plant growth can decrease oxygen levels and the attractiveness of waters for recreational purposes. Phosphorus can indicate the presence of septic systems, sewage, animal waste, lawn fertilizer, road and construction erosion, other types of pollution, or natural wetlands and atmospheric deposition.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard; as naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses.

Unit	Category
< 0.010	Ideal
0.011 – 0.025	Average
0.026 – 0.050	More than desirable
> 0.051	Excessive (potential nuisance concentration)

Total Kjeldahl Nitrogen (TKN)

- **Unit of Measurement:** Milligrams per liter (abbreviated mg/L).
- **Description:** A measure of the amount of ammonia and organic nitrogen in the water.
- **Importance:** High nitrogen can increase the amount of algae and chlorophyll-a levels in the river, but is generally of less concern in fresh water when compared to phosphorus. Nitrogen can indicate the presence of sewage, animal waste, fertilizer, erosion, or other types of pollution.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard; as naturally occurring, shall contain no nitrogen in such concentrations that would impair any existing or designated uses.

Unit	Category
< 0.25	Ideal
0.26 – 0.40	Average
0.41 – 0.50	More than desirable
> 0.51	Excessive (potential nuisance concentration)

Other Parameters

Chloride

- **Unit of Measurement:** Milligrams per liter (abbreviated as mg/L).
- **Description:** The chloride ion (Cl-) is found naturally in some surface waters and groundwater and in high concentrations in seawater. Higher-than-normal chloride concentrations in freshwater, due to sodium chloride (table salt) that is used on foods and present in body wastes, can indicate sewage pollution. The use of highway deicing salts can also introduce chlorides to surface water or ground water. Elevated groundwater chlorides in drinking water wells near coastlines may indicate saltwater intrusion. In New Hampshire, the application of road salt for winter accident prevention is a large source of chloride to the environment, which is increasing over time due to the expansion of road networks and increased vehicle traffic. Road salt (most often sodium chloride) readily dissolves and enters aquatic environments in ionic forms. Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans.
- **Importance:** Research shows that elevated chloride levels can be toxic to freshwater aquatic life. Among the species tested, freshwater aquatic plants and invertebrates tend to be the most sensitive to chloride. In order to protect freshwater aquatic life in New Hampshire, the state has adopted acute and chronic chloride criteria.

Acute Standard: 860 mg/L.

Chronic Standard: 230 mg/L.

Escherichia Coliform Bacteria ***(E. coli)***

- **Unit of Measurement:** Counts per 100 milliliter (abbreviated as cts/100 mL).
- **Description:** An indicator of the potential presence of pathogens in fresh water. *E. coli* bacteria is a normal component in the large intestines of humans and other warm-blooded animals, and can be excreted in their fecal material. Organisms causing infections or disease (pathogens) are often excreted in the fecal material of humans and other warm-blooded animals.
- **Importance:** *E.coli* bacteria is a good indicator of fecal pollution and the possible presence of pathogenic organisms. In freshwater, *E. coli* concentrations help determine if the water is safe for recreational uses such as swimming.

  Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife, and the presence of septic systems along the river.

Class A NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 47 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 153 *E.coli* cts/100 mL in any one sample.

Class B NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 126 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 406 *E.coli* cts/100 mL in any one sample.

Metals

Depending on the metal concentration, its form (dissolved or particulate), and the hardness of the water, trace metals can be toxic to aquatic life. Metals in dissolved form are generally more toxic than metals in the particulate form. The dissolved metal concentration is dependent on the pH of the water, as well as the presence of solids and organic matter that can bind with the metal to render it less toxic.

Hardness is primarily a measure of the calcium and magnesium ion concentrations in water, expressed as calcium carbonate. The hardness concentration affects the toxicity of certain metals. New Hampshire water quality regulations include numeric criteria for a variety of metals. Since dissolved metals are typically found in extremely low concentrations, the potential contamination of samples collected for trace metals analyses has become a primary concern of water quality managers. To prevent such contamination and to ensure reliable results, the use of “clean techniques” is becoming more and more frequent when sampling for dissolved metals. Because of this, sampling for metals may be more costly and require additional effort than in the past.

New Hampshire Volunteer River Assessment Program

29 Hazen Drive – PO Box 95
Concord, NH 03302-0095
p (603) 271-0699 – f (603) 271-7894
www.des.nh.gov/wmb/vrap

2008

APPENDIX C:

2007 VRAP Volunteer Monitor Field Sampling Procedures Assessment *(Field Audit)*

VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group is notified of the result of the verification visit. During the visit, volunteers were assessed in the following five categories:

1) Assessment of ***sampling procedures*** include: Appropriate storage of meters, sample collection, laboratory sample collection and transportation, beginning and end of day meter checks, collecting a field replicate once during the sampling day from the original sample, performing QA/QC meter checks, and ensuring that all calibration and sampling data was properly documented on the 2007 *"VRAP Field Data Sheet"* and the *"NHDES Laboratory Services Login & Custody Sheet"*.

2) Assessment of ***turbidity procedures*** include: Inspection and cleaning of glass turbidity vials prior to measurement of standards and samples, performing the *"Initial Turbidity Meter Check Value"* with a known standard *(1.0 or 10.0 NTU)* and calibrating the meter to a known standard at the beginning of the sampling day, recording the value of the DI Turbidity Blank *(QAQA Meter Check)* once during the sampling day, and performing the *"End of the Day Meter Check*" using a known standard *(1.0 or 10.0 NTU)* at the conclusion of the sampling day.

3) Assessment of ***pH procedures*** include: Inspection of the pH electrode probe prior to sampling, calibration to both pH 7.0 and 4.0 buffers prior to each measurement/at each station, rinsing and wiping the pH electrode probe prior to and after the measurement of standards and samples, allowing the pH measurement to stabilize prior to recording the measurement, and recording the value of the 6.0 buffer *(QAQC Meter Check)* once during the sampling day,

4) Assessment of Water ***Temperature and Dissolved Oxygen procedures*** include: Ensuring the calibration chamber sponge was sufficiently moist/dampened, ensuring the meter was turned on at least 15 minutes prior to the first calibration, ensuring the meter was kept on until the end of the day, calibration of the meter to % saturation relative to station elevation prior to each measurement/at each station, rinsing and wiping the probe prior to and after the measurement of standards and samples, slight agitation of the probe in the sample, allowing the water temperature to stabilize, allowing dissolved oxygen *(% saturation)* to stabilize during agitation, immediately taking dissolved oxygen concentration *(mg/L)* after % saturation has stabilized, properly obtaining ambient air temperature, replacing the sensor probe in the calibration chamber for a post-sample check (*Dissolved Oxygen % Saturation in Chamber),* and recording the value of the Zero Dissolved Oxygen Standard *(QAQC Meter Check)* once during the sampling day.

5) Assessment of ***Specific Conductance procedures*** include: Performing the *"Initial Conductivity Check Value"* meter check using a known standard at the beginning of the sampling day, rinsing and wiping the probe prior to and after the measurement of standards and samples, ensuring the probe was entirely submerged in the sample, slight agitation of the probe in the sample, allowing the measurement to stabilize, and performing the *"End of the Day Meter Check*" using a known standard at the conclusion of the sampling day.

During the field sampling procedures assessment, VRAP staff offer important reminders and suggestions to ensure proper sampling techniques and re-train volunteers in the areas needing improvement. Afterwards, the volunteers are sent a follow-up e-mail providing written reminders and suggestions of the methods that need improvement. It is important to ensure that all volunteers attend an annual VRAP training workshop prior to the sampling season and to familiarize themselves with proper sampling techniques, written protocols, and the use of water quality meters. Please remember to schedule an annual volunteer field sampling procedures assessment in 2008 by contacting the VRAP Coordinator at (603) 271-0699.

APPENDIX D:
New Hampshire Surface Water Quality Standards and the Surface Water Quality Assessment Reporting Process

Every two years, the federal Clean Water Act (CWA) requires states to submit two surface water quality documents to the U.S. Environmental Protection Agency. Section 305(b) of the CWA requires submittal of a report, commonly called the "305(b) Report", that describes the quality of the surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water. The second document is typically called the "303(d) List" because it is a required by Section 303(d) of the CWA. The 303(d) list includes all surface waters that

- Are impaired or threatened by a pollutant or pollutant(s);
- Are not expected to meet water quality standards even after application of best technology standards for point sources or best management practices for nonpoint sources and;
- Require development of comprehensive water quality studies called Total Maximum Daily Load (TMDL) studies.

Water Quality Standards

It is important to obtain a basic understanding of water quality standards since they are the basis of all water quality assessments. In general, water quality standards provide the baseline quality that all surface waters of the state must meet in order to protect their intended uses. They are the "yardstick" for identifying where water quality violations exist and for determining the effectiveness of regulatory pollution control and prevention programs.

Env-WS 1700 includes the state's surface water quality regulations. A copy can be obtained by visiting www.des.nh.gov/wmb/wmbrules.htm. The standards are composed of three parts: designated uses, water quality criteria, and antidegradation.

Designated Uses

All surface waters of the state are either classified as Class A or Class B, with the majority of waters being Class B. NHDES maintains a list that includes a narrative description of all the legislative classified waters. Designated uses represent the uses that a waterbody should support. As indicated below, state statute RSA 485-A:8 is quite general with regards to designated uses for New Hampshire surface waters.

- **Class A:** These are generally of the highest quality and are considered potentially usable for water supply after adequate treatment. Discharge of sewage or wastes is prohibited to waters of this classification.

- **Class B:** Of the second highest quality, these waters are considered acceptable for fishing, swimming, and other recreational purposes, and, after adequate treatment, for use as water supplies.

Further review and interpretation of the regulations (Env-Ws 1700), however, reveals that the general uses can be expanded and refined to include the seven specific designated uses. Each of the designated uses, with the exception of wildlife, is assessed during the reporting period. An assessment methodology for wildlife has not yet been developed but will be included in future assessments.

Designated Use	Definition	Applicable Surface Waters
Aquatic Life	Waters that provide suitable chemical and physical conditions for supporting a balanced, integrated and adaptive community of aquatic organisms.	All surface waters
Fish Consumption	Waters that support fish free from contamination at levels that poses a human health risk to consumers.	All surface waters
Shellfish Consumption	Waters that support a population of shellfish free from toxicants and pathogens that could pose a human health risk to consumers.	All tidal surface waters
Drinking Water Supply After Adequate Treatment	Waters that with adequate treatment will be suitable for human intake and meet state/federal drinking water regulations.	All surface waters
Primary Contact Recreation *(i.e swimming)*	Waters that are suitable for recreational uses that require or are likely to result in full body contact and/or incidental ingestion of water.	All surface waters
Secondary Contact Recreation *(i.e boating)*	Waters that support recreational uses that involve incidental contact with the water.	All surface waters
Wildlife	Waters that provide suitable physical and chemical conditions in the water and the riparian corridor to support wildlife as well as aquatic life.	All surface waters

Water Quality Criteria

The second major component of the water quality standards is the "criteria". Criteria are designed to protect the designated uses of all surface waters and may be expressed in either numeric or narrative form. A waterbody that meets the criteria for its assigned classification is considered to meet its intended use. Water quality criteria for each classification may be found in RSA 485-A:8, I-V and in the state's surface water quality regulations.

Antidegradation

The third component of water quality standards is antidegradation which are provisions designed to preserve and protect the existing beneficial uses and to minimize degradation of the state's surface waters. Antidegradation regulations are included in Part Env-Ws 1708 of the state's surface water quality regulations. According to Env-Ws 1708.03, and antidegradation applies to the following:

- Any proposed new or increased activity, including point and nonpoint source discharges or pollutants that would lower water quality or affect the existing or designated uses;
- A proposed increase in loadings to a waterbody when the proposal is associated with existing activities;
- An increase in flow alteration over an existing alteration; and
- All hydrologic modifications, such as dam construction and water withdrawals.

Assessment and Listing Methodology: Waterbody Coverage, Waterbody Types, and Assessment Units

Waterbody Coverage

Assessment units are the basic unit of record for conducting and reporting water quality assessments. In 2002, all surface waters in New Hampshire were subdivided into approximately 5,100 assessment units. The system is based on 1:100,000 scale hydrography that is linked to the National Hydrography Dataset (NHD), the national coverage used by EPA. By 2010, NHDES will attempt to move to higher resolution (1:24,000 scale) hydrography, which will result in even more accurate assessments.

Waterbody Types & Sizes

Based on the NHD coverage and to facilitate reporting, surface waters are separated into five waterbody types; Rivers and Streams, Impoundments, Lakes and Ponds, Estuaries, and the Ocean.

Assessment Units

Each waterbody is divided into smaller segments called Assessment Units (AUs). In general, AUs are the basic unit of record for conducting and reporting the results of all water quality assessments. AUs are intended to be representative of homogenous segments: consequently, sampling stations within an AU can be assumed to be representative of the segment. In general, the size of AUs are not so small that they result in an unmanageable number of AUs for reporting. On the other hand, AUs are not so large that they result in grossly inaccurate assessments. Many factors can influence the homogeneity of a segment. Factors used to establish homogenous AUs for assessments include: waterbody type, HUC-12 boundaries, water quality standards, pollutant sources, Maximum AU size for rivers and streams, major changes in land use, stream order/location of major tributaries, public water supplies, outstanding resource waters, shellfish program categories, designated beaches, and cold water fish spawning areas.

How Are Water Quality Assessments Conducted?

How do we determine if a waterbody is healthy (i.e. fully supporting), impaired (i.e. not supporting), threatened, or if there is insufficient information to make an assessment? Answers to these questions and many more can be found in the Consolidated Assessment and Listing Methodology, (CALM), which is available at http://www.des.nh.gov/WMB/swqa/. In general the CALM is the translator for how the water quality data will be used to make surface water quality attainment decisions by designated use (aquatic life, swimming, ...) consistent with state surface water quality standards, RSA 485-A:8, and Env-Ws 1700 which can be viewed by visiting www.des.nh.gov/wmb/wmbrules.htm

What is the CALM?

The Consolidated Assessment and Listing Methodology (or CALM) describes, in detail, the process used to make surface water quality attainment decisions for 305(b) reporting and 303(d) listing purposes. The term "listing" refers to the process of placing (or listing) a water on the Section 303(d) List of impaired waters. The CALM also includes descriptions and definitions of the many terms used in the presentation of assessment results; consequently all are encouraged to review the CALM prior to reviewing the assessments as it will help one to better understand and interpret assessment results.

It is important to understand that assessment methodologies are dynamic and likely to change as new information and assessment techniques become available. Such changes can also impact monitoring strategies designed to determine if waterbodies are attaining water quality standards.

Periodic updates of the methodology will hopefully result in even more accurate and reliable assessments and, therefore, better management of water resources in the future.

Is Volunteer Data Used?

As long as the quality assurance/quality control measures result in data of adequate quality, we can and do use it in the assessments. The 2006 assessments of riverine assessment units included over 53,000 water quality standard comparisons of which nearly 60 percent came from volunteer sampling efforts. This volunteer data contributed to the assessment of 1,820 miles of rivers and streams on 489 riverine assessment units.

Factors to Consider When Assessing Waterbodies

Physical, chemical, toxicological, biological and/or habitat indicators can be used to assess the aquatic life use. If data for more than one indicator is available for assessments this can sometimes lead to conflicting assessment results. That is, one indicator might suggest that the designated use is not supporting (NS) while others may indicate a fully supporting (FS) use attainment status.

To resolve cases with conflicting data, NHDES uses an approach to make final assessment decisions. In general, this approach involves "weighing" the factors shown in the following table for each of the indicators. The assessment is then based on the indicator(s) with the highest weight (i.e., score).

Factor	Comments
Data Quality *(Sampling and Analysis Protocols)*	Data of high quality is given more weight than data of low quality.
Sample Time	Usually more weight is given to data which is the most recent, but one must also consider if samples were taken at times when exceedances are most likely to occur (i.e., the critical period). For example, when sampling for dissolved oxygen in rivers, water quality exceedances are most likely to occur during the summer months in the early morning when river flows are low and temperatures are high. If data for Indicator A indicated FS and was more recent but was not collected during the critical period, and data for Indicator B was older but indicated NS, more weight would be given to Indicator B as Indicator A data was not collected during the critical period.
Sample Location	Although AUs are theoretically homogenous, in reality, water quality differences can and do occur within an AU. In general, more weight is given to data that is collected the furthest downstream in an AU as it is more representative of all conditions affecting the AU. However if a particular location within an AU is suspected or known to have a greater likelihood of criteria exceedence, samples from that site would likely be given weight over a downstream site where water quality may have recovered.
Quantity of Samples	In general, more weight is given to the indicator which has the most data as it is more likely to be representative of the population being sampled, provided that a sufficient number of samples were collected during the critical period when violations are most apt to occur. In other words, quantity of data is not permitted to override critical condition data.
Type of Data *(i.e., physical, chemical, toxicological, habitat and/or biological)*	It is generally believed that for making aquatic life use assessments, biological data should be weighted more heavily than physical, chemical, habitat or toxicological data. This is because high quality biological data provide a direct measure of aquatic life and can detect the cumulative impact of multiple stressors on the aquatic community including new or previously undetected stressors over time. Physical/chemical data, on the other hand, provides a snapshot of river conditions when the samples were taken and do not account for the long term effects of stressors or the presence of other pollutants which may be impairing the biota.

Use Support Attainments

Each designated use for each assessment unit (AU), and each assessed parameter is assigned one of the following four base use support attainment options.

- **Fully Supporting:** A use is fully supporting if there is sufficient data or evidence for the core indicators to determine that the use is fully supporting and there is no other data or evidence indicating an impaired or threatened status.

- **Not Supporting:** A use is not supporting (i.e., impaired) if there is sufficient data or evidence to indicate impairment.

- **Insufficient Information:** This option is assigned to any use associated with any AU which has some, but not enough useable data or information to make a final assessment decision.

- **Not Assessed:** This option is assigned to any use associated with any AU, which does not have any useable data or information to make an assessment decision.

The CALM further describes how the four base use support attainment options have been subdivided to describe degrees of support, non-support, and insufficient information. For example, fully supporting is broken down to illustrate cases where a parameter just meets standards (i.e. marginal) or is well above standards (i.e. good).

How Many Measurements Must VRAP Groups Take for Assessment Purposes?

Statistically, for most parameters measured, less data is required to determine that a waterbody is impaired than is necessary to say that a parameter fully meets water quality criteria. The number of samples below presumes that the parameter in question will meet water quality standards.

- **Turbidity:** Routine turbidity measurements are not currently used in surface water quality assessments. However, turbidity easements related to specific projects with ongoing management issues are compared with water quality standards.

- **pH:** 10 measurements within five years.

- **Water Temperature:** Water temperature is currently only used to assess lake and impoundment profiles. Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody. In that case, critical times and periods will be more important.

- **Dissolved Oxygen:** 10 measurements within five years. Samples must be taken during critical times and seasons depending on the water type and use:

  - If the surface water is not a cold water natural reproducing fishery, at least 50% of the minimum number of independent samples needed for Fully Supporting shall be taken between June 1 and September 30. This is when dissolved oxygen is most apt to be lowest due to high temperatures and low flows.

  - If the surface water is a cold water natural reproducing fishery, 100% of the minimum number of independent samples needed for Fully Supporting determination shall be taken between October 1 and May 14. Additionally, at least 50% of the minimum number of independent samples needed for Fully Supporting shall be taken between June 1 and September 30.

- **Chloride/Specific Conductance:** 10 measurements within five years. Chloride and specific conductance are very closely related to one another and the protocols NHDES uses to assess waterbodies allows specific conductance to be used as a formal surrogate for chloride. Monitoring for specific conductance and chloride in the winter and early spring months will help determine what the immediate runoff impact of road salt application is in the watershed. Sampling in late summer under low flow conditions will help determine the degree of chloride saturation in baseflow. At least 50% of the minimum number of independent samples needed for Fully Supporting need to come from each of these key periods and combined these samples will indicated what time of year chloride levels tend to be highest.

- ***Escherichia coli*/Bacteria *(E.coli)*:** 10 samples within five years. To be Fully Supporting, there must be sufficient data to make an assessment during the peak contact recreation season (May 24 to September 15). In order to fully determine whether a waterbody is meeting surface water standards for *E.coli* a geometric mean should be calculated. A geometric mean is calculated using three independent samples collected within a 60-day period provided that at least two of the samples are separated by a period of at least 1 day.

- **Total Phosphorus (TP):** Total Phosphorus is not currently used directly in surface water quality assessments.

- **Total Kjeldahl Nitrogen (TKN) and Nitrate/Nitrite:** Neither Total Kjeldahl Nitrogen, nor nitrate/nitrite are currently used directly in surface water quality assessments.

- **Chlorophyll-a:** 10 measurements within five years. To be Fully Supporting, there must be sufficient data to make an assessment during the peak contact recreation season (May 24 to September 15).

- **Metals:** 10 samples within five years. For seven metals; cadmium, copper, chromium+3, lead, nickel, silver, and zinc the exact water quality criteria is dependent upon the hardness of the water at the time of sampling. Consequentially, hardness samples need to be collected when one or more of those seven metals is to be analyzed. Additionally, it is important to ensure that the laboratory that will analyze the samples has detection limits that are below the water quality criteria to be compared.

How Can VRAP Groups Determine Which Portions of Their River have been Assessed?

There are an assortment of text documents available at the surface water quality assessment web-site. For those with GIS capabilities the AU shapefiles are available. As a fallback you can contact NHDES. All VRAP data marked as valid is used on the portion of river it is sampled in.

Where Can You Find the Report?

You can access the report by visiting http://des.nh.gov/wmb/swqa/.

For More Information

Contact Ken Edwardson, NHDES Water Quality Planning Section, at (603) 271-8864 or kedwardson@des.state.nh.us

APPENDIX E:

Programs, Publications & Links of Interest

Biomonitoring Program	http://www.des.nh.gov/WMB/biomonitoring/

Clean Lakes Program	http://www.des.nh.gov/wmb/CleanLakes/

Coastal Program	http://www.des.nh.gov/Coastal/

Exotic Species Program	http://www.des.nh.gov/WMB/exoticspecies/

- **Exotic Plant Distribution Map**

  http://www.des.nh.gov/WMB/ExoticSpecies/milfoil_list.htm

- **Unwanted: The Frightful Fourteen**

  http://www.des.nh.gov/WMB/ExoticSpecies/documents/Fourteen.pdf

- **Exotic Species Fact Sheets**

  http://www.des.nh.gov/WMB/ExoticSpecies/facts.htm

- **2004-2005 Exotic Species Program Report**

  http://www.des.nh.gov/WMB/ExoticSpecies/documents/2004-2005_Report.pdf

- **Weed Watchin': Annual Weed Watcher Newsletter**

  http://www.des.nh.gov/WMB/ExoticSpecies/documents/2005_Weed_Watchin.pdf

Fact Sheets of Interest	http://www.des.nh.gov/openme.htm

- **Lake Biology:** http://www.des.nh.gov/bb.htm
- **Shoreland Protection Program:** http://www.des.nh.gov/sp.htm
- **Water Supply:** http://www.des.nh.gov/sp.htm
- **Watershed Management:** http://www.des.nh.gov/sp.htm
- **Wetlands Bureau:** http://www.des.nh.gov/wet.htm

Lakes Management & Protection Program	http://www.des.nh.gov/wmb/lakes/

Rivers Management & Protection Program	http://www.des.nh.gov/rivers/

- **Publications & Fact Sheets**

  http://www.des.nh.gov/Rivers/link-2.htm

- **Meanderings: Newsletter of the Rivers Management & Protection Program**

  Spring 2007: http://www.des.nh.gov/news/meanderings/MeanderSpring07.pdf

Shoreland Protection Program http://www.des.nh.gov/cspa/

Surface Water Quality Assessments http://www.des.nh.gov/WMB/swqa/

Volunteer Lake Assessment Program http://www.des.nh.gov/WMB/vlap/

- **VLAP Field Manual**

  http://www.des.nh.gov/wmb/VLAP/documents/fieldmanual.pdf
- **The Sampler: Annual VLAP Newsletter**

  Spring 2007: http://www.des.nh.gov/wmb/VLAP/documents/Samplr07.pdf
- **Annual Reports**

  http://www.des.nh.gov/wmb/VLAP/2006/

Volunteer River Assessment Program http://www.des.nh.gov/WMB/vrap

- **Water Quality Monitoring Field Sampling Protocols for Volunteer Monitors**

  http://www.des.nh.gov/wmb/vrap/documents/Protocols.pdf
- **Interpreting VRAP Water Quality Parameters**

  http://www.des.nh.gov/wmb/vrap/documents/WQParams.pdf
- **VRAP Water Quality Standards**

  http://www.des.nh.gov/wmb/vrap/documents/WQ_Standards.pdf
- **Native Shoreland & Riparian Buffer Plantings for New Hampshire**

  http://www.des.nh.gov/wmb/vrap/documents/NativeShorelandRiparianBufferPlantingsNH.pdf
- **Glossary of River Ecology Terms**

  http://www.des.nh.gov/wmb/vrap/documents/Glossary_of_Riverine_Ecology_Terms.pdf
- **A Field Guide to Common Riparian Plants of New Hampshire**

  http://www.des.nh.gov/wmb/vrap/documents/FieldGuideToCommonRiparianPlantsOfNH.pdf
- **Streamlines: Annual VRAP Newsletter**

  June 2007: http://www.des.nh.gov/wmb/vrap/documents/Streamlines/June2007.pdf
- **Annual Reports, Data, & Maps**

  http://www.des.nh.gov/wmb/vrap/data.html

Watershed Assistance http://www.des.nh.gov/WMB/was/

- **Nonpoint Source Newsletter**

  http://www.des.nh.gov/WMB/Was/documents/NPS_news_2004.pdf
- **Greenworks: Ideas for a Cleaner Environment**

  http://www.des.nh.gov/gw-list.htm

Wetlands Bureau http://www.des.nh.gov/Wetlands/

New Hampshire Volunteer River Assessment Program
2008 Ashuelot River Watershed Water Quality Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

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NHDES R-WD-09-1B

New Hampshire Volunteer River Assessment Program
2007 Ashuelot River Watershed Water Quality Report

State of New Hampshire
Department of Environmental Services
Water Division
Watershed Management Bureau
P.O. Box 95
29 Hazen Drive
Concord, New Hampshire 03302-0095
www.des.nh.gov

Thomas S. Burack
Commissioner

Harry T. Stewart
Water Division Director

Prepared By:

Ted Walsh, VRAP Program Manager

Jen Drociak, VRAP Coordinator

Danielle Mucciarone, VRAP Assistant

February 2009

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ACKNOWLEDGEMENTS

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2008 Ashuelot River Volunteers

Barbara Skuly

Charlie Beck

Adam Black

Penny Eggleston

Patrick Eggleston

Linda Fuerderer

Jim Holley

Brad Hutchinson

Robert Lamoy

Carolyn MacDonald

Malcom MacDonald

Mike Morrison

Sigrid Scholz

Barbara Skuly

Steve Stepenuck

Ann Sweet

Roger Sweet

Robert Thompson

1.0 INTRODUCTION

1.1. Purpose of Report

Each year the New Hampshire Volunteer River Assessment Program (VRAP) prepares and distributes a water quality report for each volunteer river monitoring group that is based solely on the water quality data collected by that group during a specific year. The reports summarize and interpret the data, particularly as they relate to New Hampshire's surface water quality standards, and serve as a teaching tool and guidance document for future monitoring activities by the individual volunteer groups.

1.2. Report Format

Each report includes the following:

- **Volunteer River Assessment Program Overview**

  This section includes a description of the history of VRAP, the technical support, training and guidance provided by NHDES, and how data is transmitted to the volunteers and used in surface water quality assessments.

- **Monitoring Program Description**

  This section provides a description of the volunteer group's monitoring program including monitoring objectives as well as a table and map showing sample station locations.

- **Results and Recommendations**

  Water quality data collected during the year are summarized on a parameter-by-parameter basis using: (1) a data summary table, which includes the number of samples collected, data ranges, the number of samples meeting New Hampshire water quality standards, and the number of samples adequate for water quality assessments at each station; (2) a discussion of the data; (3) a river graph showing the range of measured values at each station; and (4) a list of applicable recommendations.

  Sample results reported as less than the detection limit were assumed equal to one-half the detection limit on the river graphs. This approach simplifies the understanding of the parameter of interest, and specifically helps one to visualize how the river or watershed is functioning from upstream to downstream. In addition, this format allows the reader to better understand potential pollution areas and target those areas for additional sampling or environmental enhancements. Where applicable, the river graph also shows New Hampshire surface water quality standards or levels of concern for comparison purposes.

- **Appendix A – Water Quality Data**

  This appendix includes a spreadsheet detailing the data results and additional information such as data results which do not meet New Hampshire surface water quality standards, and data that is unusable for assessment purposes due to quality control requirements.

- **Appendix B – Interpreting VRAP Water Quality Parameters**

  This appendix provides a brief description of water quality parameters typically sampled by VRAP volunteers and their importance, as well as applicable state water quality criteria or levels of concern.

- **Appendix C – VRAP Volunteer Monitor Field Sampling Procedures Assessment *(Field Audits)***

  This appendix provides an overview of the VRAP Volunteer Monitor Field Sampling Procedures Assessment (field audit) process with respect to programmatic quality assurance/quality control (QA/QC) guidelines.

- **Appendix D –New Hampshire Watershed Report Cards**

  This appendix provides an overview of the New Hampshire Watershed Report Cards built from the 2008 305(b)/303(d) Surface Water Quality Reports.

2.0 PROGRAM OVERVIEW

2.1 What is VRAP?

In 1998, the New Hampshire Volunteer River Assessment Program was established to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources.

Today, VRAP loans water quality monitoring equipment, provides technical support, and facilitates educational programs to volunteer groups on numerous rivers and watersheds throughout the state. VRAP volunteers conduct water quality monitoring on an ongoing basis and increase the amount of river water quality information available to local, state and federal governments, which allows for better watershed planning.

2.2 Why is VRAP Important?

VRAP establishes a regular volunteer-driven water sampling program to assist NHDES in evaluating water quality throughout the state. VRAP empowers volunteers with information about the health of New Hampshire's rivers and streams. Regular collection of water quality data allows for early detection of water quality changes allowing NHDES to trace potential problems to their source. Data collected by VRAP volunteers are directly contributing to New Hampshire's obligations under the Clean Water Act. Measurements taken by volunteers are used in assessing the water quality of New Hampshire's river and streams, and are included in reporting to the US Environmental Protection Agency.

2.3 How Does VRAP Work?

VRAP is a cooperative program between NHDES, river groups, local advisory committees, watershed associations, and individuals working to protect New Hampshire's rivers and streams. Volunteers are trained by VRAP staff in the use of water quality monitoring equipment at an annual training workshop. VRAP works with each group to establish monitoring stations and develop a sampling plan.

During the summer months, VRAP receives water quality data from trained volunteers. The data are reviewed for quality assurance, and are entered into the environmental monitoring database at NHDES. During the off-season, VRAP interprets the data and compiles the results into an annual report for each river. VRAP volunteers can use the data as a means of understanding the details of water quality, as well as guide future sampling efforts. NHDES can use the data for making surface water quality assessments, provided that the data met certain quality assurance/quality control guidelines.

2.4 Equipment and Sampling Schedule

VRAP frequently lends and maintains water quality monitoring equipment kits to VRAP groups throughout the state. The kits contain meters and supplies for routine water quality parameter measurements of turbidity, pH, dissolved oxygen, water temperature and specific conductance (conductivity). Other parameters such as nutrients, metals, and *E. coli* can also be studied, although VRAP does not always provide funds to cover laboratory analysis costs. Thus, VRAP encourages groups to pursue other fundraising activities such as association membership fees, special events, in-kind services (non-monetary contributions from individuals and organizations), and grant writing.

Each year, volunteers design and arrange a sampling schedule in cooperation with VRAP staff. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency. VRAP typically recommends sampling every other week from May through September, and VRAP groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions.

2.5 Training and Technical Support

Each VRAP volunteer attends an annual training workshop to receive a demonstration of monitoring protocols and sampling techniques and the calibration and use of water quality monitoring equipment. During the training, volunteers have an opportunity for hands-on use of the equipment and receive instruction in the collection of samples for laboratory analysis.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols (see Appendix C). If necessary, volunteers are re-trained during the visit, and the group's monitoring coordinator is notified of the result of the verification visit. VRAP groups forward water quality results to NHDES for incorporation into an annual report and state water quality assessment activities.

2.6 Data Usage

Annual Water Quality Reports

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. All data collected by volunteers are summarized in water quality reports that are prepared and distributed after the conclusion of the sampling period. VRAP groups can use the reports and data as a means of understanding the details of water quality, guiding future sampling efforts, or determining restoration activities.

New Hampshire Surface Water Quality Assessments

Along with data collected from other water quality programs, specifically the State Ambient River Monitoring Program, applicable volunteer data are used to support periodic NHDES surface water quality assessments. VRAP data are entered into NHDES's environmental monitoring database and are ultimately uploaded to the EPA database. Assessment results and the methodology used to assess surface waters are published by NHDES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act. The reader is encouraged to log on to the NHDES web page to review the assessment methodology and list of impaired waters http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm.

2.7 Quality Assurance/Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The VRAP QAPP was approved by NHDES and reviewed by EPA in the summer of 2003. The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP quality assurance/quality control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.
- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.
- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.
- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.
- **DI (De-Ionized) Turbidity Blank**: A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

2.7.1 Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables with an explanation of why the data was unusable. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1. Relative Percent Difference)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100\ \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O_2 Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	Absolute Difference <0.3 pH units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (Zero Air Reading)	± 5.0 µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <1.0 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

3.0 METHODS

In 2001, volunteers from the Ashuelot River Local Advisory Committee began monitoring water quality on the Ashuelot River. The goal of this effort was to provide water quality data from the Ashuelot River relative to surface water quality standards and to allow for the assessment of the river for support of aquatic life and primary contact recreation (swimming). The establishment of a long-term monitoring program allows for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, equipment, financial assistance for laboratory costs, and technical assistance.

During 2008, trained volunteers from the Ashuelot River Local Advisory Committee monitored water quality at 15 stations in the Ashuelot River watershed from its upper limits in Washington to just upstream of its confluence with the Connecticut River in Hinsdale (Figure 1, Table 2).

Stations IDs are designated using a three-letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed. All stations monitored in 2008 are designated as Class B waters. This classification is used to apply the appropriate water quality standard.

Water quality monitoring was conducted monthly from May to September. In-situ measurements of water temperature, air temperature, dissolved oxygen, pH, and specific conductance were taken using handheld meters. Turbidity samples were collected in the field, brought to a central location and measured the same day. Samples for *E.coli*, total phosphorous, chloride, and metals were taken using sterile and/or preserved bottles and were stored on ice during transport from the field to the NHDES laboratory or the Keene Wastewater Treatment Facility. Table 3 summarizes the parameters measured, laboratory standard methods, and equipment used.

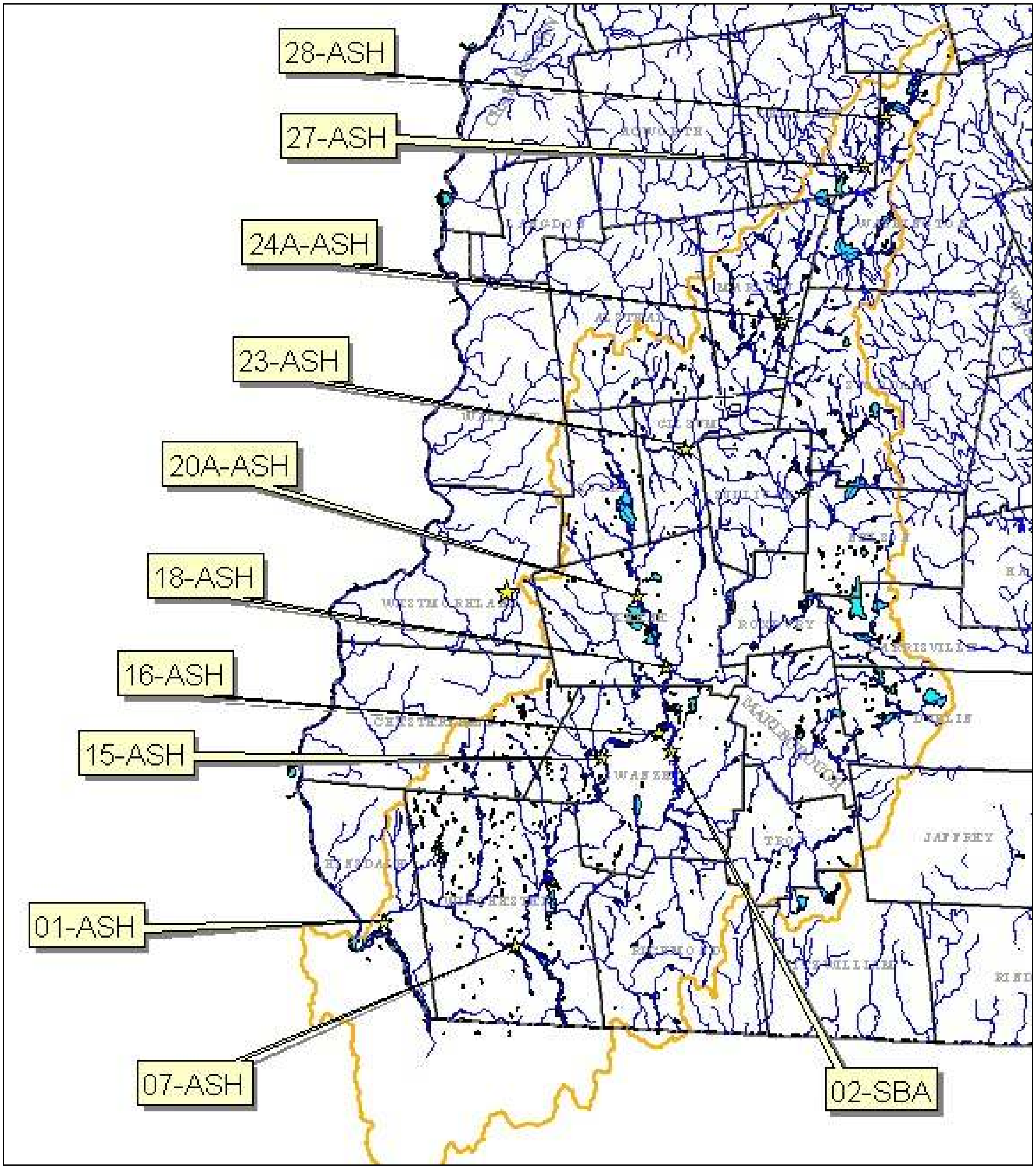
Table 2. Sampling Stations for the Ashuelot River, NHDES VRAP, 2008

Station ID & AUID	Class	Waterbody Name	Location	Town	Elevation *(Rounded to the Nearest 100 Feet)*
28-ASH NHRIV802010101-08	**B**	**Ashuelot River**	Route 31	Washington	1600
27-ASH NHRIV802010101-08	**B**	**Ashuelot River**	Mountain Road	Lempster	1500
24A-ASH NHRIV802010102-11	**B**	**Ashuelot River**	Route 10	Marlow	1100
23-ASH NHRIV802010103-22	**B**	**Ashuelot River**	Route 10	Gilsum	800
20A-ASH NHRIV802010301-04	**B**	**Ashuelot River**	Stone Arch Bridge	Keene	500
18-ASH NHRIV802010301-09	**B**	**Ashuelot River**	Route 101	Keene	500
16D-ASH NHRIV802010301-11	**B**	**Ashuelot River**	50' Upstream of Keene WWTF	Swanzey	500
16A-ASH NHRIV802010301-11	**B**	**Ashuelot River**	10' Downstream of Confluence of SBA	Swanzey	500
16-ASH NHRIV802010401-15	**B**	**Ashuelot River**	Cresson Bridge	Swanzey	500
15M-ASH NHRIV600030703-15	**B**	**Ashuelot River**	Intersection of Route 10 and Winchester Street	Swanzey	500
15J-ASH NHRIV801060702-12	**B**	**Ashuelot River**	Upstream of Faulkner's Garden	Swanzey	500
02B-SBA NHRIV600030608-15	**B**	**South Branch Ashuelot River**	Upstream of Monadnock Regional H.S.	Swanzey	500
02-SBA NHRIV802010303-23	**B**	**South Branch Ashuelot River**	Route 32 Bridge	West Swanzey	500
07-ASH NHRIV802010403-07	**B**	**Ashuelot River**	Route 119	Winchester	400
01-ASH NHRIV802010403-20	**B**	**Ashuelot River**	147 River Street	Hinsdale	200

Table 3. Sampling and Analysis Methods

Parameter	Sample Type	Standard Method	Equipment Used	Laboratory
Temperature	In-Situ	SM 2550	YSI 85	------
Dissolved Oxygen	In-Situ	SM 4500 O G	YSI 85	------
pH	In-Situ	SM 4500 H+	Oakton pH 11	------
Turbidity	In-Situ	EPA 180.1	LaMotte 2020 e	
Specific Conductance	In-Situ	SM 2510	YSI 85	------
E.coli	Bottle (Sterile)	EPA 1103.1	------	NHDES
Total Phosphorus	Bottle (w/ Preservative)	EPA 365.3	------	NHDES & Eastern Analytical
Chloride	Bottle	SM D512C	------	NHDES Limnology Center
Cadmium	Bottle (w/ Preservative)	SM 3111B	------	Keene WWTF
Copper	Bottle (w/ Preservative)	SM 3111B	------	Keene WWTF
Lead	Bottle (w/ Preservative)	SM 3111B	------	Keene WWTF
Zinc	Bottle (w/ Preservative)	SM 3111B	------	Keene WWTF

Figure 1. Ashuelot River Watershed & Sampling Stations, 2008



RESULTS AND RECOMMENDATIONS

Results and recommendations for each monitored parameter are presented in the following sections. For a description of the importance of each parameter and pertinent water quality criteria for these and other parameters, please see Appendix B, *"Interpreting VRAP Water Quality Parameters."*

4.1 Dissolved Oxygen

Between one and five measurements were taken in the field for dissolved oxygen concentration at 15 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 4). Of the 60 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

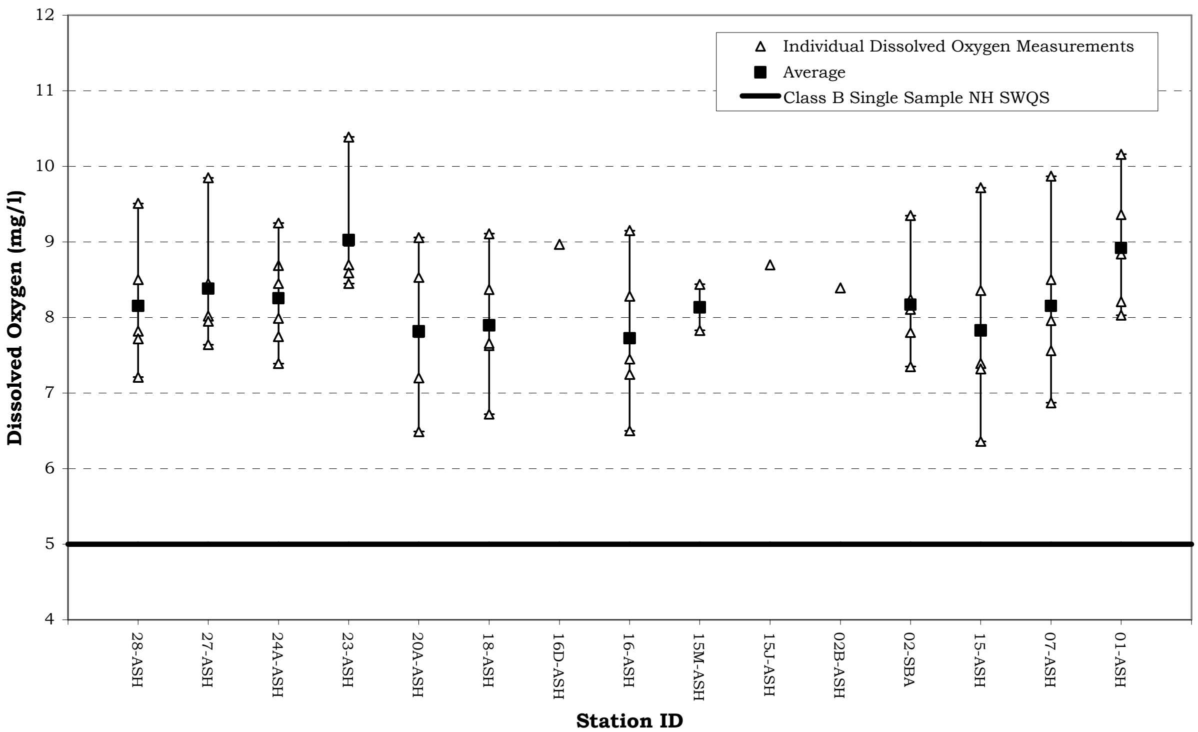
The Class B New Hampshire surface water quality standard for dissolved oxygen includes a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 percent of saturation. In other words, there are criteria for both concentration and saturation that must be met before the river can be assessed as meeting dissolved oxygen standards. Table 4 reports only dissolved oxygen concentration as more detailed analysis is required to determine if instantaneous dissolved oxygen saturation measurements are above or below water quality standards.

Dissolved oxygen concentration levels were above the New Hampshire Class B surface water quality standard at all stations and on all occasions with the average ranging from 7.73 mg/L to 9.03 mg/L (Figure 2). Levels of dissolved oxygen sustained above the standards are considered adequate for the support of aquatic life and other desirable water quality conditions.

Table 4. Dissolved Oxygen Concentration (mg/L) Summary – Ashuelot River, 2008

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	7.21 - 9.51	0	5
27-ASH	5	7.64 - 9.85	0	5
24A-ASH	5	7.39 - 9.25	0	5
23-ASH	5	8.45 - 10.39	0	5
20A-ASH	5	6.49 - 9.06	0	5
18-ASH	5	6.72 - 9.11	0	5
16A-ASH	1	8.97	0	1
16-ASH	5	6.50 - 9.15	0	5
15M-ASH	2	7.83 - 8.44	0	2
15J-ASH	1	8.70	0	1
02B-ASH	1	8.39	0	1
02-SBA	5	7.35 - 9.35	0	5
15-ASH	5	6.36 - 9.72	0	5
07-ASH	5	6.87 - 9.87	0	5
01-ASH	5	8.03 - 10.16	0	5
Total	**60**	_____	**0**	**60**

Figure 2. Dissolved Oxygen Concentration Statistics for the Ashuelot River Watershed May 17 - September 15, 2008, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- If possible, take measurements between 5 a.m. and 10 a.m., which is when dissolved oxygen is usually the lowest, and between 2 p.m. and 7 p.m. when dissolved oxygen is usually the highest. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.

- Consider incorporating the use of in-situ dataloggers to automatically record dissolved oxygen saturation levels during a period of several days.

4.2 pH

Between one and five measurements were taken in the field for pH at 15 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 5]. Of the 60 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard is 6.5 - 8.0, unless naturally occurring.

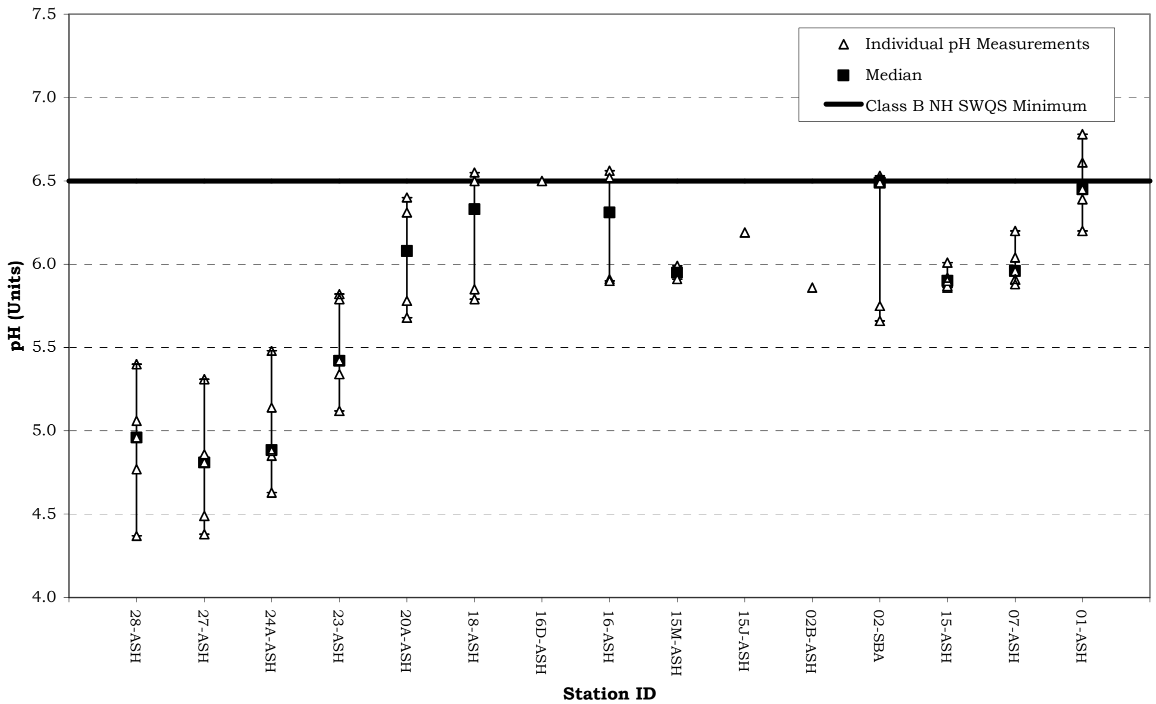
Table 5. pH Data Summary – Ashuelot River, 2008

Station ID	Samples Collected	Data Range (standard units)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	4.37 - 5.40	5	5
27-ASH	5	4.38 - 5.31	5	5
24A-ASH	5	4.63 - 5.48	5	5
23-ASH	5	5.12 - 5.82	5	5
20A-ASH	5	5.68 - 6.40	5	5
18-ASH	5	5.79 - 6.55	3	5
16A-ASH	1	6.50	0	1
16-ASH	5	5.90 - 6.56	3	5
15M-ASH	2	5.91 - 5.99	2	2
15J-ASH	1	6.19	1	1
02B-ASH	1	5.86	1	1
02-SBA	5	5.66 - 6.53	3	5
15-ASH	5	5.86 - 6.01	5	5
07-ASH	5	5.88 - 6.20	5	5
01-ASH	5	6.20 - 6.78	3	5
Total	**60**	_____	**51**	**60**

A majority of the pH measurements were below the New Hampshire surface water quality standard minimum (Figure 3). In general, stations in the upper portions of the watershed had lower pH measurements than stations in the lower portions of the watershed.

Lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area. Rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels; after the spring melt or significant rain events, surface waters will generally have a lower pH.

Figure 3. pH Statistics for the Ashuelot River Watershed
May 17 - September 15, 2008, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Consider sampling for pH in some of the tributaries and wetland areas that are influencing the pH of stations with measurements below state standards. Site conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands or other natural conditions, then the low pH measurements are not considered a violation of water quality standards. It is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life. In this case, additional information about factors influencing pH levels is needed.

4.3 Turbidity

Between one and five measurements were taken in the field for turbidity at 15 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 6]. Of the 59 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for turbidity is less than 10 NTU above natural background.

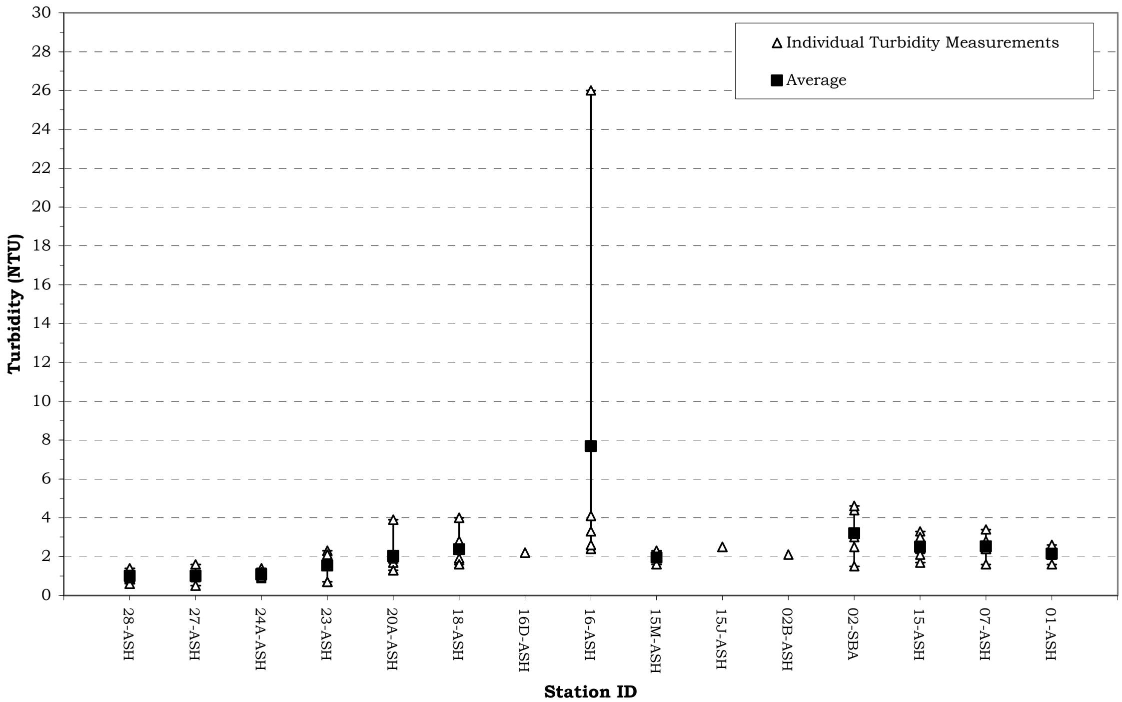
Table 6. Turbidity Data Summary – Ashuelot River, 2008

Station ID	Samples Collected	Data Range (NTU)	Acceptable Samples Potentially Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	0.6 - 1.4	0	5
27-ASH	5	0.5 - 1.6	0	5
24A-ASH	5	0.9 - 1.4	0	5
23-ASH	5	0.7 - 2.3	0	5
20A-ASH	5	1.3 - 3.9	0	5
18-ASH	5	1.6 - 4.0	0	5
16A-ASH	1	2.2	0	1
16-ASH	1	2.4 - 26	1	1
15M-ASH	5	1.6 - 2.3	0	5
15J-ASH	1	2.5	0	1
02B-ASH	1	2.1	0	1
02-SBA	5	1.5 - 4.6	0	5
15-ASH	5	1.7 - 3.3	0	5
07-ASH	5	1.6 - 3.4	0	5
01-ASH	5	1.6 - 2.6	0	5
Total	**59**	_____	**1**	**59**

Turbidity levels were low with the average ranging from 1.0 NTU to 7.7 NTU (Figure 4). Station 16-ASH had one elevated measurement of 26 NTU on 7/21/08 that potentially fails to meet the state of New Hampshire Class B surface water quality standard. Intermittent rain during the sampling date, and rain three days prior to the sampling date was noted on the VRAP Field Data Sheet and may have contributed to the higher turbidity levels due to stormwater runoff and the flushing of wetland areas.

Although clean waters are associated with low turbidity there is a high degree of natural variability involved. Precipitation often contributes to increased turbidity by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. However, human activities such as removal of vegetation near surface waters and disruption of nearby soils can lead to dramatic increases in turbidity levels. In general it is typical to see a rise in turbidity in more developed areas due to increased runoff.

Figure 4. Turbidity Statistics for the Ashuelot River Watershed
May 17 - September 15, 2008, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Collect samples during wet weather. This will help us to understand how the river responds to runoff and sedimentation.

- If a higher than normal turbidity measurement occurs, volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated turbidity levels. In addition, take good field notes and photographs. If human activity is suspected or verified as the source of elevated turbidity levels, volunteers should contact NHDES.

4.4 Specific Conductance

Between one and five measurements were taken in the field for specific conductance at 15 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 7]. Of the 60 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

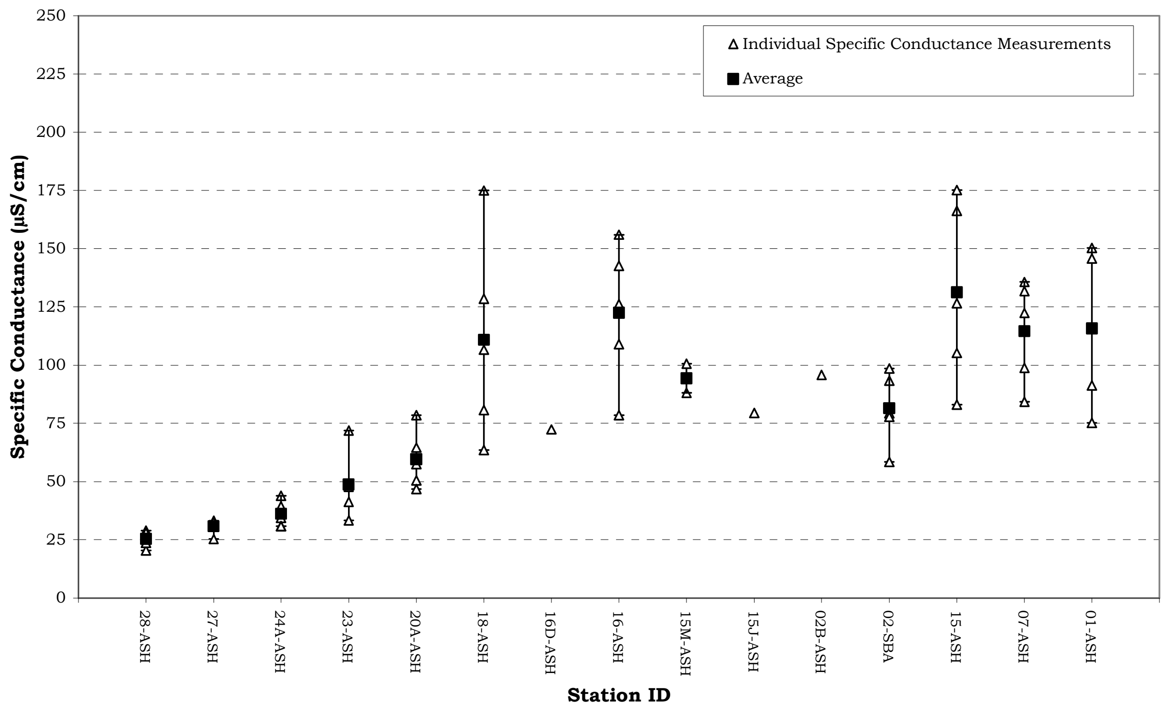
New Hampshire surface water quality standards do not contain numeric criteria for specific conductance although in many fresh surface waters, specific conductance can be used as a surrogate to predict compliance with numeric water quality criteria for chloride.

Table 7. Specific Conductance Data Summary – Ashuelot River, 2008

Station ID	Samples Collected	Data Range (µS/cm)	Acceptable Samples Not Meeting NH Class B Standards (µS/cm as chloride surrogate)	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	20 - 29	0	5
27-ASH	5	25 - 33	0	5
24A-ASH	5	31 - 44	0	5
23-ASH	5	33 - 72	0	5
20A-ASH	5	47 - 79	0	5
18-ASH	5	64 - 175	0	5
16A-ASH	1	72	0	1
16-ASH	5	79 - 156	0	5
15M-ASH	2	88 - 101	0	2
15J-ASH	1	79	0	1
02B-ASH	1	96	0	1
02-SBA	5	59 - 99	0	5
15-ASH	5	83 - 175	0	5
07-ASH	5	84 - 136	0	5
01-ASH	5	75 - 150	0	5
Total	**60**	_____	**0**	**60**

Specific conductance levels were variable with the average ranging from 25.4 µS/cm to 122.5 µS/cm (Figure 10). In general, specific conductance measurements tended to be higher in the mid to lower portion of the watershed. Higher specific conductance levels can be indicative of pollution from sources such as urban/agricultural runoff, road salt, failed septic systems, or groundwater pollution. The variable specific conductance levels generally indicate low pollutant levels at some stations and higher levels at others.

Figure 5. Specific Conductance Statistics for the Ashuelot River Watershed
May 17 - September 15, 2008, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Consider collecting chloride samples at the same time that specific conductance is measured. During the late winter/early spring snowmelt, higher specific conductance levels are often seen due to elevated concentrations of chloride in the runoff. Specific conductance levels are very closely correlated to chloride levels. Simultaneously measuring chloride and specific conductance will allow for a better understanding of their relationship.

- Consider incorporating the use of in-situ dataloggers to automatically determine specific conductance levels during rain events, snowmelt, and baseline dry weather conditions. The use of these instruments is dependent upon availability, and requires coordination with NHDES.

4.5 Water Temperature

Between one and five measurements were taken in the field for water temperature at 15 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 8]. Of the 60 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Table 8. Water Temperature Data Summary – Ashuelot River, 2008

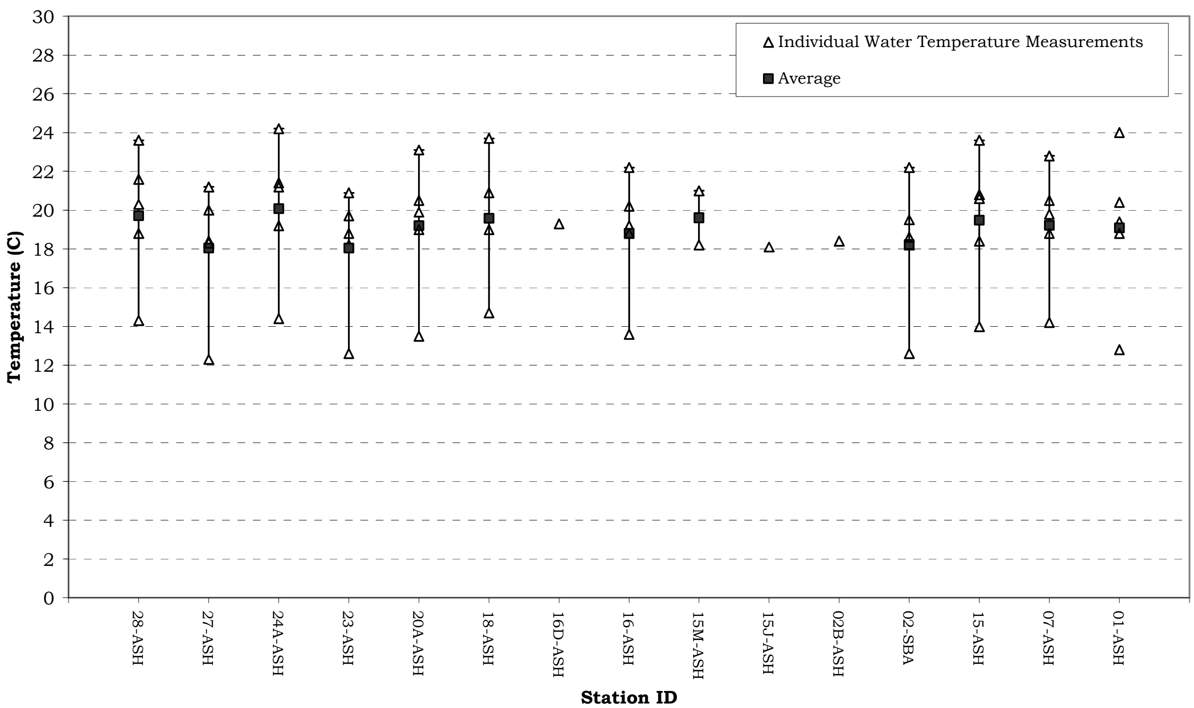
Station ID	Samples Collected	Data Range (°C)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	14.3 - 23.6	Not Applicable	5
27-ASH	5	12.3 - 21.2	N/A	5
24A-ASH	5	14.4 - 24.2	N/A	5
23-ASH	5	12.6 - 20.9	N/A	5
20A-ASH	5	13.5 - 23.1	N/A	5
18-ASH	5	14.7 - 23.7	N/A	5
16A-ASH	1	19.3	N/A	1
16-ASH	5	13.6 - 22.2	N/A	5
15M-ASH	2	18.2 - 21	N/A	2
15J-ASH	1	18.1	N/A	1
02B-ASH	1	18.4	N/A	1
02-SBA	5	12.6 - 22.2	N/A	5
15-ASH	5	14.0 - 23.6	N/A	5
07-ASH	5	14.2 - 22.8	N/A	5
01-ASH	5	12.8 - 24	N/A	5
Total	**60**	_____	**N/A**	**60**

Figure 6 shows the results of instantaneous water temperature measurements taken at 15 stations in the Ashuelot River watershed. The average water temperature varied from 18.0 °C. to 20.1 °C.

Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and the activity of bacteria in the water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation along the shoreline, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and the influence of groundwater.

Figure 6. Water Temperature Statistics for the Ashuelot River Watershed May 17 - September 15, 2008, NHDES VRAP



Recommendations

- Continue collecting water temperature data via both instantaneous reading and long-term deployment of dataloggers.

4.6 *Escherichia coli*/Bacteria

Between one and four samples were taken for *Escherichia coli* (*E. coli*) at 15 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 9). Of the 49 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

Class B New Hampshire surface water quality standards for *E.coli* are as follows:

$\leq$406 cts/100 ml, based on any single sample or
$\leq$126 cts/100 ml, based on a geometric mean calculated from three samples collected within a 60-day period.

Table 9. *E.coli* Data Summary – Ashuelot River, 2008

Station ID	Samples Collected	Data Range (cts/100ml)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	4	8 - 285	0	4
27-ASH	4	9 - 248	0	4
24A-ASH	4	44 - 236	0	4
23-ASH	4	112 - 727	1	4
20A-ASH	4	28 - 461	1	4
18-ASH	4	65 - 770	2	4
16A-ASH	1	166	0	1
16-ASH	4	128 - 2000	2	4
15M-ASH	2	162 - 228	0	2
15J-ASH	1	276	0	1
02B-ASH	1	411	1	1
02-SBA	4	231 - 866	2	4
15-ASH	4	38 - 291	0	4
07-ASH	4	59 - 1553	1	4
01-ASH	4	99 - 308	0	4
Total	**49**	_____	**10**	**49**

Seven stations had one or more *E.coli* measurements that failed to meet the state of New Hampshire Class B surface water quality standard (Figure 7). Several measurements were particularly elevated on 6/23/08 and 7/21/08. Intermittent rain on both dates, as well as rain three days prior to both dates were noted on the VRAP Field Data Sheets and may have contributed to the higher *E.coli* levels due to stormwater runoff and the flushing of wetland areas.

Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife (e.g., birds), and the presence of septic systems along the river

In order to fully determine whether a waterbody is meeting surface water standards for *E.coli* a geometric mean must be calculated. A geometric mean is calculated using three samples collected within a 60-day period. At 11 stations two geometric means were calculated. Of the 22 geometric means calculated 14 failed to meet the state of New Hampshire Class B geometric mean standard of 126 cts/100ml (Table 10).

Figure 7. *Escherichia coli* Statistics for the Ashuelot River Watershed
June 23 - September 15 2008, NHDES VRAP

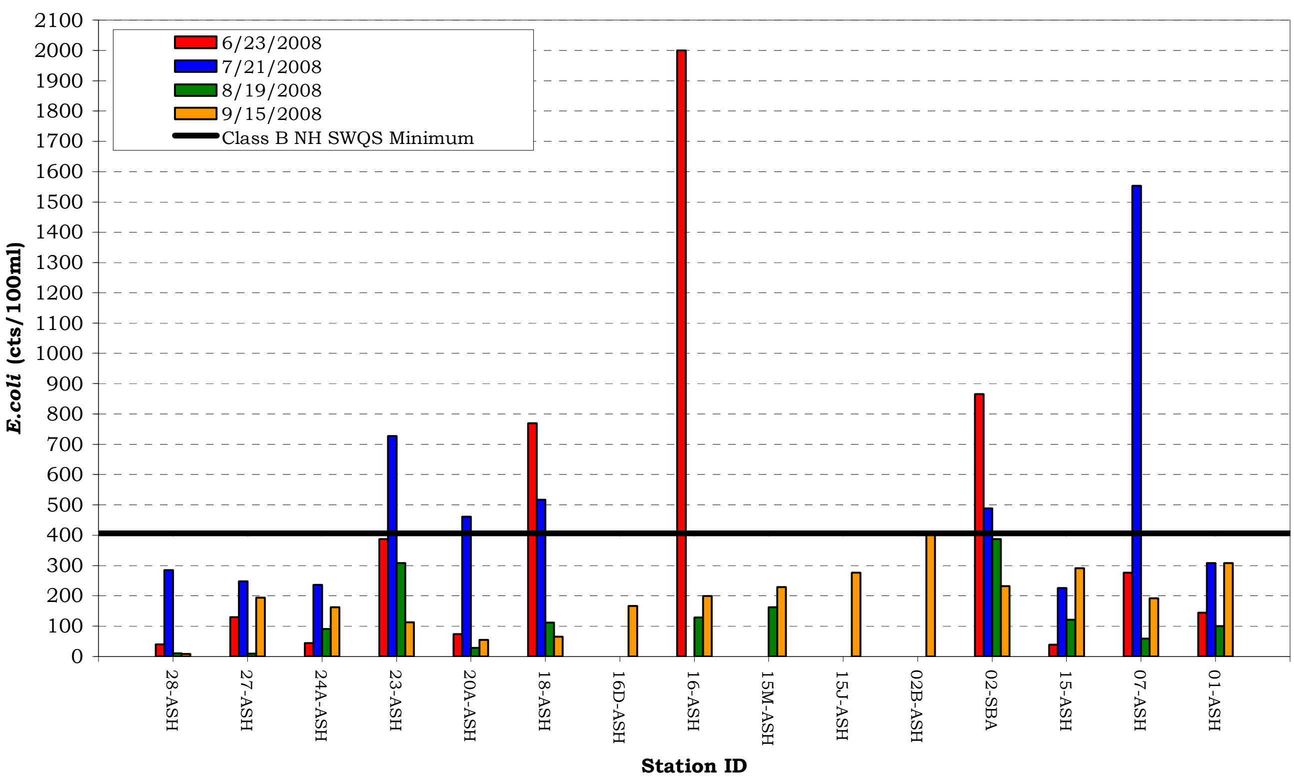


Table 10. *E. coli* Geometric Mean Data Summary – Ashuelot River, 2008

Station ID	Geometric Means Calculated	Geometric Mean 6/23/08 - 8/19/08	Geometric Mean 7/21/08 - 9/15/08	Geometric Means Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	2	48	28	0	2
27-ASH	2	66	76	0	2
24A-ASH	2	98	152	1	2
23-ASH	2	443	293	2	2
20A-ASH	2	98	89	0	2
18-ASH	2	354	155	2	2
16-ASH	2	831	385	2	2
02-SBA	2	547	352	2	2
15-ASH	2	101	199	1	2
07-ASH	2	294	260	2	2
01-ASH	2	164	211	2	2
Total	**22**	_____	_____	**14**	**22**

Recommendations

- Continue collecting three samples within any 60-day period during the summer to allow for determination of geometric means. Samples need only be collected during the critical period of May 24 to September 15 for assessment purposes. This coincides with the peak contact recreation season.

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling).

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling).At stations with particularly high bacteria levels volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated bacteria levels. Those sampling should also look for any potential sources of bacteria such as emission pipes, failed septic systems, farm animals, pet waste, wildlife and waterfowl.

4.7 Total Phosphorus

Between one and four samples were taken for total phosphorus at 15 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 11). Of the 49 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

There is no numeric standard for total phosphorus for Class B waters. The narrative standard states that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses." The NHDES "level of concern" for total phosphorous is 0.05 mg/L.

Table 11. Total Phosphorus Data Summary – Ashuelot River, 2008

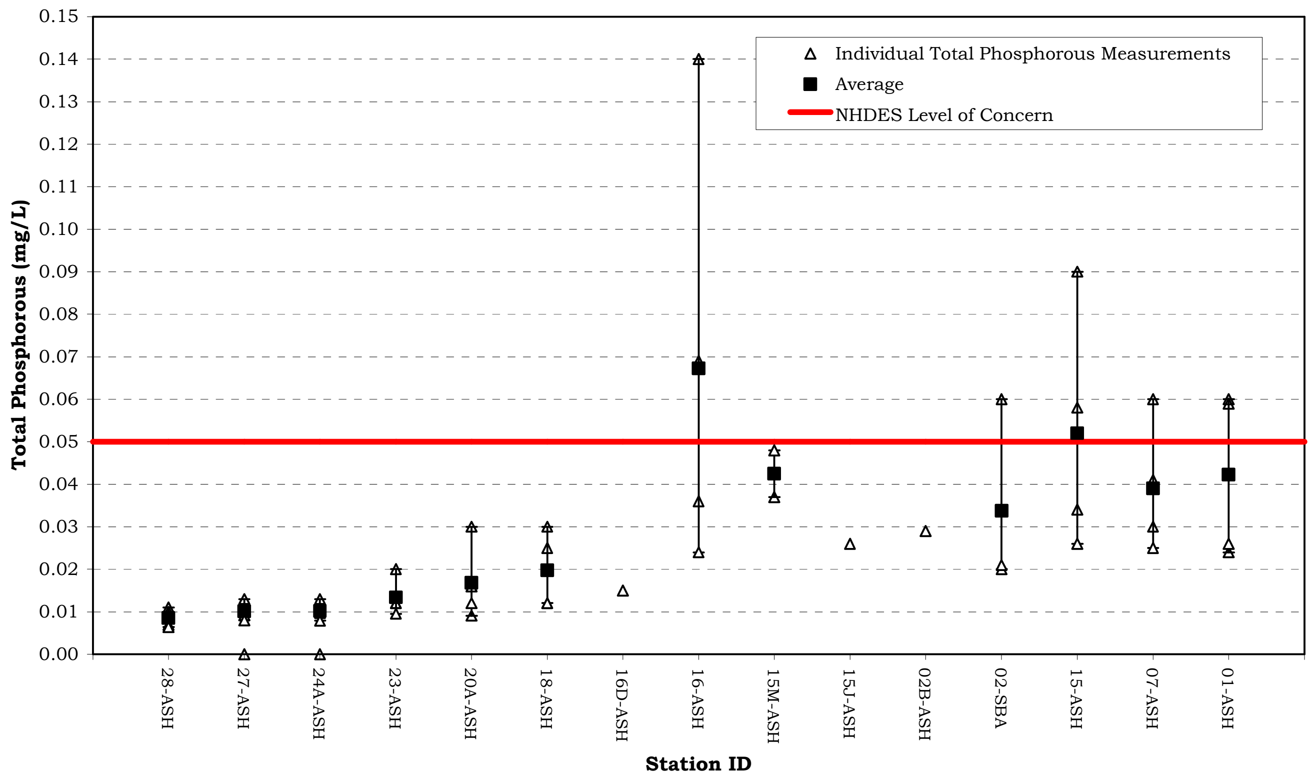
Station ID	Samples Collected	Data Range (mg/L)	Acceptable Samples Exceeding NHDES Level of Concern	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	4	0.0064 - 0.011	0	4
27-ASH	4	0.008 - 0.013	0	4
24A-ASH	4	0.0079 - 0.013	0	4
23-ASH	4	0.0095 - 0.020	0	4
20A-ASH	4	0.0091 - 0.030	0	4
18-ASH	4	0.012 - 0.030	0	4
16A-ASH	1	0.015 - 0.015	0	1
16-ASH	4	0.024 - 0.140	2	4
15M-ASH	2	0.037 - 0.048	0	2
15J-ASH	1	0.026 - 0.026	0	1
02B-ASH	1	0.029 - 0.029	0	1
02-SBA	4	0.020 - 0.060	1	4
15-ASH	4	0.026 - 0.090	2	4
07-ASH	4	0.025 - 0.060	1	4
01-ASH	4	0.024 - 0.060	2	4
Total	**49**	_____	**8**	**49**

Five stations had one or more total phosphorus levels that above the NHDES "level of concern" (Figure 8). In general, total phosphorus measurements tended to be higher in the mid to lower portion of the watershed.

Under undisturbed natural conditions phosphorus is at very low levels in aquatic ecosystems. Of the three nutrients critical for aquatic plant growth; potassium, nitrogen, and phosphorus, it is usually phosphorous that is the limiting factor to plant growth. When the supply of phosphorus is increased due to human activity, algae respond with significant growth.

A major source of excessive phosphorus concentrations in aquatic ecosystems can be wastewater treatment facilities, as sewage typically contains relatively high levels of phosphorus detergents. However, fertilizers used on lawns and agricultural areas can also contribute significant amounts of phosphorus.

Figure 8. Total Phosphorous Statistics for the Ashuelot River Watershed June 23 - September 15, 2008, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

4.8 Chloride

One sample was taken for chloride at four stations in the Ashuelot River watershed from Washington to Hinsdale (Table 12). Of the four samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for chloride is as follows:

Freshwater chronic criterion	230 mg/l
Freshwater acute criterion	860 mg/l

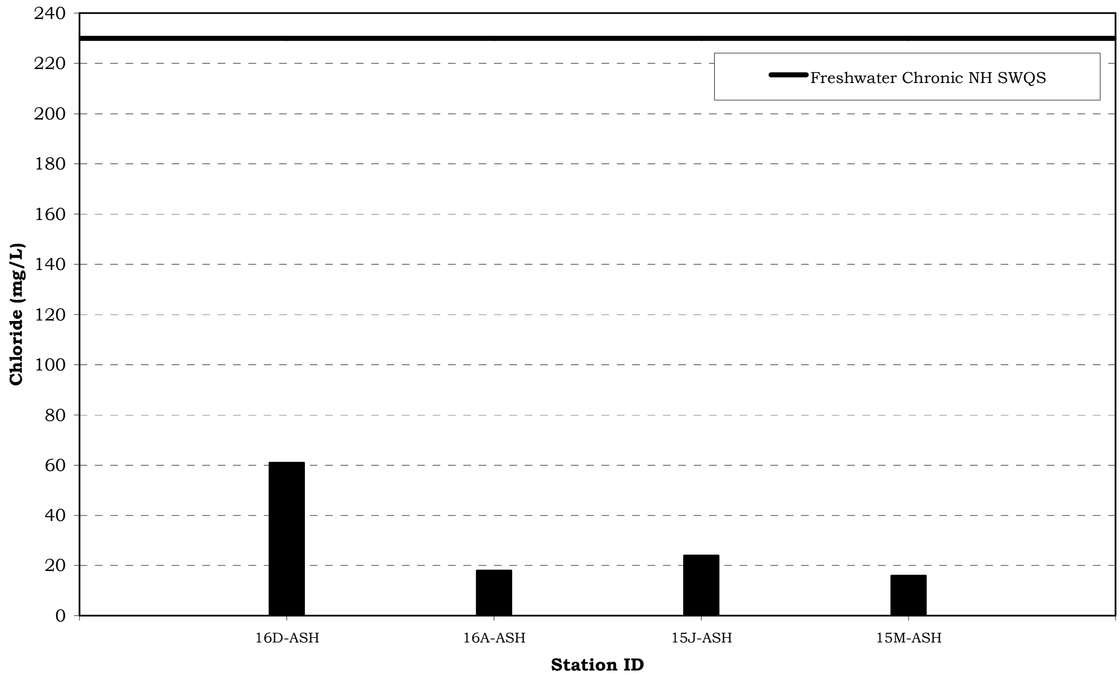
Table 12. Chloride Data Summary – Ashuelot River Watershed, 2008

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
16D-ASH	1	61	0	1
16A-ASH	1	18	0	1
15J-ASH	1	24	0	1
15M-ASH	1	16	0	1
Total	**4**	_____	**0**	**4**

All measurements were below the state of New Hampshire Class B chronic surface water quality standard (Figure 9).

Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. Road salt readily dissolves and enters aquatic environments in ionic forms. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans. Additional human sources of chloride can come from fertilizers, septic systems, and underground water softening systems.

Figure 9. Chloride Statistics for the Ashuelot River Watershed
December 10, 2008, NHDES VRAP



Recommendations

- Continue collecting chloride samples during both low-flow summer months and during snowmelt period in winter and early spring. It is critical that specific conductance be recorded when chloride samples are collected.

4.9 Cadmium

Five samples were collected for cadmium at 11 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 13). Of the 55 samples collected, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standards for cadmium are dependant on the hardness of the water. As in this case where station and date specific hardness values are not available, the 8 digit hydrologic unit code hardness median shall be used to calculate the hardness dependent critieria. The regional median hardness value for the Ashuelot River watershed is 15.9 mg/L.

Freshwater chronic criterion	0.00058 mg/l
Freshwater acute criterion:	0.00058 mg/L

The conventional methods used to collect these and most metal samples can be influenced by sample contamination. Sample contamination occurs from trace amounts of metals impacting and elevating the levels of a measurement. Sources of contamination include laboratory and sampling equipment, air and soil contamination, and residue from the individuals handling the samples.

NHDES takes into account a common contamination factor when comparing non-clean samples to the criteria threshold concentrations for the commonly contaminated metals. Using calculations outlined in the 2008 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM) we thus make a likely contamination adjustment to criteria for determining the freshwater criteria for cadmium using "non-clean" techniques:

Freshwater chronic criterion + Common Contamination Factor:	0.0083 mg/L
Freshwater acute criterion + Common Contamination Factor:	0.0084 mg/L

Table 13. Cadmium Data Summary – Ashuelot River Watershed, 2008

Station ID	Samples Collected	Data Range (mg/L)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	<0.00025	0	5
27-ASH	5	<0.00025	0	5
24A-ASH	5	<0.00025	0	5
23-ASH	5	<0.00025	0	5
20A-ASH	5	<0.00025	0	5
18-ASH	5	<0.00025 - 0.00070	0	5
16-ASH	5	<0.00025 - 0.00040	0	5
02-SBA	5	<0.00025	0	5
15-ASH	5	<0.00025	0	5
07-ASH	5	<0.00025	0	5
01-ASH	5	<0.00025 - 0.00030	0	5
Total	**55**	_____	0	**55**

Using the standard water quality criteria for cadmium, two samples at 18-ASH exceeded the freshwater acute water quality standard for cadmium. In all other cases the samples were below the laboratory detection limit and this detection limit was below the standard.

As these samples were collected without clean techniques NHDES will use the standard water quality criteria plus a common contamination factor to determine if the samples are exceeding the freshwater standard for cadmium. Those samples (such as at 18-ASH) between the standard criteria and the standard criteria plus the common contamination factor are flagged as "potentially not supporting".

Cadmium is found naturally in small quantities in air, water and soil. It can also me released into the air when household or industrial wastes are burned, from car exhaust, and from certain manufacturing processes.

Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends.
- NHDES and ARLAC should seek to sample those stations with measurements that exceed the standard criteria using clean techniques. The NHDES laboratory now has the ability to analyze metals samples collected using clean techniques.

4.10 Copper

Either four or five samples were collected for copper at 11 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 14). Of the 54 samples collected, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standards for copper are dependant on the hardness of the water. As in this case where station and date specific hardness values are not available, the 8 digit hydrologic unit code hardness median shall be used to calculate the hardness dependent critieria. The regional median hardness value for the Ashuelot River watershed is 15.9 mg/L.

Freshwater chronic criterion:	0.0019 mg/l
Freshwater acute criterion:	0.0025 mg/L

The conventional methods used to collect these and most metal samples can be influenced by sample contamination. Sample contamination occurs from trace amounts of metals impacting and elevating the levels of a measurement. Sources of contamination include laboratory and sampling equipment, air and soil contamination, and residue from the individuals handling the samples.

NHDES takes into account a common contamination factor when comparing non-clean samples to the criteria threshold concentrations for the commonly contaminated metals. Using calculations outlined in the 2008 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM) we thus make a likely contamination adjustment to criteria for determining the freshwater criteria for cadmium using "non-clean" techniques:

Freshwater chronic criterion + Common Contamination Factor:	0.0157 mg/L
Freshwater acute criterion + Common Contamination Factor:	0.0166 mg/L

Table 14. Copper Data Summary – Ashuelot River Watershed, 2008

Station ID	Samples Collected	Data Range (mg/L)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	<0.0025	0	5
27-ASH	5	<0.0025	0	5
24A-ASH	5	<0.0025 - 0.0026	0	5
23-ASH	5	<0.0025 - 0.0028	0	5
20A-ASH	5	<0.0025	0	5
18-ASH	4	<0.0025- 0.0046	0	4
16-ASH	5	<0.0025 - 0.0046	0	5
02-SBA	5	<0.0025 - 0.0028	0	5
15-ASH	5	<0.0025	0	5
07-ASH	5	<0.0025 – 0.0025	0	5
01-ASH	5	<0.0025 – 0.0041	0	5
Total	**54**	____	**0**	**54**

Using the standard water quality criteria for copper, stations 18-ASH, 16-ASH, 07-ASH and 01-ASH had at least one copper measurement that exceeded the freshwater acute water quality standard (Table 14). The laboratory detection limit for the standard method used to process these samples was 0.0025 mg/L. Since this detection limit is the same as the acute standard, any sample above the detection limit was also above the acute standard for copper. Those samples reported as less than the detection limit cannot be used for assessment purposes because the detection limit is at or above the water quality criteria.

As these samples were collected without clean techniques NHDES will use the standard water quality criteria plus a common contamination factor to determine if the samples are exceeding the freshwater standard for copper. Those samples between the standard criteria and the standard criteria plus the common contamination factor are flagged as "potentially not supporting".

Potential sources of elevated copper levels are the corrosion of plumbing, erosion of natural deposits, some mining activities, industrial pollution, and some domestic wastewaters.

Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends.

- NHDES and ARLAC should seek to sample those stations with measurements that exceed the standard criteria using clean techniques. The NHDES laboratory now has the ability to analyze metals samples collected using clean techniques.

4.13 Lead

Five samples were collected for lead at 11 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 15). Of the 55 samples collected, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standards for lead are dependant on the hardness of the water. As in this case where station and date specific hardness values are not available, the 8 digit hydrologic unit code hardness median shall be used to calculate the hardness dependent critieria. The regional median hardness value for the Ashuelot River watershed is 15.9 mg/L.

Freshwater chronic criterion:	0.0003 mg/L
Freshwater acute criterion:	0.0079 mg/L

The conventional methods used to collect these and most metal samples can be influenced by sample contamination. Sample contamination occurs from trace amounts of metals impacting and elevating the levels of a measurement. Sources of contamination include laboratory and sampling equipment, air and soil contamination, and residue from the individuals handling the samples.

NHDES takes into account a common contamination factor when comparing non-clean samples to the criteria threshold concentrations for the commonly contaminated metals. Using calculations outlined in the 2008 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM) we thus make a likely contamination adjustment to criteria for determining the freshwater criteria for cadmium using "non-clean" techniques:

Freshwater "non-clean" chronic criterion:	0.0048 mg/l
Freshwater "non-clean" acute criterion:	0.0182 mg/L

Table 15. Lead Data Summary – Ashuelot River Watershed, 2008

Station ID	Samples Collected	Data Range (mg/L)	Acceptable Samples Not Meeting NH Class B Standards for Clean and Non-Clean Techniques	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	<0.003	0	5
27-ASH	5	<0.003	0	5
24A-ASH	5	<0.003	0	5
23-ASH	5	<0.003	0	5
20A-ASH	5	<0.003	0	5
18-ASH	5	<0.003	0	5
16-ASH	5	<0.003	0	5
02-SBA	5	<0.003	0	5
15-ASH	5	<0.003	0	5
07-ASH	5	<0.003	0	5
01-ASH	5	<0.003	0	5
Total	**55**	_____	**0**	**55**

All stations had lead measurements that were below the detection limit on all occasions. However, this detection limit is above the standard chronic criteria for lead so no determinations can be made regarding water quality standards.

Potential sources of elevated lead levels are the erosion of natural deposits, industrial discharges, and presence of lead in the streambed from sources such as fishing lures or lead ammunition.

Recommendations

- Continue sampling at all stations, in order to develop a long-term data set to better understand trends as time goes on.

4.14 Zinc

Five samples were collected for zinc at 11 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 16). Of the 55 samples collected, all met quality assurance/quality control (QA/QC) requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standards for zinc are dependant on the hardness of the water. As in this case where station and date specific hardness values are not available, the 8 digit hydrologic unit code hardness median shall be used to calculate the hardness dependent critieria. The regional median hardness value for the Ashuelot River watershed is 15.9 mg/L.

Freshwater chronic criterion:	0.025 mg/l
Freshwater acute criterion:	0.025 mg/L

The conventional methods used to collect these and most metal samples can be influenced by sample contamination. Sample contamination occurs from trace amounts of metals impacting and elevating the levels of a measurement. Sources of contamination include laboratory and sampling equipment, air and soil contamination, and residue from the individuals handling the samples.

NHDES takes into account a common contamination factor when comparing non-clean samples to the criteria threshold concentrations for the commonly contaminated metals. Using calculations outlined in the 2008 Section 305(b) and 303(d) Consolidated Assessment and Listing Methodology (CALM) we thus make a likely contamination adjustment to criteria for determining the freshwater criteria for cadmium using "non-clean" techniques:

Freshwater "non-clean" chronic criterion:	0.074 mg/l
Freshwater "non-clean" acute criterion:	0.074 mg/L

Table 16. Zinc Data Summary – Ashuelot River Watershed, 2008

Station ID	Samples Collected	Data Range (mg/L)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	<0.009 – 0.010	0	5
27-ASH	5	<0.009 – 0.011	0	5
24A-ASH	5	<0.009 – 0.010	0	5
23-ASH	5	<0.009 – 0.024	0	5
20A-ASH	5	<0.009 – 0.010	0	5
18-ASH	5	<0.009 – 0.011	0	5
16-ASH	5	<0.009 – 0.017	0	5
02-SBA	5	<0.009	0	5
15-ASH	5	<0.009	0	5
07-ASH	5	<0.009 – 0.009	0	5
01-ASH	5	<0.009	0	5
Total	**55**	_____	0	**55**

Using the standard water quality criteria for zinc, all stations at all times were below the freshwater chronic water quality standard (Table 16). Station 23-ASH was 0.001 mg/L below the standard chronic criteria for zinc.

Potential sources of zinc are runoff from smelting and refining operations, industrial discharges, and weathering of bedrock. Zinc can also enter surface water via airborne sources such as atmospheric deposition as automobiles and fuel combustion.

Recommendations

- Continue sampling at all stations in order to develop a long-term dataset to better understand trends as time going on.

- NHDES and ARLAC should seek to sample those stations with measurements that are close to the standard criteria using clean techniques. The NHDES laboratory now has the ability to analyze metals samples collected using clean techniques.

APPENDIX A: 2008 ASHUELOT RIVER WATERSHED VRAP DATA

- Measurements not meeting New Hampshire surface water quality standards
- Total Phosphorous measurements exceeding NHDES level of concern
- Turbidity measuremets potentially not meeting New Hampshire surface water quality standards
- Metal samples listed as "potentially not supporting"
- Measurements not meeting NHDES quality assurance/quality control standards

[A] Hardness dependent metal. The water quality standard is caluculated based on hardness value. As in this case where site/date specific hardness values are not available, the 8 digit HUC hardness median shall be used to calulate the hardness dependent critieria. Regional median hardness value for the Ashuelot River watershed is 15.9 mg/L.

[B] Chronic water quality standard

28-ASH, Ashuelot River, Route 31, Washington

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	(µS/cm as chloride surrogate)	NA	<406	<126	NA	<0.00058[A,B] mg/L	<0.0019[A,B] mg/L	<0.00031[A,B] mg/L	<0.025[A,B] mg/L
05/17/08	07:43	9.51	92.4	4.37	0.6	25.8	14.3				<0.00025	<0.0025	<0.0030	0.01
06/23/08	07:40	7.82	86.4	4.96	1.2	27.9	20.3	40		0.011	<0.00025	<0.0025	<0.0030	<0.009
07/21/08	07:35	7.21	84.9	5.40	1.4	28.9	23.6	285		0.010	<0.00025	<0.0025	<0.0030	<0.009
08/19/08	00:00	7.72	87.5	4.77	0.9	20.4	21.6	10	48	0.007	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	07:46	8.50	91.2	5.06	0.9	23.8	18.8	8	28	0.006	<0.00025	<0.0025	<0.0030	<0.009

27-ASH, Ashuelot River, Mountain Road, Lempster

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	(µS/cm as chloride surrogate)	NA	<406	<126	NA	<0.00058[A,B] mg/L	<0.0019[A,B] mg/L	<0.00031[A,B] mg/L	<0.025[A,B] mg/L
05/17/08	08:42	9.85	92.1	4.38	0.5	30.7	12.3				<0.00025	<0.0025	<0.0030	0.009
06/23/08	08:20	8.02	85.7	4.81	1.0	33.2	18.4	130		0.013	<0.00025	<0.0025	<0.0030	<0.009
07/21/08	08:05	7.64	87.1	5.31	1.6	32.2	21.2	248		<0.010	<0.00025	<0.0025	<0.0030	0.011
08/19/08	00:00	7.95	87.4	4.86	1.0	25.3	20.0	9	66	0.009	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	08:10	8.45	89.5	4.49	1.0	32.6	18.3	194	76	0.008	<0.00025	<0.0025	<0.0030	<0.009

24A-ASH, Ashuelot River, Route 10, Marlow

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	(µS/cm as chloride surrogate)	NA	<406	<126	NA	<0.00058[A,B] mg/L	<0.0019[A,B] mg/L	<0.00031[A,B] mg/L	<0.025[A,B] mg/L
05/17/08	09:15	9.25	90.4	4.63	1.4	37.8	14.4				<0.00025	<0.0025	<0.0030	0.01
06/23/08	09:12	7.75	85.7	5.14	1.2	43.9	21.2	44		0.013	<0.00025	<0.0025	<0.0030	<0.009
07/21/08	08:40	7.39	88.0	5.48	1.0	39.4	24.2	236		<0.010	<0.00025	<0.0025	<0.0030	<0.009
08/19/08	00:00	7.99	90.3	4.85	1.1	34.4	21.4	91	98	0.010	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	08:48	8.69	94.0	4.89	0.9	30.8	19.2	162	152	0.008	<0.00025	<0.0025	<0.0030	<0.009

23-ASH, Asheulot River, Route 10, Gilsum

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	09:38	10.39	97.3	5.12	0.7	47.7	12.6				<0.00025	<0.0025	<0.0030	<0.009
06/23/08	09:44	8.70	92.2	5.79	1.9	71.9	18.2	387		0.012	<0.00025	0.0028	<0.0030	0.024
07/21/08	09:20	8.45	94.7	5.82	2.3	49.3	20.9	727		0.020	<0.00025	<0.0025	<0.0030	<0.009
08/19/08	00:00	8.59	94.1	5.42	2.1	41.3	19.7	308	443	0.012	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	09:25	9.01	96.7	5.34	0.7	33.3	18.8	112	293	0.010	<0.00025	<0.0025	<0.0030	<0.009

20A-ASH, Ashuelot River, Stone Arch Bridge, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	08:00	9.06	87.2	6.31	1.3	57.5	13.5				<0.00025	<0.0025	<0.0030	<0.009
06/23/08	07:30	7.80	81.2	6.40	1.7	78.5	19.9	73		0.016	<0.00025	<0.0025	<0.0030	0.01
07/21/08	07:15	6.49	76.0	6.08	3.9	64.6	23.1	461		0.030	<0.00025	<0.0025	<0.0030	<0.009
08/19/08	00:00	7.20	88.2	5.78	1.3	50.5	20.5	28	98	0.009	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	08:30	8.53	92.0	5.68	1.9	46.8	19.0	55	89	0.012	<0.00025	<0.0025	<0.0030	<0.009

18-ASH, Ashuelot River, Route 101, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	09:07	9.11	90.0	6.55	1.9	106.6	14.7				<0.00025	0.0046	<0.0030	0.011
06/23/08	08:10	7.63	83.3	6.50	4.0	175.0	19.6	770		0.025	0.00070		<0.0030	0.011
07/21/08	07:42	6.72	79.5	6.33	2.8	128.5	23.7	517		0.030	0.00040	<0.0025	<0.0030	<0.009
08/19/08	00:00	7.66	88.6	5.79	1.6	80.7	20.9	111	354	0.012	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	09:10	8.37	90.2	5.85	1.6	63.6	19.0	65	155	0.012	<0.00025	<0.0025	<0.0030	<0.009

16AD-ASH, 50 Feet Upstream of Keene WWTF, Swanzey

Date	Time of Sample	Chloride (mg/L)
Standard	**NA**	**230B**
12/10/08	9:15	61

16A-ASH, Ashuelot River, 10' Downstream of Confluence with South Branch Ashuelot River

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**NA**	**230[B]**
09/15/08	12:50	8.97	97.4	~~6.50~~	2.2	72.4	19.3	166	0.015	18

16-ASH, Ashuelot River, Cresson Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	10:05	9.15	88.0	6.56	3.3	126.2	13.6				<0.00025	<0.0025	<0.0030	0.010
06/23/08	09:12	7.45	80.8	6.52	4.1	156.0	19.2	2000		0.069	<0.00025	0.0045	<0.0030	<0.009
07/21/08	09:00	6.50	74.5	6.31	26.0	142.6	22.2	2241		0.140	0.00040	0.0046	0.0048	0.017
08/19/08	00:00	7.25	80.5	5.91	2.4	108.9	20.2	128	831	0.036	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	09:45	8.28	88.8	5.90	2.6	78.6	18.8	199	385	0.024	<0.00025	<0.0025	<0.0030	<0.009

15M-ASH, Ashuelot River, Intersection of Route 10 and Winchester Street, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**NA**	**230[B]**
08/19/08	09:31	7.83	87.8	5.99	1.6	100.6	21.0	162	0.037	
09/15/08	08:54	8.44	89.7	~~5.91~~	2.3	88.1	18.2	228	0.048	
12/10/08										16

15J-ASH, Ashuelot River, Upstream of Faulkner's Garden, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**NA**	**230[B]**
09/15/08	08:00	8.70	92.3	~~6.19~~	2.5	79.5	18.1	276	0.026	
12/10/08	9:35									24

02B-SBA, South Branch Ashuelot River, Upstream of Monadnock Regional High School, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	Total Phosphorus (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**NA**
09/15/08	09:35	8.39	89.3	~~5.86~~	2.1	95.8	18.4	411	0.029

02-SBA, South Branch Ashuelot River, Route 32 Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	09:35	9.35	87.9	6.51	1.5	79.3	12.6				<0.00025	<0.0025	<0.0030	<0.009
06/23/08	08:50	8.24	87.6	6.49	4.4	93.3	18.2	866		0.034	<0.00025	0.0028	<0.0030	<0.009
07/21/08	08:15	7.35	84.4	6.53	4.6	98.5	22.2	488		0.060	<0.00025	<0.0025	<0.0030	<0.009
08/19/08	00:00	7.80	80.0	5.75	3.0	77.7	19.5	387	547	0.020	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	10:30	8.11	86.8	5.66	2.5	58.5	18.6	231	352	0.021	<0.00025	<0.0025	<0.0030	<0.009

15-ASH, Ashuelot River, Thompson Bridge, West Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	09:45	9.72	94.4	5.86	1.7	126.5	14.0				<0.00025	<0.0025	<0.0030	<0.009
06/23/08	10:25	7.39	82.5	6.01	2.4	166.3	20.6	38		0.058	<0.00025	<0.0025	<0.0030	<0.009
07/21/08	09:35	6.36	74.0	5.92	3.3	175.2	23.6	225		0.090	<0.00025	<0.0025	<0.0030	<0.009
08/19/08	00:00	7.32	83.7	5.87	2.1	105.2	20.8	121	101	0.034	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	09:25	8.36	89.3	5.90	3.0	83.0	18.4	291	199	0.026	<0.00025	<0.0025	<0.0030	<0.009

07-ASH, Ashuelot River, Route 119, Winchester

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Water Temp. (°C)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	09:10	9.87	95.9	5.88	1.6	122.4	14.2				<0.00025	0.0025	<0.0030	0.009
06/23/08	09:30	7.96	87.4	6.20	2.8	135.7	19.8	276		0.041	<0.00025	<0.0025	<0.0030	<0.009
07/21/08	08:40	6.87	79.8	5.91	3.4	131.8	22.8	1553		0.060	<0.00025	<0.0025	<0.0030	<0.009
08/19/08	00:00	7.56	81.6	5.96	2.4	98.8	20.5	59	294	0.030	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	08:50	8.50	92.0	6.04	2.4	84.3	18.8	192	260	0.025	<0.00025	<0.0025	<0.0030	<0.009

01-ASH, Ashuelot River, 147 River Street, Hinsdale

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Cadmium	Copper	Lead	Zinc
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**<0.00058[A,B] mg/L**	**<0.0019[A,B] mg/L**	**<0.00031[A,B] mg/L**	**<0.025[A,B] mg/L**
05/17/08	07:40	10.16	96.3	6.20	1.6	116.2	12.8				<0.00025	<0.0025	<0.0030	0.009
06/23/08	08:34	8.84	96.1	6.78	2.3	150.3	19.4	145		0.059	0.00030	<0.0025	<0.0030	<0.009
07/21/08	08:05	8.03	95.4	6.61	2.6	145.8	24.0	308		0.060	<0.00025	0.0041	<0.0030	<0.009
08/19/08	00:00	8.21	92.0	6.45	2.1	91.3	20.4	99	164	0.024	<0.00025	<0.0025	<0.0030	<0.009
09/15/08	08:15	9.36	100.2	6.39	2.1	75.2	18.8	308	211	0.026	<0.00025	<0.0025	<0.0030	<0.009

APPENDIX B:
Interpreting VRAP Water Quality Monitoring Parameters

Chemical Parameters

Dissolved Oxygen (DO)

- **Unit of Measurement:** concentration in milligrams per liter (mg/L) and percent saturation (%).
- **Description:** A measure of the amount of oxygen in the water: Concentration is a measure of the amount of oxygen in a volume of water; saturation is a measurement of the amount of oxygen in the water compared to the amount of oxygen the water can actually hold at full saturation. Both of these measurements are necessary to accurately determine whether New Hampshire surface water quality standards are met.
- **Importance**: Oxygen is dissolved into the water from the atmosphere, aided by wind and wave action, or by rocky, steep, or uneven stream beds. The presence of dissolved oxygen is vital to bottom-dwelling organisms as well as fish and amphibians. Aquatic plants and algae produce oxygen in the water during the day, and consume oxygen during the night. Bacteria utilize oxygen both day and night when they process organic matter into smaller and smaller particles.

Class A NH Surface Water Quality Standard: 6 mg/L at any place or time, or 75% minimum daily average – (unless naturally occurring).

Class B NH Surface Water Quality Standard: 5 mg/L at any place or time or 75% minimum daily average – (unless naturally occurring).

Several measurements of oxygen saturation taken in a 24-hour period must be averaged to compare to the 75 percent daily average saturation standard. The concentration of dissolved oxygen is dependent on many factors including temperature and sunlight, and tends to fluctuate throughout the day. Saturation values are averaged because a reading taken in the morning may be low due to respiration, while a measurement that afternoon may show that the saturation has recovered to acceptable levels. Water can become saturated with more than 100 percent dissolved oxygen.

pH

- **Unit of Measurement:** units (no abbreviation).
- **Description:** A measure of hydrogen ion activity in water, or, in general terms, the acidity of water. pH is measured on a logarithmic scale of 0 to 14, with 7 being neutral. A high pH indicates alkaline (or basic) conditions and a low pH indicates acidic conditions. pH is influenced by geology and soils, organic acids (decaying leaves and other matter), and human-induced acids from acid rain (which typically has a pH of 3.5 to 5.5).
- **Importance:** pH affects many chemical and biological processes in the water and this is important to the survival and reproduction of fish and other aquatic life. Different organisms flourish within different ranges of pH. Measurements outside of an organism's preferred range can limit growth and reproduction and lead to physiological stress. Low pH can also affect the toxicity of aquatic compounds such as ammonia and certain metals by making them more "available" for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life.

Class A NH Surface Water Quality Standard: Between 6.5 and 8.0 (unless naturally occurring).

Class B NH Surface Water Quality Standard: Between 6.5 and 8.0 (unless naturally occurring).

Sometimes, readings that fall below this range are determined to be naturally occurring. This is often a result of wetlands near the sample station. Wetlands can lower pH because the tannic and humic acids released by decaying plants can cause water to become more acidic.

pH Units	Category
<5.0	High Impact
5.0 – 5.9	Moderate to High Impact
6.0 – 6.4	Normal; Low Impact
6.5 – 8.0	Normal;
6.1 – 8.0	Satisfactory

Specific Conductance or Conductivity

- **Unit of Measurement:** micromhos per centimeter (umhos/cm) or microsiemens per centimeter (uS/cm).
- **Description:** The numerical expression of the ability of water to carry an electrical current at 25° C and a measure of free ion (charged particles) content in the water. These ions can come from natural sources such as bedrock, or human sources such as stormwater runoff. Specific conductance can be used to indicate the presence of chlorides, nitrates, sulfates, phosphates, sodium, magnesium, calcium, iron, and aluminum ions. There is a difference between conductivity and specific conductance. Specific conductance measures the free ion content of water at a *specific* water temperature, whereas conductivity measures the free ion content of water at 25° C. VRAP uses the term "specific conductance" because our conductivity measurements account for temperature. In some studies and programs, the term "conductivity" is used. This term should only be used when the measurement *does not* adjust to a specific temperature.
- **Importance:** Specific conductance readings can help locate potential pollution sources because polluted water usually has a higher specific conductance than unpolluted waters. High specific conductance values often indicate pollution from road salt, septic systems, wastewater treatment plants, or urban/agricultural runoff. Specific conductance can also be related to geology. In unpolluted rivers and streams, geology and groundwater are the primary influences on specific conductance levels.

Class A NH Surface Water Quality Standard: No numeric standard.

Class B NH Surface Water Quality Standard: No numeric standard.

Although there is no formal standard for specific conductance, data collect by VRAP groups and NHDES indicated a very close relationship between specific conductance levels and chloride. In some cases NHDES can use specific conductance measurements as a surrogate for chloride levels. The data collected by NHDES indicate that the chronic chloride standard is correlated with a specific conductance level of approximately 850 µS/cm.

Specific Conductance *(uS/cm)*	**Category**
0 – 100	Normal
101 – 200	Low Impact
201 – 500	Moderate Impact
> 501	High Impact
> 850	Likely exceeding chronic chloride standard

Turbidity

- **Unit of Measurement:** Nephelometric Turbidity Units (abbreviated at NTU).
- **Description:** A measurement of the amount of suspended material in the water. This material, which is comprised of particles such as clay, silt, algae, suspended sediment, and decaying plant material, causes light to be scattered and absorbed, rather than transmitted in straight lines through the water.
- **Importance:** Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces dissolved oxygen (DO) concentrations because warm water holds less DO than cold water. Higher turbidity also reduces the amount of light that can penetrate the water, which reduces photosynthesis and DO production. Suspended materials can clog fish gills, reducing disease resistance, lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates. Clean waters are generally associated with low turbidity, but there is a high degree of natural variability involved. Rain events can increase turbidity in surface waters by flushing sediment, organic matter and other materials into the water. Human activities such as vegetation removal and soil disruption can also lead to dramatic increases in turbidity levels.

Class A NH Surface Water Quality Standard: As naturally occurs.

Class B NH Surface Water Quality Standard: Shall not exceed naturally occurring conditions bv more than 10 NTU.

Physical Parameters

Temperature

- **Unit of Measurement:** Degrees Celsius (° C)
- **Importance:** Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and bacteria activity in water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

  A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and groundwater.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard

Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Chlorophyll-a (Chlor a)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** An indicator of the biomass, or abundance, of planktonic algae in the river. The technical term "biomass" is used to represent "amount by weight." Chlorophyll-a can be strongly influenced by phosphorus, which is derived by natural and human activities.

Importance: Because algae is a plant and contains the green pigment chlorophyll-a, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae. If the chlorophyll-a concentration increases, this indicates an increase in the algal population.

Class A NH Surface Water Quality Standard: No numeric standard.

Class B NH Surface Water Quality Standard: No numeric standard.

Chlorophyll-a *(mg/L)*	**Category**
< 3	Excellent
3 – 7	Good
7 – 15	Less than desirable
> 15	Nuisance

Total Phosphorus (TP)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** A measure of all forms of phosphorus in the water, including inorganic and organic forms. There are many sources of phosphorus, both natural and human. These include soil and rocks, sewage, animal manure, fertilizer, erosion, and other types of contamination.
- **Importance:** Phosphorus is a nutrient that is essential to plants and animals. However, excess amounts can cause rapid increases in the biological activity in water. Phosphorus is usually the "limiting nutrient" in freshwater streams, which means relatively small amounts can increase algae and chlorophyll-a levels. Algal blooms and/or excessive aquatic plant growth can decrease oxygen levels and make water unattractive. Phosphorus can indicate the presence of septic systems, sewage, animal waste, lawn fertilizer, road and construction erosion, other types of pollution, or natural wetlands and atmospheric deposition.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard; as naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses.

Total Phosphorus *(mg/L)*	**Category**
< 0.010	Ideal
0.011 – 0.025	Average
0.026 – 0.050	More than desirable
> 0.051	Excessive (potential nuisance concentration)

Total Kjeldahl Nitrogen (TKN)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** A measure of the amount of ammonia and organic nitrogen in the water.
- **Importance:** High nitrogen levels can increase algae and chlorophyll-a levels in the river, but is generally less of a concern in fresh water than phosphorus. Nitrogen can indicate the presence of sewage, animal waste, fertilizer, erosion, or other types of pollution.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard; as naturally occurring, shall contain no nitrogen in such concentrations that would impair any existing or designated uses.

TKN *(mg/L)*	**Category**
< 0.25	Ideal
0.26 – 0.40	Average
0.41 – 0.50	More than desirable
> 0.51	Excessive (potential nuisance concentration)

Other Parameters

Chloride

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** The chloride ion (Cl-) is found naturally in some surface waters and groundwater. It is also found in high concentrations in seawater. Higher-than-normal chloride concentrations in freshwater is detrimental to water quality. In New Hampshire, applying road salt for winter accident prevention is a large source of chloride to the environment. Unfortunately, this has increased over time due to road expansion and increased vehicle traffic. Road salt (most often sodium chloride) readily dissolves and enters aquatic environments in ionic forms. Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Sodium chloride is also used on foods as table salt, and consequently is present in human waste. Thus, sometimes chloride in water can indicate sewage pollution. Saltwater intrusion can also elevate groundwater chlorides in drinking water wells near coastlines. Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans.
- **Importance:** Research shows elevated chloride levels can be toxic to freshwater aquatic life. Among the species tested, freshwater aquatic plants and invertebrates tend to be the most sensitive to chloride. In order to protect freshwater aquatic life in New Hampshire, the state has adopted acute and chronic chloride criteria.

Acute Standard: 860 mg/L.

Chronic Standard: 230 mg/L.

Escherichia Coliform Bacteria *(E. coli)*

- **Unit of Measurement:** Counts per 100 milliliter (cts/100 mL).
- **Description:** An indicator of the potential presence of pathogens in fresh water. *E. coli* bacteria is a normal component in the large intestines of humans and other warm-blooded animals, and can be excreted in their fecal material. Organisms causing infections or disease (pathogens) are often excreted in the fecal material of humans and other warm-blooded animals.
- **Importance:** *E.coli* bacteria is a good indicator of fecal pollution and the possible presence of pathogenic organisms. In freshwater, *E. coli* concentrations help determine if the water is safe for recreational uses such as swimming.

  Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife, and the presence of septic systems along the river.

Class A NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 47 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 153 *E.coli* cts/100 mL in any one sample.

Class B NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 126 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 406 *E.coli* cts/100 mL in any one sample.

Metals

Depending on the metal concentration, its form (dissolved or particulate), and the hardness of the water, trace metals can be toxic to aquatic life. Metals in dissolved form are generally more toxic than metals in the particulate form. The dissolved metal concentration is dependent on pH, as well as the presence of solids and organic matter that can bind with the metal to render it less toxic.

Hardness is primarily a measure of the calcium and magnesium ion concentrations in water, expressed as calcium carbonate. The hardness concentration affects the toxicity of certain metals. New Hampshire water quality regulations include numeric criteria for a variety of metals. Since dissolved metals are typically found in extremely low concentrations, the potential contamination of samples collected for trace metals analyses has become a primary concern of water quality managers. To prevent such contamination and to ensure reliable results, the use of “clean techniques” is becoming more and more frequent when sampling for dissolved metals. Because of this, sampling for metals may be more costly and require additional effort than in the past.

New Hampshire Volunteer River Assessment Program

29 Hazen Drive – PO Box 95
Concord, NH 03302-0095
p (603) 271-0699 – f (603) 271-7894
www.des.nh.gov

2008

APPENDIX C:

2008 VRAP Field Audit

On August 19, 2008 VRAP staff visited volunteers from the Ashuelot River VRAP group to conduct a field audit. VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group is notified of the result of the verification visit. During the visit, volunteers were assessed in the following five categories:

1) **Overall Sampling Procedures**

   Appropriate storage of meters, sample collection, laboratory sample collection and transportation, beginning and end of day meter checks, collecting a field replicate, performing QA/QC Meter Checks, and ensuring that all calibration and sampling data are properly documented on the 2008 VRAP Field Data Sheet and the Laboratory Services Login & Custody Sheet.

2) **Turbidity**

   Inspecting and cleaning of glass turbidity vials prior to measurement of standards and samples, performing the *Initial Turbidity Meter Check,* calibrating the meter to a known standard at the beginning of the sampling day, recording the value of the DI turbidity blank *(QA/QC Meter Check)* once during the sampling day, and performing the *End of the Day Meter Check* at the conclusion of the sampling day.

3) **pH**

   Inspecting the pH electrode prior to sampling, calibrating to both pH 7.0 and 4.0 buffers prior to each measurement, rinsing and wiping the pH electrode probe prior to and after the measurement of standards and samples, allowing the pH measurement to stabilize prior to recording the measurement, and recording the value of the 6.0 buffer *(QA/QC Meter Check)* once during the sampling day.

4) **Water Temperature/Dissolved Oxygen**

   Ensuring that the meter is allowed an adequate time to stabilize prior to the first calibration, the meter is calibrated prior to each measurement, the calibration value is properly recorded, the chamber reading is properly recorded, that sufficient time is allowed for readings to stabilize, and that a zero oxygen check (*QA/QC Meter Check)* is completed during the sampling day.

5) **Specific Conductance**

   Performing the *Initial Conductivity Meter Check* using a known standard, allowing for the meter to properly stabilize before recording measurements, properly cleaning the probe between stations, and performing the *End of the Day Meter Check* at the conclusion of the sampling day.

During the field sampling procedures assessment, VRAP staff offered important reminders and suggestions to ensure proper sampling techniques and re-trained volunteers in the areas needing improvement. Afterwards, the volunteers were sent a follow-up e-mail providing written reminders and suggestions of the methods that need improvement. Overall, the Ashuelot River VRAP group did an excellent job. It is important to ensure that all volunteers attend an annual VRAP training workshop prior to the sampling season and to familiarize themselves with proper sampling techniques. Please remember to schedule an annual field audit in 2009.

APPENDIX D:
New Hampshire Watershed Report Cards
Built from the 2008 305(b)/303(d) Surface Water Quality Reports

305(b)/303(d) Integrated Report Background
http://des.nh.gov/organization/divisions/water/wmb/swqa/

The Surface Water Quality Assessment Program produces two surface water quality documents every two years, the "305(b) Report" and the "303(d) List". As the two documents use the same data and assessment methodology, the 305(b) Report and 303(d) List were combined into one Integrated Report. The Integrated Report describes the quality of New Hampshire's surface waters and an analysis of the extent to which all such waters provide for the protection and propagation of a balanced population of shellfish, fish, and wildlife, and allow recreational activities in and on the water.

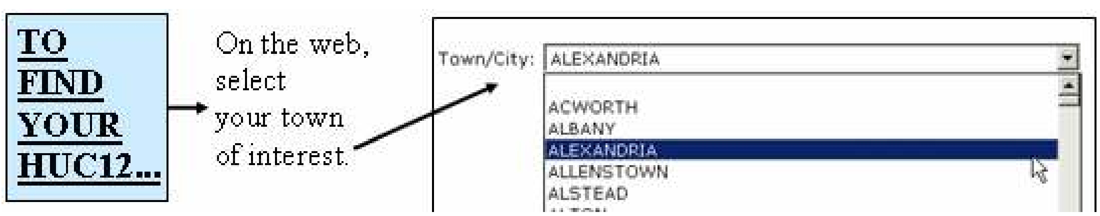
Each Watershed Report Card covers a single 12 digit Hydrologic Unit Code (HUC12), on average a 34 square mile area. Each Watershed Report Card has three components;

1. **Report Card:** A one page card that summarizes the overall use support for Aquatic Life, Primary Contact (i.e. Swimming), and Secondary Contact (i.e. Boating) Designated Uses on every Assessment Unit ID (AUID) within the HUC12.

2. **HUC 12 Map:** A map of the watershed with abbreviated labels for each AUID within the HUC12.

3. **Assessment Details:** Anywhere from one to forty pages with the detailed assessment information for each and every AUID in the Report Card and Map.

How to Find Your HUC12 Watershed Report Card:
http://des.nh.gov/organization/divisions/water/wmb/swqa/report_cards.htm
then go to: http://www2.des.nh.gov/SWQA



What are Assessment Units?

Each waterbody is divided into smaller segments called Assessment Units (AUs). In general, AUs are the basic unit of record for conducting and reporting the results of all water quality assessments. AUs are intended to be representative of homogenous segments: consequently, sampling stations within an AU can be assumed to be representative of the segment. Many factors can influence the homogeneity of a segment. Factors used to establish homogenous

AUs for assessments include: waterbody type, HUC12 boundaries, water quality standards, pollutant sources, Maximum AU size for rivers and streams, major changes in land use, stream order/location of major tributaries, public water supplies, outstanding resource waters, shellfish program categories, designated beaches, and cold water fish spawning areas.

Assessment Unit IDs (AUIDs) for each of the stations your group monitored in 2008 can be found in the sampling station table in this year's VRAP report. Similarly, a list of all current and historic sampling stations for your group can be found on the VRAP webpage at http://des.nh.gov/organization/divisions/water/wmb/vrap/index.htm.

How are the Surface Water Quality Assessment Determinations Made?

All readily available data with reliable Quality Assurance/Quality Control is used in the biennial surface water quality assessments. For a full understanding of how the Surface Water Quality Standards (Env-Wq 1700) are translated into surface water quality assessments we urge the reader to review the 2008 Consolidated Assessment and Listing Methodology (CALM) at
http://des.nh.gov/organization/divisions/water/wmb/swqa/2008/index.htm (Appendices 4 & 5)

Where Can I find More Advanced Resources?

Additional resources including GIS shapefiles (Appendix 12) of all AUIDs in a sortable EXCEL file (Appendix 22) of the detailed assessments are available at
http://des.nh.gov/organization/divisions/water/wmb/swqa/2008/index.htm.

How Are Assessments Coded in the Report Card?

Assessment outcomes are displayed on a color scale as well as an alpha numeric scale that provides additional distinctions for the designated use and Parameter level assessments as outlined in the table below.

		Severe	**Poor**	**Likely Bad**	**No Data**	**Likely Good**	**Marginal**	**Good**
		Not Supporting, Severe	Not Supporting, Marginal	Insufficient Information – Potentially Not Supporting	No Data	Insufficient Information – Potentially Full Supporting	Full Support, Marginal	Full Support, Good
Category	**Description**							
*Category 2	Meets standards						2-M or 2-OBS	2-G
Category 3	Insufficient Information			3-PNS	3-ND	3-PAS		
Category 4	Does not Meet Standards;							
4A	TMDL^ Completed	4A-P	4A-M or 4A-T					
4B	Other enforceable measure will correct the issue.	4B-P	4B-M or 4B-T					
4C	Non-pollutant (i.e. exotic weeds)	4C-P	4C-M					
Category 5	TMDL^ Needed	5-P	5-M or 5-T					

* "Category 1" only exists at the Assessment Unit Level.
^ TMDL stands for Total Maximum Daily Load studies (http://des.nh.gov/organization/divisions/water/wmb/tmdl/index.htm)

For More Information:

Ken Edwardson, NHDES Surface Water Quality Assessment Program Coordinator
(603) 271-8864 - Kenneth.Edwardson@des.nh.gov

WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010101

HUC 12 NAME ASHUELOT POND

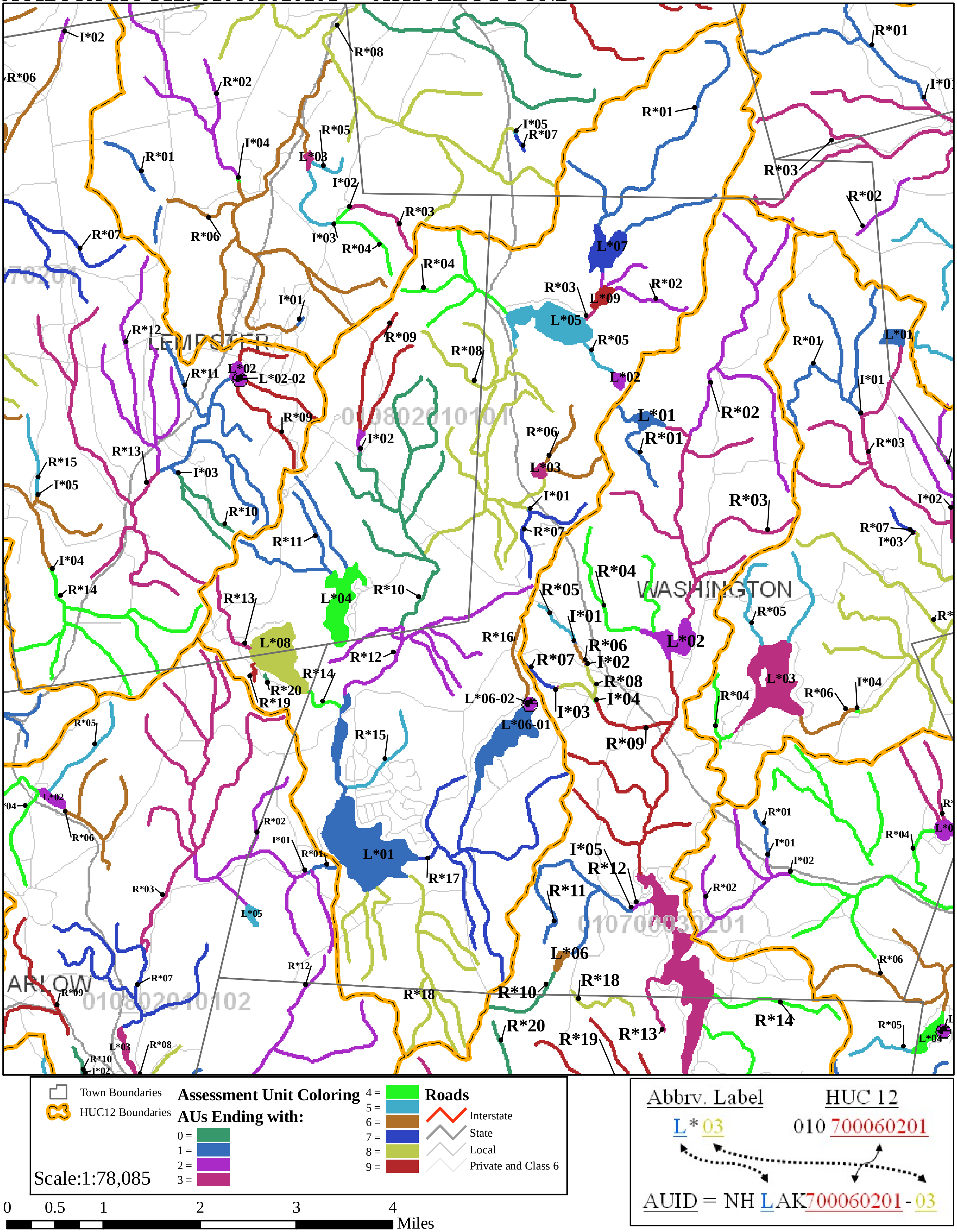
(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good		Full Support Good
Marginal		Full Support Marginal
Likely Good		Insufficient Information – Potentially Full Support
No Data		No Data
Likely Bad		Insufficient Information – Potentially Not Support
Poor		Not Support Marginal
Severe		Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010101-01	I*01	UNKNOWN RIVER - SAUNDERS DAM	3-ND	3-ND	3-ND	4A-M
NHIMP802010101-02	I*02	RICHARDSON BROOK - RICHARDSON BROOK POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010101-01	L*01	ASHUELOT POND	5-M	2-G	2-G	4A-M
NHLAK802010101-02	L*02	BACON POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010101-03	L*03	FLETCHER POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010101-04	L*04	LONG POND	4A-P	2-G	2-G	4A-M
NHLAK802010101-05	L*05	MAY POND	4A-P	2-G	2-G	4A-M
NHLAK802010101-06-01	L*06-01	MILLEN POND	4A-P	2-G	2-G	4A-M
NHLAK802010101-06-02	L*06-02	MILLEN POND - TOWN BEACH	5-M	5-P	2-G	4A-M
NHLAK802010101-07	L*07	NORTH POND	3-PAS	2-G	2-G	4A-M
NHLAK802010101-08	L*08	SAND POND	4A-P	2-G	2-G	4A-M
NHLAK802010101-09	L*09	MILL POND	3-PNS	3-PAS	3-ND	4A-M
NHRIV802010101-01	R*01	ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-02	R*02	ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-03	R*03	ASHUELOT RIVER	5-P	3-PAS	3-PAS	4A-M
NHRIV802010101-04	R*04	UNNAMED BROOKS - TO BUTTERFIELD POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-05	R*05	UNNAMED BROOK - FROM BACON POND TO MAY POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-06	R*06	UNNAMED BROOK - TO FLETCHER POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-07	R*07	UNNAMED BROOKS - TO SAUNDERS DAME	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-08	R*08	ASHUELOT RIVER	5-P	5-P	2-M	4A-M
NHRIV802010101-09	R*09	RICHARDSON BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-10	R*10	ASHUELOT RIVER - RICHARDSON BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-11	R*11	UNNAMED BROOKS - TO LONG POND	5-P	3-PAS	3-PAS	4A-M
NHRIV802010101-12	R*12	ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-13	R*13	UNNAMED BROOK - TO SAND POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010101-14	R*14	UNNAMED BROOK - FROM SAND POND TO ASHUELOT POND	5-M	3-ND	3-ND	4A-M
NHRIV802010101-15	R*15	UNNAMED BROOK - TO ASHUELOT POND	5-P	3-ND	3-ND	4A-M
NHRIV802010101-16	R*16	UNNAMED BROOK - TO MILLEN LAKE	5-P	3-ND	3-ND	4A-M
NHRIV802010101-17	R*17	UNNAMED BROOKS - TO ASHUELOT LAKE	5-P	3-ND	3-ND	4A-M

AUIDs for HUC12: 010802010101 - ASHUELOT POND



WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010102

HUC 12 NAME MARLOW TRIBUTARIES

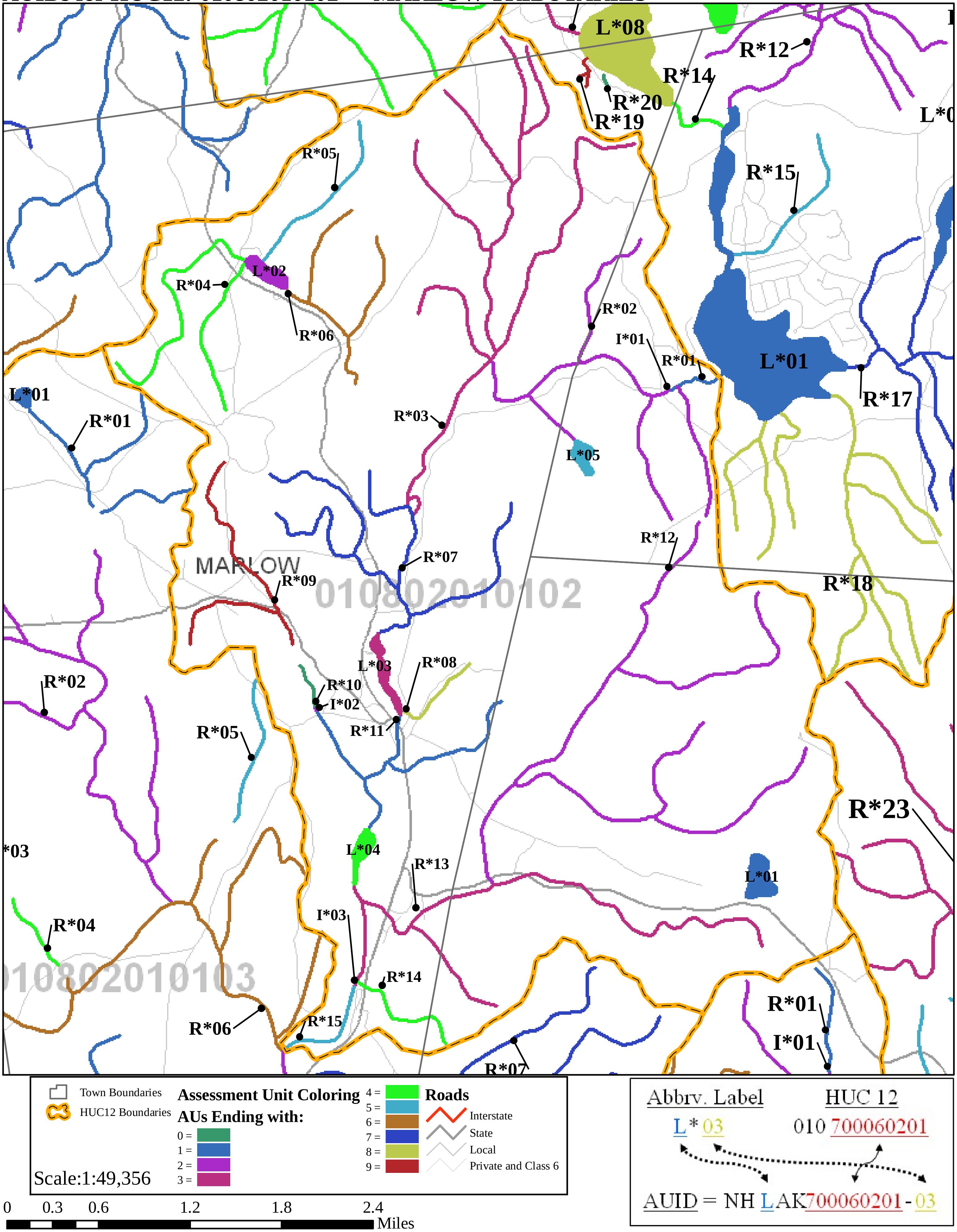
(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good		Full Support Good
Marginal		Full Support Marginal
Likely Good		Insufficient Information – Potentially Full Support
No Data		No Data
Likely Bad		Insufficient Information – Potentially Not Support
Poor		Not Support Marginal
Severe		Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010102-01	I*01	ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHIMP802010102-02	I*02	UNKNOWN RIVER - PAUL COLSMANN DAM I	3-ND	3-ND	3-ND	4A-M
NHIMP802010102-03	I*03	ASHUELOT RIVER - NASH MILL	3-ND	3-ND	3-ND	4A-M
NHLAK802010102-01	L*01	COLD SPRING POND	4A-M	2-G	2-G	4A-M
NHLAK802010102-02	L*02	STONE POND	3-PAS	2-G	2-G	4A-M
NHLAK802010102-03	L*03	VILLAGE POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010102-04	L*04	BIG POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010102-05	L*05	BARRETT POND	4A-P	2-G	2-G	4A-M
NHRIV802010102-01	R*01	ASHUELOT RIVER	5-P	3-ND	3-ND	4A-M
NHRIV802010102-02	R*02	ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-03	R*03	ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-04	R*04	GEE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-05	R*05	UNNAMED BROOK - TO STONE POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-06	R*06	GEE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-07	R*07	ASHUELOT RIVER - GEE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-08	R*08	UNNAMED BROOK - FROM UNNAMED POND TO VILLAGE POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-09	R*09	BUTLER BROOK - UNNAMED BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-10	R*10	BUTLER BROOK - TO PHELPS POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-11	R*11	ASHUELOT RIVER	5-P	2-M	2-G	4A-M
NHRIV802010102-12	R*12	ABBOTT BROOK - JEFTS BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-13	R*13	ASHUELOT RIVER - ABBOTT BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-14	R*14	UNNAMED BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010102-15	R*15	ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M

AUIDs for HUC12: 010802010102 - MARLOW TRIBUTARIES



WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010103

HUC 12 NAME GILSUM TRIBUTARIES

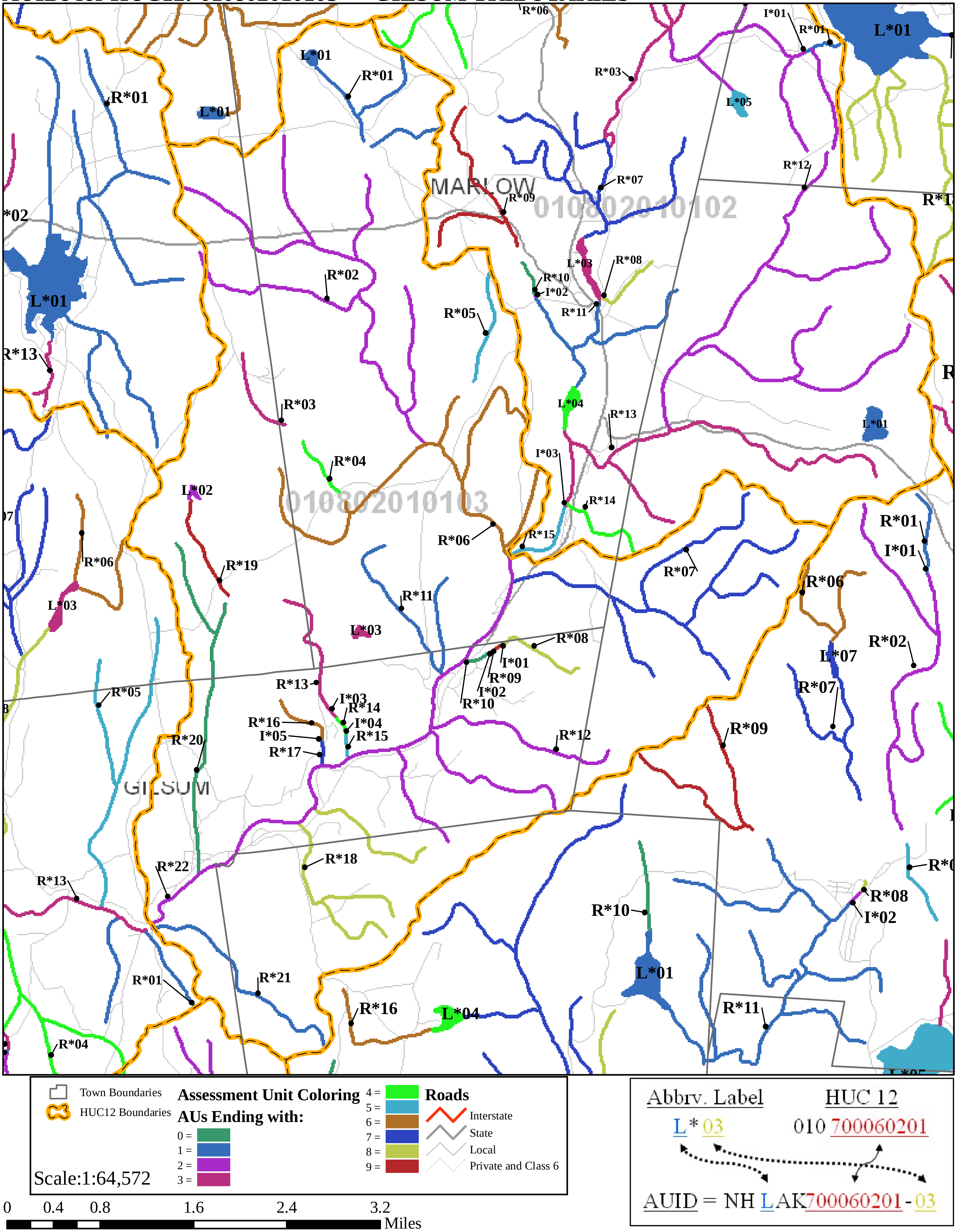
(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good	Full Support Good
Marginal	Full Support Marginal
Likely Good	Insufficient Information – Potentially Full Support
No Data	No Data
Likely Bad	Insufficient Information – Potentially Not Support
Poor	Not Support Marginal
Severe	Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010103-01	I*01	EMERSON BROOK	3-ND	3-ND	3-ND	4A-M
NHIMP802010103-02	I*02	EMERSON BROOK	3-ND	3-ND	3-ND	4A-M
NHIMP802010103-03	I*03	UNKNOWN RIVER - SPOONS POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010103-04	I*04	UNKNOWN RIVER - CHARLIES POOL DAM	3-ND	3-ND	3-ND	4A-M
NHIMP802010103-05	I*05	UNKNOWN RIVER - AUDETS BROOK DAM	3-ND	3-ND	3-ND	4A-M
NHLAK802010103-01	L*01	GUSTIN POND	3-PAS	3-ND	3-ND	4A-M
NHLAK802010103-02	L*02	LILY POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010103-03	L*03	WILDLIFE POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-01	R*01	GRASSY BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-02	R*02	GRASSY BROOK - HALE BROOK	3-PAS	3-ND	3-ND	4A-M
NHRIV802010103-03	R*03	WHITTEMORE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-04	R*04	WHITTEMORE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-05	R*05	UNNAMED BROOK - TO UNNAMED POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-06	R*06	GRASSY BROOK - WHITTEMORE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-07	R*07	DOWNING BROOK - UNNAMED BROOKS - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-08	R*08	EMERSON BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-09	R*09	EMERSON BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-10	R*10	EMERSON BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-11	R*11	UNNAMED BROOKS - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-12	R*12	TROUT BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-13	R*13	CONVERSE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-14	R*14	CONVERSE BROOK - FROM CHARLIES POOL DAM	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-15	R*15	CONVERSE BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-16	R*16	AUDETS BROOK - TO AUDETS BROOK DAM	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-17	R*17	AUDETS BROOK - FROM AUDETS BROOK DAM TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-18	R*18	THORNTON BROOK - UNNAMED BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-19	R*19	HAYWARD BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-20	R*20	HAYWARD BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010103-21	R*21	WHITE BROOK	3-ND	3-ND	3-ND	4A-M

AUIDs for HUC12: 010802010103 - GILSUM TRIBUTARIES



WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010104

HUC 12 NAME SURRY DAM

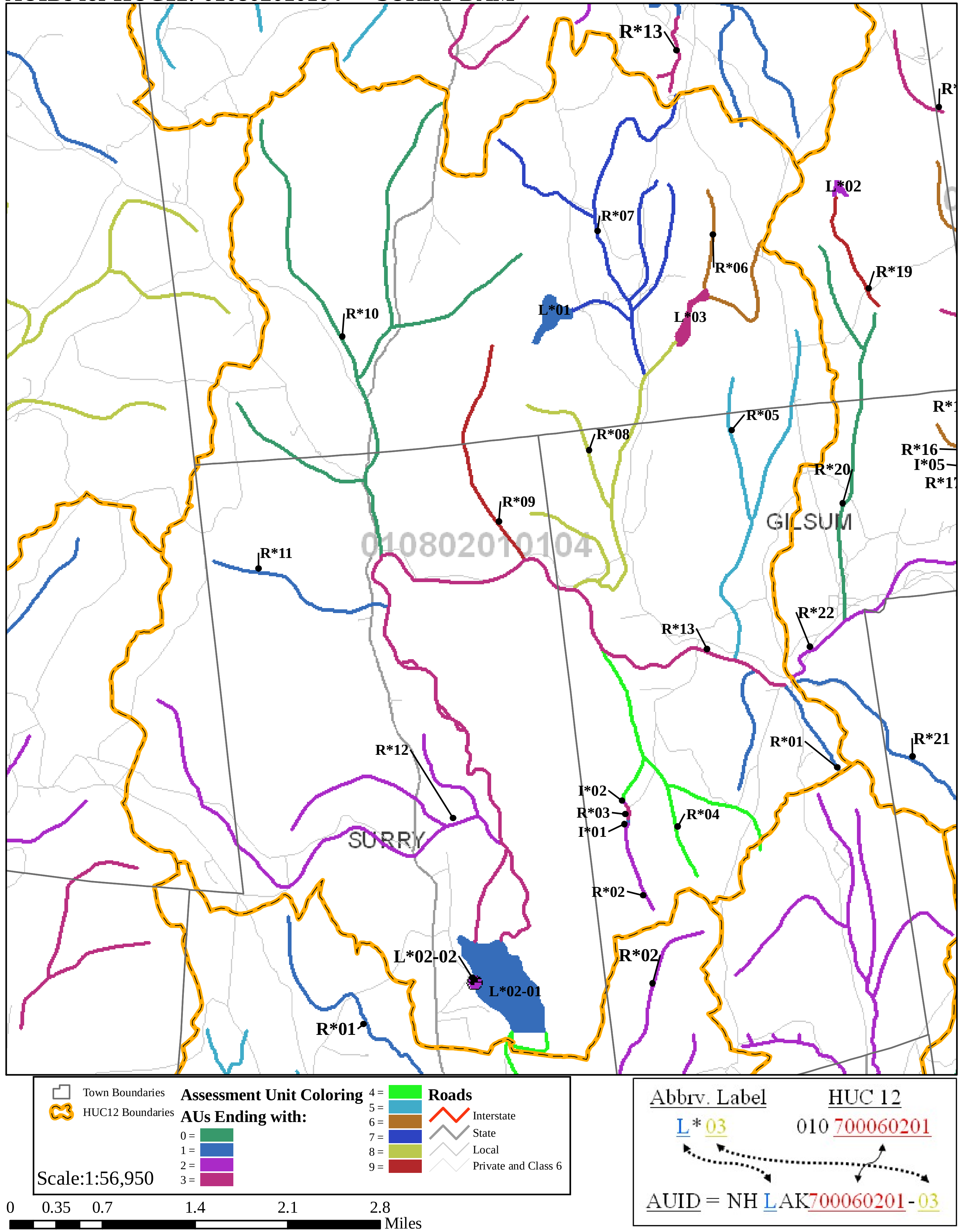
(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good	Full Support Good
Marginal	Full Support Marginal
Likely Good	Insufficient Information – Potentially Full Support
No Data	No Data
Likely Bad	Insufficient Information – Potentially Not Support
Poor	Not Support Marginal
Severe	Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010104-01	I*01	UNKNOWN RIVER - WILDLIFE POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010104-02	I*02	HAMMOND BROOK - TRIB TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHLAK802010104-01	L*01	CALDWELL POND	4A-M	2-G	2-G	4A-M
NHLAK802010104-02-01	L*02-01	SURRY MOUNTAIN RESERVOIR	3-PNS	3-PAS	3-PAS	4A-M
NHLAK802010104-02-02	L*02-02	SURRY MOUNTAIN RESERVOIR - REC AREA BEACH	3-PNS	5-P	2-G	4A-M
NHLAK802010104-03	L*03	CRANBERRY POND	4A-M	2-G	2-G	4A-M
NHRIV802010104-01	R*01	UNNAMED BROOKS - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-02	R*02	HAMMOND BROOK - TO WILDLIFE POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-03	R*03	HAMMOND BROOK - FROM WILDLIFE POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-04	R*04	HAMMOND BROOK - UNNAMED BROOKS	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-05	R*05	MAY BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-06	R*06	UNNAMED BROOKS - TO CRANBERRY POND FROM CRANE & KIDDERS PONDS	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-07	R*07	DART BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-08	R*08	DART BROOK	5-P	3-ND	3-ND	4A-M
NHRIV802010104-09	R*09	CANNON BROOK	3-PNS	3-ND	3-ND	4A-M
NHRIV802010104-10	R*10	THOMPSON BROOK	3-PNS	3-ND	3-ND	4A-M
NHRIV802010104-11	R*11	UNNAMED BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-12	R*12	MERRIAM BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010104-13	R*13	ASHUELOT RIVER	3-PAS	3-ND	3-ND	4A-M

AUIDs for HUC12: 010802010104 - SURRY DAM



WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010201

HUC 12 NAME OTTER BROOK RESERVOIR

(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good	Full Support Good
Marginal	Full Support Marginal
Likely Good	Insufficient Information – Potentially Full Support
No Data	No Data
Likely Bad	Insufficient Information – Potentially Not Support
Poor	Not Support Marginal
Severe	Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010201-01	I*01	ROBINSON BROOK - ANDORRA POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010201-02	I*02	OTTER BROOK - OTTER BROOK AT WOODS MILL	3-ND	3-ND	3-ND	4A-M
NHIMP802010201-03	I*03	UNKNOWN RIVER - WILDLIFE POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010201-04	I*04	UNKNOWN RIVER - FIRE POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010201-05	I*05	FERRY BROOK	3-ND	3-ND	3-ND	4A-M
NHLAK802010201-01	L*01	BOLSTER POND	5-M	3-PAS	3-ND	4A-M
NHLAK802010201-02	L*02	CENTER POND	4A-M	3-PAS	3-ND	4A-M
NHLAK802010201-03	L*03	CENTER POND	3-PAS	2-M	2-G	4A-M
NHLAK802010201-04	L*04	CHAPMAN POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010201-05	L*05	GRANITE LAKE	4A-P	5-M	2-G	4A-M
NHLAK802010201-06-01	L*06-01	OTTER BROOK POOL	3-ND	3-ND	3-ND	4A-M
NHLAK802010201-06-02	L*06-02	OTTER BROOK - OTTER BROOK PK BEACH	3-ND	5-P	2-G	4A-M
NHLAK802010201-07	L*07	DEER POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-01	R*01	ROBINSON BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-02	R*02	ROBINSON BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-03	R*03	UNNAMED BROOKS - TO CENTER POND	5-P	3-PAS	3-PAS	4A-M
NHRIV802010201-04	R*04	OTTER BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-05	R*05	UNNAMED BROOK - TO CHANDLER MEADOW	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-06	R*06	UNNAMED BROOKS - TO DEER POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-07	R*07	DAVIS BROOK - UNNAMED BROOK - TO CHANDLER MEADOW	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-08	R*08	OTTER BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-09	R*09	UNNAMED BROOKS - TO TAYLOR POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-10	R*10	BOLSTER BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-11	R*11	OTTER BROOK - BOLSTER BROOK	3-PNS	3-ND	3-ND	4A-M
NHRIV802010201-12	R*12	UNNAMED BROOK - TO WILDLIFE POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-13	R*13	ROARING BROOK	5-P	3-PAS	3-PAS	4A-M
NHRIV802010201-14	R*14	UNNAMED BROOKS	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-15	R*15	ROARING BROOK	5-P	3-ND	3-ND	4A-M
NHRIV802010201-16	R*16	UNNAMED BROOK - TO CHAPMAN POND	3-ND	3-ND	3-ND	4A-M

WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010201

HUC 12 NAME OTTER BROOK RESERVOIR

(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good	Full Support Good
Marginal	Full Support Marginal
Likely Good	Insufficient Information – Potentially Full Support
No Data	No Data
Likely Bad	Insufficient Information – Potentially Not Support
Poor	Not Support Marginal
Severe	Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHRIV802010201-20	R*20	FERRY BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010201-21	R*21	FERRY BROOK	3-ND	3-ND	3-ND	4A-M

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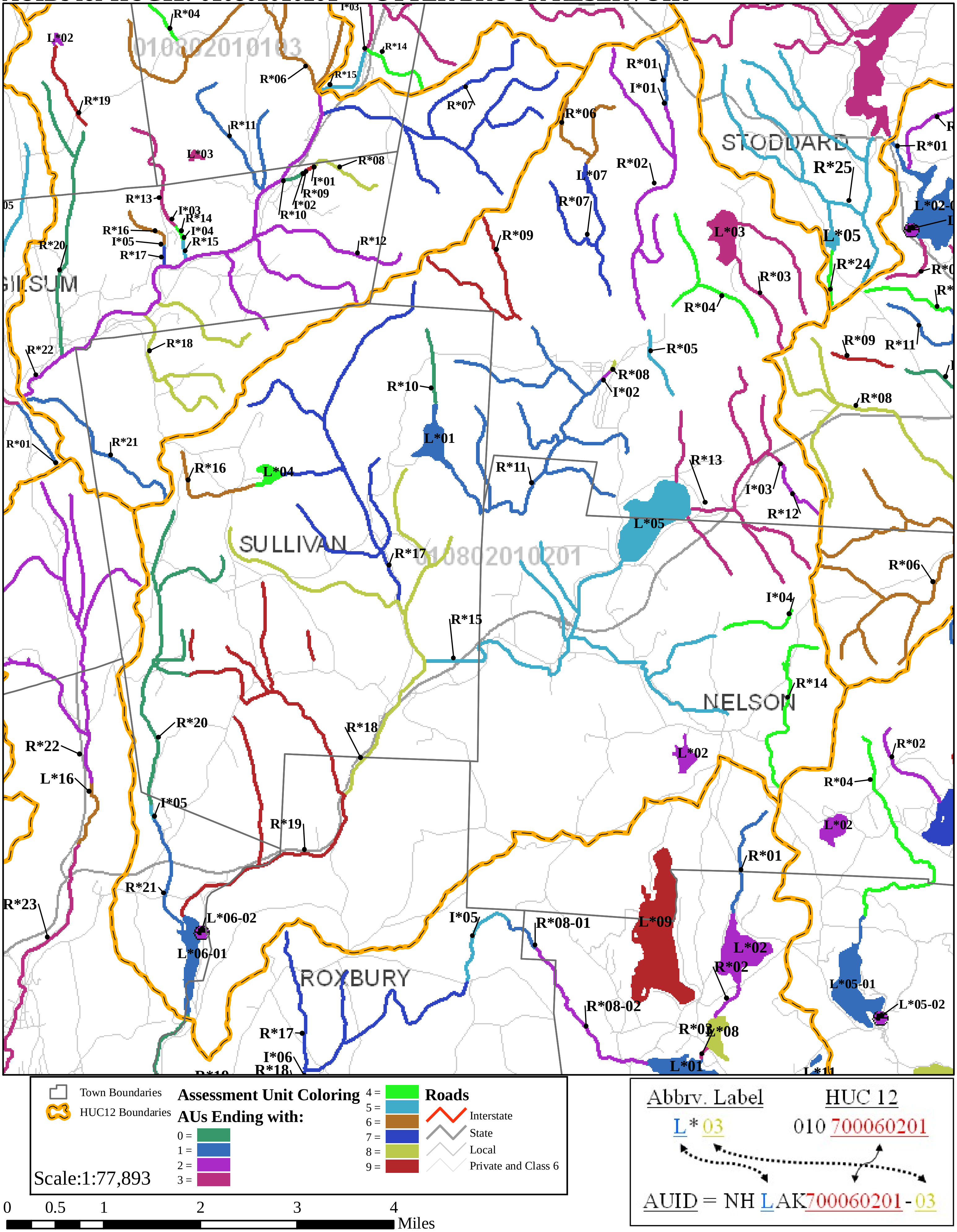

WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010301

HUC 12 NAME KEENE TRIBUTARIES

(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

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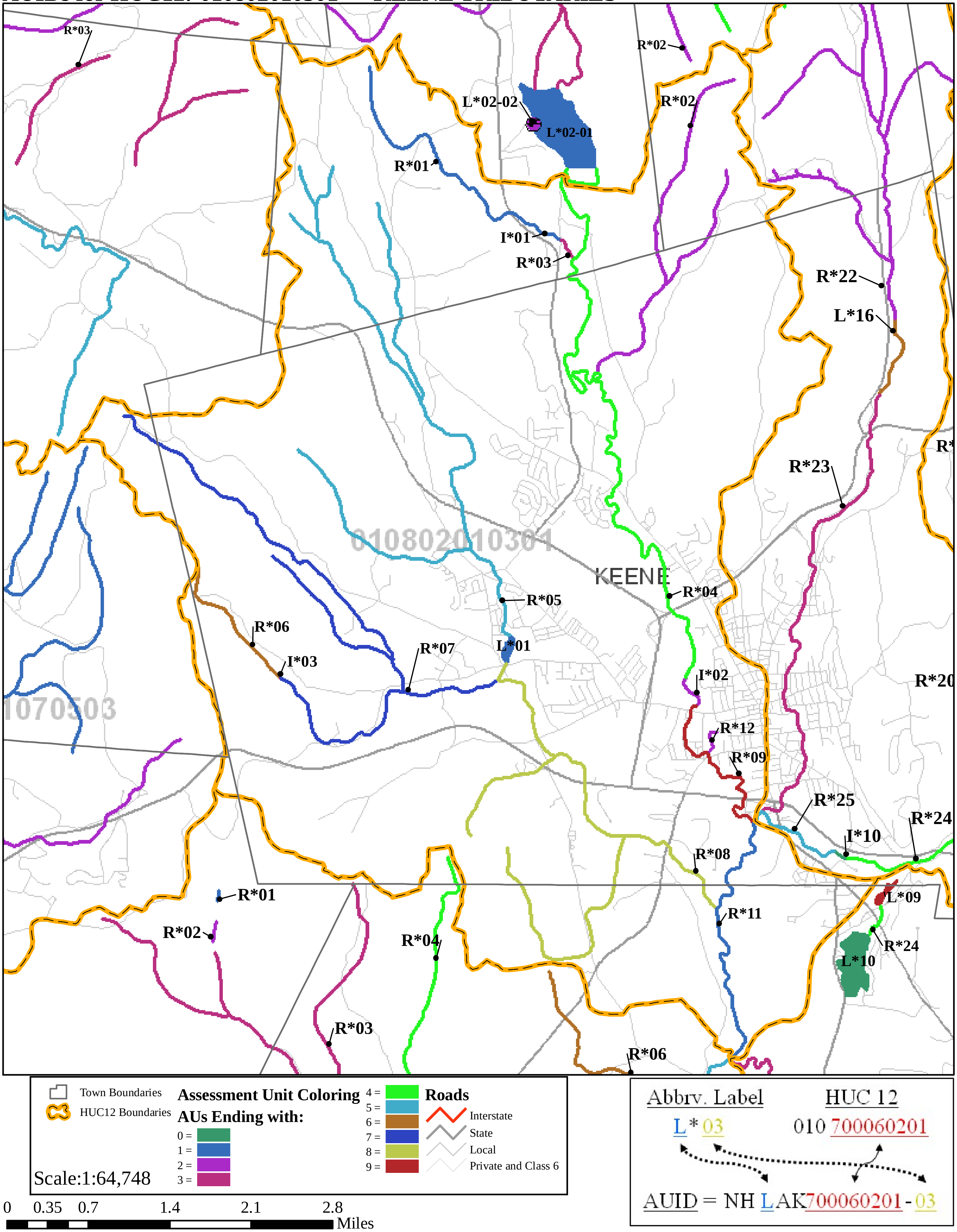
Marginal		Full Support Marginal
Likely Good		Insufficient Information – Potentially Full Support
No Data		No Data
Likely Bad		Insufficient Information – Potentially Not Support
Poor		Not Support Marginal
Severe		Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010301-01	I*01	UNKNOWN RIVER - RODGERS POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010301-02	I*02	ASHUELOT RIVER DAM POND	5-P	3-PNS	3-PNS	4A-M
NHIMP802010301-03	I*03	GRIMES BROOK - RECREATION POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010301-01	L*01	WILSON POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010301-01	R*01	JOHN BRITTON BROOK - TO ROGERS POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010301-02	R*02	STURTEVANT BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010301-03	R*03	JOHN BRITTON BROOK - FROM ROGERS POND TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010301-04	R*04	ASHUELOT RIVER - ACOE DAM TO ASHUELOT RIVER DAM POND	5-M	3-PNS	2-G	4A-M
NHRIV802010301-05	R*05	ASH SWAMP BROOK - DICKINSON BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010301-06	R*06	GRIMES BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010301-07	R*07	GRIMES BROOK - HURRICANE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010301-08	R*08	ASH SWAMP BROOK	3-PNS	3-PAS	3-ND	4A-M
NHRIV802010301-09	R*09	ASHUELOT RIVER - ASHUELOT RIVER DAM POND TO OTTER BR	5-M	5-P	2-M	4A-M
NHRIV802010301-11	R*11	ASHUELOT RIVER - OTTER BR TO SOUTH BRANCH	5-M	3-PAS	3-ND	4A-M
NHRIV802010301-12	R*12	MILL CREEK	5-M	3-ND	3-ND	4A-M

AUIDs for HUC12: 010802010301 - KEENE TRIBUTARIES



WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010303

HUC 12 NAME SOUTH BRANCH ASHUELOT RIVER

(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good	Full Support Good
Marginal	Full Support Marginal
Likely Good	Insufficient Information – Potentially Full Support
No Data	No Data
Likely Bad	Insufficient Information – Potentially Not Support
Poor	Not Support Marginal
Severe	Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010303-01	I*01	SOUTH BRANCH ASHUELOT RIVER - TROY SEWAGE LAGOONS	3-ND	3-ND	3-ND	4A-M
NHIMP802010303-02	I*02	UNKNOWN RIVER - RECREATION POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010303-03	I*03	UNKNOWN RIVER - SILICA POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010303-04-01	I*04-01	UNKNOWN RIVER - VILLAGE POND	3-ND	3-ND	3-ND	4A-M
NHIMP802010303-04-02	I*04-02	UNKNOWN RIVER - SAND DAM VILLAGE POND TOWN BEACH	3-ND	4A-P	2-G	4A-M
NHLAK802010303-01	L*01	BOWKER POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010303-02	L*02	MEETINGHOUSE POND	5-M	3-PAS	3-ND	4A-M
NHLAK802010303-03	L*03	PERKINS POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010303-04	L*04	ROCKWOOD POND	4A-P	3-PAS	3-ND	4A-M
NHLAK802010303-05-01	L*05-01	STONE POND	4A-M	3-PAS	3-ND	4A-M
NHLAK802010303-05-02	L*05-02	STONE POND - TOWN BEACH	4A-M	2-G	2-G	4A-M
NHLAK802010303-06	L*06	QUARRY POND	3-PNS	2-G	2-G	4A-M
NHLAK802010303-07	L*07	SAND POND	4A-M	3-PAS	3-ND	4A-M
NHLAK802010303-08	L*08	WEST HILL RESERVOIR	3-ND	3-ND	3-ND	4A-M
NHLAK802010303-09	L*09	UPPER WILSON POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010303-10	L*10	WILSON POND	5-M	3-PAS	3-ND	4A-M
NHRIV802010303-01	R*01	ROCKWOOD BROOK - UNNAMED BROOK	5-M	3-PNS	2-M	4A-M
NHRIV802010303-02	R*02	UNNAMED BROOK - TO WEST HILL RESERVOIR	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-03	R*03	NESTER BROOK - TO WEST HILL RESERVOIR	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-04	R*04	QUARRY BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-05	R*05	FASSETT BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-06	R*06	QUARRY BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-07	R*07	QUARRY BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-08	R*08	NESTER BROOK - FROM WEST HILL RESERVOIR	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-09	R*09	NESTER BROOK - FROM SILICA POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-10	R*10	ROCKWOOD BROOK - FROM SAND POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-11	R*11	SOUTH BRANCH ASHUELOT RIVER - QUARRY BROOK	5-P	5-P	2-M	4A-M
NHRIV802010303-12	R*12	SOUTH BRANCH ASHUELOT RIVER	3-ND	5-M	3-ND	4A-M
NHRIV802010303-13	R*13	SOUTH BRANCH ASHUELOT RIVER	3-PAS	3-PAS	3-ND	4A-M

WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010303

HUC 12 NAME SOUTH BRANCH ASHUELOT RIVER

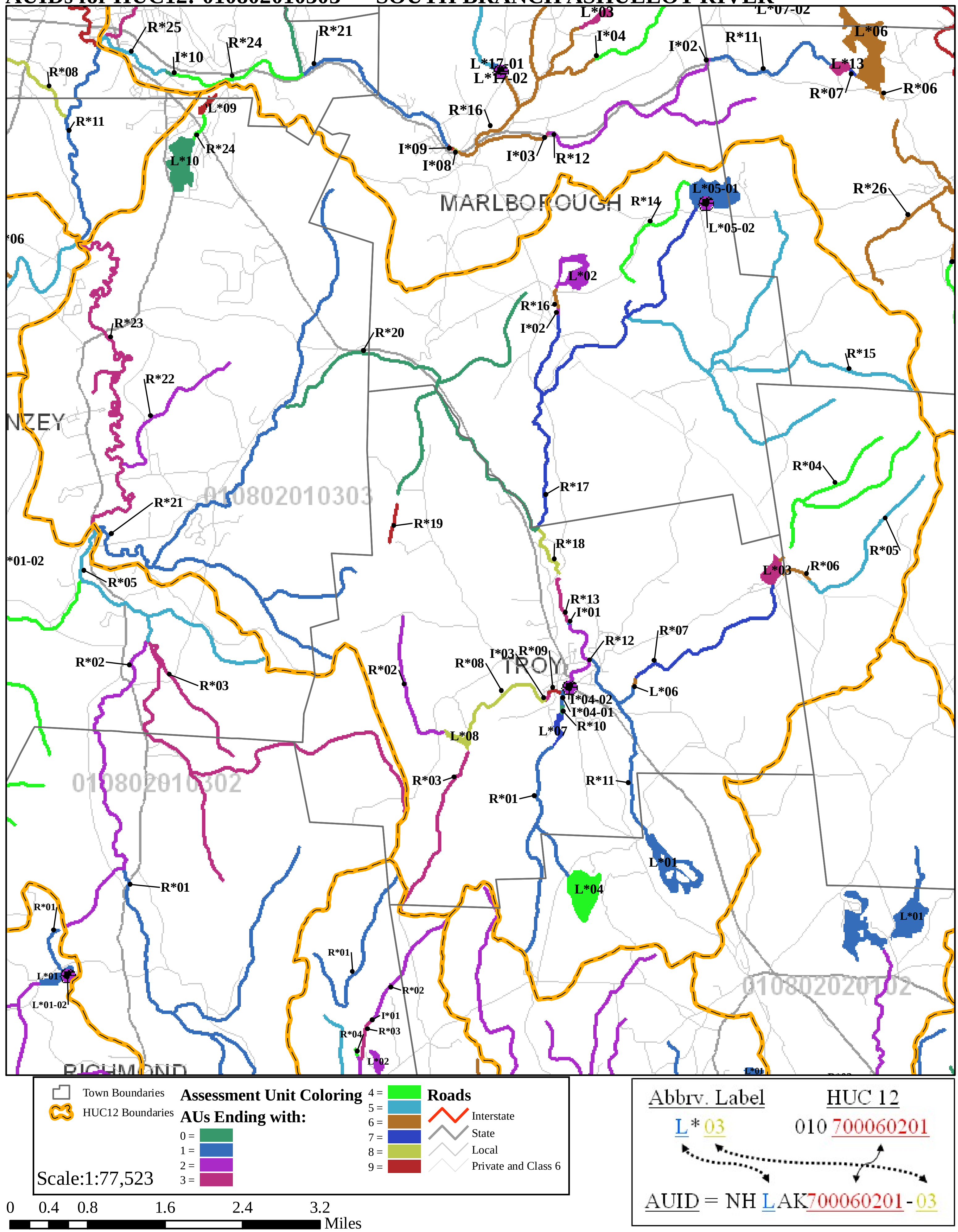
(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good	Full Support Good
Marginal	Full Support Marginal
Likely Good	Insufficient Information – Potentially Full Support
No Data	No Data
Likely Bad	Insufficient Information – Potentially Not Support
Poor	Not Support Marginal
Severe	Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHRIV802010303-17	R*17	SHAKER BROOK	5-M	3-ND	3-ND	4A-M
NHRIV802010303-18	R*18	SOUTH BRANCH ASHUELOT RIVER	5-M	5-P	2-M	4A-M
NHRIV802010303-19	R*19	UNNAMED BROOK - FROM CUMMINGS POND TO CAREY POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-20	R*20	SOUTH BRANCH ASHUELOT RIVER	3-PAS	5-P	2-M	4A-M
NHRIV802010303-21	R*21	SOUTH BRANCH ASHUELOT RIVER - BRIDGE BROOK - FORBUSH BROOK	3-PAS	3-PAS	3-ND	4A-M
NHRIV802010303-22	R*22	UNNAMED BROOK - TO SOUTH ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010303-23	R*23	SOUTH BRANCH ASHUELOT RIVER	5-M	5-M	2-G	4A-M
NHRIV802010303-24	R*24	UNNAMED BROOK - UPPER TO LOWER WILSON POND	5-M	3-PNS	3-PAS	4A-M

AUIDs for HUC12: 010802010303 - SOUTH BRANCH ASHUELOT RIVER



WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010401

HUC 12 NAME WINCHESTER-SWANZEY TRIBUTARIES

(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good	Full Support Good
Marginal	Full Support Marginal
Likely Good	Insufficient Information – Potentially Full Support
No Data	No Data
Likely Bad	Insufficient Information – Potentially Not Support
Poor	Not Support Marginal
Severe	Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010401-01	I*01	ASHUELOT RIVER - HOMESTEAD WOOLEN MILL DAM	5-M	5-P	2-G	4A-M
NHIMP802010401-02	I*02	CALIFORNIA BROOK	3-ND	3-ND	3-ND	4A-M
NHLAK802010401-01-01	L*01-01	FOREST LAKE	4C-M	5-M	2-G	4A-M
NHLAK802010401-01-02	L*01-02	FOREST LAKE - TOWN BEACH	4C-M	2-G	2-G	4A-M
NHLAK802010401-02	L*02	SPOT MEADOW POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-01	R*01	UNNAMED BROOK - TRIB TO CALIFORNIA BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-02	R*02	UNNAMED BROOK - TRIB TO CALIFORNIA BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-03	R*03	CALIFORNIA BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-04	R*04	CALIFORNIA BROOK - BAILEY BROOK	3-PNS	3-ND	3-ND	4A-M
NHRIV802010401-05	R*05	UNNAMED BROOK - TO CALIFORNIA BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-06	R*06	UNNAMED BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-07	R*07	INDIAN BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-08	R*08	UNNAMED BROOK - TO UNNAMED POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-09	R*09	UNNAMED BROOK - FROM UNNAMED POND TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-10	R*10	RIXFORD BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-11	R*11	WHEELOCK BROOK - RIXFORD BROOK	5-P	3-ND	3-ND	4A-M
NHRIV802010401-12	R*12	UNNAMED BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-13	R*13	SPOT MEADOW BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-14	R*14	UNNAMED BROOKS - TO FOREST LAKE	5-M	3-ND	3-ND	4A-M
NHRIV802010401-15	R*15	ASHUELOT RIVER - SOUTH BRANCH TO HOMESTEAD DAM	5-P	5-P	2-M	4A-M
NHRIV802010401-16	R*16	ASHUELOT RIVER - HOMESTEAD DAM TO 300 FT US OF SWANZEY WWTF	5-M	3-PAS	3-ND	4A-M
NHRIV802010401-17	R*17	ASHUELOT RIVER - 300 FT US OF SWANZEY WWTF TO 3000 FT DS OF WWTF	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-18	R*18	CALIFORNIA BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010401-19	R*19	ASHUELOT RIVER - 3000 FT DS OF SWANZEY WWTF TO OLD WINCHESTER DAM	5-M	5-P	3-ND	4A-M

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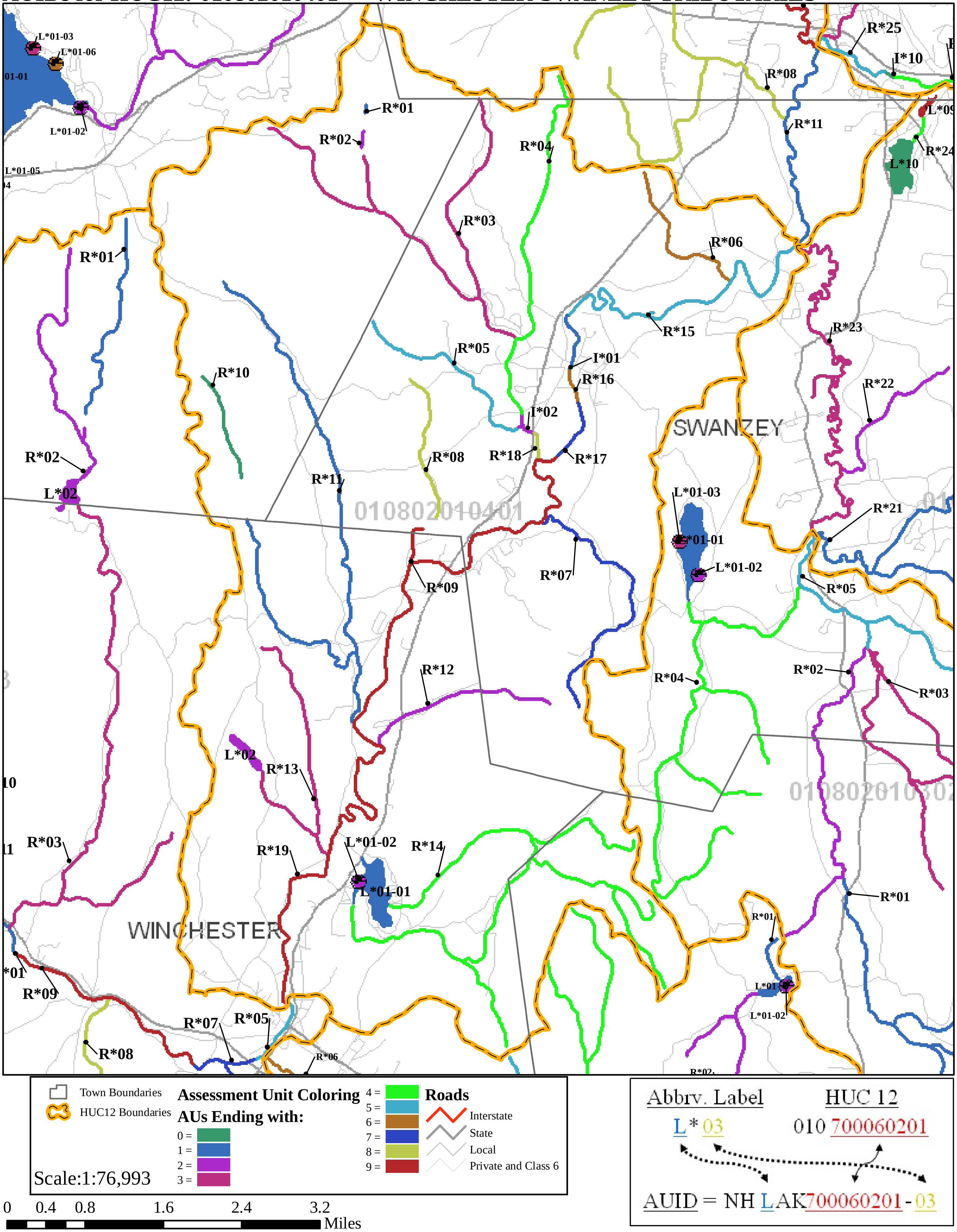


WATERSHED 305(b) ASSESSMENT SUMMARY REPORT:

HUC 12 010802010403

HUC 12 NAME HINSDALE-WINCHESTER TRIBUTARIES

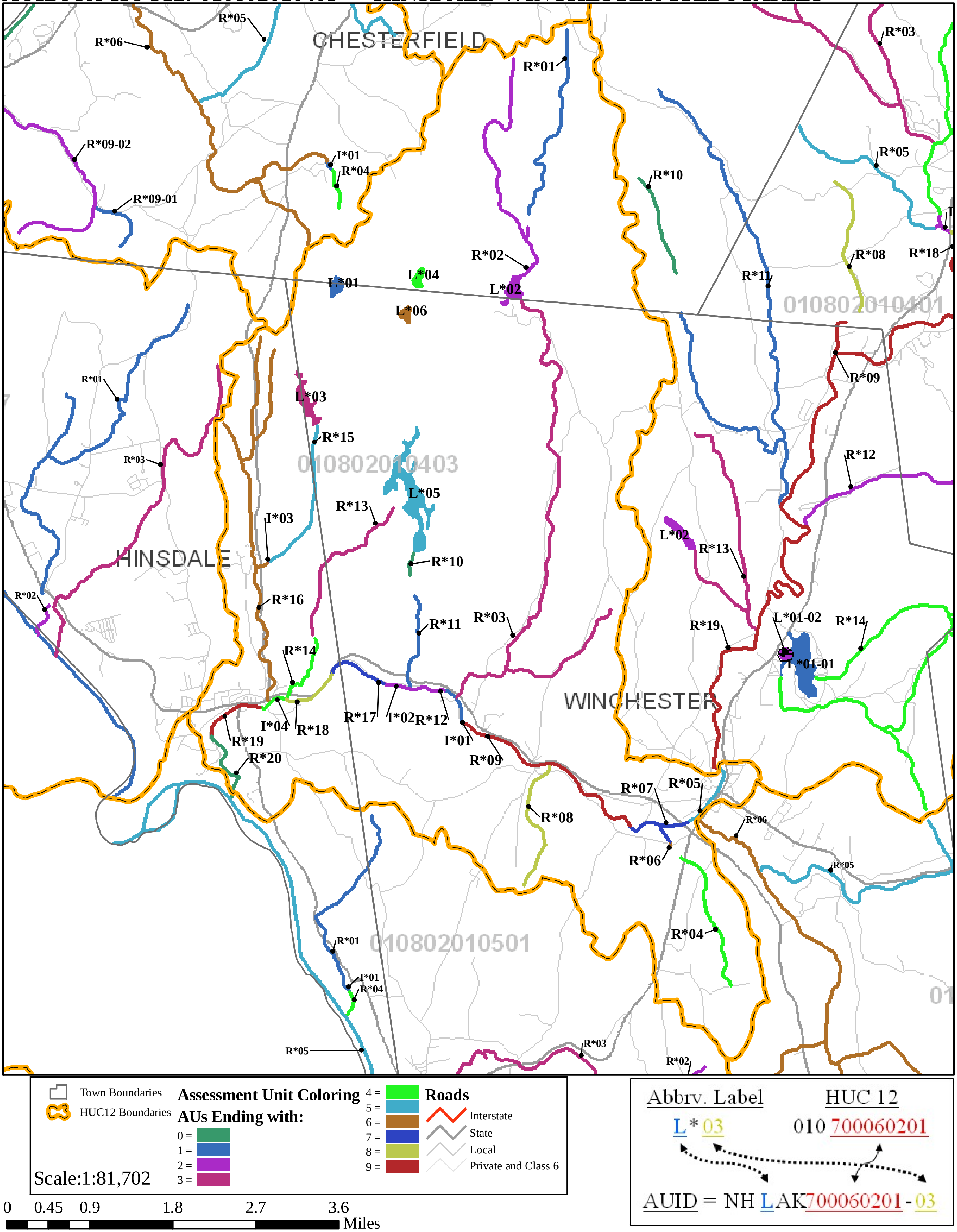
(Locator map on next page only applies to this HUC12)

Assessment Cycle 2008

Good		Full Support Good
Marginal		Full Support Marginal
Likely Good		Insufficient Information – Potentially Full Support
No Data		No Data
Likely Bad		Insufficient Information – Potentially Not Support
Poor		Not Support Marginal
Severe		Not Support Severe

ASSESSMENT UNIT ID	MAP LABEL	ASSESSMENT UNIT NAME	AQUATIC LIFE	SWIMMING	BOATING	FISH CONSUMP.
NHIMP802010403-01	I*01	ASHUELOT RIVER - LOWER ROBERTSON DAM	3-PNS	2-M	2-G	4A-M
NHIMP802010403-02	I*02	ASHUELOT RIVER - ASHUELOT PAPER	3-ND	3-ND	3-ND	4A-M
NHIMP802010403-03	I*03	KILBURN BROOK - KILBURN BROOK III	3-ND	3-ND	3-ND	4A-M
NHIMP802010403-04	I*04	ASHUELOT RIVER - FISK MILL HYDRO	5-P	3-ND	3-ND	4A-M
NHLAK802010403-01	L*01	BAKER POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010403-02	L*02	FULLAM POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010403-03	L*03	KILBURN POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010403-04	L*04	LILY POND	3-ND	3-ND	3-ND	4A-M
NHLAK802010403-05	L*05	PISGAH RESERVOIR	3-ND	3-ND	3-ND	4A-M
NHLAK802010403-06	L*06	NORTH ROUND POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-01	R*01	UNNAMED BROOK - TO UNNAMED POND	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-02	R*02	BROAD BROOK	3-PNS	3-ND	3-ND	4A-M
NHRIV802010403-03	R*03	BROAD BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-04	R*04	SNOW BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-05	R*05	ASHUELOT RIVER - OLD WINCHESTER DAM TO 300FT US OF WINCHESTER WWTF	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-06	R*06	SNOW BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-07	R*07	ASHUELOT RIVER - 300FT US OF WINCHESTER WWTF TO 3000FT DS OF WWTF	5-M	5-M	2-M	4A-M
NHRIV802010403-08	R*08	UNNAMED BROOK - TO ASHUELOT RIVER	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-09	R*09	ASHUELOT RIVER - 3000FT DS OF WINC WWTF TO LOWER ROBERTSON DAM	3-ND	2-M	2-G	4A-M
NHRIV802010403-10	R*10	TUFTS BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-11	R*11	TUFTS BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-12	R*12	ASHUELOT RIVER - LOWER ROBERTSON TO ASHUELOT PAPER	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-13	R*13	HOG TONGUE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-14	R*14	HOG TONGUE BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-15	R*15	KILBURN BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-16	R*16	KILBURN BROOK	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-17	R*17	ASHUELOT RIVER - ASHUELOT PAPER TO US OF OLD MCGOLDRICK DAM	3-ND	2-M	2-G	4A-M
NHRIV802010403-18	R*18	ASHUELOT RIVER - US OF OLD MCGOLDRICK DAM TO FISK MILL HYDRO	3-ND	3-ND	3-ND	4A-M
NHRIV802010403-19	R*19	ASHUELOT RIVER - FISK MILL HYDRO TO 300FT US OF HINSDALE WWTF	5-M	3-PNS	2-M	4A-M

AUIDs for HUC12: 010802010403 - HINSDALE-WINCHESTER TRIBUTARIES



New Hampshire Volunteer River Assessment Program
2009 Ashuelot River Watershed Water Quality Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

January 2010

NHDES R-WD-10-1B

New Hampshire Volunteer River Assessment Program
2009 Ashuelot River Watershed Water Quality Report

State of New Hampshire
Department of Environmental Services
Water Division
Watershed Management Bureau
P.O. Box 95
29 Hazen Drive
Concord, New Hampshire 03302-0095
www.des.nh.gov

Thomas S. Burack
Commissioner

Harry T. Stewart
Water Division Director

Prepared By:

Ted Walsh, VRAP Program Manager

Jen Drociak, VRAP Coordinator

Sabrina Kliman, VRAP Assistant

Cover Photo: Ashuelot River, 07-ASH, Winchester

January 2010

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List of Appendices

ACKNOWLEDGEMENTS

The New Hampshire Department of Environmental Services Volunteer River Assessment Program extends sincere thanks to the volunteers of the Ashuelot River Local Advisory Committee for their efforts during 2009. This report was created solely from the data collected by the volunteers listed below. Their time and dedication is an expression of their genuine concern for local water resources and has significantly contributed to our knowledge of river and stream water quality in New Hampshire.

2009 Ashuelot River Volunteers

Adam Black

Jeffrey Brooks

Gabriella Cebada-Mora

Paul Daniello

Patrick Eggleston

Penny Eggleston

Linda Fuererder

David Hoitt

Jim Holley

Sue Holley

LouDonna Johnson

Bob Lamoy

Carolyn MacDonald

Mike Morrison

Sherry Morrison

Carl Shephardson

Marge Shepardson

Barbara Skuly

Steve Stepenuck

Ann Sweet

Roger Sweet

Bob Thompson

1.0 INTRODUCTION

1.1. Purpose of Report

Each year the New Hampshire Volunteer River Assessment Program (VRAP) prepares and distributes a water quality report for each volunteer river monitoring group that is based solely on the water quality data collected by that group during a specific year. The reports summarize and interpret the data, particularly as they relate to New Hampshire's surface water quality standards, and serve as a teaching tool and guidance document for future monitoring activities by the individual volunteer groups.

1.2. Report Format

Each report includes the following:

- **Volunteer River Assessment Program Overview**

  This section includes a description of the history of VRAP, the technical support, training and guidance provided by NHDES, and how data is transmitted to the volunteers and used in surface water quality assessments.

- **Monitoring Program Description**

  This section provides a description of the volunteer group's monitoring program including monitoring objectives as well as a table and map showing sample station locations.

- **Results and Recommendations**

  Water quality data collected during the year are summarized on a parameter-by-parameter basis using: (1) a data summary table, which includes the number of samples collected, data ranges, the number of samples meeting New Hampshire water quality standards, and the number of samples adequate for water quality assessments at each station; (2) a discussion of the data; (3) a river graph showing the range of measured values at each station; and (4) a list of applicable recommendations.

  Sample results reported as less than the detection limit were assumed equal to one-half the detection limit on the river graphs. This approach simplifies the understanding of the parameter of interest, and specifically helps one to visualize how the river or watershed is functioning from upstream to downstream. In addition, this format allows the reader to better understand potential pollution areas and target those areas for additional sampling or environmental enhancements. Where applicable, the river graph also shows New Hampshire surface water quality standards or levels of concern for comparison purposes.

- **Appendix A – Water Quality Data**

  This appendix includes a spreadsheet detailing the data results and additional information such as data results which do not meet New Hampshire surface water quality standards, and data that is unusable for assessment purposes due to quality control requirements.

- **Appendix B – Interpreting VRAP Water Quality Parameters**

  This appendix provides a brief description of water quality parameters typically sampled by VRAP volunteers and their importance, as well as applicable state water quality criteria or levels of concern.

- **Appendix C – VRAP Volunteer Monitor Field Sampling Procedures Assessment *(Field Audits)***

  This appendix provides an overview of the VRAP Volunteer Monitor Field Sampling Procedures Assessment (field audit) process with respect to programmatic quality assurance/quality control (QA/QC) guidelines.

PROGRAM OVERVIEW

2.1 What is VRAP?

In 1998, the New Hampshire Volunteer River Assessment Program was established to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources.

Today, VRAP loans water quality monitoring equipment, provides technical support, and facilitates educational programs to volunteer groups on numerous rivers and watersheds throughout the state. VRAP volunteers conduct water quality monitoring on an ongoing basis and increase the amount of river water quality information available to local, state and federal governments, which allows for better watershed planning.

2.2 Why is VRAP Important?

VRAP establishes a regular volunteer-driven water sampling program to assist NHDES in evaluating water quality throughout the state. VRAP empowers volunteers with information about the health of New Hampshire's rivers and streams. Regular collection of water quality data allows for early detection of water quality changes allowing NHDES to trace potential problems to their source. Data collected by VRAP volunteers are directly contributing to New Hampshire's obligations under the Clean Water Act. Measurements taken by volunteers are used in assessing the water quality of New Hampshire's river and streams, and are included in reporting to the US Environmental Protection Agency.

2.3 How Does VRAP Work?

VRAP is a cooperative program between NHDES, river groups, local advisory committees, watershed associations, and individuals working to protect New Hampshire's rivers and streams. Volunteers are trained by VRAP staff in the use of water quality monitoring equipment at an annual training workshop. VRAP works with each group to establish monitoring stations and develop a sampling plan.

During the summer months, VRAP receives water quality data from trained volunteers. The data are reviewed for quality assurance, and are entered into the environmental monitoring database at NHDES. During the off-season, VRAP interprets the data and compiles the results into an annual report for each river. VRAP volunteers can use the data as a means of understanding the details of water quality, as well as guide future sampling efforts. NHDES can use the data for making surface water quality assessments, provided that the data met certain quality assurance/quality control guidelines.

2.4 Equipment and Sampling Schedule

VRAP frequently lends and maintains water quality monitoring equipment kits to VRAP groups throughout the state. The kits contain meters and supplies for routine water quality parameter measurements of turbidity, pH, dissolved oxygen, water temperature and specific conductance (conductivity). Other parameters such as nutrients, metals, and *E. coli* can also be studied, although VRAP does not always provide funds to cover laboratory analysis costs. Thus, VRAP encourages groups to pursue other fundraising activities such as association membership fees, special events, in-kind services (non-monetary contributions from individuals and organizations), and grant writing.

Each year, volunteers design and arrange a sampling schedule in cooperation with VRAP staff. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency. VRAP typically recommends sampling every other week from May through September, and VRAP groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions.

2.5 Training and Technical Support

Each VRAP volunteer attends an annual training workshop to receive a demonstration of monitoring protocols and sampling techniques and the calibration and use of water quality monitoring equipment. During the training, volunteers have an opportunity for hands-on use of the equipment and receive instruction in the collection of samples for laboratory analysis.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group's monitoring coordinator is notified of the result of the verification visit. VRAP groups forward water quality results to NHDES for incorporation into an annual report and state water quality assessment activities.

2.6 Data Usage

Annual Water Quality Reports

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. All data collected by volunteers are summarized in water quality reports that are prepared and distributed after the conclusion of the sampling period. VRAP groups can use the reports and data as a means of understanding the details of water quality, guiding future sampling efforts, or determining restoration activities.

New Hampshire Surface Water Quality Assessments

Along with data collected from other water quality programs, specifically the State Ambient River Monitoring Program, applicable volunteer data are used to support periodic NHDES surface water quality assessments. VRAP data are entered into NHDES's environmental monitoring database and are ultimately uploaded to the EPA database. Assessment results and the methodology used to assess surface waters are published by NHDES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act. The reader is encouraged to log on to the NHDES web page to review the assessment methodology and list of impaired waters http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm.

2.7 Quality Assurance/Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The VRAP QAPP was approved by NHDES and reviewed by EPA in the summer of 2003. The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP quality assurance/quality control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.
- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.
- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.
- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.
- **DI (De-Ionized) Turbidity Blank**: A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

2.7.1 Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables with an explanation of why the data was unusable. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1. Relative Percent Difference)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O_2 Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	Absolute Difference <0.3 pH units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (Zero Air Reading)	± 5.0 µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <1.0 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

3.0 METHODS

In 2001, volunteers from the Ashuelot River Local Advisory Committee began monitoring water quality on the Ashuelot River. The goal of this effort was to provide water quality data from the Ashuelot River relative to surface water quality standards and to allow for the assessment of the river for support of aquatic life and primary contact recreation (swimming). The establishment of a long-term monitoring program allows for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, equipment, financial assistance for laboratory costs, and technical assistance.

During 2009, trained volunteers from the Ashuelot River Local Advisory Committee monitored water quality at 14 stations in the Ashuelot River watershed from its upper limits in Washington to just upstream of its confluence with the Connecticut River in Hinsdale (Table 3)

Stations IDs are designated using a three-letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed. All stations monitored in 2009 are designated as Class B waters. This classification is used to apply the appropriate water quality standard.

Water quality monitoring was conducted monthly from May to September. In-situ measurements of pH, water temperature, dissolved oxygen, and specific conductance were taken using handheld meters. Turbidity samples were collected in the field, brought to a central location and measured the same day. Samples for *E.coli,* total phosphorous, and chloride were taken using sterile and/or preserved bottles and were stored on ice during transport from the field to the NHDES laboratory or EAI Analytical Laboratory. Table 2 summarizes the parameters measured, laboratory standard methods, and equipment used.

Table 2. Sampling and Analysis Methods

Parameter	Sample Type	Standard Method	Equipment Used	Laboratory
Dissolved Oxygen	In-Situ	SM 4500 O G	YSI 55 YSI 95	------
pH	In-Situ	SM 4500 H+	Orion 210A	------
Turbidity	In-Situ	EPA 180.1	LaMotte 2020	
Specific Conductance	In-Situ	SM 2510	YSI 30	------
Temperature	In-Situ	SM 2550	YSI 95	------
E.coli	Bottle (Sterile)	EPA 1103.1	------	EAI Analytical Labs
Total Phosphorus	Bottle (w/ Preservative)	EPA 365.3	------	NHDES
Chloride	Bottle	SM D512C	------	NHDES Limnology Ctr.

Table 3. Sampling Stations for the Ashuelot River, NHDES VRAP, 2009

Station ID & AUID	Class	Waterbody Name	Location	Town	Elevation (Rounded to the Nearest 100 Feet)
28-ASH NHRIV802010101-08	**B**	**Ashuelot River**	Route 31	Washington	1600
27-ASH NHRIV802010101-08	**B**	**Ashuelot River**	Mountain Road	Lempster	1500
24A-ASH NHRIV802010102-11	**B**	**Ashuelot River**	Route 10	Marlow	1100
23-ASH NHRIV802010103-22	**B**	**Ashuelot River**	Route 10	Gilsum	800
20A-ASH NHRIV802010301-04	**B**	**Ashuelot River**	Stone Arch Bridge	Keene	500
18-ASH NHRIV802010301-09	**B**	**Ashuelot River**	Route 101	Keene	500
16D-ASH NHRIV802010301-11	**B**	**Ashuelot River**	40' Upstream of Keene WWTF	Swanzey	500
16A-ASH NHRIV802010301-11	**B**	**Ashuelot River**	Mouth of the South Branch	Swanzey	500
16-ASH NHRIV802010401-15	**B**	**Ashuelot River**	Cresson Bridge	Swanzey	500
02B-SBA NHRIV600030608-15	**B**	**South Branch Ashuelot River**	Upstream of Monadnock Regional High School	Swanzey	500
02-SBA NHRIV802010303-23	**B**	**South Branch Ashuelot River**	Route 32 Bridge	Swanzey	500
15-ASH NHIMP802010401-01	**B**	**Ashuelot River**	Thompson Covered Bridge	West Swanzey	400
07-ASH NHRIV802010403-07	**B**	**Ashuelot River**	Route 119	Winchester	400
01-ASH NHRIV802010403-20	**B**	**Ashuelot River**	147 River Street	Hinsdale	200

RESULTS AND RECOMMENDATIONS

Results and recommendations for each monitored parameter are presented in the following sections. For a description of the importance of each parameter and pertinent water quality criteria for these and other parameters, please see Appendix B, *"Interpreting VRAP Water Quality Parameters."*

4.1 Dissolved Oxygen

Five measurements were taken in the field for dissolved oxygen concentration at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 4). Of the 70 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

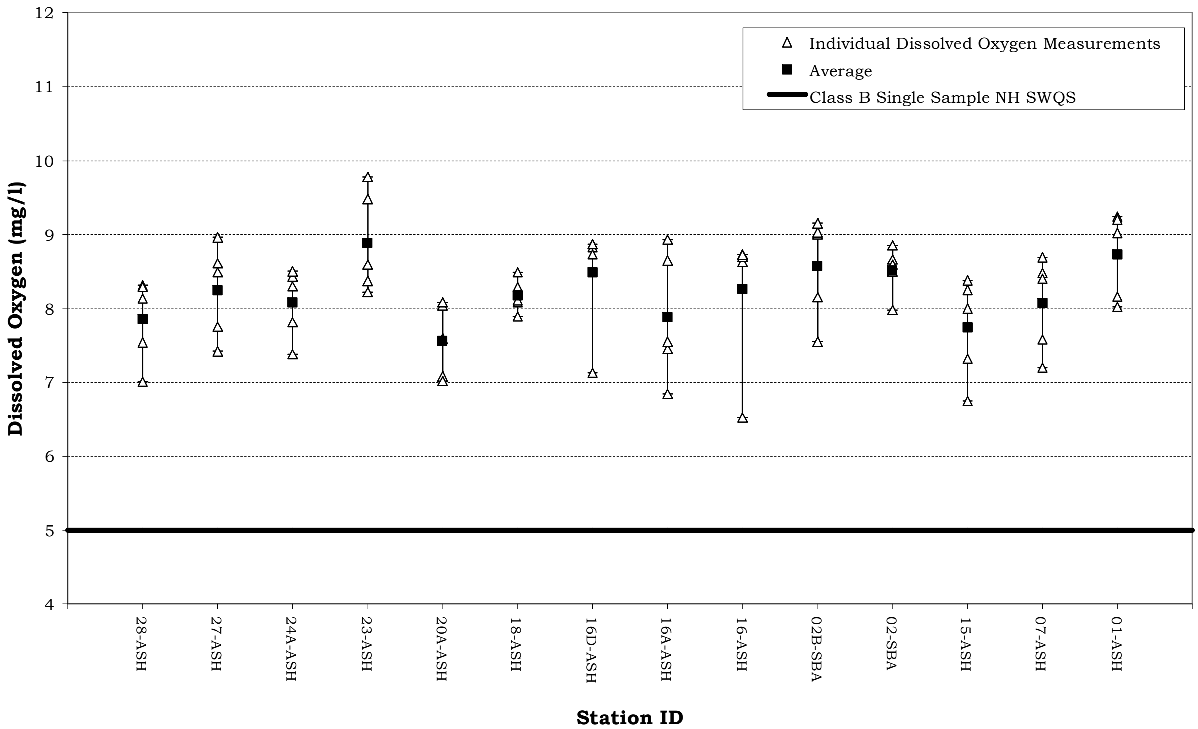
The Class B New Hampshire surface water quality standard for dissolved oxygen includes a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 percent of saturation. In other words, there are criteria for both concentration and saturation that must be met before the river can be assessed as meeting dissolved oxygen standards. Table 4 reports only dissolved oxygen concentration as more detailed analysis is required to determine if instantaneous dissolved oxygen saturation measurements are above or below water quality standards.

Table 4. Dissolved Oxygen Concentration (mg/L) Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	7.01 - 8.31	0	5
27-ASH	5	7.42 - 8.96	0	5
24A-ASH	5	7.38 - 8.50	0	5
23-ASH	5	8.22 - 9.78	0	5
20A-ASH	5	7.02 - 8.08	0	5
18-ASH	5	7.89 - 8.49	0	5
16D-ASH	5	7.13 - 8.87	0	5
16A-ASH	5	6.84 - 8.93	0	5
16-ASH	5	6.52 - 8.73	0	5
02B-SBA	5	7.55 - 9.15	0	5
02-SBA	5	7.98 - 8.85	0	5
15-ASH	5	6.75 - 8.38	0	5
07-ASH	5	7.20 - 8.69	0	5
01-ASH	5	8.02 - 9.24	0	5
Total	**70**	_____	**0**	**70**

Dissolved oxygen concentration levels were above the New Hampshire Class B surface water quality standard at all stations and on all occasions with the average ranging from 7.56 mg/L to 8.89 mg/L (Figure 1). Levels of dissolved oxygen sustained above the standards are considered adequate for the support of aquatic life and other desirable water quality conditions.

Figure 1. Dissolved Oxygen Concentration Statistics for the Ashuelot River Watershed May 26 - September 15, 2009, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- If possible, take measurements between 5 a.m. and 10 a.m., which is when dissolved oxygen is usually the lowest, and between 2 p.m. and 7 p.m. when dissolved oxygen is usually the highest. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.
- Consider incorporating the use of in-situ dataloggers to automatically record dissolved oxygen saturation levels during a period of several days.

4.2 pH

Either four or five measurements were taken in the field for pH at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 5]. Of the 68 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard is 6.5 - 8.0, unless naturally occurring.

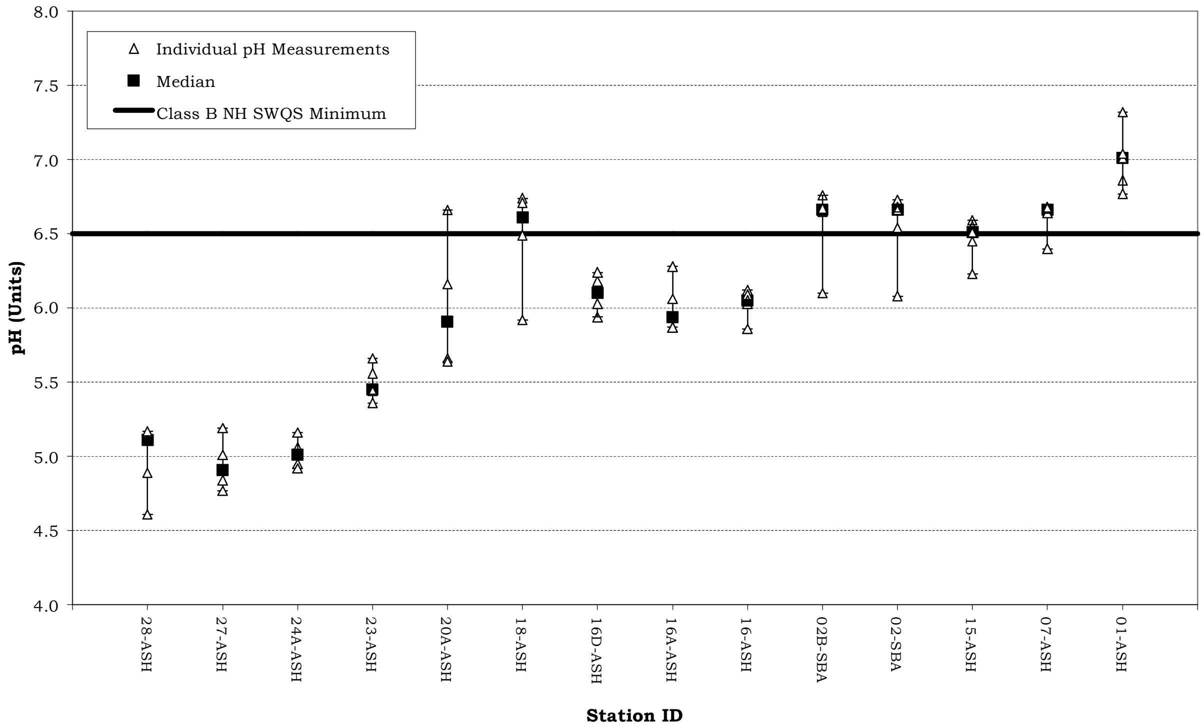
Table 5. pH Data Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (standard units)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	4.61 - 5.17	5	5
27-ASH	5	4.77 - 5.19	5	5
24A-ASH	5	4.92 - 5.16	5	5
23-ASH	5	5.36 - 5.66	5	5
20A-ASH	4	5.64 - 6.66	3	4
18-ASH	5	5.92 - 6.74	5	5
16D-ASH	5	5.94 - 6.24	5	5
16A-ASH	5	5.87 - 6.28	5	5
16-ASH	5	5.86 - 6.12	0	5
02B-SBA	4	6.10 - 6.76	1	4
02-SBA	5	6.08 - 6.73	1	5
15-ASH	5	6.23 - 6.59	2	5
07-ASH	5	6.40 - 6.68	1	5
01-ASH	5	6.77 - 7.32	0	5
Total	**68**	_____	**43**	**68**

All but two stations had one or more pH measurements that were below the New Hampshire surface water quality standard minimum (Figure 2). In general, stations in the upper portions of the watershed had lower pH measurements than stations in the lower portions of the watershed.

Lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area. Rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels; after the spring melt or significant rain events, surface waters will generally have a lower pH.

Figure 2. pH Statistics for the Ashuelot River Watershed
May 26 - September 15, 2009, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Consider sampling for pH in some of the tributaries and wetland areas that are influencing the pH of stations with measurements below state standards. Site conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands or other natural conditions, then the low pH measurements are not considered a violation of water quality standards. It is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life. In this case, additional information about factors influencing pH levels is needed.

4.3 Turbidity

Either four or five measurements were taken in the field for turbidity at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 6]. Of the 70 measurements taken, 63 met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for turbidity is less than 10 NTU above natural background.

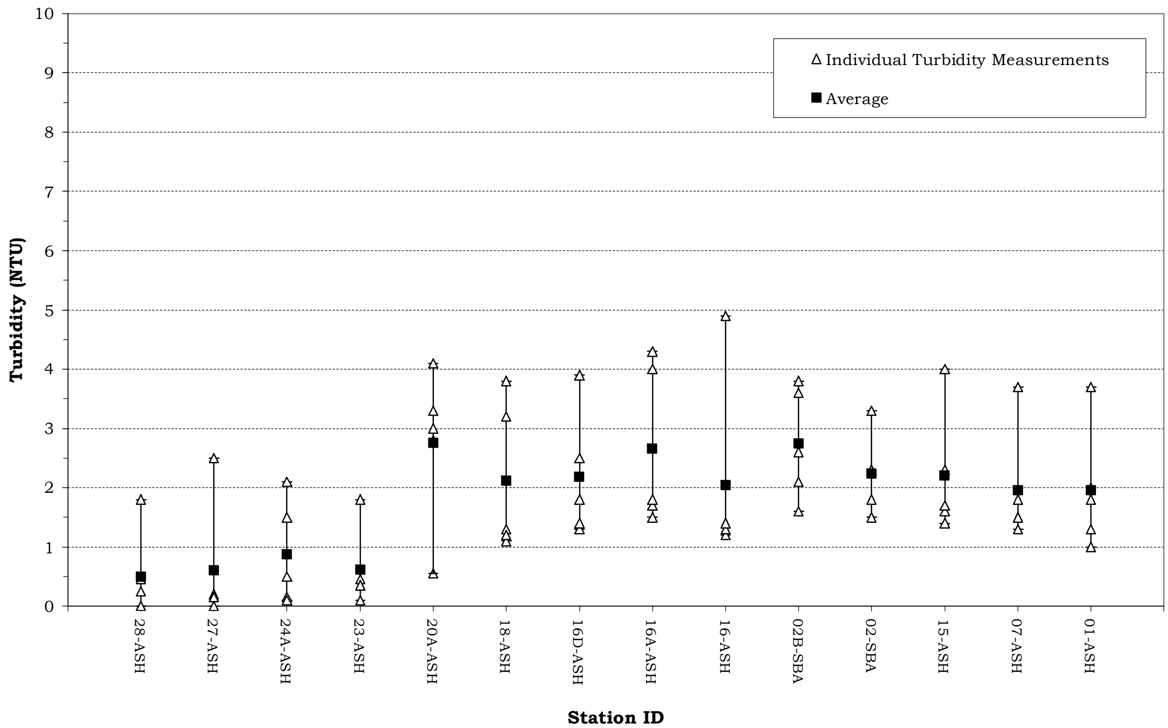
Table 6. Turbidity Data Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (NTU)	Acceptable Samples Potentially Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	0.00 - 1.80	0	5
27-ASH	5	0.00 - 2.50	0	5
24A-ASH	5	0.10 - 2.10	0	5
23-ASH	5	0.10 - 1.80	0	5
20A-ASH	5	0.55 - 4.10	0	4
18-ASH	5	1.10 - 3.80	0	4
16D-ASH	5	1.30 - 3.90	0	5
16A-ASH	5	1.50 - 4.30	0	5
16-ASH	5	1.20 - 4.90	0	5
02B-SBA	5	1.60 - 3.80	0	4
02-SBA	5	1.50 - 3.30	0	4
15-ASH	5	1.40 - 4.00	0	4
07-ASH	5	1.30 - 3.70	0	4
01-ASH	5	1.00 - 3.70	0	4
Total	**70**	_____	**0**	**63**

Turbidity levels were low at all stations and on all occassions with the average ranging from 0.50 NTU to 2.75 NTU (Figure 3).

Although clean waters are associated with low turbidity there is a high degree of natural variability involved. Precipitation often contributes to increased turbidity by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. However, human activities such as removal of vegetation near surface waters and disruption of nearby soils can lead to dramatic increases in turbidity levels. In general it is typical to see a rise in turbidity in more developed areas due to increased runoff.

Figure 3. Turbidity Statistics for the Ashuelot River Watershed
May 26 - September 15, 2009, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Collect samples during wet weather. This will help us to understand how the river responds to runoff and sedimentation.
- If a higher than normal turbidity measurement occurs, volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated turbidity levels. In addition, take good field notes and photographs. If human activity is suspected or verified as the source of elevated turbidity levels, volunteers should contact NHDES.

4.4 Specific Conductance

Five measurements were taken in the field for specific conductance at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 7]. Of the 70 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

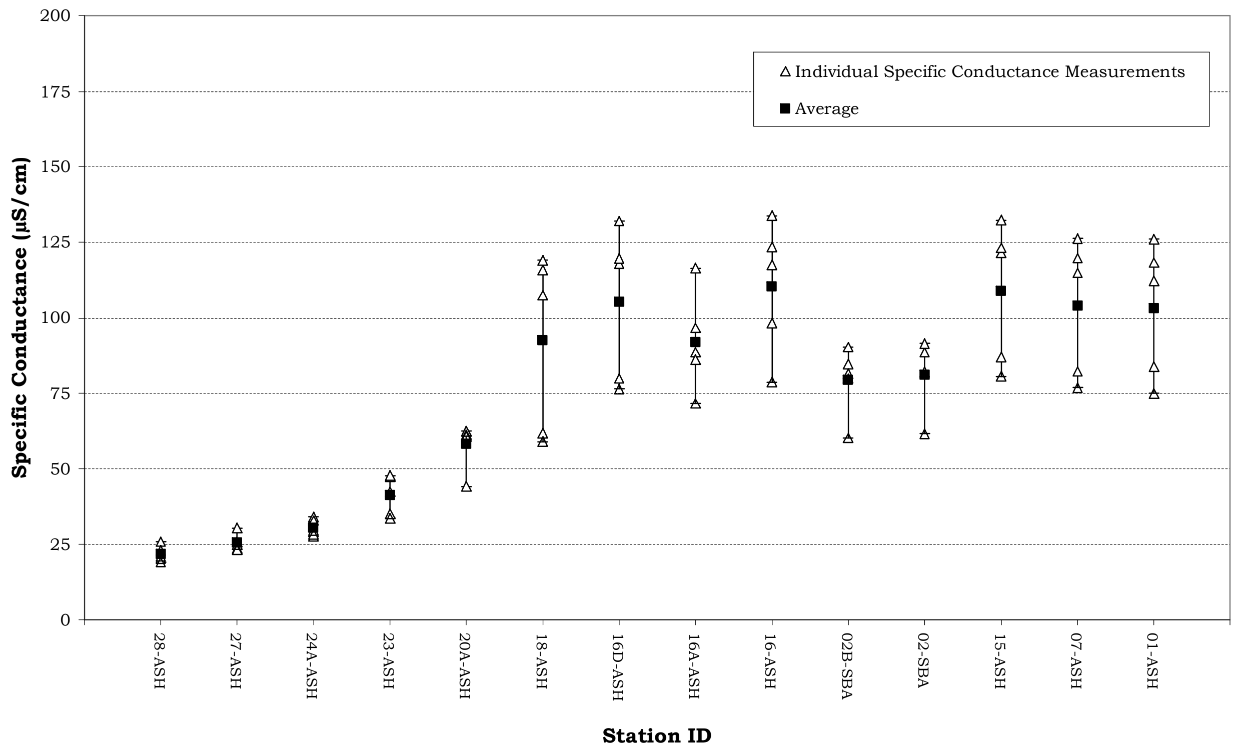
New Hampshire surface water quality standards do not contain numeric criteria for specific conductance although in many fresh surface waters, specific conductance can be used as a surrogate to predict compliance with numeric water quality criteria for chloride.

Table 7. Specific Conductance Data Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (µS/cm)	Acceptable Samples Not Meeting NH Class B Standards (µS/cm as chloride surrogate)	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	19.1 - 25.9	0	5
27-ASH	5	23.3 - 30.4	0	5
24A-ASH	5	27.6 - 34.1	0	5
23-ASH	5	33.7 - 47.8	0	5
20A-ASH	5	44.2 - 62.5	0	5
18-ASH	5	59.0 - 119.1	0	5
16D-ASH	5	76.5 - 132.1	0	5
16A-ASH	5	71.7 - 116.5	0	5
16-ASH	5	78.8 - 133.9	0	5
02B-SBA	5	60.3 - 90.3	0	5
02-SBA	5	61.7 - 91.5	0	5
15-ASH	5	80.6 - 132.4	0	5
07-ASH	5	76.9 - 126.3	0	5
01-ASH	5	75.0 - 126.1	0	5
Total	**70**	_____	**0**	**70**

Specific conductance levels were variable with the average ranging from 21.9 µS/cm in the upper portion of the watershed to 109.0 µS/cm in the lower portion of the watershed (Figure 4). Higher specific conductance levels can be indicative of pollution from sources such as urban/agricultural runoff, road salt, failed septic systems, or groundwater pollution. The variable specific conductance levels generally indicate low pollutant levels at some stations and higher levels at others.

Figure 4. Specific Conductance Statistics for the Ashuelot River Watershed
May 26 - September 15, 2009, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Consider collecting chloride samples at the same time that specific conductance is measured. During the late winter/early spring snowmelt, higher specific conductance levels are often seen due to elevated concentrations of chloride in the runoff. Specific conductance levels are very closely correlated to chloride levels. Simultaneously measuring chloride and specific conductance will allow for a better understanding of their relationship.
- Consider incorporating the use of in-situ dataloggers to automatically determine specific conductance levels during rain events, snowmelt, and baseline dry weather conditions. The use of these instruments is dependent upon availability, and requires coordination with NHDES.

4.5 Water Temperature

Five measurements were taken in the field for water temperature at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 8]. Of the 70 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

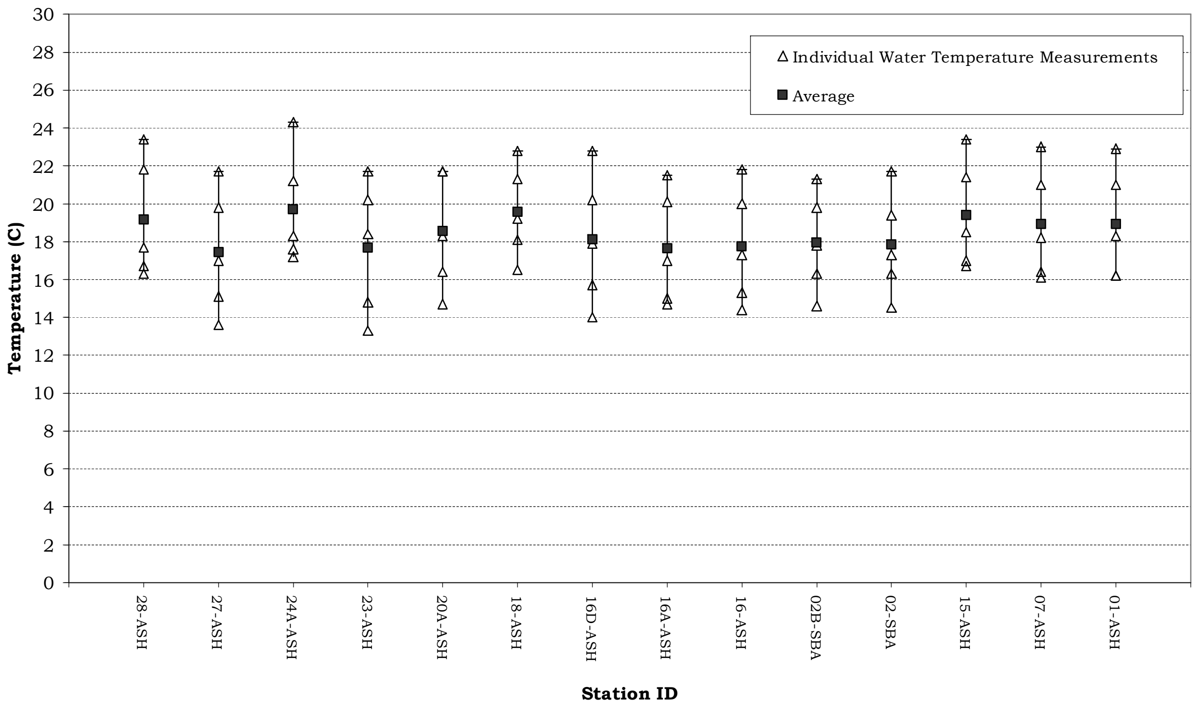
Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Table 8. Water Temperature Data Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (°C)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	16.3 - 23.4	Not Applicable	5
27-ASH	5	13.6 - 21.7	N/A	5
24A-ASH	5	17.2 - 24.3	N/A	5
23-ASH	5	13.3 - 21.7	N/A	5
20A-ASH	5	14.7 - 21.7	N/A	5
18-ASH	5	16.5 - 22.8	N/A	5
16D-ASH	5	14.0 - 22.8	N/A	5
16A-ASH	5	14.7 - 21.5	N/A	5
16-ASH	5	14.4 - 21.8	N/A	5
02B-SBA	5	14.6 - 21.3	N/A	5
02-SBA	5	14.5 - 21.7	N/A	5
15-ASH	5	16.7 - 23.4	N/A	5
07-ASH	5	16.1 - 23.0	N/A	5
01-ASH	5	16.2 - 22.9	N/A	5
Total	**70**	_____	**N/A**	**70**

Figure 5 shows the results of instantaneous water temperature measurements taken at 15 stations in the Ashuelot River watershed. The average water temperature varied from 17.4 °C. to 19.4 °C.

Figure 5. Water Temperature Statistics for the Ashuelot River Watershed
May 26 - September 15, 2009, NHDES VRAP



Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and the activity of bacteria in the water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation along the shoreline, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and the influence of groundwater.

Recommendations

- Continue collecting water temperature data via both instantaneous reading and long-term deployment of dataloggers.

4.6 *Escherichia coli*/Bacteria

Three samples were taken for *Escherichia coli* (*E. coli*) at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 9). Of the 56 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

Class B New Hampshire surface water quality standards for *E.coli* are as follows:

$\leq$406 cts/100 ml, based on any single sample or
$\leq$126 cts/100 ml, based on a geometric mean calculated from three samples collected within a 60-day period.

Table 9. *E.coli* Data Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (cts/100ml)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	4	1 - 3	0	4
27-ASH	4	12 - 19	0	4
24A-ASH	4	24 - 32	0	4
23-ASH	4	13 - 165	0	4
20A-ASH	4	26 - 66	0	4
18-ASH	4	56 - 69	0	4
16D-ASH	4	53 - 130	0	4
16A-ASH	4	53 - 104	0	4
16-ASH	4	74 - 162	0	4
02B-SBA	4	74 - 144	0	4
02-SBA	4	43 - 165	0	4
15-ASH	4	60 - 89	0	4
07-ASH	4	33 - 50	0	4
01-ASH	4	33 - 56	0	4
Total	**56**	_____	**0**	**56**

All measurements taken for *E.coli* met the state of New Hampshire Class B surface water quality standard (Figure 6).

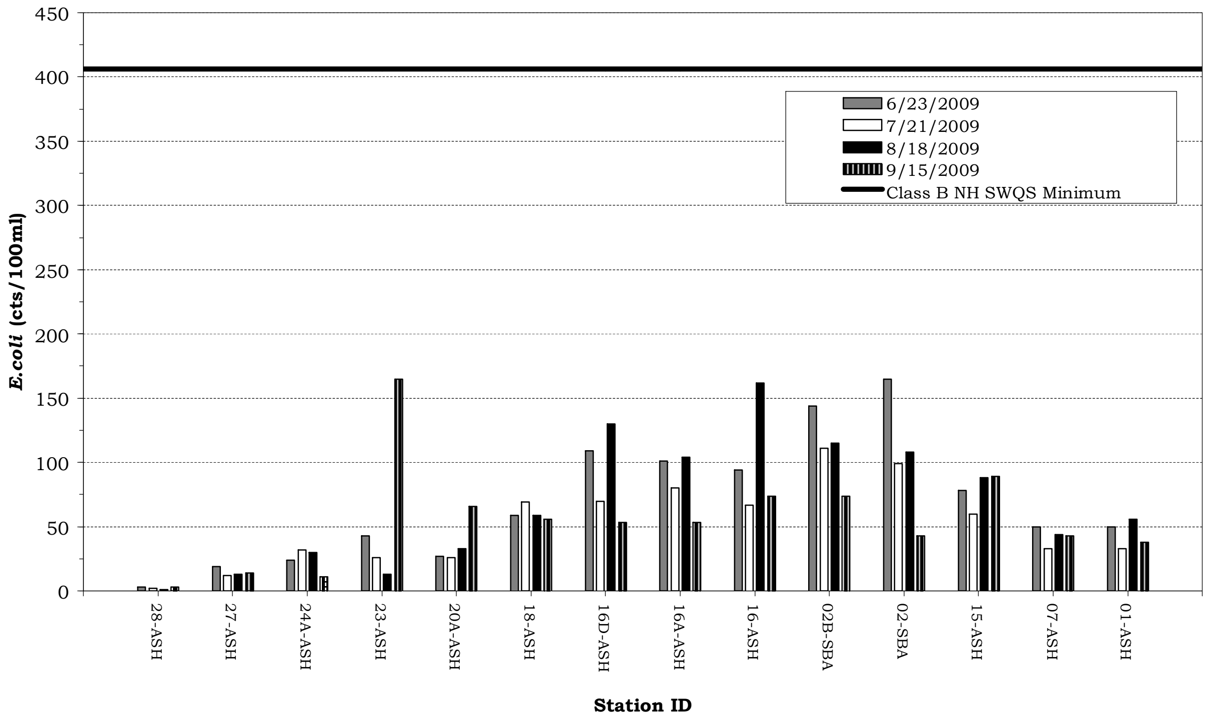
Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife (e.g., birds), and the presence of septic systems along the river.

In order to fully determine whether a waterbody is meeting surface water standards for *E.coli* a geometric mean must be calculated. A geometric mean is calculated using three samples collected within a 60-day period.
At all 14 stations two geometric means were calculated. All stations met the state of New Hampshire Class B geometric mean standard of 126 cts/100ml (Table 10).

Table 10. *E. coli* Geometric Mean Data Summary – Ashuelot River Watershed, 2009

Station ID	Number of Geometric Means Calculated	Geometric Mean 6/23/09 - 8/18/09	Geometric Mean 7/21/09 - 9/15/09	Geometric Means Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	2	2	2	0	2
27-ASH	2	14	13	0	2
24A-ASH	2	28	22	0	2
23-ASH	2	24	38	0	2
20A-ASH	2	29	38	0	2
18-ASH	2	62	21	0	2
16D-ASH	2	100	78	0	2
16A-ASH	2	94	76	0	2
16-ASH	2	104	93	0	2
02B-SBA	2	122	98	0	2
02-SBA	2	121	77	0	2
15-ASH	2	74	78	0	2
07-ASH	2	42	40	0	2
01-ASH	2	45	41	0	2
Total	**28**	_____	_____	**0**	**28**

Figure 6. *Escherichia coli* Statistics for the Ashuelot River Watershed
June 23 - September 15, 2009, NHDES VRAP



Recommendations

- Continue collecting three samples within any 60-day period during the summer to allow for determination of geometric means. Samples need only be collected during the critical period of May 24 to September 15 for assessment purposes. This coincides with the peak contact recreation season.

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling).

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling). At stations with particularly high bacteria levels volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated bacteria levels. Those sampling should also look for any potential sources of bacteria such as emission pipes, failed septic systems, farm animals, pet waste, wildlife and waterfowl.

4.7 Total Phosphorus

Three samples were taken for total phosphorus at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 11). Of the 41 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

There is no numeric standard for total phosphorus for Class B waters. The narrative standard states that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses." The NHDES "level of concern" for total phosphorous is 0.05 mg/L.

Table 11. Total Phosphorus Data Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (mg/L)	Acceptable Samples Exceeding NHDES Level of Concern	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	3	0.0075 - 0.015	0	3
27-ASH	3	0.012 - 0.016	0	3
24A-ASH	3	0.011 - 0.015	0	3
23-ASH	3	0.011 - 0.014	0	3
20A-ASH	2	0.014 - 0.023	0	2
18-ASH	3	0.014 - 0.024	0	3
16D-ASH	3	0.019 - 0.025	0	3
16A-ASH	3	0.027 - 0.047	0	3
16-ASH	3	0.018 - 0.032	0	3
02B-SBA	3	0.025 - 0.052	1	3
02-SBA	3	0.026 - 0.028	0	3
15-ASH	3	0.022 - 0.028	0	3
07-ASH	3	0.019 - 0.027	0	3
01-ASH	3	0.021 - 0.027	0	3
Total	**41**	____	**0**	**41**

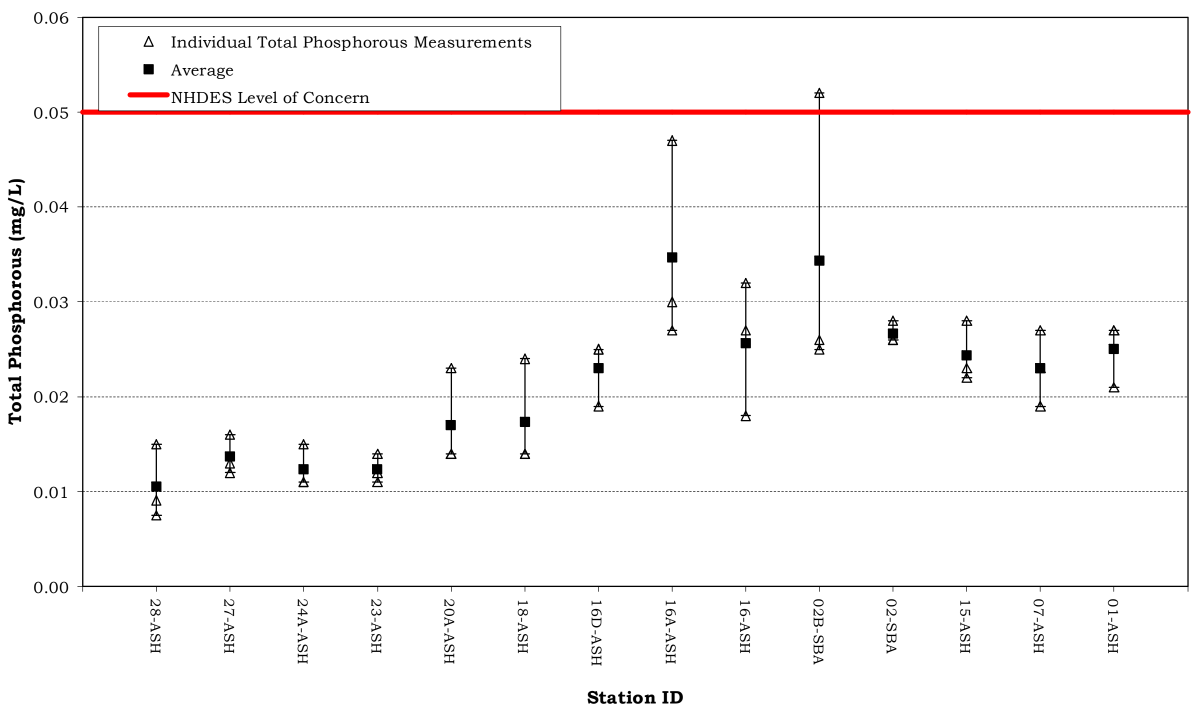
One measurement (at station 02B-SBA) was above the NHDES "level of concern" (Figure 7).

Under undisturbed natural conditions phosphorus is at very low levels in aquatic ecosystems. Of the three nutrients critical for aquatic plant growth;

potassium, nitrogen, and phosphorus, it is usually phosphorous that is the limiting factor to plant growth. When the supply of phosphorus is increased due to human activity, algae respond with significant growth.

A major source of excessive phosphorus concentrations in aquatic ecosystems can be wastewater treatment facilities, as sewage typically contains relatively high levels of phosphorus detergents. However, fertilizers used on lawns and agricultural areas can also contribute significant amounts of phosphorus.

Figure 7. Total Phosphorous Statistics for the Ashuelot River Watershed
June 23 - August 18, 2009, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

4.8 Chloride

Five samples were taken for chloride at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 12). Of the 70 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2010 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for chloride is as follows:

Freshwater chronic criterion	230 mg/l
Freshwater acute criterion	860 mg/l

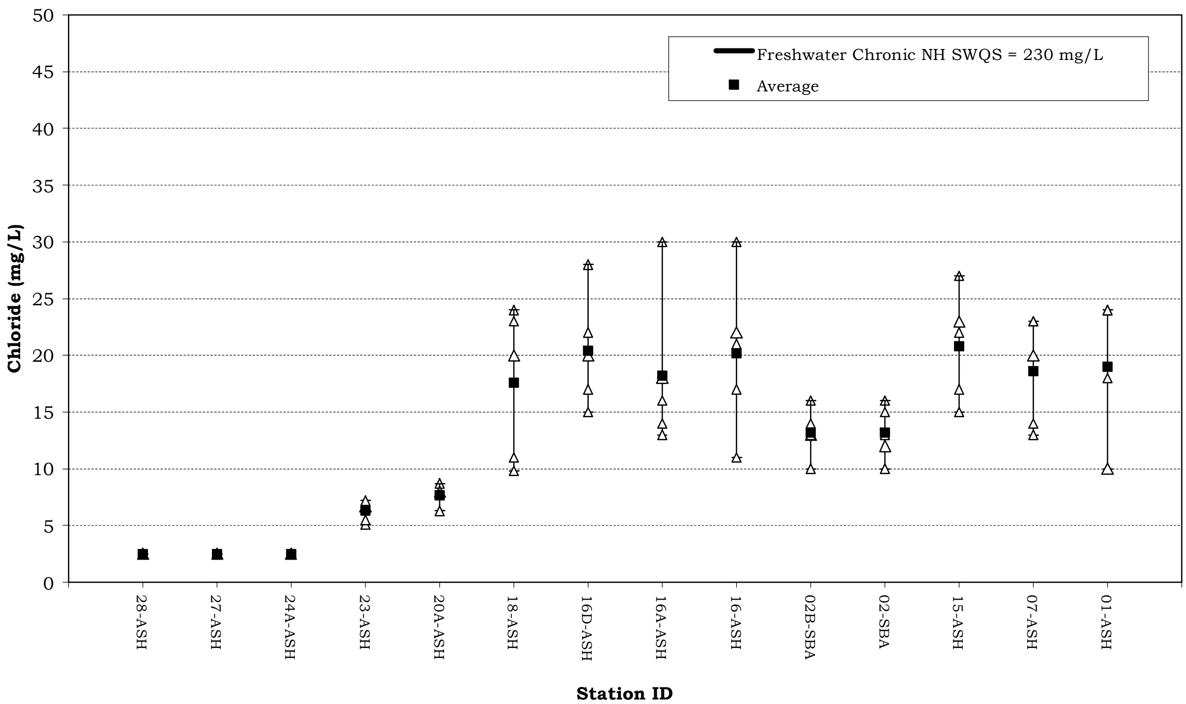
Table 12. Chloride Data Summary – Ashuelot River Watershed, 2009

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2010 NH Surface Water Quality Assessment
28-ASH	5	2.5 - 2.5	0	5
27-ASH	5	2.5 - 2.5	0	5
24A-ASH	5	2.5 - 2.5	0	5
23-ASH	5	5.1 - 7.2	0	5
20A-ASH	5	6.3 - 8.7	0	5
18-ASH	5	9.8 - 24	0	5
16D-ASH	5	15 - 28	0	5
16A-ASH	5	13 - 30	0	5
16-ASH	5	11 - 30	0	5
02B-SBA	5	10 - 16	0	5
02-SBA	5	10 - 16	0	5
15-ASH	5	15 - 27	0	5
07-ASH	5	13 - 23	0	5
01-ASH	5	10 - 24	0	5
Total	**70**	_____	**0**	**70**

All measurements were below the state of New Hampshire Class B chronic surface water quality standard (Figure 8).

Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. Road salt readily dissolves and enters aquatic environments in ionic forms. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans. Additional human sources of chloride can come from fertilizers, septic systems, and underground water softening systems.

Figure 8. Chloride Statistics for the Ashuelot River Watershed
May 26 - September 15, 2009, NHDES VRAP



Recommendations

- Continue collecting chloride samples during both low-flow summer months and during snowmelt period in winter and early spring. It is critical that specific conductance be recorded when chloride samples are collected.

APPENDIX A: 2009 ASHUELOT RIVER WATERSHED VRAP DATA REPORT

Measurements not meeting New Hampshire surface water quality standards
Total Phosphorous measurements exceeding NHDES level of concern
Measurements not meeting NHDES quality assurance/quality control standards

[A] Chronic water quality standard

28-ASH, Ashuelot River, Route 31, Washington

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	07:05	8.13	83.1	4.61	0.45	25.9	16.3				<5
6/23/2009	07:42	8.31	87.0	4.89	0.25	19.1	17.7	3		0.015	<5
7/21/2009	07:21	7.54	85.5	5.11	0.00	20.3	21.8	2		0.008	<5
8/18/2009	07:58	7.01	82.3	5.16	1.80	21.0	23.4	1	2	0.009	<5
9/15/2009	07:21	8.29	85.3	5.17	0.00	23.1	16.7	3	2		<5

27-ASH, Ashuelot River, Mountain Road, Lempster

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	07:48	8.96	86.1	4.77	0.20	30.4	13.6				<5
6/23/2009	08:22	8.49	87.9	4.84	0.00	25.0	17.0	19		0.016	<5
7/21/2009	07:56	7.75	84.8	4.91	0.15	23.6	19.8	12		0.012	<5
8/18/2009	08:28	7.42	84.5	5.01	2.50	23.3	21.7	13	14	0.013	<5
9/15/2009	07:56	8.61	85.3	5.19	0.15	25.8	15.1	14	13		<5

24A-ASH, Ashuelot River, Route 10, Marlow

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	08:50	8.30	87.1	5.01	1.50	34.1	17.6				<5
6/23/2009	09:18	8.43	89.5	4.95	0.50	29.7	18.3	24		0.011	<5
7/21/2009	08:36	7.81	88.1	5.06	0.15	27.6	21.2	32		0.011	<5
8/18/2009	09:04	7.38	87.3	4.92	2.10	28.3	24.3	30	28	0.015	<5
9/15/2009	08:33	8.50	88.3	5.16	0.10	32.9	17.2	11	22		<5

23-ASH, Asheulot River, Route 10, Gilsum

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	09:26	9.78	93.4	5.56	0.45	47.5	13.3				6.7
6/23/2009	09:44	8.59	91.8	5.44	0.35	33.7	18.4	43		0.011	5.1
7/21/2009	09:13	8.37	92.4	5.45	0.35	35.1	20.2	26		0.012	5.5
8/18/2009	09:31	8.22	93.5	5.66	1.80	42.4	21.7	13	24	0.014	7.0
9/15/2009	09:03	9.48	93.3	5.36	0.10	47.8	14.8	165	38		7.2

20A-ASH, Ashuelot River, Stone Arch Bridge, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	08:15	8.04	79.4	6.16	2.80	60.7	14.7				8.0
6/23/2009	07:30	8.08	86.2	6.66	3.30	44.2	18.3	27		0.014	6.3
7/21/2009	07:30	7.77	87.2	6.44	0.85	44.1	20.9	26			5.8
8/18/2009	08:12	7.02	79.8	5.64	~~4.10~~	62.5	21.7	33	29	0.023	8.7
9/15/2009	08:15	7.59	79.2		0.55	61.3	16.4	66	38		7.7

18-ASH, Ashuelot River, Route 101, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	09:15	8.29	85.1	6.49	1.10	107.5	16.5				20
6/23/2009	08:40	8.08	88.0	6.74	3.20	59.0	19.2	59		0.014	9.8
7/21/2009	08:25	7.89	89.6	6.61	1.30	61.8	21.3	69		0.014	11
8/18/2009	09:27	8.49	98.5	5.92	~~3.80~~	115.8	22.8	59	62	0.024	24
9/15/2009	09:30	8.11	85.8	6.71	1.20	119.1	18.1	56	21		23

16D-ASH, Ashuelot River, 40 Feet Upstream of Keene WWTF, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/26/2009	08:45	8.83	85.5	6.10	1.30	118.0	14.0				20
6/23/2009	09:35	8.87	93.5	6.18	1.80	76.5	17.9	109		0.019	15
7/21/2009	10:37	8.73	90.0	5.94	2.50	80.0	20.2	70		0.025	17
8/18/2009	10:25	7.13	82.8	6.24	3.90	132.1	22.8	130	100	0.025	28
9/15/2009	09:34	8.87	89.3	6.03	1.40	119.7	15.7	53	78		22

16A-ASH, Mouth of South Branch Ashuelot River, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	10:24	7.45	73.1	5.87	1.70	116.5	14.7				18
6/23/2009	08:40	7.55	78.2	5.87	4.00	71.7	17.0	101		0.047	14
7/21/2009	09:13	8.65	84.8	5.94	1.80	88.6	20.1	80		0.030	16
8/18/2009	09:50	6.84	77.9	6.28	4.30	96.7	21.5	104	94	0.027	30
9/15/2009	08:50	8.93	88.7	6.06	1.50	86.3	15.0	53	76		13

16-ASH, Ashuelot River, Cressen Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/26/2009	09:32	8.73	85.5	6.03	1.40	123.5	14.4				22
6/23/2009	08:05	8.63	89.9	6.12	1.20	78.8	17.3	94		0.018	11
7/21/2009	08:20	8.70	86.9	6.05	1.30	98.3	20.0	67		0.032	17
8/18/2009	08:20	6.52	75.0	6.09	4.90	133.9	21.8	162	104	0.027	30
9/15/2009	08:13	8.72	87.1	5.86	1.40	117.5	15.3	74	93		21

02B-SBA, South Branch Ashuelot River, Upstream of Monadnock Regional High School, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	10:55	9.00	88.4	6.65	1.60	84.7	14.6				13
6/23/2009	10:25	9.03	95.1	6.67	2.10	60.3	17.8	144		0.025	10
7/21/2009	08:55	8.15	89.4	6.76	2.60	81.6	19.8	111		0.052	14
8/18/2009	10:40	7.55	85.4	6.10	~~3.80~~	90.3	21.3	115	122	0.026	16
9/15/2009	12:05	9.15	98.0		3.60	80.0	16.3	74	98		13

02-SBA, South Branch Ashuelot River, Route 32 Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	10:05	8.85	86.7	6.73	1.80	88.6	14.5				12
6/23/2009	09:30	8.66	90.5	6.66	2.30	61.7	17.3	165		0.026	10
7/21/2009	08:55	7.98	87.3	6.68	2.30	82.0	19.4	99		0.028	15
8/18/2009	10:00	8.59	97.8	6.08	~~3.30~~	91.5	21.7	108	121	0.026	16
9/15/2009	10:15	8.50	90.2	6.54	1.50	82.1	16.3	43	77		13

15-ASH, Ashuelot River, Thompson Covered Bridge, West Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	09:26	8.00	83.2	6.55	1.40	121.5	17.0				23
6/23/2009	09:20	8.25	87.8	6.45	2.30	80.6	18.5	78		0.023	15
7/21/2009	10:33	7.32	82.8	6.59	1.60	87.1	21.4	60		0.022	17
8/18/2009	09:55	6.75	79.2	6.51	~~4.00~~	132.4	23.4	88	74	0.028	27
9/15/2009	08:55	8.38	86.1	6.23	1.70	123.2	16.7	89	78		22

07-ASH, Ashuelot River, Route 119, Winchester

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Water Temp. (°C)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	08:55	8.48	86.5	6.66	1.50	114.9	16.1				20
6/23/2009	08:35	8.69	92.2	6.64	1.80	76.9	18.2	50		0.023	13
7/21/2009	09:48	7.58	85.3	6.67	1.50	82.3	21.0	33		0.019	14
8/18/2009	09:15	7.20	83.8	6.68	~~3.70~~	119.8	23.0	44	42	0.027	23
9/15/2009	08:25	8.40	86.1	6.40	1.30	126.3	16.4	43	40		23

01-ASH, Ashuelot River, 147 River Street, Hinsdale

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**(µS/cm as chloride surrogate)**	**NA**	**<406**	**<126**	**NA**	**230[A]**
5/26/2009	07:55	9.24	94.5	7.32	1.30	112.3	16.2				18
6/23/2009	07:50	9.02	96.7	7.01	2.00	75.0	18.3	50		0.027	13
7/21/2009	08:34	8.16	91.6	6.86	1.80	83.9	21.0	33		0.021	17
8/18/2009	08:30	8.02	93.8	7.04	~~3.70~~	118.3	22.9	56	45	0.027	24
9/15/2009	07:45	9.20	93.9	6.77	1.00	126.1	16.2	38	41		24

APPENDIX B:
Interpreting VRAP Water Quality Monitoring Parameters

Chemical Parameters

Dissolved Oxygen (DO)

- **Unit of Measurement:** concentration in milligrams per liter (mg/L) and percent saturation (%).
- **Description:** A measure of the amount of oxygen in the water: Concentration is a measure of the amount of oxygen in a volume of water; saturation is a measurement of the amount of oxygen in the water compared to the amount of oxygen the water can actually hold at full saturation. Both of these measurements are necessary to accurately determine whether New Hampshire surface water quality standards are met.
- **Importance**: Oxygen is dissolved into the water from the atmosphere, aided by wind and wave action, or by rocky, steep, or uneven stream beds. The presence of dissolved oxygen is vital to bottom-dwelling organisms as well as fish and amphibians. Aquatic plants and algae produce oxygen in the water during the day, and consume oxygen during the night. Bacteria utilize oxygen both day and night when they process organic matter into smaller and smaller particles.

Class A NH Surface Water Quality Standard: 6 mg/L at any place or time, or 75% minimum daily average – (unless naturally occurring).

Class B NH Surface Water Quality Standard: 5 mg/L at any place or time or 75% minimum daily average – (unless naturally occurring).

Several measurements of oxygen saturation taken in a 24-hour period must be averaged to compare to the 75 percent daily average saturation standard. The concentration of dissolved oxygen is dependent on many factors including temperature and sunlight, and tends to fluctuate throughout the day. Saturation values are averaged because a reading taken in the morning may be low due to respiration, while a measurement that afternoon may show that the saturation has recovered to acceptable levels. Water can become saturated with more than 100 percent dissolved oxygen.

pH

- **Unit of Measurement:** units (no abbreviation).
- **Description:** A measure of hydrogen ion activity in water, or, in general terms, the acidity of water. pH is measured on a logarithmic scale of 0 to 14, with 7 being neutral. A high pH indicates alkaline (or basic) conditions and a low pH indicates acidic conditions. pH is influenced by geology and soils, organic acids (decaying leaves and other matter), and human-induced acids from acid rain (which typically has a pH of 3.5 to 5.5).
- **Importance:** pH affects many chemical and biological processes in the water and this is important to the survival and reproduction of fish and other aquatic life. Different organisms flourish within different ranges of pH. Measurements outside of an organism's preferred range can limit growth and reproduction and lead to physiological stress. Low pH can also affect the toxicity of aquatic compounds such as ammonia and certain metals by making them more "available" for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life.

Class A NH Surface Water Quality Standard: Between 6.5 and 8.0 (unless naturally occurring).

Class B NH Surface Water Quality Standard: Between 6.5 and 8.0 (unless naturally occurring).

Sometimes, readings that fall below this range are determined to be naturally occurring. This is often a result of wetlands near the sample station. Wetlands can lower pH because the tannic and humic acids released by decaying plants can cause water to become more acidic.

pH Units	Category
<5.0	High Impact
5.0 – 5.9	Moderate to High Impact
6.0 – 6.4	Normal; Low Impact
6.5 – 8.0	Normal;
6.1 – 8.0	Satisfactory

Specific Conductance or Conductivity

- **Unit of Measurement:** micromhos per centimeter (umhos/cm) or microsiemens per centimeter (uS/cm).
- **Description:** The numerical expression of the ability of water to carry an electrical current at 25° C and a measure of free ion (charged particles) content in the water. These ions can come from natural sources such as bedrock, or human sources such as stormwater runoff. Specific conductance can be used to indicate the presence of chlorides, nitrates, sulfates, phosphates, sodium, magnesium, calcium, iron, and aluminum ions. There is a difference between conductivity and specific conductance. Specific conductance measures the free ion content of water at a *specific* water temperature, whereas conductivity measures the free ion content of water at 25° C. VRAP uses the term "specific conductance" because our conductivity measurements account for temperature. In some studies and programs, the term "conductivity" is used. This term should only be used when the measurement *does not* adjust to a specific temperature.
- **Importance:** Specific conductance readings can help locate potential pollution sources because polluted water usually has a higher specific conductance than unpolluted waters. High specific conductance values often indicate pollution from road salt, septic systems, wastewater treatment plants, or urban/agricultural runoff. Specific conductance can also be related to geology. In unpolluted rivers and streams, geology and groundwater are the primary influences on specific conductance levels.

Class A NH Surface Water Quality Standard: No numeric standard.

Class B NH Surface Water Quality Standard: No numeric standard.

Although there is no formal standard for specific conductance, data collect by VRAP groups and NHDES indicated a very close relationship between specific conductance levels and chloride. In some cases NHDES can use specific conductance measurements as a surrogate for chloride levels. The data collected by NHDES indicate that the chronic chloride standard is correlated with a specific conductance level of approximately 850 µS/cm.

Specific Conductance *(uS/cm)*	**Category**
0 – 100	Normal
101 – 200	Low Impact
201 – 500	Moderate Impact
> 501	High Impact
> 850	Likely exceeding chronic chloride standard

Turbidity

- **Unit of Measurement:** Nephelometric Turbidity Units (abbreviated at NTU).
- **Description:** A measurement of the amount of suspended material in the water. This material, which is comprised of particles such as clay, silt, algae, suspended sediment, and decaying plant material, causes light to be scattered and absorbed, rather than transmitted in straight lines through the water.
- **Importance:** Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces dissolved oxygen (DO) concentrations because warm water holds less DO than cold water. Higher turbidity also reduces the amount of light that can penetrate the water, which reduces photosynthesis and DO production. Suspended materials can clog fish gills, reducing disease resistance, lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates. Clean waters are generally associated with low turbidity, but there is a high degree of natural variability involved. Rain events can increase turbidity in surface waters by flushing sediment, organic matter and other materials into the water. Human activities such as vegetation removal and soil disruption can also lead to dramatic increases in turbidity levels.

Class A NH Surface Water Quality Standard: As naturally occurs.

Class B NH Surface Water Quality Standard: Shall not exceed naturally occurring conditions bv more than 10 NTU.

Physical Parameters

Temperature

- **Unit of Measurement:** Degrees Celsius (° C)
- **Importance:** Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and bacteria activity in water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

  A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and groundwater.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard

Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Chlorophyll-a (Chlor a)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** An indicator of the biomass, or abundance, of planktonic algae in the river. The technical term "biomass" is used to represent "amount by weight." Chlorophyll-a can be strongly influenced by phosphorus, which is derived by natural and human activities.

Importance: Because algae is a plant and contains the green pigment chlorophyll-a, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae. If the chlorophyll-a concentration increases, this indicates an increase in the algal population.

Class A NH Surface Water Quality Standard: No numeric standard.

Class B NH Surface Water Quality Standard: No numeric standard.

Chlorophyll-a *(mg/L)*	**Category**
< 3	Excellent
3 – 7	Good
7 – 15	Less than desirable
> 15	Nuisance

Total Phosphorus (TP)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** A measure of all forms of phosphorus in the water, including inorganic and organic forms. There are many sources of phosphorus, both natural and human. These include soil and rocks, sewage, animal manure, fertilizer, erosion, and other types of contamination.
- **Importance:** Phosphorus is a nutrient that is essential to plants and animals. However, excess amounts can cause rapid increases in the biological activity in water. Phosphorus is usually the "limiting nutrient" in freshwater streams, which means relatively small amounts can increase algae and chlorophyll-a levels. Algal blooms and/or excessive aquatic plant growth can decrease oxygen levels and make water unattractive. Phosphorus can indicate the presence of septic systems, sewage, animal waste, lawn fertilizer, road and construction erosion, other types of pollution, or natural wetlands and atmospheric deposition.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard; as naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses.

Total Phosphorus *(mg/L)*	**Category**
< 0.010	Ideal
0.011 – 0.025	Average
0.026 – 0.050	More than desirable
> 0.051	Excessive (potential nuisance concentration)

Total Kjeldahl Nitrogen (TKN)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** A measure of the amount of ammonia and organic nitrogen in the water.
- **Importance:** High nitrogen levels can increase algae and chlorophyll-a levels in the river, but is generally less of a concern in fresh water than phosphorus. Nitrogen can indicate the presence of sewage, animal waste, fertilizer, erosion, or other types of pollution.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard; as naturally occurring, shall contain no nitrogen in such concentrations that would impair any existing or designated uses.

TKN *(mg/L)*	**Category**
< 0.25	Ideal
0.26 – 0.40	Average
0.41 – 0.50	More than desirable
> 0.51	Excessive (potential nuisance concentration)

Other Parameters

Chloride

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** The chloride ion (Cl-) is found naturally in some surface waters and groundwater. It is also found in high concentrations in seawater. Higher-than-normal chloride concentrations in freshwater is detrimental to water quality. In New Hampshire, applying road salt for winter accident prevention is a large source of chloride to the environment. Unfortunately, this has increased over time due to road expansion and increased vehicle traffic. Road salt (most often sodium chloride) readily dissolves and enters aquatic environments in ionic forms. Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Sodium chloride is also used on foods as table salt, and consequently is present in human waste. Thus, sometimes chloride in water can indicate sewage pollution. Saltwater intrusion can also elevate groundwater chlorides in drinking water wells near coastlines. Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans.
- **Importance:** Research shows elevated chloride levels can be toxic to freshwater aquatic life. Among the species tested, freshwater aquatic plants and invertebrates tend to be the most sensitive to chloride. In order to protect freshwater aquatic life in New Hampshire, the state has adopted acute and chronic chloride criteria.

Acute Standard: 860 mg/L.

Chronic Standard: 230 mg/L.

Escherichia Coliform Bacteria *(E. coli)*

- **Unit of Measurement:** Counts per 100 milliliter (cts/100 mL).
- **Description:** An indicator of the potential presence of pathogens in fresh water. *E. coli* bacteria is a normal component in the large intestines of humans and other warm-blooded animals, and can be excreted in their fecal material. Organisms causing infections or disease (pathogens) are often excreted in the fecal material of humans and other warm-blooded animals.
- **Importance:** *E.coli* bacteria is a good indicator of fecal pollution and the possible presence of pathogenic organisms. In freshwater, *E. coli* concentrations help determine if the water is safe for recreational uses such as swimming.

  Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife, and the presence of septic systems along the river.

Class A NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 47 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 153 *E.coli* cts/100 mL in any one sample.

Class B NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 126 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 406 *E.coli* cts/100 mL in any one sample.

Metals

Depending on the metal concentration, its form (dissolved or particulate), and the hardness of the water, trace metals can be toxic to aquatic life. Metals in dissolved form are generally more toxic than metals in the particulate form. The dissolved metal concentration is dependent on pH, as well as the presence of solids and organic matter that can bind with the metal to render it less toxic.

Hardness is primarily a measure of the calcium and magnesium ion concentrations in water, expressed as calcium carbonate. The hardness concentration affects the toxicity of certain metals. New Hampshire water quality regulations include numeric criteria for a variety of metals. Since dissolved metals are typically found in extremely low concentrations, the potential contamination of samples collected for trace metals analyses has become a primary concern of water quality managers. To prevent such contamination and to ensure reliable results, the use of “clean techniques” is becoming more and more frequent when sampling for dissolved metals. Because of this, sampling for metals may be more costly and require additional effort than in the past.

New Hampshire Volunteer River Assessment Program

29 Hazen Drive – PO Box 95
Concord, NH 03302-0095
p (603) 271-0699 – f (603) 271-7894
www.des.nh.gov

2008

APPENDIX C:

2009 VRAP Field Audit

VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group is notified of the result of the verification visit. During the visit, volunteers were assessed in the following five categories:

1) **Overall Sampling Procedures**

   Appropriate storage of meters, sample collection, laboratory sample collection and transportation, beginning and end of day meter checks, collecting a field replicate, performing QA/QC Meter Checks, and ensuring that all calibration and sampling data are properly documented on the VRAP Field Data Sheet and the Laboratory Services Login & Custody Sheet.

2) **Turbidity**

   Inspecting and cleaning of glass turbidity vials prior to measurement of standards and samples, performing the *Initial Turbidity Meter Check,* calibrating the meter to a known standard at the beginning of the sampling day, recording the value of the DI turbidity blank *(QA/QC Meter Check)* once during the sampling day, and performing the *"End of the Day Meter Check"* at the conclusion of the sampling day.

3) **pH**

   Inspecting the pH electrode prior to sampling, calibrating to both pH 7.0 and 4.0 buffers prior to each measurement, rinsing and wiping the pH electrode probe prior to and after the measurement of standards and samples, allowing the pH measurement to stabilize prior to recording the measurement, and recording the value of the 6.0 buffer *(QA/QC Meter Check)* once during the sampling day.

4) **Water Temperature/Dissolved Oxygen**

   Ensuring that the meter is allowed an adequate time to stabilize prior to the first calibration, the meter is calibrated prior to each measurement, the calibration value is properly recorded, the chamber reading is properly recorded, that sufficient time is allowed for readings to stabilize, and that a zero oxygen check (*QA/QC Meter Check)* is completed during the sampling day.

5) **Specific Conductance**

   Performing the *Initial Conductivity Meter Check* using a known standard, allowing for the meter to properly stabilize before recording measurements, properly cleaning the probe between stations, and performing the *End of the Day Meter Check* at the conclusion of the sampling day.

During the field audit, VRAP staff offer important reminders and suggestions to ensure proper sampling techniques and re-trained volunteers in the areas needing improvement. It is important to ensure that all volunteers attend an annual VRAP training workshop prior to the sampling season to familiarize themselves with proper sampling techniques. Please remember to schedule an annual field audit in 2010.

New Hampshire Volunteer River Assessment Program 2010 Ashuelot River Watershed Water Quality Report

NEW HAMPSHIRE DEPARTMENT OF Environmental Services

February 2011

NHDES R-WD-11-1B

New Hampshire Volunteer River Assessment Program
2010 Ashuelot River Watershed Water Quality Report

State of New Hampshire
Department of Environmental Services
Water Division
Watershed Management Bureau
P.O. Box 95
29 Hazen Drive
Concord, New Hampshire 03302-0095
www.des.nh.gov

Thomas S. Burack
Commissioner

Harry T. Stewart
Water Division Director

Prepared By:

Ted Walsh, VRAP Program Manager

Jen Drociak, VRAP Coordinator

Suzanne Richardson, VRAP Assistant

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February 2011

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The New Hampshire Department of Environmental Services Volunteer River Assessment Program extends sincere thanks to the volunteers of the Ashuelot River Local Advisory Committee for their efforts during 2010. This report was created solely from the data collected by the volunteers listed below. Their time and dedication is an expression of their genuine concern for local water resources and has significantly contributed to our knowledge of river and stream water quality in New Hampshire.

2010 Ashuelot River Volunteers

Jeffrey Brooks
Paul Daniello
John Davis
Pat Eggleston
Linda Fuerderer
Felicity Freese
Josh Goodell
Jim Holley
Sue Holley
Bob Lamoy
Carolyn MacDonald
Mike Morrison
Mary-Kate Sheridan
Barbara Skuly
Ann Sweet
Roger Sweet
Brett Thelen
Bob Thompson

1.0 INTRODUCTION

1.1. Purpose of Report

Each year the New Hampshire Volunteer River Assessment Program (VRAP) prepares and distributes a water quality report for each volunteer river monitoring group that is based solely on the water quality data collected by that group during a specific year. The reports summarize and interpret the data, particularly as they relate to New Hampshire's surface water quality standards, and serve as a teaching tool and guidance document for future monitoring activities by the individual volunteer groups.

1.2. Report Format

Each report includes the following:

- **Volunteer River Assessment Program Overview**

  This section includes a description of the history of VRAP, the technical support, training and guidance provided by NHDES, and how data is transmitted to the volunteers and used in surface water quality assessments.

- **Monitoring Program Description**

  This section provides a description of the volunteer group's monitoring program including monitoring objectives as well as a table and map showing sample station locations.

- **Results and Recommendations**

  Water quality data collected during the year are summarized on a parameter-by-parameter basis using: (1) a data summary table, which includes the number of samples collected, data ranges, the number of samples meeting New Hampshire water quality standards, and the number of samples adequate for water quality assessments at each station; (2) a discussion of the data; (3) a river graph showing the range of measured values at each station; and (4) a list of applicable recommendations.

  Sample results reported as less than the detection limit were assumed equal to one-half the detection limit on the river graphs. This approach simplifies the understanding of the parameter of interest, and specifically helps one to visualize how the river or watershed is functioning from upstream to downstream. In addition, this format allows the reader to better understand potential pollution areas and target those areas for additional sampling or environmental enhancements. Where applicable, the river graph also shows New Hampshire surface water quality standards or levels of concern for comparison purposes.

- **Appendix A – Water Quality Data**

  This appendix includes a spreadsheet detailing the data results and additional information such as data results which do not meet New Hampshire surface water quality standards, and data that is unusable for assessment purposes due to quality control requirements.

- **Appendix B – Interpreting VRAP Water Quality Parameters**

  This appendix provides a brief description of water quality parameters typically sampled by VRAP volunteers and their importance, as well as applicable state water quality criteria or levels of concern.

- **Appendix C – VRAP Volunteer Monitor Field Sampling Procedures Assessment *(Field Audits)***

  This appendix provides an overview of the VRAP Volunteer Monitor Field Sampling Procedures Assessment (field audit) process with respect to programmatic quality assurance/quality control (QA/QC) guidelines.

PROGRAM OVERVIEW

2.1 What is VRAP?

In 1998, the New Hampshire Volunteer River Assessment Program was established to promote awareness and education of the importance of maintaining water quality in New Hampshire's rivers and streams. VRAP aims to educate people about river and stream water quality and ecology and to improve water quality monitoring coverage for the protection of water resources.

Today, VRAP loans water quality monitoring equipment, provides technical support, and facilitates educational programs to volunteer groups on numerous rivers and watersheds throughout the state. VRAP volunteers conduct water quality monitoring on an ongoing basis and increase the amount of river water quality information available to local, state and federal governments, which allows for better watershed planning.

2.2 Why is VRAP Important?

VRAP establishes a regular volunteer-driven water sampling program to assist NHDES in evaluating water quality throughout the state. VRAP empowers volunteers with information about the health of New Hampshire's rivers and streams. Regular collection of water quality data allows for early detection of water quality changes allowing NHDES to trace potential problems to their source. Data collected by VRAP volunteers are directly contributing to New Hampshire's obligations under the Clean Water Act. Measurements taken by volunteers are used in assessing the water quality of New Hampshire's river and streams, and are included in reporting to the US Environmental Protection Agency.

2.3 How Does VRAP Work?

VRAP is a cooperative program between NHDES, river groups, local advisory committees, watershed associations, and individuals working to protect New Hampshire's rivers and streams. Volunteers are trained by VRAP staff in the use of water quality monitoring equipment at an annual training workshop. VRAP works with each group to establish monitoring stations and develop a sampling plan.

During the summer months, VRAP receives water quality data from trained volunteers. The data are reviewed for quality assurance, and are entered into the environmental monitoring database at NHDES. During the off-season, VRAP interprets the data and compiles the results into an annual report for each river. VRAP volunteers can use the data as a means of understanding the details of water quality, as well as guide future sampling efforts. NHDES can use the data for making surface water quality assessments, provided that the data met certain quality assurance/quality control guidelines.

2.4 Equipment and Sampling Schedule

VRAP frequently lends and maintains water quality monitoring equipment kits to VRAP groups throughout the state. The kits contain meters and supplies for routine water quality parameter measurements of turbidity, pH, dissolved oxygen, water temperature and specific conductance (conductivity). Other parameters such as nutrients, metals, and *E. coli* can also be studied, although VRAP does not always provide funds to cover laboratory analysis costs. Thus, VRAP encourages groups to pursue other fundraising activities such as association membership fees, special events, in-kind services (non-monetary contributions from individuals and organizations), and grant writing.

Each year, volunteers design and arrange a sampling schedule in cooperation with VRAP staff. Project designs are created through a review and discussion of existing water quality information, such as known and perceived problem areas or locations of exceptional water quality. The interests, priorities, and resources of the partnership determine monitoring locations, parameters, and frequency. VRAP typically recommends sampling every other week from May through September, and VRAP groups are encouraged to organize a long-term sampling program in order to begin to determine trends in river conditions.

2.5 Training and Technical Support

Each VRAP volunteer attends an annual training workshop to receive a demonstration of monitoring protocols and sampling techniques and the calibration and use of water quality monitoring equipment. During the training, volunteers have an opportunity for hands-on use of the equipment and receive instruction in the collection of samples for laboratory analysis.

VRAP groups conduct sampling according to a prearranged monitoring schedule and VRAP protocols. VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group's monitoring coordinator is notified of the result of the verification visit. VRAP groups forward water quality results to NHDES for incorporation into an annual report and state water quality assessment activities.

2.6 Data Usage

Annual Water Quality Reports

Water quality measurements repeated over time create a picture of the fluctuating conditions in rivers and streams and help to determine where improvements, restoration or preservation may benefit the river and the communities it supports. All data collected by volunteers are summarized in water quality reports that are prepared and distributed after the conclusion of the sampling period. VRAP groups can use the reports and data as a means of understanding the details of water quality, guiding future sampling efforts, or determining restoration activities.

New Hampshire Surface Water Quality Assessments

Along with data collected from other water quality programs, specifically the State Ambient River Monitoring Program, applicable volunteer data are used to support periodic NHDES surface water quality assessments. VRAP data are entered into NHDES's environmental monitoring database and are ultimately uploaded to the EPA database. Assessment results and the methodology used to assess surface waters are published by NHDES every two years (i.e., Section 305(b) Water Quality Reports) as required by the federal Clean Water Act. The reader is encouraged to log on to the NHDES web page to review the assessment methodology and list of impaired waters http://des.nh.gov/organization/divisions/water/wmb/swqa/index.htm.

2.7 Quality Assurance/Quality Control

In order for VRAP data to be used in the assessment of New Hampshire's surface waters, the data must meet quality control guidelines as outlined in the VRAP Quality Assurance Project Plan (QAPP). The VRAP QAPP was approved by NHDES and reviewed by EPA in the summer of 2003. The QAPP is reviewed annually and is officially updated and approved every five years. The VRAP quality assurance/quality control (QA/QC) measures include a six-step approach to ensuring the accuracy of the equipment and consistency in sampling efforts.

- **Calibration:** Prior to each measurement, the pH and DO meters must be calibrated. Conductivity and turbidity meters are checked against a known standard before the first measurement and after the last one.
- **Replicate Analysis:** A second measurement by each meter is taken from the original sample at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the replicate analysis should be conducted at different stations. Replicates should be measured within 15 minutes of the original measurements.
- **6.0 pH Standard:** A reading of the pH 6.0 buffer is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the 6.0 pH standard check should be conducted at different stations.
- **Zero Oxygen Solution:** A reading of a zero oxygen solution is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the zero oxygen standard check should be conducted at different stations.
- **DI (De-Ionized) Turbidity Blank**: A reading of the DI blank is recorded at one of the stations during the sampling day. If the same sampling schedule is used throughout the monitoring season, the blank check should be conducted at different stations.
- **End of the Day Conductivity and Turbidity Meter Check:** At the conclusion of each sampling day, the conductivity and turbidity meters are re-checked against a known standard.

2.7.1 Measurement Performance Criteria

Precision is calculated for field and laboratory measurements through measurement replicates (instrumental variability) and is calculated for each sampling day. The use of VRAP data for assessment purposes is contingent on compliance with a parameter-specific relative percent difference (RPD) as derived from equation 1, below. Any data exceeding the limits of the individual measures are disqualified from surface water quality assessments. All data that exceeds the limits defined by the VRAP QAPP are acknowledged in the data tables with an explanation of why the data was unusable. Table 1 shows typical parameters studied under VRAP and the associated quality control procedures.

(Equation 1. Relative Percent Difference)

$$RPD = \frac{|x_1 - x_2|}{\frac{x_1 + x_2}{2}} \times 100 \%$$

where x_1 is the original sample and x_2 is the replicate sample

Table 1. Field Analytical Quality Controls

Water Quality Parameter	QC Check	QC Acceptance Limit	Corrective Action	Person Responsible for Corrective Action	Data Quality Indicator
Temperature	Measurement Replicate	RPD < 10% or Absolute Difference <0.8 C.	Repeat Measurement	Volunteer Monitors	Precision
Dissolved Oxygen	Measurement Replicate	RPD < 10%	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (Zero O_2 Sol.)	RPD < 10% or Absolute Difference <0.4 mg/L	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Relative Accuracy
pH	Measurement Replicate	Absolute Difference <0.3 pH units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Buffer (pH = 6.0)	± 0.1 std units	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Specific Conductance	Measurement Replicate	RPD < 10% or Absolute Difference <5µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Known Standard	± 20% µS/cm	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Turbidity	Measurement Replicate	RPD < 10% or Absolute Difference <1.0 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Precision
	Method Blank (DI Water)	± 0.1 NTU	Recalibrate Instrument, Repeat Measurement	Volunteer Monitors	Accuracy
Laboratory Parameters	Measurement Replicate	RPD < 20% or Absolute Difference less than ½ the mean value of the parameter in NHDES's Environmental Monitoring Database	Repeat Measurement	Volunteer Monitors	Precision

3.0 METHODS

In 2001, volunteers from the Ashuelot River Local Advisory Committee began monitoring water quality on the Ashuelot River. The goal of this effort was to provide water quality data from the Ashuelot River relative to surface water quality standards and to allow for the assessment of the river for support of aquatic life and primary contact recreation (swimming). The establishment of a long-term monitoring program allows for an understanding of the river's dynamics, or variations on a station-by-station and year-to-year basis. The data can also serve as a baseline from which to determine any water pollution problems in the river and/or watershed. The Volunteer River Assessment Program has provided field training, equipment, financial assistance for laboratory costs, and technical assistance.

During 2010, trained volunteers from the Ashuelot River Local Advisory Committee monitored water quality at 14 stations in the Ashuelot River watershed from its upper limits in Washington to just upstream of its confluence with the Connecticut River in Hinsdale (Table 3).

Stations IDs are designated using a three-letter code to identify the waterbody name plus a number indicating the relative position of the station. The higher the station number the more upstream the station is in the watershed. All stations monitored in 2010 are designated as Class B waters. This classification is used to apply the appropriate water quality standard.

Water quality monitoring was conducted monthly from May to September. In-situ measurements of pH, water temperature, dissolved oxygen, and specific conductance were taken using handheld meters. Turbidity samples were collected in the field, brought to a central location, and measured the same day. Samples for *E.coli*, total phosphorous, and chloride were taken using sterile and/or preserved bottles and were stored on ice during transport from the field to the NHDES laboratory or EAI Analytical Laboratory. Table 2 summarizes the parameters measured, laboratory standard methods, and equipment used.

Table 2. Sampling and Analysis Methods

Parameter	Sample Type	Standard Method	Equipment Used	Laboratory
Dissolved Oxygen	In-Situ	SM 4500 O G	YSI 55 YSI 95	------
pH	In-Situ	SM 4500 H+	Orion 210A	------
Turbidity	In-Situ	EPA 180.1	LaMotte 2020	
Specific Conductance	In-Situ	SM 2510	YSI 30	------
Temperature	In-Situ	SM 2550	YSI 95	------
E.coli	Bottle (Sterile)	EPA 1103.1	------	EAI Analytical Laboratory
Total Phosphorus	Bottle (w/ Preservative)	EPA 365.3	------	NHDES
Chloride	Bottle	SM D512C	------	NHDES Limnology Center

Table 3. Sampling Stations for the Ashuelot River, NHDES VRAP, 2010

Station ID & AUID	Class	Waterbody Name	Location	Town	Elevation (Rounded to the Nearest 100 Feet)
28-ASH NHRIV802010101-08	**B**	**Ashuelot River**	Route 31	Washington	1600
27-ASH NHRIV802010101-08	**B**	**Ashuelot River**	Mountain Road	Lempster	1500
24A-ASH NHRIV802010102-11	**B**	**Ashuelot River**	Route 10	Marlow	1100
23-ASH NHRIV802010103-22	**B**	**Ashuelot River**	Route 10	Gilsum	800
20A-ASH NHRIV802010301-04	**B**	**Ashuelot River**	Stone Arch Bridge	Keene	500
18-ASH NHRIV802010301-09	**B**	**Ashuelot River**	Route 101	Keene	500
16D-ASH NHRIV802010301-11	**B**	**Ashuelot River**	50' Upstream of Keene WWTF	Swanzey	500
16A-ASH NHRIV802010301-11	**B**	**Ashuelot River**	Mouth of the South Branch	Swanzey	500
16-ASH NHRIV802010401-15	**B**	**Ashuelot River**	Cresson Bridge	Swanzey	500
02B-SBA NHRIV600030608-15	**B**	**South Branch Ashuelot River**	Upstream of Monadnock Regional High School	Swanzey	500
02-SBA NHRIV802010303-23	**B**	**South Branch Ashuelot River**	Route 32 Bridge	Swanzey	500
15-ASH NHIMP802010401-01	**B**	**Ashuelot River**	Thompson Covered Bridge	West Swanzey	400
07-ASH NHRIV802010403-07	**B**	**Ashuelot River**	Route 119	Winchester	400
01-ASH NHRIV802010403-20	**B**	**Ashuelot River**	147 River Street	Hinsdale	200

RESULTS AND RECOMMENDATIONS

Results and recommendations for each monitored parameter are presented in the following sections. For a description of the importance of each parameter and pertinent water quality criteria for these and other parameters, please see Appendix B, *"Interpreting VRAP Water Quality Parameters."*

4.1 Dissolved Oxygen

Either four or five measurements were taken in the field for dissolved oxygen concentration at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 4). Of the 68 measurements taken, 65 met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

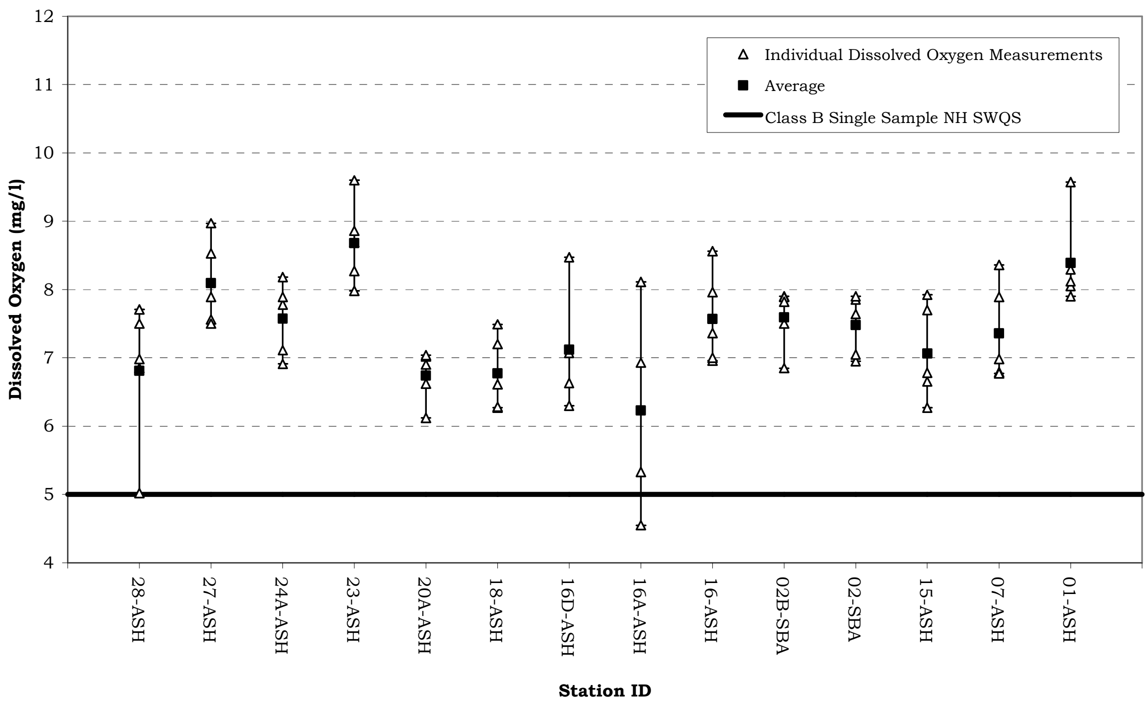
The Class B New Hampshire surface water quality standard for dissolved oxygen includes a minimum concentration of 5.0 mg/L **and** a minimum daily average of 75 percent of saturation. In other words, there are criteria for both concentration and saturation that must be met before the river can be assessed as meeting dissolved oxygen standards. Table 4 reports only dissolved oxygen concentration as more detailed analysis is required to determine if instantaneous dissolved oxygen saturation measurements are above or below water quality standards.

Table 4. Dissolved Oxygen (mg/L) Summary – Ashuelot River Watershed, 2010

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	5	5.02 – 7.71	0	5
27-ASH	5	7.50 – 8.97	0	5
24A-ASH	5	6.91 – 8.18	0	5
23-ASH	5	7.98 – 9.60	0	5
20A-ASH	5	6.12 – 7.04	0	5
18-ASH	5	6.27 – 7.49	0	5
16D-ASH	4	6.30 – 8.47	0	4
16A-ASH	4	4.55 – 8.11	1	4
16-ASH	5	6.96 – 8.56	0	5
02B-SBA	5	6.85 – 7.90	0	5
02-SBA	5	6.95 – 7.90	0	5
15-ASH	5	6.27 – 7.92	0	4
07-ASH	5	6.77 – 8.36	0	4
01-ASH	5	7.90 – 9.57	0	4
Total	**68**	_____	**1**	**65**

All but one measurement for dissolved oxygen concentration (station 16A-ASH) were above the New Hampshire Class B surface water quality standard with the average ranging from 6.23 mg/L to 8.68 mg/L (Figure 1). Levels of dissolved oxygen sustained above the standards are considered adequate for the support of aquatic life and other desirable water quality conditions.

Figure 1. Dissolved Oxygen Concentration Statistics for the Ashuelot River Watershed
May 25 - September 14, 2010, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- If possible, take measurements between 5 a.m. and 10 a.m., which is when dissolved oxygen is usually the lowest, and between 2 p.m. and 7 p.m. when dissolved oxygen is usually the highest. In general, dissolved oxygen levels are lowest in the early morning when there is low photosynthetic activity and a peak in respiration from organisms throughout the water column. This is the time of least oxygen production and greatest carbon dioxide emission. Peak dissolved oxygen levels occur when photosynthetic activity is at its peak. The greater the amount of photosynthetic activity the greater the production of oxygen as a byproduct of photosynthesis.
- Consider incorporating the use of in-situ dataloggers to automatically record dissolved oxygen saturation levels during a period of several days.

4.2 pH

Either four or five measurements were taken in the field for pH at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 5]. Of the 68 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard is 6.5 - 8.0, unless naturally occurring.

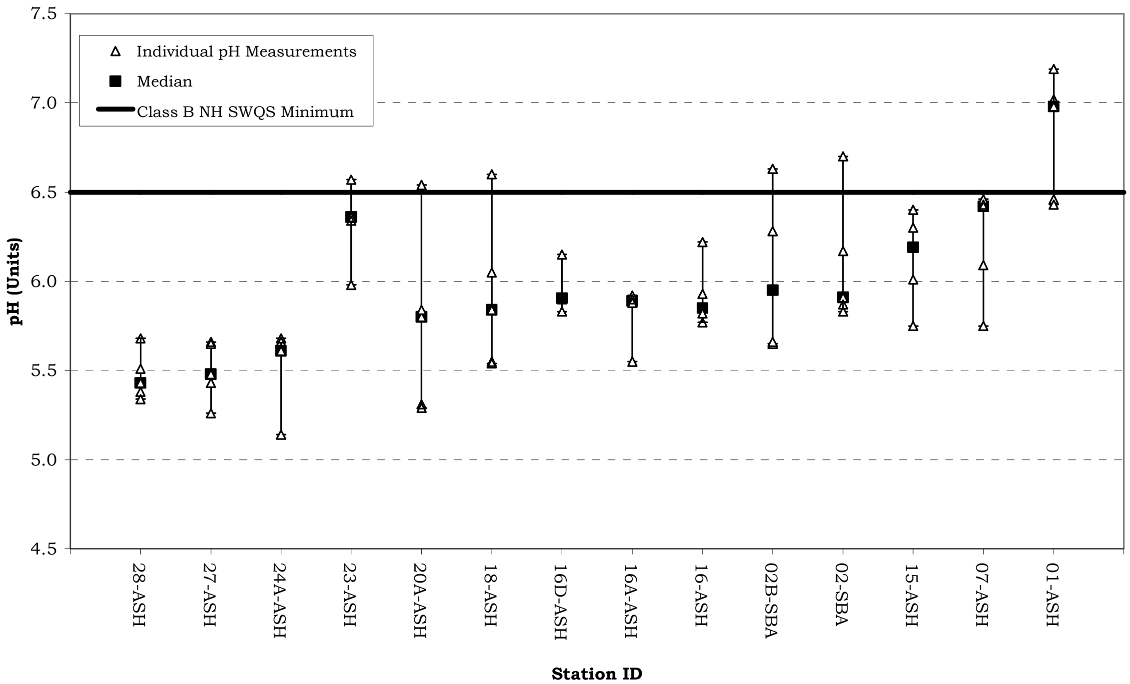
Table 5. pH Data Summary – Ashuelot River Watershed, 2010

Station ID	Samples Collected	Data Range (standard units)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	5	5.34 - 5.68	5	5
27-ASH	5	5.26 - 5.66	5	5
24A-ASH	5	5.14 - 5.68	5	5
23-ASH	5	5.98 - 6.57	4	5
20A-ASH	5	5.29 - 6.54	4	5
18-ASH	5	5.54 - 6.60	4	5
16D-ASH	4	5.83 - 6.15	4	4
16A-ASH	4	5.55 - 5.92	4	4
16-ASH	5	5.77 - 6.22	5	5
02B-SBA	5	5.65 - 6.63	4	5
02-SBA	5	5.83 - 6.70	4	5
15-ASH	5	5.75 - 6.40	5	5
07-ASH	5	5.75 - 6.46	5	5
01-ASH	5	6.43 - 7.19	2	5
Total	**68**	_____	**60**	**68**

A majority of measurements taken for pH were below the New Hampshire surface water quality standard minimum (Figure 2). In general, stations in the upper portions of the watershed had lower pH measurements than stations in the lower portions of the watershed.

Lower pH measurements are likely the result of natural conditions such as the soils, geology, or the presence of wetlands in the area. Rain and snow falling in New Hampshire is relatively acidic, which can also affect pH levels; after the spring melt or significant rain events, surface waters will generally have a lower pH.

Figure 2. pH Statistics for the Ashuelot River Watershed
May 25 - September 14, 2010, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

- Consider sampling for pH in some of the tributaries and wetland areas that are influencing the pH of stations with measurements below state standards. Site conditions are considered along with pH measurements because of the narrative portion of the pH standard. RSA 485-A:8 states that pH of Class B waters *shall be between 6.5 and 8.0, except when due to natural causes*. Wetlands can lower the pH of a river naturally by releasing tannic and humic acids from decaying plant material. If the sampling location is influenced by wetlands or other natural conditions, then the low pH measurements are not considered a violation of water quality standards. It is important to note that the New Hampshire water quality standard for pH is fairly conservative, thus pH levels slightly below the standard are not necessarily harmful to aquatic life. In this case, additional information about factors influencing pH levels is needed.

4.3 Turbidity

Either four or five measurements were taken in the field for turbidity at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 6]. Of the 68 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for turbidity is less than 10 NTU above natural background.

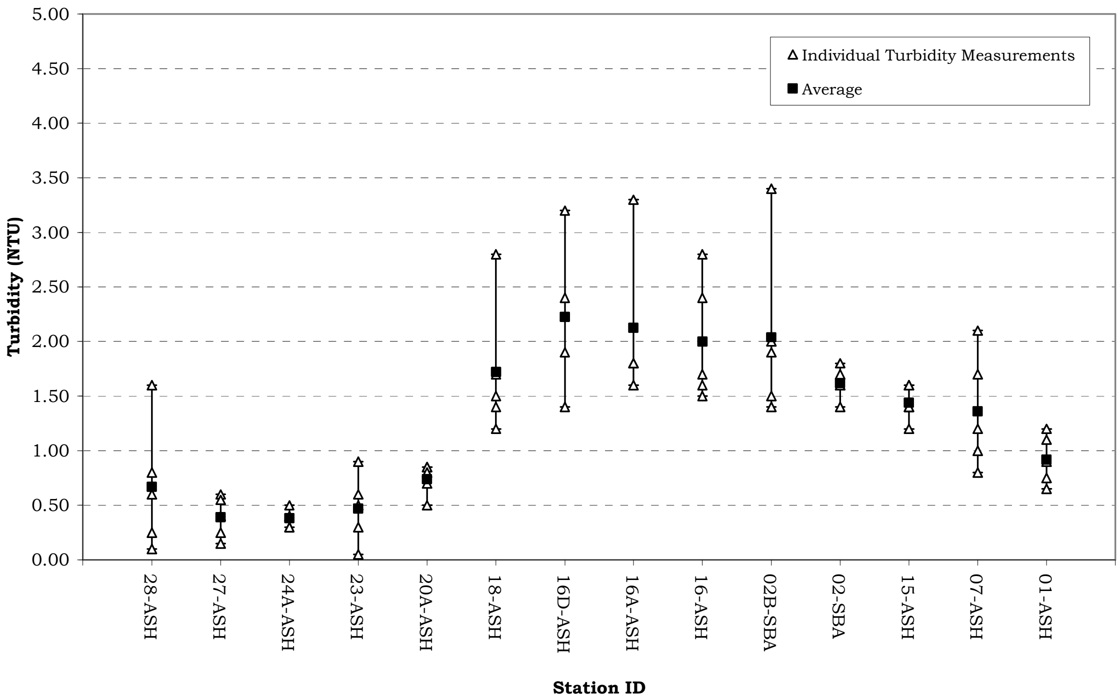
Table 6. Turbidity Data Summary – Ashuelot River Watershed, 2010

Station ID	Samples Collected	Data Range (NTU)	Acceptable Samples Potentially Not Meeting NH Class B Standards	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	5	0.10 - 1.60	0	5
27-ASH	5	0.15 - 0.60	0	5
24A-ASH	5	0.30 - 0.50	0	5
23-ASH	5	0.05 - 0.90	0	5
20A-ASH	5	0.50 - 0.85	0	5
18-ASH	5	1.20 - 2.80	0	5
16D-ASH	4	1.40 - 3.20	0	4
16A-ASH	4	1.60 - 3.30	0	4
16-ASH	5	1.50 - 2.80	0	5
02B-SBA	5	1.40 - 3.40	0	5
02-SBA	5	1.40 - 1.80	0	5
15-ASH	5	1.20 - 1.60	0	5
07-ASH	5	0.80 - 2.10	0	5
01-ASH	5	0.65 - 1.20	0	5
Total	**68**	_____	**0**	**68**

Turbidity levels were low at all stations and on all occasions with the average ranging from 0.38 NTU to 2.23 NTU (Figure 3).

Although clean waters are associated with low turbidity there is a high degree of natural variability involved. Precipitation often contributes to increased turbidity by flushing sediment, organic matter and other materials from the surrounding landscape into surface waters. However, human activities such as removal of vegetation near surface waters and disruption of nearby soils can lead to dramatic increases in turbidity levels. In general it is typical to see a rise in turbidity in more developed areas due to increased runoff.

Figure 3. Turbidity Statistics for the Ashuelot River Watershed
May 25 - September 14, 2010, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Collect samples during wet weather. This will help us to understand how the river responds to runoff and sedimentation.
- If a higher than normal turbidity measurement occurs, volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated turbidity levels. In addition, take good field notes and photographs. If human activity is suspected or verified as the source of elevated turbidity levels, volunteers should contact NHDES.

4.4 Specific Conductance

Either four or five measurements were taken in the field for specific conductance at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 7]. Of the 68 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

Although New Hampshire surface water quality standards do not contain numeric criteria for specific conductance, the New Hampshire Consolidated Assessment and Listing Methodology (CALM) allows for instantaneous specific conductance measurements to be used as a surrogate to predict compliance with numeric water quality criteria for chloride. NHDES has developed a statewide specific conductance to chloride relationship based on simultaneous measurement of specific conductance and chloride.

The Class B New Hampshire surface water quality standard for chloride and corresponding specific conductance measurements are as follows:

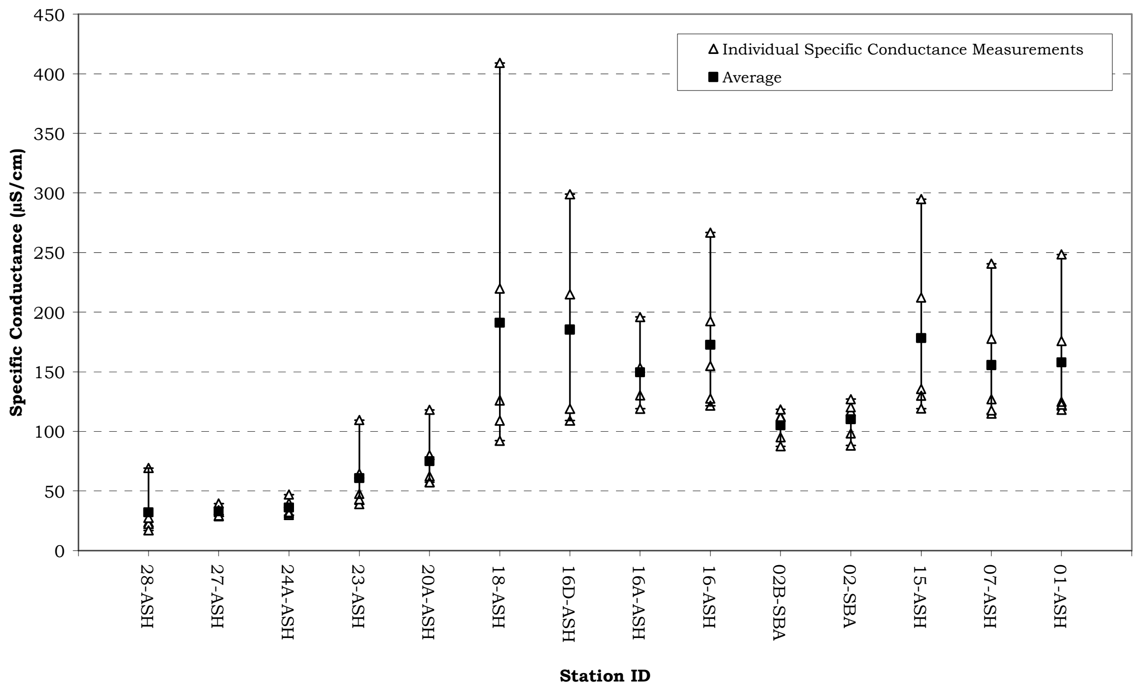
Freshwater chronic criterion	230 mg/l	835 uS/cm
Freshwater acute criterion	860 mg/l	2755 uS/cm

Table 7. Specific Conductance Data Summary – Ashuelot River Watershed, 2010

Station ID	Samples Collected	Data Range (µS/cm)	Acceptable Samples Not Meeting NH Class B Standards (µS/cm as chloride surrogate)	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	5	17.0 - 69.2	0	5
27-ASH	5	28.8 - 39.4	0	5
24A-ASH	5	29.7 - 46.9	0	5
23-ASH	5	38.9 - 109.5	0	5
20A-ASH	5	57.3 - 118.1	0	5
18-ASH	5	92.1 - 409.1	0	5
16D-ASH	4	109.0 - 299.0	0	4
16A-ASH	4	119.0 - 196.0	0	4
16-ASH	5	121.5 - 266.8	0	5
02B-SBA	5	87.5 - 118.4	0	5
02-SBA	5	88.2 - 127.1	0	5
15-ASH	5	119.2 - 294.8	0	5
07-ASH	5	115.0 - 240.7	0	5
01-ASH	5	118.1 - 248.4	0	5
Total	**68**	_____	**0**	**68**

Specific conductance levels were variable with the average ranging from 32.0 µS/cm to 191.2 µS/cm (Figure 4). Higher specific conductance levels can be indicative of pollution from sources such as urban/agricultural runoff, road salt, failed septic systems, or groundwater pollution. The variable specific conductance levels generally indicate low pollutant levels at some stations and higher levels at others.

Figure 4. Specific Conductance Statistics for the Ashuelot River Watershed
May 25 - September 14, 2010, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.
- Consider collecting chloride samples at the same time that specific conductance is measured. During the late winter/early spring snowmelt, higher specific conductance levels are often seen due to elevated concentrations of chloride in the runoff. Specific conductance levels are very closely correlated to chloride levels. Simultaneously measuring chloride and specific conductance will allow for a better understanding of their relationship.
- Consider incorporating the use of in-situ dataloggers to automatically determine specific conductance levels during rain events, snowmelt, and baseline dry weather conditions. The use of these instruments is dependent upon availability, and requires coordination with NHDES.

4.5 Water Temperature

Either four or five measurements were taken in the field for water temperature at 14 stations in the Ashuelot River watershed from Washington to Hinsdale [Table 8]. Of the 68 measurements taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

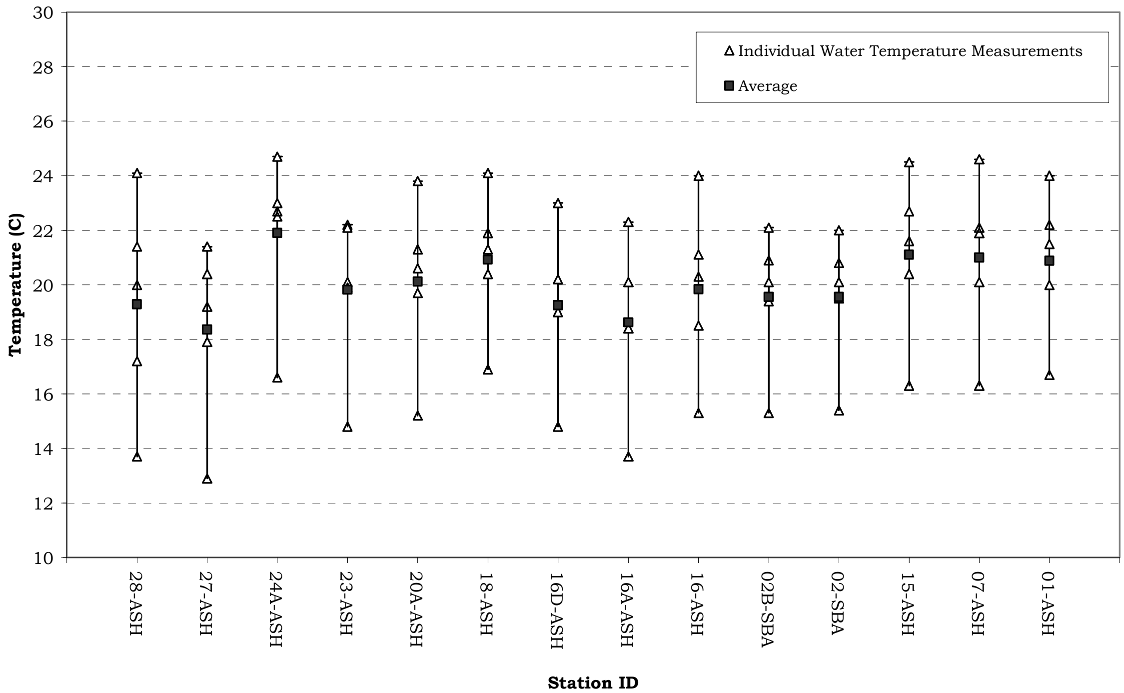
Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

Table 8. Water Temperature Data Summary – Ashuelot River Watershed, 2010

Station ID	Samples Collected	Data Range (°C)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	5	13.7 - 24.1	Not Applicable	5
27-ASH	5	12.9 - 21.4	N/A	5
24A-ASH	5	16.6 - 24.7	N/A	5
23-ASH	5	14.8 - 22.2	N/A	5
20A-ASH	5	15.2 - 23.8	N/A	5
18-ASH	5	16.9 - 24.1	N/A	5
16D-ASH	4	14.8 - 23.0	N/A	4
16A-ASH	4	13.7 - 22.3	N/A	4
16-ASH	5	15.3 - 24.0	N/A	5
02B-SBA	5	15.3 - 22.1	N/A	5
02-SBA	5	15.4 - 22.0	N/A	5
15-ASH	5	16.3 - 24.5	N/A	5
07-ASH	5	16.3 - 24.6	N/A	5
01-ASH	5	16.7 - 24.0	N/A	5
Total	**68**	_____	**N/A**	**68**

Figure 5 shows the results of instantaneous water temperature measurements taken at 14 stations in the Ashuelot River watershed. The average water temperature varied from 18.4 °C. to 21.9 °C.

Figure 5. Water Temperature Statistics for the Ashuelot River Watershed
May 25 - September 14, 2010, NHDES VRAP



Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and the activity of bacteria in the water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertebrate species can survive in a given river or stream.

A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation along the shoreline, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and the influence of groundwater.

Recommendations

- Continue collecting water temperature data via both instantaneous reading and long-term deployment of dataloggers.

4.6 *Escherichia coli*/Bacteria

Between two and four samples were taken for *Escherichia coli* (*E. coli*) at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 9). Of the 53 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

Class B New Hampshire surface water quality standards for *E.coli* are as follows:

$\leq$406 cts/100 ml, based on any single sample or
$\leq$126 cts/100 ml, based on a geometric mean calculated from three samples collected within a 60-day period.

Table 9. *E.coli* Data Summary – Ashuelot River Watershed, 2010

Station ID	Samples Collected	Data Range (cts/100m)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	4	2 - 31	0	4
27-ASH	4	4 - 105	0	4
24A-ASH	4	4 - 26	0	4
23-ASH	4	3 - 71	0	4
20A-ASH	4	45 - 113	0	4
18-ASH	4	61 - 326	0	4
16D-ASH	2	219 - 435	1	2
16A-ASH	3	36 - 93	0	3
16-ASH	4	122 - 649	1	4
02B-SBA	4	105 - 194	0	4
02-SBA	4	111 - 219	0	4
15-ASH	4	30 - 145	0	4
07-ASH	4	52 - 613	2	4
01-ASH	4	28 - 65	0	4
Total	**53**	_____	**4**	**53**

All but four measurements taken for *E.coli* met the state of New Hampshire Class B surface water quality standard (Figure 6).

Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife (e.g., birds), and the presence of septic systems along the river.

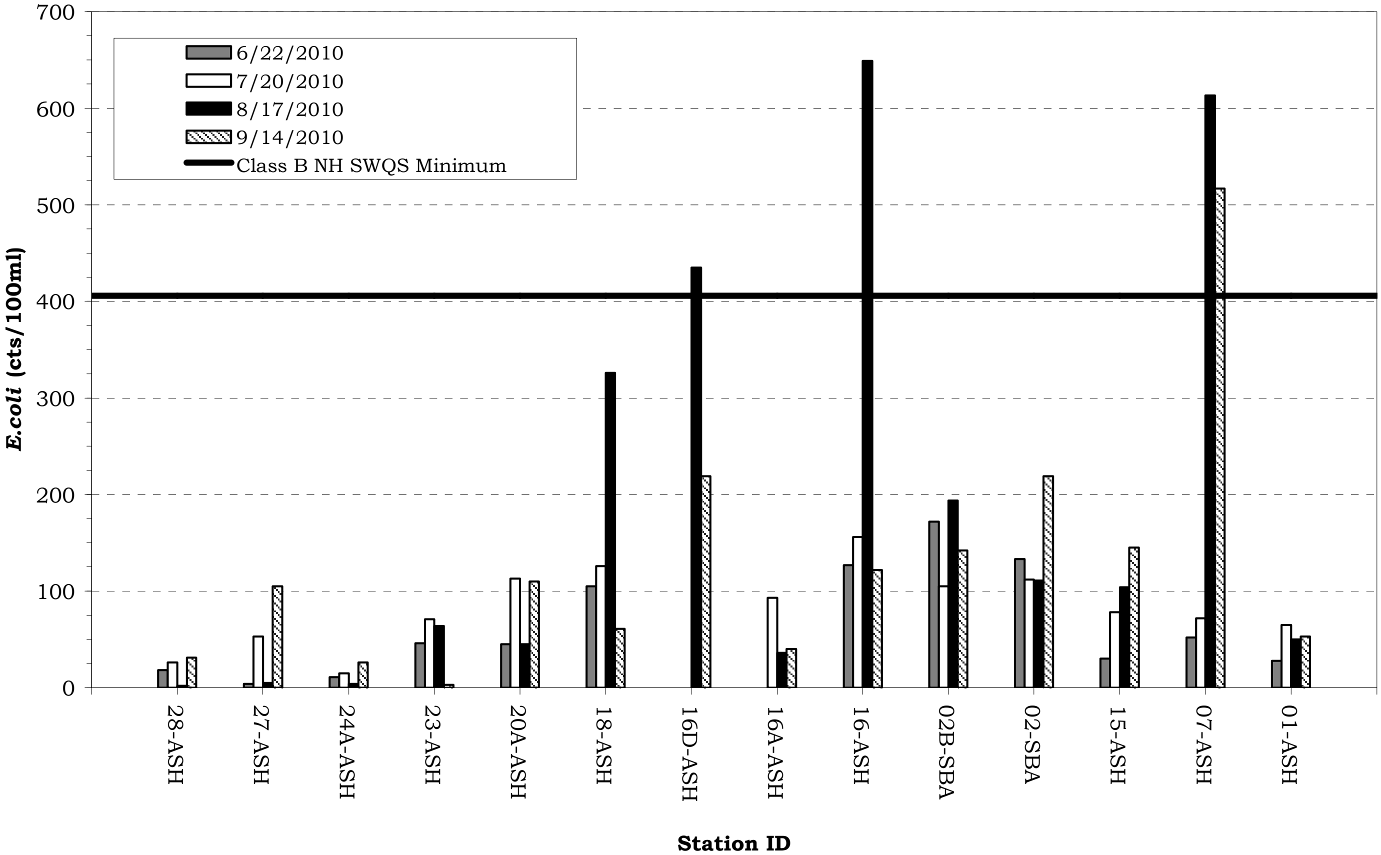
In order to fully determine whether a waterbody is meeting surface water standards for *E.coli* a geometric mean must be calculated. A geometric mean is calculated using three samples collected within a 60-day period.

At 12 stations two geometric means were calculated and at one station one geometric mean was calculated. Nine measurements failed to meet the state of New Hampshire Class B geometric mean standard of 126 cts/100ml (Table 10).

Table 10. *E. coli* Geometric Mean Data Summary – Ashuelot River Watershed, 2010

Station ID	Number of Geometric Means Calculated	Geometric Mean 6/22/10 - 8/17/10	Geometric Mean 7/20/10 - 9/14/10	Geometric Means Not Meeting NH Class B Standards	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	2	10	12	0	2
27-ASH	2	10	30	0	2
24A-ASH	2	9	12	0	2
23-ASH	2	59	24	0	2
20A-ASH	2	61	82	0	2
18-ASH	2	163	136	2	2
16A-ASH	1		51	0	1
16-ASH	2	234	231	2	2
02B-SBA	2	152	142	2	2
02-SBA	2	118	140	1	2
15-ASH	2	62	106	0	2
07-ASH	2	132	284	2	2
01-ASH	2	45	56	0	2
Total	**25**	_____	_____	**9**	**25**

Figure 6. *Escherichia coli* Statistics for the Ashuelot River Watershed June 22 - September 14, 2010, NHDES VRAP



Recommendations

- Continue collecting three samples within any 60-day period during the summer to allow for determination of geometric means. Samples need only be collected during the critical period of May 24 to September 15 for assessment purposes. This coincides with the peak contact recreation season.

- Continue to document river conditions and station characteristics (including the presence of wildlife in the area during sampling). At stations with particularly high bacteria levels volunteers can investigate further by moving upstream and taking additional measurements. This will facilitate isolating the location of the cause of the elevated bacteria levels. Those sampling should also look for any potential sources of bacteria such as emission pipes, failed septic systems, farm animals, pet waste, wildlife and waterfowl.

4.7 Total Phosphorus

Three samples were taken for total phosphorus at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 11). Of the 42 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

There is no numeric standard for total phosphorus for Class B waters. The narrative standard states that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses."

New Hampshire's surface water regulations (Env-Wq 1700) for Class B waters include narrative criteria for phosphorus which state that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses". New Hampshire does not currently have numeric nutrient criteria for rivers and streams, but is in the process of developing them. Draft numeric nutrient criteria developed for Vermont and Maine surface waters indicate a maximum allowable summer mean phosphorus level of approximately 0.035 mg/L. Although this value is approximately two to three times typical natural background levels in many rivers and streams, it is considered protective of all designated uses (i.e., swimming, aquatic life, etc). in Vermont and Maine. It's possible that phosphorus criteria for New Hampshire rivers and streams will be similar.

Table 11. Total Phosphorus Data Summary – Ashuelot River Watershed, 2010

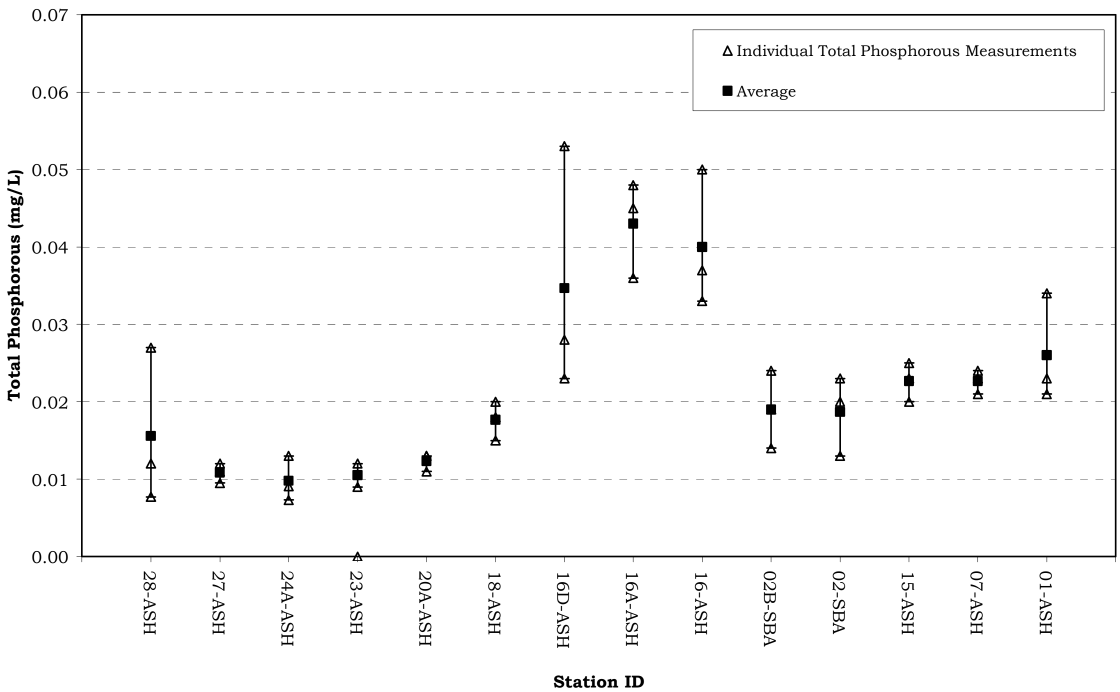
Station ID	Samples Collected	Data Range (mg/L)	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	3	0.008 - 0.027	3
27-ASH	3	0.0095 - 0.012	3
24A-ASH	3	0.007 - 0.013	3
23-ASH	3	0.009 - 0.012	3
20A-ASH	3	0.011 - 0.013	3
18-ASH	3	0.015 - 0.020	3
16D-ASH	3	0.023 - 0.053	3
16A-ASH	3	0.036 - 0.048	3
16-ASH	3	0.033 - 0.050	3
02B-SBA	3	0.014 - 0.024	3
02-SBA	3	0.013 - 0.023	3
15-ASH	3	0.020 - 0.025	3
07-ASH	3	0.021 - 0.024	3
01-ASH	3	0.021 - 0.034	3
Total	**42**	____	**42**

The mean total phosphorous concentration ranged from 0.010 mg/L to 0.043 mg/L (Figure 7)

Under undisturbed natural conditions phosphorus is at very low levels in aquatic ecosystems. Of the three nutrients critical for aquatic plant growth; potassium, nitrogen, and phosphorus, it is usually phosphorous that is the limiting factor to plant growth. When the supply of phosphorus is increased due to human activity, algae respond with significant growth.

A major source of excessive phosphorus concentrations in aquatic ecosystems can be wastewater treatment facilities, as sewage typically contains relatively high levels of phosphorus detergents. However, fertilizers used on lawns and agricultural areas can also contribute significant amounts of phosphorus.

Figure 7. Total Phosphorous Statistics for the Ashuelot River Watershed July 20 - September14, 2010, NHDES VRAP



Recommendations

- Continue sampling at all stations in order to develop a long-term data set to better understand trends as time goes on.

4.8 Chloride

Either four or five samples were taken for chloride at 14 stations in the Ashuelot River watershed from Washington to Hinsdale (Table 12). Of the 68 samples taken, all met quality assurance/quality control requirements and are usable for New Hampshire's 2012 surface water quality report to the US Environmental Protection Agency.

The Class B New Hampshire surface water quality standard for chloride is as follows:

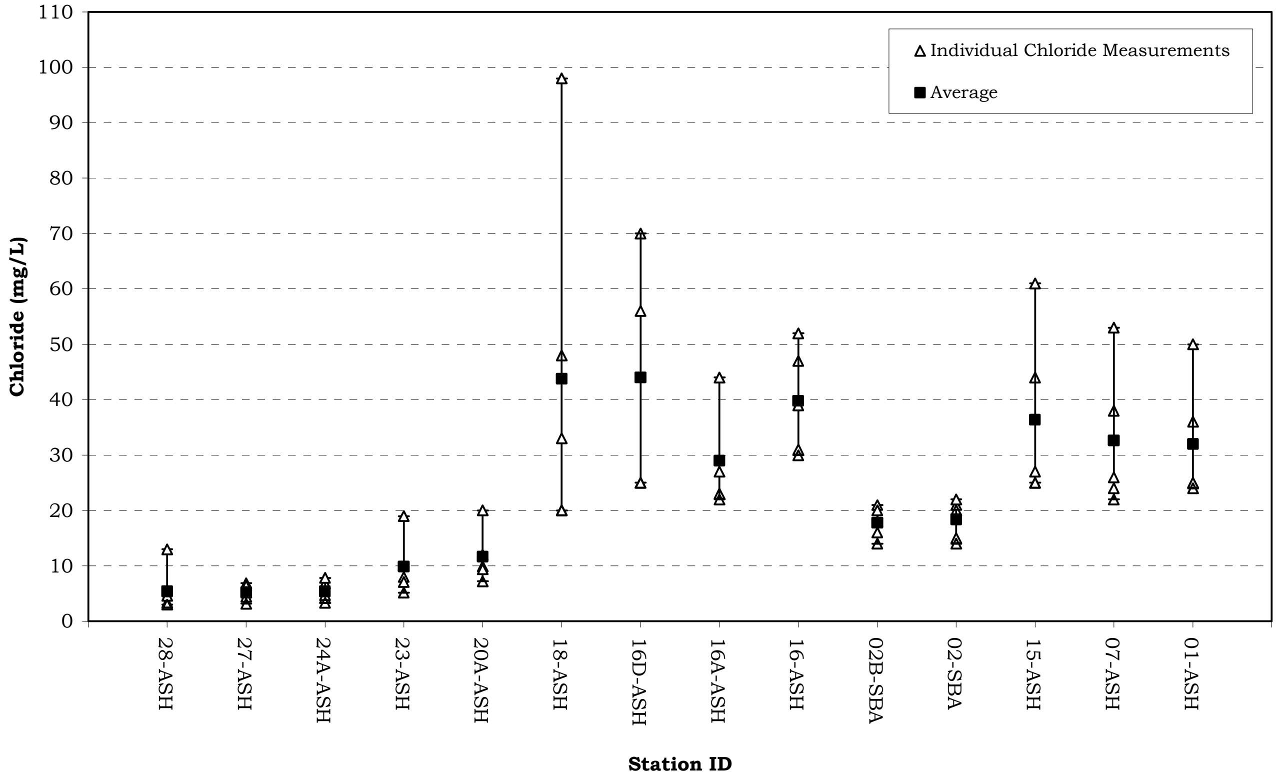
Freshwater chronic criterion	230 mg/l
Freshwater acute criterion	860 mg/l

Table 12. Chloride Data Summary – Ashuelot River Watershed, 2010

Station ID	Samples Collected	Data Range (mg/l)	Acceptable Samples Not Meeting NH Class B Standards	Number of Usable Samples for 2012 NH Surface Water Quality Assessment
28-ASH	5	3.0 - 13.0	0	5
27-ASH	5	3.2 - 6.9	0	5
24A-ASH	5	3.3 - 7.8	0	5
23-ASH	5	5.2 - 19.0	0	5
20A-ASH	5	7.2 - 20.0	0	5
18-ASH	5	20.0 - 98.0	0	5
16D-ASH	4	25.0 - 70.0	0	4
16A-ASH	4	22.0 - 44.0	0	4
16-ASH	5	30.0 - 52.0	0	5
02B-SBA	5	14.0 - 21.0	0	5
02-SBA	5	14.0 - 22.0	0	5
15-ASH	5	25.0 - 61.0	0	5
07-ASH	5	22.0 - 53.0	0	5
01-ASH	5	24.0 - 50.0	0	5
Total	**68**	_____	**0**	**68**

All measurements were below the state of New Hampshire Class B chronic surface water quality standard (Figure 8).

Figure 8. Chloride Statistics for the Ashuelot River Watershed
May 25 - September 14, 2010, NHDES VRAP



Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. Road salt readily dissolves and enters aquatic environments in ionic forms. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans. Additional human sources of chloride can come from fertilizers, septic systems, and underground water softening systems.

Recommendations

- Continue collecting chloride samples during both low-flow summer months and during snowmelt period in winter and early spring. It is critical that specific conductance be recorded when chloride samples are collected.

APPENDIX A: 2010 ASHUELOT RIVER WATERSHED VRAP DATA

Measurements not meeting New Hampshire surface water quality standards
Measurements not meeting NHDES quality assurance/quality control standards

[A] Specific conductance > 835 µS/cm indicate exceedance of chronic chloride standard of 230 mg/L
[B] Chronic water quality standard

28-ASH, Ashuelot River, Route 31, Washington

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	835 µS/cm[A]	NA	<406	<126	NA	230[B]
5/25/2010	08:13	7.71	87.2	5.51	0.10	23.8	21.4				<3
6/22/2010	07:17	5.02	52.0	5.38	0.80	69.2	17.2	18			13.0
7/20/2010	07:17	6.85	81.5	5.68	0.60	22.4	24.1	26		0.012	<3
8/17/2010	07:00	6.98	76.8	5.43	0.25	27.5	20.0	2	10	0.008	3.4
9/14/2010	07:15	7.50	72.3	5.34	1.60	17.0	13.7	31	12	0.027	4.6

27-ASH, Ashuelot River, Mountain Road, Lempster

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	835 µS/cm[A]	NA	<406	<126	NA	230[B]
5/25/2010	09:00	8.53	94.5	5.65	0.15	28.8	20.4				3.2
6/22/2010	07:56	7.89	83.2	5.26	0.60	33.8	17.9	4			6.9
7/20/2010	07:46	7.56	85.4	5.66	0.40	29.2	21.4	53		0.012	4.4
8/17/2010	07:33	7.50	81.0	5.48	0.25	33.7	19.2	5	10	0.010	5.2
9/14/2010	07:58	8.97	84.8	5.43	0.55	39.4	12.9	105	30	0.011	6.4

24A-ASH, Ashuelot River, Route 10, Marlow

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	NA	>5.0	>75% Daily Average	6.5-8.0	<10 NTU above backgrd	835 µS/cm[A]	NA	<406	<126	NA	230[B]
5/25/2010	09:40	8.18	95.7	5.61	0.40	29.7	23.0				3.3
6/22/2010	08:45	7.78	90.0	5.14	0.50	32.3	22.5	11			4.2
7/20/2010	08:22	7.11	85.5	5.66	0.30	31.1	24.7	15		0.013	4.7
8/17/2010	08:12	6.91	80.2	5.61	0.40	39.8	22.7	4	9	0.009	6.9
9/14/2010	08:37	7.89	81.0	5.68	0.30	46.9	16.6	26	12	0.007	7.8

23-ASH, Asheulot River, Route 10, Gilsum

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	10:12	8.86	97.0	6.36	0.90	38.9	22.2				5.2
6/22/2010	09:07	8.69	93.2	5.98	0.30	47.7	20.1	46			8.0
7/20/2010	09:04	7.98	91.6	6.34	0.60	43.1	22.1	71		0.012	7.1
8/17/2010	08:39	8.27	91.3	6.36	0.50	64.5	19.9	64	59	0.009	10.0
9/14/2010	09:02	9.60	94.7	6.57	0.05	109.5	14.8	3	24	ND	19.0

20A-ASH, Ashuelot River, Stone Arch Bridge, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	07:58	7.02	76.8	6.54	0.50	57.4	19.7				7.2
6/22/2010	07:55	6.90	77.2	5.80	0.70	62.3	20.6	45			9.9
7/20/2010	07:15	6.12	72.8	5.31	0.85	57.3	23.8	113		0.013	9.4
8/17/2010	07:40	6.62	74.0	5.29	0.85	80.0	21.3	45	61	0.013	12.0
9/14/2010	08:05	7.04	69.4	5.84	0.80	118.1	15.2	110	82	0.011	20.0

18-ASH, Ashuelot River, Route 101, Keene

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	09:03	7.49	83.0	6.60	1.70	109.1	20.4				20.0
6/22/2010	08:57	7.20	81.3	6.05	1.40	126.0	21.3	105			33.0
7/20/2010	08:10	6.61	78.0	5.54	1.20	92.1	24.1	126		0.018	20.0
8/17/2010	08:20	6.27	71.7	5.55	1.50	219.7	21.9	326	163	0.015	48.0
9/14/2010	08:51	6.28	63.2	5.84	2.80	409.1	16.9	61	136	0.020	98.0

16D-ASH, Ashuelot River, 40 Feet Upstream of Keene WWTF, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**NA**	**230[B]**
5/25/2010	09:30	8.47	90.0	5.90	1.90	119.0	19.0			25.0
7/20/2010	08:11	7.07	81.7	5.83	1.40	109.0	23.0		0.023	25.0
8/17/2010	07:58	6.30	69.3	5.91	3.20	214.8	20.2	435	0.053	56.0
9/14/2010	08:15	6.63	75.2	6.15	2.40	299.0	14.8	219	0.028	70.0

16A-ASH, Mouth of South Branch Ashuelot River, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	08:59	8.11	86.5	5.55	1.60	119.0	18.4				23.0
7/20/2010	09:20	6.93	79.1	5.92	1.80	130.2	22.3	93		0.036	27.0
8/17/2010	08:56	5.33	58.8	5.90	1.80	196.0	20.1	36		0.045	44.0
9/14/2010	09:20	4.55	44.6	5.88	3.30	153.2	13.7	40	51	0.048	22.0

16-ASH, Ashuelot River, Cressen Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	08:02	7.96	84.5	5.82	1.60	121.5	18.5				30.0
6/22/2010	10:55	6.96	78.0	5.85	1.50	155.0	21.1	127			39.0
7/20/2010	10:04	7.36	85.8	5.77	1.70	127.5	24.0	156		0.050	31.0
8/17/2010	09:40	7.00	77.8	5.93	2.40	192.4	20.3	649	234	0.033	47.0
9/14/2010	09:46	8.56	85.5	6.22	2.80	266.8	15.3	122	231	0.037	52.0

02B-SBA, South Branch Ashuelot River, Upstream of Monadnock Regional High School, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	10:16	7.90	85.9	6.63	1.90	87.5	19.4				14.0
6/22/2010	09:50	7.89	87.1	6.28	3.40	95.1	20.1	172			16.0
7/20/2010	09:25	6.85	77.8	5.95	2.00	112.6	22.1	105		0.024	21.0
8/17/2010	09:30	7.50	78.3	5.65	1.50	111.8	20.9	194	152	0.019	18.0
9/14/2010	09:42	7.82	77.7	5.66	1.40	118.4	15.3	142	142	0.014	20.0

02-SBA, South Branch Ashuelot River, Route 32 Bridge, Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	09:43	7.85	85.4	6.70	1.60	88.2	19.5				14.0
6/22/2010	09:29	7.64	84.3	6.17	1.60	98.1	20.1	133			15.0
7/20/2010	08:45	6.95	79.5	5.87	1.80	116.7	22.0	112		0.023	21.0
8/17/2010	09:00	7.05	78.3	5.83	1.70	120.3	20.8	111	118	0.020	20.0
9/14/2010	09:19	7.90	79.1	5.91	1.40	127.1	15.4	219	140	0.013	22.0

15-ASH, Ashuelot River, Thompson Covered Bridge, West Swanzey

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	09:40	7.70	85.5	6.01	1.40	135.5	20.4				25.0
6/22/2010	10:20	6.78	78.5	5.75	1.40	130.1	22.7	30			27.0
7/20/2010	09:17	~~6.65~~	79.6	6.19	1.60	119.2	24.5	78		0.025	25.0
8/17/2010	09:05	6.27	71.2	6.30	1.20	212.2	21.6	104	62	0.023	44.0
9/14/2010	09:20	7.92	80.0	6.40	1.60	294.8	16.3	145	106	0.020	61.0

07-ASH, Ashuelot River, Route 119, Winchester

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Water Temp. (°C)	Specific Conductance (uS/cm)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	09:00	7.89	87.2	6.09	0.80	115.0	20.1				22.0
6/22/2010	09:30	6.79	78.9	5.75	1.00	127.0	21.9	52			26.0
7/20/2010	08:35	~~6.77~~	81.7	6.43	1.20	117.6	24.6	72		0.023	24.0
8/17/2010	08:35	6.98	80.2	6.42	1.70	177.9	22.1	613	132	0.024	38.0
9/14/2010	08:58	8.36	85.5	6.46	2.10	240.7	16.3	517	284	0.021	53.0

01-ASH, Ashuelot River, 147 River Street, Hinsdale

Date	Time of Sample	DO (mg/L)	DO (% sat.)	pH	Turbidity (NTUs)	Specific Conductance (uS/cm)	Water Temp. (°C)	*E. coli* (CTS/100mL)	*E.coli* Geometric Mean	Total Phosphorus (mg/L)	Chloride (mg/L)
Standard	**NA**	**>5.0**	**>75% Daily Average**	**6.5-8.0**	**<10 NTU above backgrd**	**835 µS/cm[A]**	**NA**	**<406**	**<126**	**NA**	**230[B]**
5/25/2010	08:00	8.29	91.9	6.46	0.75	118.1	20.0				24.0
6/22/2010	08:40	8.05	91.1	6.43	1.10	124.8	21.5	28			25.0
7/20/2010	07:55	~~7.90~~	94.0	7.02	1.20	122.4	24.0	65		0.034	25.0
8/17/2010	07:55	8.12	92.8	6.98	0.65	175.7	22.2	50	45	0.023	36.0
9/14/2010	08:15	9.57	98.2	7.19	0.90	248.4	16.7	53	56	0.021	50.0

APPENDIX B:
Interpreting VRAP Water Quality Monitoring Parameters

Chemical Parameters

Dissolved Oxygen (DO)

- **Unit of Measurement:** concentration in milligrams per liter (mg/L) and percent saturation (%).
- **Description:** A measure of the amount of oxygen in the water: Concentration is a measure of the amount of oxygen in a volume of water; saturation is a measurement of the amount of oxygen in the water compared to the amount of oxygen the water can actually hold at full saturation. Both of these measurements are necessary to accurately determine whether New Hampshire surface water quality standards are met.
- **Importance**: Oxygen is dissolved into the water from the atmosphere, aided by wind and wave action, or by rocky, steep, or uneven stream beds. The presence of dissolved oxygen is vital to bottom-dwelling organisms as well as fish and amphibians. Aquatic plants and algae produce oxygen in the water during the day, and consume oxygen during the night. Bacteria utilize oxygen both day and night when they process organic matter into smaller and smaller particles.

Class A NH Surface Water Quality Standard: 6 mg/L at any place or time, or 75% minimum daily average – (unless naturally occurring).

Class B NH Surface Water Quality Standard: 5 mg/L at any place or time or 75% minimum daily average – (unless naturally occurring).

Several measurements of oxygen saturation taken in a 24-hour period must be averaged to compare to the 75 percent daily average saturation standard. The concentration of dissolved oxygen is dependent on many factors including temperature and sunlight, and tends to fluctuate throughout the day. Saturation values are averaged because a reading taken in the morning may be low due to respiration, while a measurement that afternoon may show that the saturation has recovered to acceptable levels. Water can become saturated with more than 100 percent dissolved oxygen.

pH

- **Unit of Measurement:** units (no abbreviation).
- **Description:** A measure of hydrogen ion activity in water, or, in general terms, the acidity of water. pH is measured on a logarithmic scale of 0 to 14, with 7 being neutral. A high pH indicates alkaline (or basic) conditions and a low pH indicates acidic conditions. pH is influenced by geology and soils, organic acids (decaying leaves and other matter), and human-induced acids from acid rain (which typically has a pH of 3.5 to 5.5).
- **Importance:** pH affects many chemical and biological processes in the water and this is important to the survival and reproduction of fish and other aquatic life. Different organisms flourish within different ranges of pH. Measurements outside of an organism's preferred range can limit growth and reproduction and lead to physiological stress. Low pH can also affect the toxicity of aquatic compounds such as ammonia and certain metals by making them more "available" for uptake by aquatic plants and animals. This can produce conditions that are toxic to aquatic life.

Class A/B NH Surface Water Quality Standard: Between 6.5 and 8.0 (unless naturally occurring).

Sometimes, readings that fall below this range are determined to be naturally occurring. This is often a result of wetlands near the sample station. Wetlands can lower pH because the tannic and humic acids released by decaying plants can cause water to become more acidic.

pH Units	Category
<5.0	High Impact
5.0 – 5.9	Moderate to High Impact
6.0 – 6.4	Normal; Low Impact
6.5 – 8.0	Normal;
6.1 – 8.0	Satisfactory

Specific Conductance or Conductivity

- **Unit of Measurement:** micromhos per centimeter (umhos/cm) or microsiemens per centimeter (uS/cm).
- **Description:** The numerical expression of the ability of water to carry an electrical current at 25^{o} C and a measure of free ion (charged particles) content in the water. These ions can come from natural sources such as bedrock, or human sources such as stormwater runoff. Specific conductance can be used to indicate the presence of chlorides, nitrates, sulfates, phosphates, sodium, magnesium, calcium, iron, and aluminum ions. There is a difference between conductivity and specific conductance. Specific conductance measures the free ion content of water at a *specific* water temperature, whereas conductivity measures the free ion content of water at 25º C. VRAP uses the term "specific conductance" because our conductivity measurements account for temperature. In some studies and programs, the term "conductivity" is used. This term should only be used when the measurement *does not* adjust to a specific temperature.
- **Importance:** Specific conductance readings can help locate potential pollution sources because polluted water usually has a higher specific conductance than unpolluted waters. High specific conductance values often indicate pollution from road salt, septic systems, wastewater treatment plants, or urban/agricultural runoff. Specific conductance can also be related to geology. In unpolluted rivers and streams, geology and groundwater are the primary influences on specific conductance levels.

Class A/B NH Surface Water Quality Standard: No numeric standard.

Although NH surface water quality standards do not contain numeric criteria for specific conductance, the NH Consolidated Assessment and Listing Methodology (CALM) allows for instantaneous specific conductance measurements to be used as a surrogate to predict compliance with numeric water quality criteria for chloride. NHDES has developed a statewide specific conductance to chloride relationship based on simultaneous measurement of specific conductance and chloride.

The Class B New Hampshire surface water quality standard for chloride and corresponding specific conductance measurements are as follows:

Freshwater chronic criterion	230 mg/l	835 uS/cm
Freshwater acute criterion	860 mg/l	2755 uS/cm

Specific Conductance *(uS/cm)*	**Category**
0 – 100	Normal
101 – 200	Low Impact
201 – 500	Moderate Impact
> 501	High Impact
> 835	Exceeding chronic chloride standard

Turbidity

- **Unit of Measurement:** Nephelometric Turbidity Units (abbreviated at NTU).
- **Description:** A measurement of the amount of suspended material in the water. This material, which is comprised of particles such as clay, silt, algae, suspended sediment, and decaying plant material, causes light to be scattered and absorbed, rather than transmitted in straight lines through the water.
- **Importance:** Higher turbidity increases water temperatures because suspended particles absorb more heat. This, in turn, reduces dissolved oxygen (DO) concentrations because warm water holds less DO than cold water. Higher turbidity also reduces the amount of light that can penetrate the water, which reduces photosynthesis and DO production. Suspended materials can clog fish gills, reducing disease resistance, lowering growth rates, and affecting egg and larval development. As the particles settle, they can blanket the stream bottom, especially in slower waters, and smother fish eggs and benthic macroinvertebrates. Clean waters are generally associated with low turbidity, but there is a high degree of natural variability involved. Rain events can increase turbidity in surface waters by flushing sediment, organic matter and other materials into the water. Human activities such as vegetation removal and soil disruption can also lead to dramatic increases in turbidity levels.

Class A NH Surface Water Quality Standard: As naturally occurs.

Class B NH Surface Water Quality Standard: Shall not exceed naturally occurring conditions by more than 10 NTU.

Physical Parameters

Temperature

- **Unit of Measurement:** Degrees Celsius (° C)
- **Importance:** Water temperature is a critical parameter for aquatic life and has an impact on other water quality parameters such as dissolved oxygen concentrations, and bacteria activity in water. Water temperature controls the metabolic and reproductive processes of aquatic species and can determine which fish and macroinvertabrate species can survive in a given river or stream.

  A number of factors can have an impact on water temperature including the quantity and maturity of riparian vegetation, the rate of flow, the percent of impervious surfaces contributing stormwater, thermal discharges, impoundments and groundwater.

Class A NH Surface Water Quality Standard: As naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard

Although there is currently no numerical water quality criteria for water temperature, NHDES is in the process of collecting biological and water temperature data that will contribute to the development of a procedure for assessing rivers and stream based on water temperature and its corresponding impact to the biological integrity of the waterbody.

<u>Chlorophyll-a</u> (Chlor a)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** An indicator of the biomass, or abundance, of planktonic algae in the river. The technical term "biomass" is used to represent "amount by weight." Chlorophyll-a can be strongly influenced by phosphorus, which is derived by natural and human activities.

Importance: Because algae is a plant and contains the green pigment chlorophyll-a, the concentration of chlorophyll-a found in the water gives an estimation of the concentration of algae. If the chlorophyll-a concentration increases, this indicates an increase in the algal population.

Class A NH Surface Water Quality Standard: No numeric standard.

Class B NH Surface Water Quality Standard: No numeric standard.

Chlorophyll-a *(mg/L)*	**Category**
< 3	Excellent
3 – 7	Good
7 – 15	Less than desirable
> 15	Nuisance

<u>Total Phosphorus</u> (TP)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** A measure of all forms of phosphorus in the water, including inorganic and organic forms. There are many sources of phosphorus, both natural and human. These include soil and rocks, sewage, animal manure, fertilizer, erosion, and other types of contamination.
- **Importance:** Phosphorus is a nutrient that is essential to plants and animals. However, excess amounts can cause rapid increases in the biological activity in water. Phosphorus is usually the "limiting nutrient" in freshwater streams, which means relatively small amounts can increase algae and chlorophyll-a levels. Algal blooms and/or excessive aquatic plant growth can decrease oxygen levels and make water unattractive. Phosphorus can indicate the presence of septic systems, sewage, animal waste, lawn fertilizer, road and construction erosion, other types of pollution, or natural wetlands and atmospheric deposition.

Class A/B NH Surface Water Quality Standard: There is no numeric standard for total phosphorus for Class A/B waters. The narrative standard states that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses." New Hampshire's surface water regulations (Env-Wq 1700) for Class B waters include narrative criteria for phosphorus which state that "unless naturally occurring, shall contain no phosphorus in such concentrations that would impair any existing or designated uses". New Hampshire does not currently have numeric nutrient criteria for rivers and streams, but is in the process of developing them. Draft numeric nutrient criteria developed for Vermont and Maine surface waters indicate a maximum allowable summer mean phosphorus level of approximately 0.035 mg/L. Although this value is approximately two to three times typical natural background levels in many rivers and streams, it is considered protective of all designated uses (i.e., swimming, aquatic life, etc). in Vermont and Maine. It's possible that phosphorus criteria for New Hampshire rivers and streams will be similar.

Total Phosphorus *(mg/L)*	**Category**
< 0.010	Ideal
0.011 – 0.025	Average
0.026 – 0.049	More than desirable
≥ 0.050	Potential nuisance concentration

Total Kjeldahl Nitrogen (TKN)

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** A measure of the amount of ammonia and organic nitrogen in the water.
- **Importance:** High nitrogen levels can increase algae and chlorophyll-a levels in the river, but is generally less of a concern in fresh water than phosphorus. Nitrogen can indicate the presence of sewage, animal waste, fertilizer, erosion, or other types of pollution.

Class A NH Surface Water Quality Standard: No numeric standard; as naturally occurs.

Class B NH Surface Water Quality Standard: No numeric standard; as naturally occurring, shall contain no nitrogen in such concentrations that would impair any existing or designated uses.

TKN *(mg/L)*	**Category**
< 0.25	Ideal
0.26 – 0.40	Average
0.41 – 0.50	More than desirable
> 0.51	Excessive (potential nuisance concentration)

Other Parameters

Chloride

- **Unit of Measurement:** Milligrams per liter (mg/L).
- **Description:** The chloride ion (Cl-) is found naturally in some surface waters and groundwater. It is also found in high concentrations in seawater. Higher-than-normal chloride concentrations in freshwater is detrimental to water quality. In New Hampshire, applying road salt for winter accident prevention is a large source of chloride to the environment. Unfortunately, this has increased over time due to road expansion and increased vehicle traffic. Road salt (most often sodium chloride) readily dissolves and enters aquatic environments in ionic forms. Although chloride can originate from natural sources, most of the chloride that enters the environment is associated with the storage and application of road salt. As such, chloride-containing compounds commonly enter surface water, soil, and groundwater during late-spring snowmelt (since the ground is frozen during much of the late winter and early spring). Sodium chloride is also used on foods as table salt, and consequently is present in human waste. Thus, sometimes chloride in water can indicate sewage pollution. Saltwater intrusion can also elevate groundwater chlorides in drinking water wells near coastlines. Chloride ions are conservative, which means they are not degraded in the environment and tend to remain in solution, once dissolved. Chloride ions that enter ground water can ultimately be expected to reach surface water and, therefore, influence aquatic environments and humans.
- **Importance:** Research shows elevated chloride levels can be toxic to freshwater aquatic life. Among the species tested, freshwater aquatic plants and invertebrates tend to be the most sensitive to chloride. In order to protect freshwater aquatic life in New Hampshire, the state has adopted acute and chronic chloride criteria.

Acute Standard: 860 mg/L.

Chronic Standard: 230 mg/L.

Escherichia Coliform Bacteria *(E. coli)*

- **Unit of Measurement:** Counts per 100 milliliter (cts/100 mL).
- **Description:** An indicator of the potential presence of pathogens in fresh water. *E. coli* bacteria is a normal component in the large intestines of humans and other warm-blooded animals, and can be excreted in their fecal material. Organisms causing infections or disease (pathogens) are often excreted in the fecal material of humans and other warm-blooded animals.
- **Importance:** *E.coli* bacteria is a good indicator of fecal pollution and the possible presence of pathogenic organisms. In freshwater, *E. coli* concentrations help determine if the water is safe for recreational uses such as swimming.

  Several factors can contribute to elevated *E. coli* levels, including, but not limited to rain storms, low river flows, the presence of wildlife, and the presence of septic systems along the river.

Class A NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 47 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 153 *E.coli* cts/100 mL in any one sample.

Class B NH Surface Water Quality Standard: Unless naturally occurring, shall contain not more than either a geometric mean of 126 *E.coli* cts/100 mL based on at least three samples obtained over a sixty-day period, or greater than 406 *E.coli* cts/100 mL in any one sample.

Metals

Depending on the metal concentration, its form (dissolved or particulate), and the hardness of the water, trace metals can be toxic to aquatic life. Metals in dissolved form are generally more toxic than metals in the particulate form. The dissolved metal concentration is dependent on pH, as well as the presence of solids and organic matter that can bind with the metal to render it less toxic.

Hardness is primarily a measure of the calcium and magnesium ion concentrations in water, expressed as calcium carbonate. The hardness concentration affects the toxicity of certain metals. New Hampshire water quality regulations include numeric criteria for a variety of metals. Since dissolved metals are typically found in extremely low concentrations, the potential contamination of samples collected for trace metals analyses has become a primary concern of water quality managers. To prevent such contamination and to ensure reliable results, the use of "clean techniques" is becoming more and more frequent when sampling for dissolved metals. Because of this, sampling for metals may be more costly and require additional effort than in the past.

New Hampshire Volunteer River Assessment Program

29 Hazen Drive – PO Box 95
Concord, NH 03302-0095
p (603) 271-0699 – f (603) 271-7894
www.des.nh.gov

2008 (Revised 2010)

APPENDIX C:

2010 VRAP Field Audit

On August 17, 2010, VRAP staff visited volunteers from the Ashuelot River VRAP group to conduct a field audit. VRAP staff aim to visit each group annually during a scheduled sampling event to verify that volunteers successfully follow the VRAP protocols. If necessary, volunteers are re-trained during the visit, and the group is notified of the result of the verification visit. During the visit, volunteers were assessed in the following five categories:

1) **Overall Sampling Procedures**

   Appropriate storage of meters, sample collection, laboratory sample collection and transportation, beginning and end of day meter checks, collecting a field replicate, performing QA/QC Meter Checks, and ensuring that all calibration and sampling data are properly documented on the VRAP Field Data Sheet and the Laboratory Services Login & Custody Sheet.

2) **Turbidity**

   Inspecting and cleaning of glass turbidity vials prior to measurement of standards and samples, performing the *Initial Turbidity Meter Check,* calibrating the meter to a known standard at the beginning of the sampling day, recording the value of the DI turbidity blank *(QA/QC Meter Check)* once during the sampling day, and performing the *End of the Day Meter Check* at the conclusion of the sampling day.

3) **pH**

   Inspecting the pH electrode prior to sampling, calibrating to both pH 7.0 and 4.0 buffers prior to each measurement, rinsing and wiping the pH electrode probe prior to and after the measurement of standards and samples, allowing the pH measurement to stabilize prior to recording the measurement, and recording the value of the 6.0 buffer *(QA/QC Meter Check)* once during the sampling day.

4) **Water Temperature/Dissolved Oxygen**

   Ensuring that the meter is allowed an adequate time to stabilize prior to the first calibration, the meter is calibrated prior to each measurement, the calibration value is properly recorded, the chamber reading is properly recorded, that sufficient time is allowed for readings to stabilize, and that a zero oxygen check (*QA/QC Meter Check)* is completed during the sampling day.

5) **Specific Conductance**

   Performing the *Initial Conductivity Meter Check* using a known standard, allowing for the meter to properly stabilize before recording measurements, properly cleaning the probe between stations, and performing the *End of the Day Meter Check* at the conclusion of the sampling day.

During the field sampling procedures assessment, VRAP staff offered important reminders and suggestions to ensure proper sampling techniques and re-trained volunteers in the areas needing improvement. Overall, the Ashuelot River VRAP group did an excellent job. It is important to ensure that all volunteers attend an annual VRAP training workshop prior to the sampling season and to familiarize themselves with proper sampling techniques. Please remember to schedule an annual field audit in 2011.

VRAP Receiving Water Total Phosphorus (TP) Data				
Sampling Station	Year	Samples Collected	TP Range (mg/L)	Acceptable Samples Above Level of Concern
28-ASH	2015	3	0.009-0.015	0
27-ASH	2015	3	0.013-0.016	0
24A-ASH	2015	3	0.011-0.015	0
23-ASH	2015	3	0.011-0.027	0
20A-ASH	2015	3	0.014-0.017	0
18-ASH	2015	3	0.015-0.019	0
16D-ASH	2015	3	0.018-0.027	0
16A-ASH	2015	3	0.025-0.039	0
16-ASH	2015	3	0.018-0.023	0
02B-SBA	2015	3	0.016-0.025	0
02-SBA	2015	3	0.016-0.023	0
15A-ASH	2015	3	0.016-0.031	0
07-ASH	2015	3	0.018-0.032	0
02-ASH	2015	4	0.019-0.020	0
01-ASH	2015	3	0.020-0.027	0
28-ASH	2016	3	0.009-0.011	0
27-ASH	2016	3	0.012-0.036	0
24A-ASH	2016	3	0.010-0.013	0
23-ASH	2016	3	0.006-0.016	0
20A-ASH	2016	3	0.009-0.019	0
18-ASH	2016	3	0.018-0.022	0
16D-ASH	2016	3	0.014-0.021	0
16A-ASH	2016	3	0.016-0.066	1
16-ASH	2016	3	0.015-0.026	0
02B-SBA	2016	3	0.015-0.025	0
02-SBA	2016	3	0.014-0.031	0
15A-ASH	2016	3	0.014-0.029	0
07-ASH	2016	3	0.014-0.027	0
02-ASH	2016	4	0.014-0.020	0
01-ASH	2016	3	0.019-0.30	0
28-ASH	2017	2	0.008	0
27-ASH	2017	2	0.009-0.012	0
24A-ASH	2017	2	0.009-0.125	1
23-ASH	2017	2	0.008-0.013	0
20A-ASH	2017	2	0.010-0.011	0
18-ASH	2017	2	0.011-0.014	0
16D-ASH	2017	2	0.012-0.013	0
16A-ASH	2017	2	0.013-0.015	0
16-ASH	2017	2	0.012-0.016	0
02B-SBA	2017	2	0.016	0
02-SBA	2017	2	0.014-0.015	0

VRAP Receiving Water Total Phosphorus (TP) Data				
Sampling Station	Year	Samples Collected	TP Range (mg/L)	Acceptable Samples Above Level of Concern
15A-ASH	2017	2	0.013-0.014	0
07-ASH	2017	2	0.014-0.015	0
02-ASH	2017	4	0.010-0.031	0
01-ASH	2017	2	0.013-0.016	0
28-ASH	2018	2	0.009-0.014	0
27-ASH	2018	2	0.009-0.015	0
24A-ASH	2018	2	0.012	0
23-ASH	2018	2	0.014-0.040	0
20A-ASH	2018	2	0.012-0.015	0
18-ASH	2018	2	0.020-0.026	0
16D-ASH	2018	4	0.019-0.026	0
16C-ASH	2018	3	0.020-0.031	0
16A-ASH	2018	2	0.018-0.026	0
16-ASH	2018	2	0.024-0.025	0
02B-SBA	2018	2	0.020-0.022	0
07U-SBA	2018	3	0.022-0.062	1
08-SBA	2018	3	0.022-0.061	1
02-SHK	2018	3	0.020-0.022	0
02-SBA	2018	2	0.020-0.026	0
15A-ASH	2018	2	0.015-0.026	0
14-ASH	2018	3	0.023-0.024	0
12-ASH	2018	3	0.023-0.025	0
07-ASH	2018	2	0.015-0.024	0
02-ASH	2018	4	0.010-0.038	0
01-ASH	2018	2	0.021-0.027	0
28-ASH	2019	2	0.010	0
27-ASH	2019	2	0.008-0.014	0
24A-ASH	2019	2	0.008-0.012	0
23-ASH	2019	2	0.011-0.021	0
20A-ASH	2019	2	0.014-0.016	0
18-ASH	2019	2	0.018-0.025	0
16D-ASH	2019	2	0.023-0.045	0
16A-ASH	2019	2	0.018-0.039	0
16-ASH	2019	2	0.018-0.044	0
02B-SBA	2019	2	0.016-0.052	1
02-SBA	2019	2	0.017-0.045	0
15A-ASH	2019	2	0.015-0.031	0
07-ASH	2019	2	0.016-0.026	0
02-ASH	2019	5	0.016-0.021	0
01-ASH	2019	2	0.017-0.031	0

APPENDIX E

Total Recoverable Aluminum Sampling Parameters

2018 EPA Aluminum Criteria Sampling Parameters						
Sampling Date	pH	DOC	Calcium	Magnesium	Calculated Hardness	Sample Location
	S.U.	mg/L	mg/L	mg/L	Mg/L	
SEC112718	7.2	4.4	20.6	3.0	63.7	
ASHUP112818	5.7	4.8	n/a	n/a	n/a	bridge
SEC120318	7.2	3.4	16.1	2.5	50.6	
ASHUP120418	5.9	3.0	n/a	n/a	n/a	bridge
SEC121018	7.1	4.2	15.6	2.6	49.6	
ASHUP121118	5.4	4.1	n/a	n/a	n/a	bridge
SEC121718	7.1	4.8	17.8	2.9	56.5	
ASHUP121818	5.4	3.4	n/a	n/a	n/a	bridge
SEC122518	7.2	4.1	17.3	2.6	54.1	
ASHUP122618	5.9	3.5	1.5	0.5	5.7	bridge
SEC010119	6.9	3.1	17.7	2.8	55.6	
ASHUP010219	6.4	4.7	2.0	0.6	7.6	bridge
SEC011519	7.0	5.8	18	3.1	57.7	
ASHUP011619	5.3	3.6	3.0	0.8	10.6	bridge
SEC012219	7.0	6.7	16	2.9	51.9	
ASHUP0112319	5.8	3.1	3.2	0.9	11.5	bridge
SEC012919	7.0	5.5	17	2.1	51.1	
ASHUP013019	5.7	6.3	2.1	0.6	7.7	bridge
SEC020519	6.7	6.2	15	2.9	49.4	
ASHUP020619	5.8	2.7	2.6	0.64	9.1	bridge
SEC021219	7.1	5.6	16	2.6	50.7	
ASHUP021319	5.1	3.3	2.9	0.7	10.1	bridge
SEC021919	7.0	5.8	18	3	57.3	
ASHUP022019	5.3	3.9	3.1	0.8	10.9	bridge
SEC022619	7.1	6.0	14	2.6	45.7	
ASHUP022719	5.3	1.9	3.4	0.8	11.9	bridge
SEC030519	7.2	5.5	14	3.1	47.7	
ASHUP030619	5.4	2.2	3.5	0.86	12.3	bridge
SEC031219	7.1	5.8	16	3.4	53.9	
SEC031919	7.0	6.2	20	3.8	65.6	bridge
ASHUP032019	6.6	2.8	2.4	0.66	8.7	
SEC032619	7.1	4.9	20	3.7	65.2	bridge
ASHUP032719	5.6	2.8	2.8	0.66	9.7	
SEC040219	7.2	4.9	16	2.8	51.5	bridge
ASHUP040319	5.3	3.2	1.5	0.44	5.6	
SEC040919	7.4	4.3	17.0	3.0	54.8	bridge
ASHUP040919	5.1	3.5	1.8	0.5	6.6	
SEC041619	6.5	5.1	16	3.3	53.5	bridge
ASHUP41719	5.7	3.4	1.5	0.45	5.6	
SEC042319	7.1	4.6	18	3.3	58.5	bridge
ASHUP042419	5.9	3.5	1.7	0.46	6.1	
SEC043019	7.0	4.1	19	3.2	60.6	bridge
ASHUP050119	5.8	3.7	1.5	0.44	5.6	
SEC050719	7.1	4.4	17	3.1	55.2	bridge
ASHUP050819	5.7	3.4	2.4	0.68	8.8	
SEC051419	7.0	4.3	17	3.1	55.2	bridge
ASHUP051519	5.7	3.2	2.3	0.65	8.4	
SEC060419	6.8	5.3	16	2.9	51.9	bridge

2018 EPA Aluminum Criteria Sampling Parameters						
Sampling Date	pH	DOC	Calcium	Magnesium	Calculated Hardness	Sample Location
	S.U.	mg/L	mg/L	mg/L	Mg/L	
ASHUP060519	6.0	3.5	2.5	0.67	9.0	
SEC061819	7.2	8.4	17	3.4	56.4	bridge
ASHUP061919	5.5	5.5	3.1	0.78	10.9	
SEC070919	7.2	5.2	17	3.4	56.4	
ASHWET071019	5.6	4.0	4.5	1.2	16.2	Location change -
SEC073019	7.0	4.8	16	3.3	53.5	from canoe WET location
ASHUP073119	5.9	3.1	4.9	1.3	17.6	bridge
SEC082019	7.2	4.4	19	4.1	64.3	
ASHUP082119	6.9	5.5	6.5	1.7	23.2	bridge
SEC091719	7.1	5.9	18	4.1	61.8	
ASHUP091819	5.9	3.2	6.8	1.7	24.0	bridge
SEC102919	7.0	4.2	18.0	3.8	60.6	
ASHUP103019	6.0	6.0	2.1	0.64	7.9	bridge
SEC111219	7.1	3.8	19	4.0	63.9	
ASHUP111319	4.9	4.5	2.3	0.63	8.3	bridge
SEC121019	6.8	1.9	17	3.9	58.5	
ASHUP121119	6.2	3.9	1.7	0.6	6.7	bridge
SEC011420	6.9	1.65	17	3	54.8	
ASHUP011520	6.0	3.68	1.7	0.48	6.2	bridge - high flows
SEC021120	7.2	1.90	15	3.1	50.2	
ASHUP021220	6.1	3.04	3.0	0.77	10.7	
SEC031020	7.0	2.5	15.1	3.1	50.5	
ASHUP031120	5.2	3.00	2.0	0.55	7.3	
SEC041420	6.7	2.0	17	3.1	55.2	
ASHUP041510	6.0	4.0	1.4	0.44	5.3	high flows
SEC051220	6.9	2.9	16	3.3	53.5	
ASHUP051320	5.9	1.5	2.5	0.63	8.8	
SEC060920	6.2	2.7	15	4.7	56.77	
ASHUP061020	6.2	3.0	4.7	1.2	16.67	
Median ASHUP	5.8	3.4	-	-	8.8	
Median SEC	7.0	4.85	-	-	55.2	

APPENDIX F

1994 Metals Limit, Total Recoverable Copper

04-16-08A10:53 RCVD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY RECEIVED APR 21 2008

REGION 1
1 CONGRESS STREET, SUITE 1100
BOSTON, MASSACHUSETTS 02114-2023

→ Copy to K. Blomquist
" " D. Hanscom
" " File

APR 1 - 2008

VIA CERTIFIED MAIL

John A. MacLean, City Manager
City of Keene
3 Washington Street
Keene, New Hampshire 03431-3191

Re: Notice of Final Permit Decision
NPDES Permit No. NH0100790
NPDES Appeal No. 07-18

Dear Mr. MacLean:

Pursuant to 40 C.F.R. § 124.19(f)(1)(i), this is a notice of the United States Environmental Protection Agency's (EPA's) final permit decision regarding NPDES Permit NH0100790 (Permit), which EPA reissued to the City of Keene, New Hampshire (City), on August 24, 2007.

On September 28, 2007, the City filed a Petition for Review of the Permit with the U.S. EPA Environmental Appeals Board (Board) pursuant to 40 C.F.R. § 124.19(a). EPA placed the uncontested and severable conditions of the Permit into effect on December 1, 2007. The contested conditions were stayed under 40 C.F.R. § 124.16(a) pending final agency action.

While the Petition for Review was pending before the Board, EPA partially withdrew the Permit's effluent limits for total recoverable copper, lead and zinc, as authorized by 40 C.F.R. § 124.19(d). *See* Notice of Withdrawal of Certain Contested Permit Conditions, November 20, 2007. The Board subsequently dismissed the portion of the City's appeal addressing the disputed metals limits as moot. *See* Order Noticing Partial Withdrawal of Permit and Dismissing Portion of Petition for Review as Moot, December 5, 2007 (Order). The corresponding limits from the City's prior permit, originally issued in 1994 and administratively continued in 1999, remain in effect. *See* Order at 1.

On March 25, 2008, the Board issued an Order Denying Review of the Permit. Therefore, EPA has determined and hereby notifies you that the contested portions of the Permit which had been stayed by the pending appeal (*i.e.*, the seasonal (April 1- October 31) monthly average phosphorus limit of 0.2 mg/l and the seasonal (November 1-March 31) monthly average phosphorus limit of 1.0 mg/l) shall take effect beginning May 1, 2008. Future Discharge Monitoring Reports will reflect these new requirements.

EPA expects to issue an administrative order that will contain a reasonable compliance schedule to allow the City to complete the construction upgrade necessary to comply with the Permit.

If you have any questions regarding this correspondence, please do not hesitate to contact Samir Bukhari, EPA's legal counsel in this matter, at 617-918-1095, or Brian Pitt, in our Office of Ecosystem Protection, at 617-918-1875.

Sincerely,

Robert W. Varney
Regional Administrator

cc:

Andrew W. Serrell, Rath, Young and Pignatelli, P.C. (via First Class US Mail)
Roger Janson, EPA
Mike Fedak, EPA

APPENDIX G

Industrial Users List

2015 Keene Significant Industrial Users				
EPA Category	Industry Name and Address	Type of Business	Permitted Average Process Flow, gal/day	Type of pre-treatment
None	Cheshire Medical Center 580 Court St. Keene, NH 03431	Hospital	30,000 combined process/domestic	Grease trap in employee cafeteria. Cyanide destruction of lab analyzer solution. Neutralization of internal scope sterilization chemical (ortho-phthalaldehyde) with glycine.
Metal Finishing	Corning Specialty Materials, Inc. 69 island Street Keene, NH 03431	Manufacturer optical components	1165	Baffled sampling tank to aid in solids settling. Oil separator for compressor condensate. Solids separation for tumbling wastewater. Evaporation and/or hauling of all plating process wastewaters and sludges with no discharge from plating area
Metal Finishing	EVS Metal 50 Optical Avenue. Keene, NH 03431	Sheet metal products manufacturing	80	None
None	Janos Technology 55 Black Brook Road Keene, NH 03431	Manufacturer optical components	150	Settling and filtration for solids removal
None	Keene Water Treatment Facility Roxbury Rd. Keene, NH 03431	Water treatment	37,000	Physical settling of flocculated solids which are then discharged to sewer. Oil separation for compressor condensate.
None*	Markem-Imaje Corporation 150 Congress ST. Keene, NH 03431	Manufacture of ink and inking machines	1730	Oil removal from compressor condensate. Evaporation of wastestreams potentially high in zinc. Grease trap in employee cafeteria.
Textile mill	The Mountain Corporation 18 Water Street Marlborough, NH 03455	Dying and printing tee shirts	65,000	Pretreat spent dye wastewater for color with ozone treatment. Filtration of solids from screen reclaiming process. Waste ink captured to reduce zinc-laden waste ink discharge.

2015 Keene Significant Industrial Users				
EPA Category	Industry Name and Address	Type of Business	Permitted Average Process Flow, gal/day	Type of pre-treatment
None	People's Linen Rental PO Box 751, 9 Tiffin St. Keene, NH 03431	Industrial laundry, restaurant and hotel linens only	80,000	Lint removal. pH-neutralization for high alkali washwaters.
Metal Finishing	SNF Finishing	Finishing of gun parts and accessories	3,840	pH neutralization system.
Metal Finishing	Timken Corporation, Plant 1 PO Box 547, Optical Ave. Keene, NH 03431	Manufacturer of precision bearing parts	Permitted avg. process = 16,000; avg. total = 25,000	Ultrafiltration for oil and solids removal. Settling tanks for solids removal from tumbling process. Additional settling tank and 5 um filtration for solids removal from some tumbling processes. Grease trap in employee cafeteria.

2020 Keene Significant Industrial Users				
EPA Category	Industry Name and Address	Type of Business	Permitted Average Process Flow, gal/day	Type of pre-treatment
None	Cheshire Medical Center 580 Court St. Keene, NH 03431	Hospital	34,000 combined process/domestic	Grease trap in employee cafeteria. Destruction of lab analyzer solution. Neutralization of internal scope sterilization chemical (ortho-phthalaldehyde) with glycine. Neutralization of waste formaldehyde.
Metal Finishing	Corning Specialty Materials, Inc. 69 island Street Keene, NH 03431	Manufacturer optical components	1,280	Baffled sampling tank to aid in solids settling. Oil separator for compressor condensate. Solids separation for tumbling wastewater. Evaporation and/or hauling of all plating process wastewaters and sludges with no discharge from plating area
Metal Finishing	EVS Metal 50 Optical Avenue. Keene, NH 03431	Sheet metal products manufacturing	90	Filtration for solids removal
None	Janos Technology 55 Black Brook Road Keene, NH 03431	Manufacturer optical components	150	Settling and filtration for solids removal
None	Keene Water Treatment Facility Roxbury Rd. Keene, NH 03431	Water treatment	58,000	Physical settling of flocculated solids which are then discharged to sewer. Oil separation for compressor condensate.
None	Markem-Imaje Corporation 150 Congress ST. Keene, NH 03431	Manufacture of ink and inking machines	1,100	Oil removal from compressor condensate. Evaporation of wastestreams potentially high in zinc. Grease trap in employee cafeteria.
Textile mill	The Mountain Corporation 18 Water Street Marlborough, NH 03455 PO Box 686 Keene, NH 03431	Dying and printing tee shirts	17,000	Pretreat spent dye wastewater for color with ozone treatment. Filtration of solids from screen reclaiming process. Waste ink captured to reduce zinc-laden waste ink discharge. Ink-wash wastewater filtered for enhanced zinc-removal.
None	People's Linen Rental PO Box 751, 9 Tiffin St. Keene, NH 03431	Industrial laundry, restaurant and hotel linens	80,000	Lint removal. pH-neutralization for high alkali washwaters.

2020 Keene Significant Industrial Users				
EPA Category	Industry Name and Address	Type of Business	Permitted Average Process Flow, gal/day	Type of pre-treatment
		only		
None	People's Linen Rental II PO Box 751, 4 Forge St. Keene, NH 03431	Industrial laundry, restaurant and hotel linens only	46,000	Lint removal.
Metal Finishing	SNF Finishing 32 Optical Ave., Keene, NH 03431	Finishing of gun parts and accessories	7,560	pH neutralization system. Evaporation of concentrated wastestreams.
Metal Finishing	Timken Corporation, Plant 1 PO Box 547, Optical Ave. Keene, NH 03431	Manufacturer of precision bearing parts	Permitted avg. process = 16,000; avg. total = 25,000	Ultrafiltration for oil and solids removal. Settling tanks for solids removal from tumbling process. Additional settling tank and 5 um filtration for solids removal from some tumbling processes. Grease trap in employee cafeteria.