Humboldt Bay Municipal Water District
and
Ruth Lake Community Services District

Prevention Plan for Quagga and Zebra Mussels at Ruth Lake

Updated April 2019

Updated September 2015
Updated August 2013
January 2009

Approved by Ruth Lake CSD Board of Directors April 2019
and the HBMWD Board of Directors April 2019

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INTRODUCTION

The Humboldt Bay Municipal Water District (HBMWD) and the Ruth Lake Community Services District (Ruth Lake CSD) are committed to protecting the long-term water quality and water supply interests of the regional drinking water system, the ecosystem and fisheries at Ruth Lake and in the Mad River, as well as recreational and sport fishing opportunities at Ruth Lake. To that end, this Prevention Plan has been developed to protect the water resource, and to preserve the ecosystem and recreational opportunities at Ruth Lake by preventing the introduction of two very destructive aquatic invasive species –quagga and zebra mussels.

This plan presents a number of control measures aimed at preventing these invasive species from being introduced into Ruth Lake from other water bodies that are known to be infested, or are potentially infested. These measures must be fully implemented and strictly adhered to at all time if the objective of this plan is to be achieved over the longer-term. The plan also serves as a guide for education and outreach efforts and for monitoring to facilitate early detection should the mussels be introduced into Ruth Lake.

Currently, this plan applies only to quagga and zebra mussels since these species present similar threats and given that their spread is prevented by identical methods. While this plan does not address the prevention of other aquatic invasive species, some of the strategies used to prevent the spread of zebra or quagga mussels may also assist in preventing the spread of other invasive species. This plan may be updated to address other invasive species as needed over time.

BACKGROUND

Quagga (*Dreissena rostriformiss bugensis*) and Zebra (*Dreissena polymorpha*) mussels are small freshwater mollusks that are native to the Ukraine. Zebra mussels were first discovered in the United States in Lake St. Clair in 1988. They most likely arrived in the Great Lake region via ballast water discharged from transoceanic ships. The Zebra and Quagga mussels quickly spread and have since colonized most of the Great Lakes, the Mississippi River watershed, and many other water bodies in the Midwest and East. There was an extensive, multi-agency effort to try to keep these mussels contained in the eastern United States (known as the 100th Meridian). However, that effort failed.

In January 2007, Quagga mussels were discovered in the lower Colorado River system at Lake Mead, and shortly thereafter, in Lake Mohave and Lake Havasu. By August 2007, they were discovered in reservoirs in the San Diego region.

In 2008 there were 18 lakes and reservoirs in California with known infestations of

Quagga mussels and one lake with a known infestation of Zebra mussels. As of December 2017, there were 41 lakes and reservoirs with know infestations of Quagga mussels and two reservoirs with known infestations of Zebra mussels. Appendix A contains a map depicting the reservoirs and lakes with known infestations.

Quagga and Zebra mussels in the larval or veliger stage are so small that they cannot be seen. In this state, they are highly mobile floating near the water's surface for up to five weeks before settling and attaching to a surface. The mussels are able to attach to almost any solid or semi-solid surface. Common attachment points are docks, piers, boat hulls and trailers, water intakes and water conveyance pipes/canals. Once adults take hold in a lake or reservoir, they multiply very quickly – a single mussel may release 40,000 eggs at one time and up to 1,000,000 eggs in a spawning season.

These mussels spread quickly and easily via water released from an infested water body; therefore, the Mad River may become infested if these mussels are introduced into Ruth Lake. They also spread easily via watercraft which have been in an infested lake or reservoir and then launch in another water body. Once an infestation occurs in a water body, there is currently no known eradication method available.

The invasive mussels cause physical, environmental and economic damage. Physical damage includes clogging water system infrastructure (intakes, outlet works, screens, pumps, pipes/canals, hydro-electric facilities), colonizing on docks, ramps and other marina facilities, and colonizing on boats and clogging their intakes or engines.

Environmental impacts include damage to the ecosystem since the mussels filter organic nutrients and plankton, thereby altering the aquatic food chain in the water body. Over the long-term, they harm native and sports fisheries as well. When significant infestation occurs, their consumption of organic material causes the water to become too clear, allowing sunlight to penetrate deeper, which stimulates growth of nuisance aquatic weeds and algae. This in turn may cause fish kills, given oxygen deprivation at certain times. Over the long term if a significant infestation occurs, the shoreline may become littered with dead, decomposing mussels.

If an infestation occurs, economic impacts will most likely be significant. In 2008 the federal government reported $3 billion direct costs and $5 billion indirect costs associated with the infestation in the Great Lakes region. For water agencies, maintenance costs have and will continue to increase, in some cases, quite significantly. Millions of dollars have already been spent by water agencies in southern and central California to address this issue. For marinas and recreational boaters, costs will increase too. Furthermore, once an infestation occurs, measures to prevent further spread must be implemented – either via installation of expensive decontamination facilities or closure of the lake to all recreational boating.

Fish and Game Code Section 2302 requires that:(a) Any person, or federal, state, or local agency, district, or authority that owns or manages a reservoir, as defined in Section 6004.5 of the Water Code, where recreational, boating, or fishing activities are permitted, except a privately owned reservoir that is not open to the public, shall do both of the following: (1) Assess the vulnerability of the reservoir for the introduction of nonnative dreissenid mussel species. (2) Develop and implement a program designed to prevent the introduction of nonnative dreissenid mussel species. (b) The program shall include, at a

minimum, all of the following: (1) Public education. (2) Monitoring. (3) Management of those recreational, boating, or fishing activities that are permitted. (c) Any person, or federal, state, or local agency, district, or authority, that owns or manages a reservoir, as defined in Section 6004.5 of the Water Code, where recreational, boating, or fishing activities of any kind are not permitted, except a privately owned reservoir that is not open to the public, shall, based on its available resources and staffing, include visual monitoring for the presence of mussels as part of its routine field activities. (d) Any entity that owns or manages a reservoir, as defined in Section 6004.5 of the Water Code, except a privately owned reservoir that is not open to the public for recreational, boating, or fishing activities, may refuse the planting of fish in that reservoir by the department unless the department can demonstrate that the fish are not known to be infected with nonnative dreissenid mussels. (e) Except as specifically set forth in this section, this section applies both to reservoirs that are owned or managed by governmental entities and reservoirs that are owned or managed by private persons or entities. (f) Violation of this section is not subject to the sanctions set forth in Section 12000. In lieu of any other penalty provided by law, a person who violates this section shall, instead, be subject to a civil penalty, in an amount not to exceed one thousand dollars ($1,000) per violation, that is imposed administratively by the department. To the extent that sufficient funds and personnel are available to do so, the department may adopt regulations establishing procedures to implement this subdivision and enforce this section. (Amended by Stats.2009, Ch.140, Sec. 73 (AB 1164) Effective January 1, 2010)

DESIRED OUTCOMES

1. Keeping the invasive mussels out of Ruth Lake and the Mad River, now and in the future, thereby protecting the water resource and maintaining a healthy ecosystem and fisheries

2. Maintaining recreational opportunities at Ruth Lake

3. Minimizing adverse economic impacts to stakeholders - HBMWD; Ruth Lake CSD; and leaseholders, property owners and businesses around Ruth Lake

4. Raising awareness in the boating, fishing and community at-large and enlisting their support to combat this issue

KEY ASSUMPTIONS

The following assumptions have been used in the development of this plan, and are based on the best information available at the time the plan was prepared:

1. Quagga/zebra mussels are destructive invasive species that have the potential to infest not only Ruth Lake, but also the Mad River and other lakes/reservoirs in northern California.

2. There is a time lag (up to two years) between when the larvae are introduced into a lake or reservoir and when adult mussels are actually detected. Therefore, mussels in their larvae state may be in neighboring lakes/reservoirs (e.g. Trinity, Lewiston, Whiskeytown, Clear Lake) before an infestation is known to exist.

3. There are significant risks of "doing nothing," and yet there are still risks of "doing something." However, by "doing something" – by introducing prudent prevention and control measures – HBMWD and Ruth Lake CSD will increase the likelihood that these mussels are not introduced into Ruth Lake.

4. If a quagga or zebra mussel infestation occurs in Ruth Lake, there is no known method to eradicate them.

5. Such an infestation will adversely impact:
   - HBMWD's regional water system and will increase maintenance costs to water ratepayers;
   - Ruth Lake CSD's infrastructure;
   - Recreational boating and sport fishing at Ruth Lake, which would adversely affect leaseholders, property owners, businesses, and the public;
   - The ecosystem and fisheries in Ruth Lake, and possibly the Mad River.

   The exact nature of the impacts and costs are not known.

ELEMENTS OF THE PREVENTION PLAN

1. ASSESSMENT OF VULNERABILITY

The most common pathways of introduction of quagga and zebra mussels to Ruth Lake are through recreational use of the lake by watercraft and fisherman, facilities maintenance and firefighting aircraft. The District identified the most common points of entry for watercraft and permanently closed off two of the five launch sites. The three remaining sites are blocked and access allowed only after passing an inspection. District staff provides maintenance on the log boom and dam. Staff conducts self inspection and follows decontamination procedures when conducting facilities maintenance. On occasion, the USFS and CalFire will utilize the lake water in their firefighting efforts. Both entities have their own inspection and decontamination process as well.

Appendix G has data for calcium and pH. Based on this information, one could conclude that Ruth Lake poses a "Low" chemical threat based on the readings for these two parameters, per the table below.

Table 1. Relative risk criteria used to determine chance of Dreissenid establishment (adapted from Mackie and Claudi 2010)

Parameter	Very Low	Low	Moderate	High
Calcium (mg/L)	<12	>12-15	>15-25	>25
pH	<7.0 or >9.6	7.1-7.5 or 9.1-9.5	7.6-8.0 or 8.9-0.0	8.1-8.8

Mackie, G.L. and R. Claudi. 2010. Monitoring and control of microfouling mollusks in fresh water systems. CRC Press, Taylor and Francis Group, Boca FL.

Although categorized as "low risk" in the above table, that does not equate to no risk. Ruth Reservoir is the District's impound for the domestic and industrial water diversions that take place at Essex, some 75 miles downstream. The water quality parameters downstream of Ruth Lake have not been analyzed for calcium carbonate deposits. If Quagga or Zebra mussel veligers are introduced into Ruth Lake and are swept downstream, there may exist a higher degree of potential risk for growth and settlement in the watershed which could potential affect the District's diversion infrastructure.

2. MANAGEMENT OF RECREATIONAL ACTIVITIES, INCLUDING PUBLIC EDUCTION AND OUTREACH

a) Education and Outreach

A broad-based education and outreach effort was launched by HBMWD in July 2008 to begin to educate key stakeholders and the public at-large.

Letters were sent to the Humboldt and Trinity County Boards of Supervisors and the District's wholesale customers. Two letters were sent to stakeholders at Ruth Lake – to all leaseholders, and approximately 200 private property owners, including local businesses. Two letters were also sent to marina operators, marine/boat stores and fishing/tackle shops in Humboldt, Trinity, Shasta and Del Norte Counties. In total, over 1,000 letters were mailed to these parties in July and August 2008 to raise awareness of this important issue and to solicit support in addressing it.

Additional modes and methods to communicate were also initiated including: 1) notice to out-of-town parties who had reservations at Ruth Lake CSD campgrounds, 2) placement of signs at various locations around Ruth Lake, 3) posting information on HBMWD's website, 4) creation of a telephone hotline for boaters, 5) issuance of several Press Releases which generated articles in local newspapers, and 6) advertisements in newspapers and on radio stations in Eureka, Ukiah and Redding markets.

i. Continued Education and Outreach

Communication efforts will continue to targeted audiences as follows:

- Stakeholders around Ruth Lake (US Forest Service, leaseholders, private property owners, and local businesses)
- HBMWD's wholesale customers
- Trinity and Humboldt County
- State legislative representatives
- Boat owners/fishermen in Humboldt, Trinity and neighboring counties
- The public at-large in Trinity and Humboldt Counties

The timing and manner in which communication occurs will be tailored to the audience and specific needs at the time.

ii. Placement of Signs

Once this Prevention Plan was approved, the 13 "STOP" signs which were placed at various locations around Ruth Lake in July 2008 were removed and replaced with new signs with appropriate content. The 13 "Don't Move a Mussel" signs will remain in place at this time at various locations around Ruth Lake since they communicate general information to the boating community and provide DFG's contact information.

"Permanent" signs are proposed to be placed on all highway and county roads leading to Ruth Lake pending approval from CalTrans and the County. Proposed Location of Highway Signs:

- Highway 36 just west of Red Bluff
- Highway 36, just west of the Highway 3 junction
- Highway 36, east of the junction with Rohnerville Road near Carlotta
- Lower Mad River Road (County Road 504) just after turn off from Highway 36
- Alderpoint Road just east of Highway 101 near Garberville

Proposed Locations for Signs Around Ruth Lake:

- Ruth Lake CSD Marina
- Ruth Lake CSD Ruth Recreation Campground
- Sheriff's Cove Day-use area
- Old Ruth Day-use area
- Ruth Lake CSD Hobart Creek Campground
- Ruth Lake CSD Barlow Group Campsite
- Ruth Lake CSD Hetton (Boyscout) Cove Day-use and primitive camping area
- USFS Fir Cove Campground
- USFS Bailey Canyon Campground
- USFS Mad River Campground (just downstream of Ruth Lake)

HBMWD and Ruth Lake CSD will work with the US Forest Service on signs they can place in their campgrounds given internal standards and requirements.

b) Control Measures - Watercraft

i. Segregation of Watercraft and Requirements for Each

Watercraft shall be segmented into two categories as follows with specific requirements tailored to each segment.

Category 1 – Watercraft *Resident* to Ruth Lake

Watercraft in this category must be: 1) ***resident*** to the immediate area around Ruth Lake, 2) only launched in Ruth Lake, and 3) remain in this immediate area at all times (except for the one allowance noted below).

The area in which a watercraft may be designated ***resident*** is within the boundaries of the Ruth Lake CSD and the Southern Trinity Joint Unified School District, which Districts have contiguous boundaries. Appendix B contains a map illustrating this area.

Owners of R*esident Watercraft* shall register their watercraft and sign a sworn affidavit that their watercraft is only used in Ruth Lake and never leaves the immediate area, but for one possible exception. If a watercraft meets the resident requirement and remains at all times in the immediate area during the boating season, but is then removed from the immediate area for winter storage on land, that watercraft must be banded with a tamper proof band upon leaving the Ruth Lake area (see banding details in next section). Upon return to Ruth Lake the following year, if the band is still in tact, that watercraft may reregister in Category 1 without an inspection. However, if the band is not in tact, that boat will be subject to an inspection prior to registration.

Upon successful registration and payment of an annual fee, the owner will be issued two **Yellow** stickers. One sticker must be affixed to the watercraft and the other sticker must be affixed to the trailer.

Each sticker will have a unique registration number, and the year in which the sticker is valid. Each year, owners of *Resident Watercraft* must re-register, sign the sworn affidavit, and pay the annual fee to obtain a new sticker.

The registration form and sworn affidavit for this category are contained in Appendix B.

Category 2 – All other Watercraft

All watercraft which do not qualify for Category 1, are in this second Category 2. Many watercraft in this category reportedly are from Trinity and Humboldt Counties, and quite often only frequent Ruth Lake (per information provided by Ruth Lake CSD and the Ruth Lake Leaseholders Association). Given that, owners of watercraft in this category may take advantage of a "banding" program that, once initiated, will allow them to launch at Ruth Lake without further registration or inspection until the next year.

All owners must register their watercraft and undergo an initial inspection. If the watercraft passes inspection, it will be issued two Red stickers and the watercraft (if trailered) is eligible for "banding" which secures the boat to the trailer with a tamper-proof band. Non-trailered watercraft must be inspected before launching.

Regarding banding, its purpose is to ensure that a watercraft has not been launched elsewhere thereby protecting Ruth Lake, yet allows that watercraft to quickly and efficiently launch at Ruth Lake if the tamper-proof band is still in tact. If the band is in place, watercraft in this category will be allowed to launch without further registration or inspection. When the watercraft exits Ruth Lake, the owner/operator may request that a new band be installed. If a band is not in place, watercraft in this Category will be subject to the registration and inspection process again.

Furthermore, if a watercraft which passed inspection and been issued a Red sticker, will be staying at Ruth Lake for consecutive days in one of the Ruth Lake CSD or USFS campgrounds, or on a Ruth Lake CSD Lease Site, a "duration pass" may be obtained allowing that watercraft to launch at any authorized site during that time period without further processing.

Regarding the Red stickers which are issued for this category, one must be affixed to the watercraft and the other must be affixed to the trailer (if a trailered watercraft). Each sticker will have a unique registration number, and the year in which the sticker is valid. Each year, owners of watercraft in this category must re-register their watercraft and pay the fee (annual or per launch) to obtain new stickers.

Appendix C contains detailed instructions for the registration and inspection process.

HBMWD and Ruth Lake CSD provided several registration and inspection opportunities within the local community the first winter season (2008-09). This allowed owners to pre-register their watercraft, undergo the required inspection, and be banded prior to the start of the 2009 boating season at Ruth Lake. The timing and location of these registration opportunities were announced and advertised in advance. Currently there are three locations outside of the Ruth Lake CSD boundaries that have trained inspectors conducting inspections for Ruth Lake.

Note Regarding Non-motorized Watercraft

Risk factors associated with non-motorized watercraft (e.g. kayaks, canoes, sailboats) are generally less than risk factors associated with motorized watercraft. However, non-motorized watercraft still pose some risk if they were launched in another body and still contain water from that water body upon entering Ruth Lake. Non-motorized watercraft will also be segmented into one of the two Categories outlined above, and all requirements for the applicable category must be satisfied prior to launch. Obviously, the banding option would not be available to most non-motorized watercraft since they are not trailered. Each non-motorized craft will be inspected on a case by case basis to see if a band can be used.

ii. Summary of Inspection Requirements

The registration and inspection requirements for watercraft in each Category were introduced above and are outlined in greater detail in Appendix C. They are summarized here to help the reader quickly understand the requirements.

Inspections must be done by trained and certified inspectors. Inspectors, as well as HBMWD and Ruth Lake CSD staff who are consulted on inspection requirements, must at all times adhere to a "zero-tolerance" policy related to the inspection policy and procedures. If a watercraft fails any step in the inspection process, that watercraft will be denied access to Ruth Lake and placed on the quarantine list for the minimum specified time.

Inspections are required on all watercraft wishing to launch at Ruth Lake with the only exceptions as follows:

- Watercraft approved in Category 1 ("*Resident*") which have been issued a **Yellow** sticker for the current year; and
- Watercraft in Category 2 (all other watercraft) which previously passed an inspection and have been issued a **Red** sticker for the current year, and which have either: 1) the tamper-proof band in tact which ties the watercraft to the trailer, or 2) a valid "duration pass". Boats which are not banded or do not possess a valid "duration pass" must be inspected and registered prior to launch.

iii. Quarantine Times (During Which Watercraft May Not Launch)

If a watercraft is *from a high-risk area, or has been used in a high-risk area,* permission to launch at Ruth Lake is revoked for a period of **thirty (30) days** (provided that boat remains in quarantine during the 30-day period). High-risk areas are defined in Appendix C, but generally include San Benito County, any areas south of the Tehachapi Mountains in Southern California, or outside the State of California. High-risk areas are subject to change over time as understanding of infested water bodies grows. If infestations occur in lakes and reservoirs closer to Ruth Lake, this policy may be revisited with consideration

given to permanent revocation of right to launch at Ruth Lake if watercraft are from or have been in infested water bodies.

All other watercraft which fail the required inspection shall not be allowed to launch at Ruth Lake and will be placed on "quarantine" for the following period of time:

- If in July or August, either **five (5) days *or* twelve (12) days,** depending on where the boat will be staying for that time period (see Appendices C and D for details); or
- At all other times of the year, **thirty (30) days**.

The quarantine times were established based on discussions with CA DFG staff and by utilizing the "Quarantine Estimator" from the 100th Meridian Initiative. Information from the 100th Meridian Initiative regarding recommended quarantine times is included in Appendix D.

If a watercraft is determined to have Quagga Mussels or Zebra Mussels on it, permission to launch at Ruth Lake will be revoked indefinitely, and the results will immediately be reported to the California State Department of Fish and Wildlife.

iv. Launch Sites - Generally

There were five launch ramps around Ruth Lake where trailered watercraft could launch. The boat launch ramps at Hobart Creek Campground and Hetton Cove day-use/primitive camp area (also called Boy Scout) were immediately and indefinitely closed. Access to these ramps are permanently blocked (note – access has already been blocked by large rocks).

Gates with key card locks are installed across the entry to the three remaining boat launch sites at Old Ruth day-use area, the Ruth Recreation Campground and the Ruth Lake CSD Marina. All motorized watercraft must launch from these sites in accordance with the provisions outlined below. Motorized watercraft are prohibited from launching at all other locations.

There are certain locations around the lake from which motorized watercraft are capable of launching from the shore without using a boat ramp. One such area is Hetton Cove day-use/primitive camp area. Access to the lake at Hetton Cove is blocked by placement of large rocks (or other means) to prevent boats from launching from the shore. Another location is the Ruth Rec Campground. Access shall be blocked at Ruth Rec by rocks, or other means, to prevent boats from launching from the shore. Any other location around the lake from which boats are found to be launching from the shore shall have rock placed to prevent such access.

There are numerous sites around Ruth Lake from which non-motorized water craft – such as canoes and kayaks - may launch. After registration, inspection, and issuance of either a Yellow or Red sticker, and possibly a "duration pass", non-

motorized watercraft will be allowed to launch from any location around Ruth Lake for the authorized time period.

v. Launch Site at Old Ruth Day-Use Area

As noted above, locked gates are installed across all existing boat launch sites. Access to the launch site at Old Ruth was previously only granted to owners of R*esident* watercraft (Category1) who have registered their watercraft, signed the sworn affidavit that their watercraft is only used in Ruth Lake and never leaves the immediate area, and had a valid Yellow sticker on their boat and trailer.

The HBMWD received a grant for fiscal year 16/17 from the Department of Boating and Waterways to convert Old Ruth to public launch site. This launch site is now public and not restricted to residents. Key cards are required to access this gate once watercraft have passed inspections.

If the gate at this location is torn down, or otherwise vandalized rendering it ineffective, access to the launch will immediately be blocked by large rocks (or other means) and all boating access to Ruth Lake will be directed to the Ruth Recreation Campground (if open) or the Marina. Access shall remain blocked until such time as the Ruth Lake CSD replaces the gate and key card system.

vi. Launch Site at Ruth Rec Campground

As noted above, gates are installed across existing boat launch sites, including the one at Ruth Rec Campground. . The gate is automatic with an electronic card key system. The purpose of the card key system is to allow watercraft that are properly registered and authorized, to enter Ruth Lake without additional process or procedure. A manual mechanism will also be installed across the boat ramp, which will be closed if the cross arms of the automatic gate is broken or otherwise breached. Access shall remain blocked until such time as the Ruth Lake CSD replaces the gate and lock system.

Ruth Rec Campground is one of the locations at which watercraft registration and inspections will occur. All boats that possess a yellow sticker, or a red sticker with a band, and have a valid card key may launch immediately. All other boats must check in at Ruth Rec or the Marina for inspection and processing. All boats, that are properly registered and pass inspection, will be issued a "card key". This card key may then be used to access the boat launch at Ruth Rec, Old Ruth or the Marina during the hours of operation for the valid duration. For non-trailered water craft (e.g. kayaks, canoes) a "duration pass" will consist of a Blue sticker noting the duration of the current visit to Ruth Lake.

Trained inspector(s) shall be present on-site. The inspector shall:

1. register watercraft which have not previously been registered and issue the appropriate sticker;

2. for Category 2 watercraft, confirm a valid Red sticker has been issued, ***and*** confirm the band is in place, or that a valid "duration pass" has been issued and is in place;
3. conduct inspections for all Category 2 boats which are not banded or do not possess a valid "duration" sticker;
4. place watercraft which do not pass inspection on quarantine and prohibit their entry into the lake for the entire quarantine period; and
5. re-band Category 2 watercraft when they exit the lake.

Registration and inspections shall be done in accordance with the procedures in Appendix C.

Watercraft may launch from the Ruth Rec boat launch during the season and hours of operation noted above, subject to the following conditions being met.

i. Category 1 - Owners of R*esident* watercraft who have registered their watercraft, signed the sworn affidavit that their watercraft is only used in Ruth Lake and never leaves the immediate area, and have a valid Yellow sticker on their boat and trailer.

ii. Category 2 - Owners/operators of all other watercraft whose watercraft has been registered, displays a valid Red sticker on the boat and trailer, ***and*** which has the tamper-proof band in place, ***or*** possesses a valid "duration pass". If the watercraft does not meet the above criteria, it must register and successfully pass inspection.

vii. Launch Site at Ruth Lake CSD's Marina

As noted above, gates are installed across existing boat launch sites, including at the Marina. Two gates are installed. The two gates are automatic with an electronic card key system. The purpose of the card key system is to allow watercraft that are properly registered and authorized, to enter Ruth Lake without additional process or procedure. A manual gate isalso installed across the boat ramp, which will be closed if the cross arms of the automatic gates are broken or otherwise breached. Access shall remain blocked until such time as the Ruth Lake CSD replaces the gate and lock system.

The Marina will be open year-round to those boats with a valid yellow sticker, or red sticker with band in place, or a (Blue) duration sticker. All require a current card key.

All boats wishing to launch at the Marina, except Category 1, or Banded with a valid card key, or having a (Blue) duration sticker, must first be properly registered and pass inspection, then will be issued a "duration pass". For trailered watercraft, this "duration pass" consists of card key which is programmed to

allow access only for the duration of the current visit to Ruth Lake. This card key may then be used to access the boat launch at Ruth Rec or the Marina or Old Ruth during the hours of operation for the valid duration. For non-trailered water craft (e.g. kayaks, canoes) the "duration pass" will consist of a Blue sticker noting the duration of the current visit to Ruth Lake.

At Ruth Lake CSD's discretion, watercraft registration and inspection may also be done at the Marina. This may occur on weekends to help expedite boat launches (especially on busy weekends). At such times, a trained inspector shall be present on-site. The inspector shall:

1. confirm requirements for any Category 1 watercraft wishing to launch and confirm a valid **Yellow** sticker is in place;
2. register watercraft which have not previously been registered and issue the appropriate sticker;
3. for Category 2 watercraft, confirm a valid Red sticker has been issued, ***and*** confirm the band is in place, or that a valid "duration pass" has been issued and is in place;
4. conduct inspections for all Category 2 boats which are not banded or do not possess a valid "duration" sticker;
5. place watercraft which do not pass inspection on quarantine and prohibit their entry into the lake for the entire quarantine period; and
6. re-band Category 2 watercraft when they exit the lake.

Registration and inspections shall be done in accordance with the procedures in Appendix C.

Watercraft may launch from the Marina subject to the following conditions being met:

i. Category 1 - Owners of R*esident* watercraft who have registered their watercraft, signed the sworn affidavit that their watercraft is only used in Ruth Lake and never leaves the immediate area, and have a valid Yellow sticker on their boat and trailer.

ii. Category 2 - Owners/operators of all other watercraft whose watercraft has been registered, displays valid Red stickers on the boat and trailer, ***and*** which has the tamper-proof band in place, ***or*** possesses a valid "duration pass" at the time of launch. If the watercraft does not meet the above criteria, it must register and successfully pass inspection.

c) Other Control Measures

i. Organized Recreational Events
The sponsor of Bass Tournaments, or other organized events on the lake, shall develop procedures for the tournament or other event. The procedures must, at

a minimum, include provisions for registration and inspection of all watercraft, in accordance with the requirements outlined in Appendix C.

ii. System to Track Watercraft Registration and Quarantine Periods
A system was developed to track all watercraft that are registered at Ruth Lake in each Category, the results of the inspection process for each watercraft, and quarantine periods for any watercraft which did not pass inspection. This tracking system is used by inspectors during the registration process to confirm that a boat is not on the quarantine list and is eligible to launch. It is also used to generate any reports of interest to HBMWD, Ruth Lake CSD.

iii. Fish Stocking
The California Department of Fish and Wildlife currently stocks Ruth Lake with Rainbow Trout. HBMWD request that DFW protect Ruth Lake from introduction of these invasive mussels, and expects that DFW will confirm the water quality before the lake is stocked.

iv. Wildfire Suppression
HBMWD has allowed agencies to draw water from Ruth Lake for fighting wildfires in the Mad River basin. HBMWD initiated discussions with the Forest Service (given their land holdings around Ruth Lake) regarding policies or practices to protect water bodies from invasive species during fire fighting activities. The Forest Service has informed HBMWD that Region 6 has adopted a policy to address this issue, but Region 5, which includes Six River National Forest, has not. HBMWD has had discussions with the Forest Service and CalFire regarding the appropriate measures in place, to the extent feasible, to protect Ruth Lake from introduction of quagga and zebra mussels.

v. Enforcement
Ruth Lake CSD will endeavor to have law enforcement on the lake during weekends and high-volume times such as Memorial Day, Independence Day, etc. The District will budget $5,000 annually to assist with enforcement on the lake including checking to see that watercraft have the proper stickers proving they passed the Quagga inspection process. There may be times when Ruth Lake CSD is unable to procure enforcement on the lake. The District will provide financial assistance for law enforcement only when enforcement services on the lake are available.

3. Monitoring Program for Adult and Juvenile Dreissenid Mussels

The California Department of Fish and Wildlife (CDFW) placed three substrate-monitoring devices in Ruth Lake at locations where quagga or zebra mussels would potentially colonize if introduced into the lake. CDFW, with support from HBMWD and Ruth Lake staff, has conducted ongoing monitoring of these substrate devices since 2009 to determine if the mussels have colonized. To date, no mussels have colonized. Substrate monitoring is conducted monthly within the boating season. This helps determine if quagga/zebra mussels are present in Ruth Lake. HBMWD and Ruth Lake CSD staff also visually monitor other structures too (e.g. piers and

docks at the Marina and the log boom) to see of the mussels have colonized. To date, no mussels have colonized. This surface monitoring is conducted on a quarterly basis. Additionally, plankton tow monitoring will be conducted annually. All monitoring is conducted using CDFW protocols.

Appendix F contains DFG's Substrate Monitoring Protocol and reporting procedures which HBMWD and Ruth Lake CSD staff will reference and utilize.

4. Water Quality Monitoring Plan and Threat Assessment

HBMWD engaged Stillwater Science to develop a Water Quality Monitoring Plan for Ruth Lake. This purpose of this plan is to:

1) collect and record certain water quality parameters for Ruth Lake to establish "baseline" data for comparative purposes and future analysis;
2) determine certain water quality parameters to assess the potential for quagga and zebra colonization; and
3) determine other water quality parameters to assess the potential for blue green algae (microcystis aeruginosa).

Water quality parameters and samples were collected at five locations and various depths at four times of the year as follows: August 2008, October 2008, December 2008 and April 2009.

Once the water quality parameters were collected and laboratory results obtained for the four time periods, Stillwater Science conducted a threat assessment for Ruth Lake. They compared the in-situ and analytical data collected to quagga/zebra mussel habitat requirements as established in the scientific literature. They also did a similar assessment for blue-green algae. The report, The Water Quality Assessment for Colonization of Quagga Mussels and Microcystis Aeruginosa in Ruth Lake, California is contained in Appendix G.
While this analysis may not be conclusive, provides a general indication as to how conducive an environment Ruth Lake is for quagga/zebra mussel colonization, and also provides valuable "baseline" data for future use.

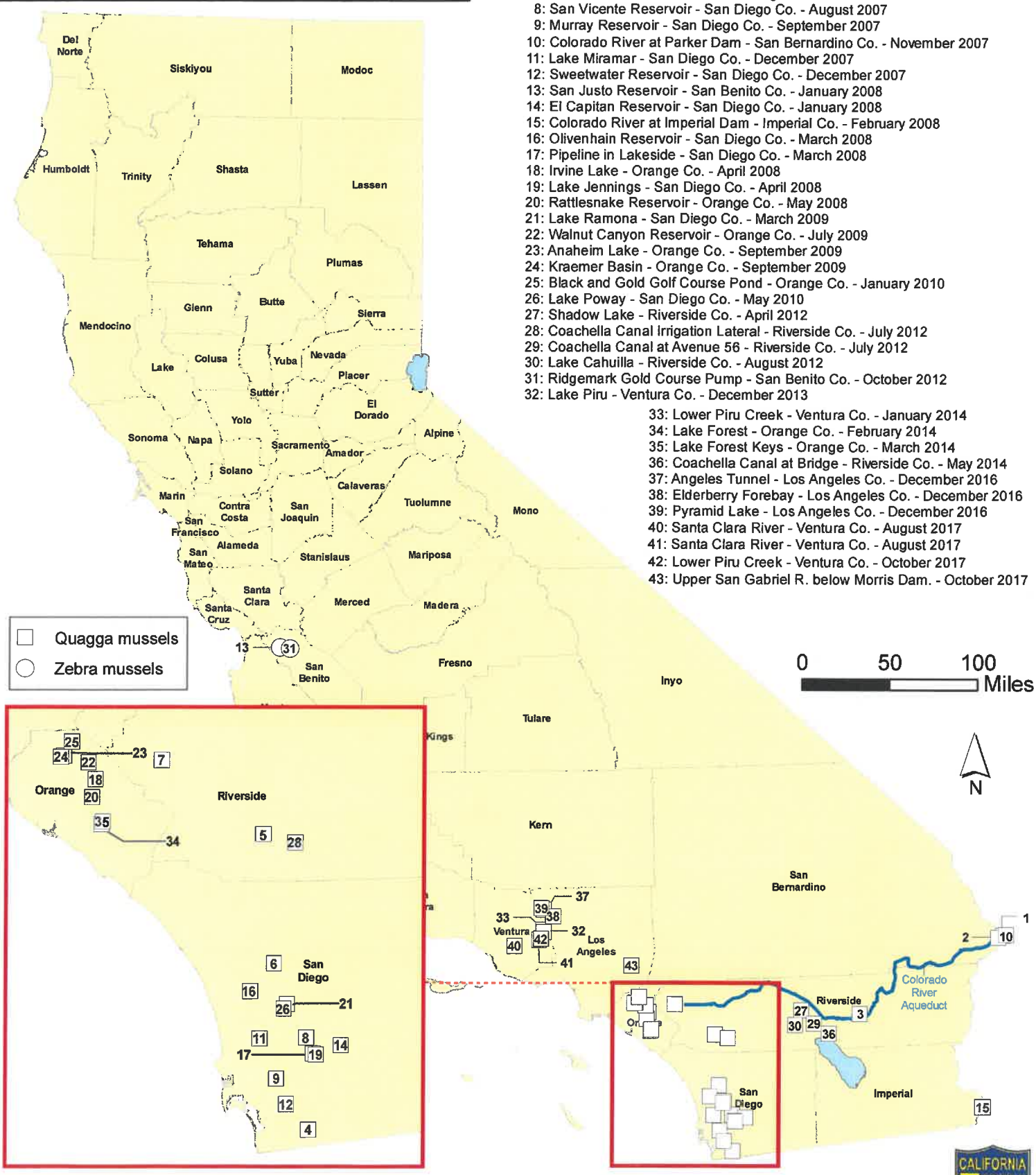
Prevention Plan for Quagga and Zebra Mussels at Ruth Lake

APPENDICES

Appendix A	Maps Showing Quagga and Zebra Mussel Sightings
Appendix B	Registration Form and Affidavit for Watercraft in Category 1 and Area from which Watercraft must reside year round to qualify for Category 1
Appendix C	Watercraft Inspection and Banding Procedures ▪ Instructions for Inspectors ▪ Watercraft Inspection Checklist (to be completed by Inspector) ▪ Watercraft Survey (to be completed by owner/operator) ▪ Watercraft Inspection Failure Notice (to be completed by Inspector following inspection)
Appendix D	Quarantine Time Estimation for northern California (from 100th Meridian's Quarantine Estimator)
Appendix E	Informational Material from CA Dept of Fish and Game: • Invasive Mussel Guidebook for Recreational Water Managers and Users – Strategies for Local Involvement • A Guide to Cleaning Boats and Preventing Mussel Damage
Appendix F	Zebra and Quagga Mussel Artificial Substrate Monitoring Protocol (from CA Dept of Fish and Game)
Appendix G	Water Quality Monitoring Plan to Assess Quagga Mussel Colonization Potential and *Microcystis Aeruginosa* and *Microcystin* Levels in Ruth Lake
Appendix H	Ordinance 19-An Ordinance of the Board of Directors of HBMWD Adopting a Registration and Inspection Program For All Watercraft at Ruth Lake
Appendix I	Maps of Ruth Lake Inspection/Launch sites, Mad River Watershed, and Northern California area

Appendix A

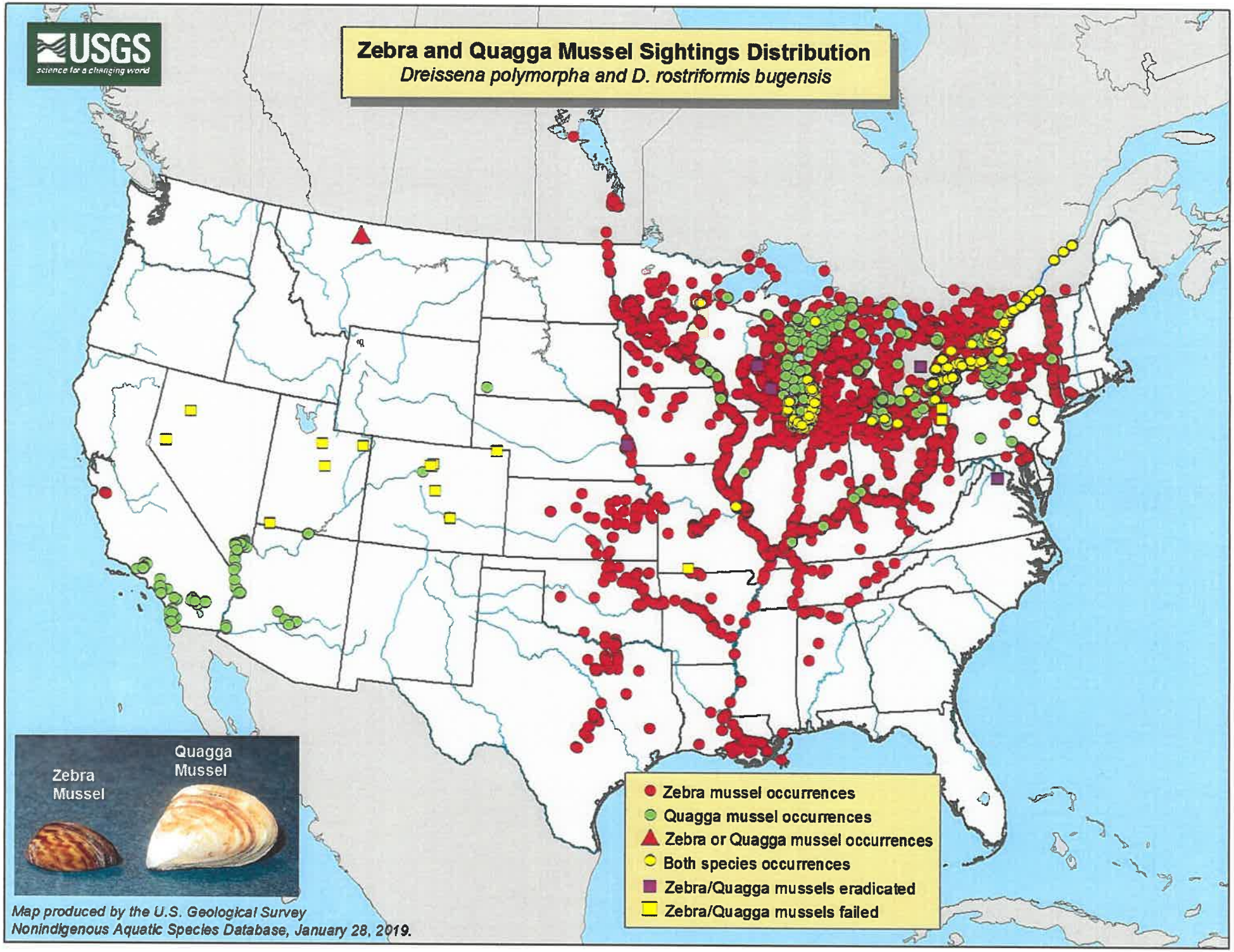
Quagga and Zebra Mussel Sightings Distribution in California, 2007 - 2017



----------LOCATIONS----------

1: Lake Havasu - San Bernardino Co. - January 2007
2: Copper Basin Reservoir - San Bernardino Co. - March 2007
3: Colorado River Aqueduct - Riverside Co. - July 2007
4: Lower Otay Lake - San Diego Co. - August 2007
5: Skinner Reservoir - Riverside Co. - August 2007
6: Dixon Reservoir - San Diego Co. - August 2007
7: Lake Mathews - Riverside Co. - August 2007
8: San Vicente Reservoir - San Diego Co. - August 2007
9: Murray Reservoir - San Diego Co. - September 2007
10: Colorado River at Parker Dam - San Bernardino Co. - November 2007
11: Lake Miramar - San Diego Co. - December 2007
12: Sweetwater Reservoir - San Diego Co. - December 2007
13: San Justo Reservoir - San Benito Co. - January 2008
14: El Capitan Reservoir - San Diego Co. - January 2008
15: Colorado River at Imperial Dam - Imperial Co. - February 2008
16: Olivenhain Reservoir - San Diego Co. - March 2008
17: Pipeline in Lakeside - San Diego Co. - March 2008
18: Irvine Lake - Orange Co. - April 2008
19: Lake Jennings - San Diego Co. - April 2008
20: Rattlesnake Reservoir - Orange Co. - May 2008
21: Lake Ramona - San Diego Co. - March 2009
22: Walnut Canyon Reservoir - Orange Co. - July 2009
23: Anaheim Lake - Orange Co. - September 2009
24: Kraemer Basin - Orange Co. - September 2009
25: Black and Gold Golf Course Pond - Orange Co. - January 2010
26: Lake Poway - San Diego Co. - May 2010
27: Shadow Lake - Riverside Co. - April 2012
28: Coachella Canal Irrigation Lateral - Riverside Co. - July 2012
29: Coachella Canal at Avenue 56 - Riverside Co. - July 2012
30: Lake Cahuilla - Riverside Co. - August 2012
31: Ridgemark Gold Course Pump - San Benito Co. - October 2012
32: Lake Piru - Ventura Co. - December 2013
33: Lower Piru Creek - Ventura Co. - January 2014
34: Lake Forest - Orange Co. - February 2014
35: Lake Forest Keys - Orange Co. - March 2014
36: Coachella Canal at Bridge - Riverside Co. - May 2014
37: Angeles Tunnel - Los Angeles Co. - December 2016
38: Elderberry Forebay - Los Angeles Co. - December 2016
39: Pyramid Lake - Los Angeles Co. - December 2016
40: Santa Clara River - Ventura Co. - August 2017
41: Santa Clara River - Ventura Co. - August 2017
42: Lower Piru Creek - Ventura Co. - October 2017
43: Upper San Gabriel R. below Morris Dam. - October 2017

Data Sources: CA Department of Fish and Wildlife, City of San Diego Water Authority, Imperial Irrigation District, Helix Water District, Irvine Ranch Water District, Coachella Valley Water District, National Park Service, CA Department of Water Resources, Los Angeles Department of Water and Power, United Water Conservation District. Map produced by the California Department of Fish and Wildlife, December 15, 2017.


USGS
science for a changing world
Zebra and Quagga Mussel Sightings Distribution
Dreissena polymorpha and D. rostriformis bugensis
Zebra Mussel
Quagga Mussel
Zebra mussel occurrences
Quagga mussel occurrences
Zebra or Quagga mussel occurrences
Both species occurrences
Zebra/Quagga mussels eradicated
Zebra/Quagga mussels failed
Map produced by the U.S. Geological Survey
Nonindigenous Aquatic Species Database, January 28, 2019.

Appendix B

Ruth Lake Resident Watercraft Affidavit Form

Watercraft Owner/Operator Information			
Name:		Phone No. _____	CF No. _____
Address:			
City:	State:	Zip:	County:

Watercraft Information		
Watercraft Type:	Make/Model:	
Is the watercraft registered? Y N	What State and County?	

History of Where Watercraft Has Been
Within the last year, has your watercraft been operated or moored in any lake, reservoir or water body other than Ruth Lake? **NO YES** If yes, when and where?
This upcoming year, will you be operating or mooring your watercraft in any other lake, reservoir or water body? **NO YES**

AFFIDAVIT:

My watercraft is resident year round to the immediate area around Ruth Lake (within the boundaries of the Ruth Lake CSD and Southern Trinity Joint Unified School District). It is **only** launched in Ruth Lake and remains in this immediate area at all times. It has not been launched in another lake, reservoir or water body during the past year. I will not operate or moor my watercraft in any other lake, reservoir or water body, other than Ruth Lake, this year.

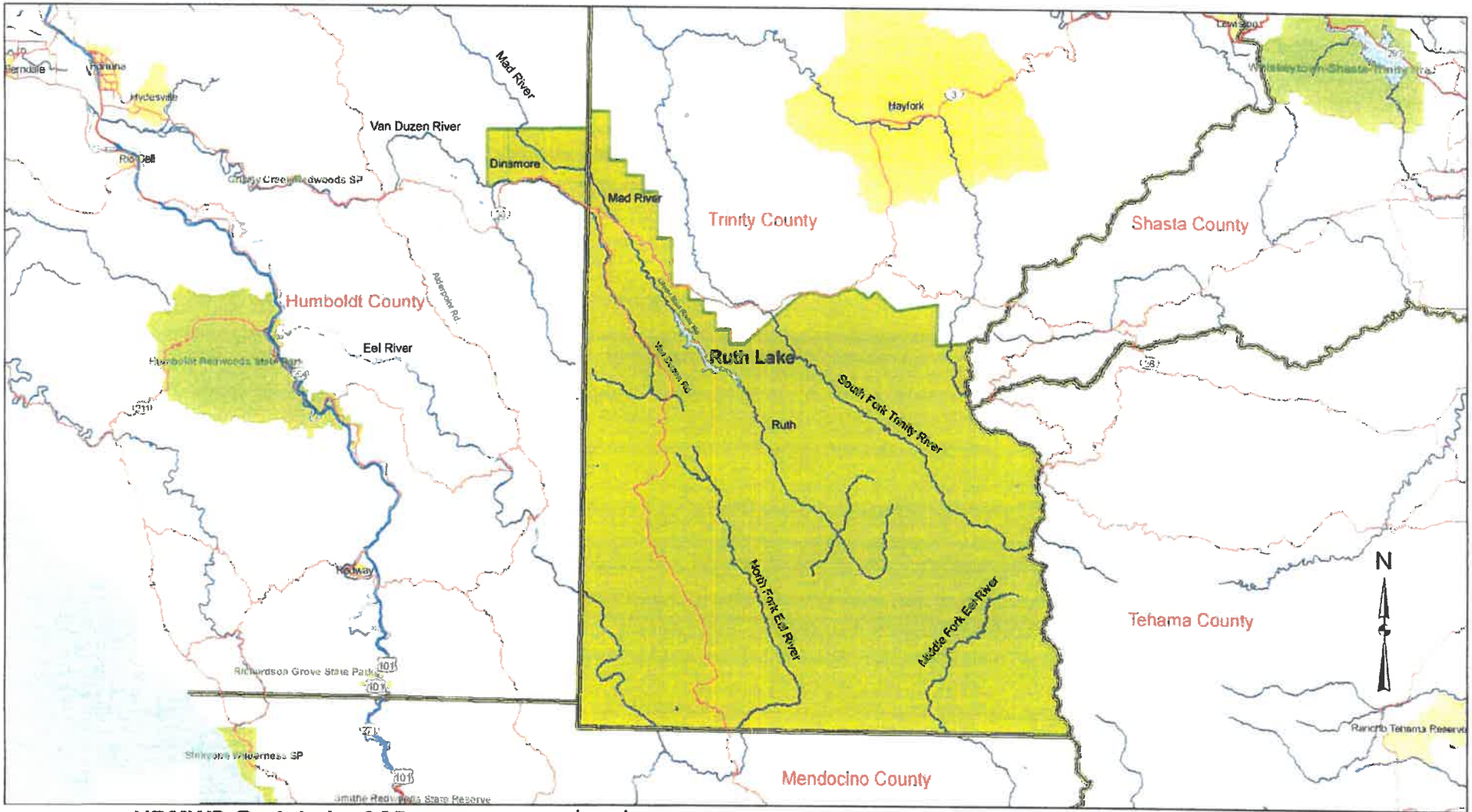
If provided the key or combination for the lock at Old Ruth Boat Ramp, I understand it is for my exclusive use only, and I will not provide it to anyone else at any time. If I do, I understand that my privilege to access Ruth Lake at Old Ruth will be permanently revoked.

I declare under penalty of perjury under the laws of the State of California that the foregoing is true and correct.

_____ _____

Signature of Owner Operator Date

FOR OFFICE USE ONLY			
Residency Confirmed by:		Valid for year: _____	
Yellow sticker(s) provided: Y N	Sticker #:	Combo provided: Y N	
Name of Person completing form:		Date:	



HBMWD-Ruth Lake CSD
"Resident" Watercraft Boundary for Ruth Lake
(Southern Trinity Joint Unified School District Area)

Legend
- County Boundaries
- Rivers and Streams
- Resident Watercraft Boundary

0 3.5 7 14 21 28 Miles
1 inch = 7 miles

Appendix C

Ruth Lake
Watercraft Inspection and Banding Procedures
Instructions for Inspectors

This document outlines the inspection procedures for Inspectors to follow for watercraft launching at Ruth Lake. These procedures are being implemented to ensure that the invasive Zebra and Quagga mussels are not introduced into Ruth Lake, and therefore, do not adversely impact HBMWD's and Ruth Lake CSD's infrastructure and threaten the lake's ecosystem.

A Watercraft Inspection Checklist (which follows) has been developed to assist the Inspector with the inspection process. These procedures, or the attached checklist, may change from time to time based on updated policies or new information.

Inspections must be done by fully trained inspectors. Inspectors must strictly adhere to these procedures at all times. Inspectors, as well as HBMWD and Ruth Lake CSD staff who are consulted on these procedures, must adhere to a "zero-tolerance" policy related to inspection criteria. If a watercraft fails any step on the Watercraft Inspection Checklist, that watercraft ***must*** be denied access to Ruth Lake and placed on the quarantine list for the minimum specified time.

Inspections are required on all watercraft which wish to launch at Ruth Lake *except:*

- Watercraft approved in Category 1 ("*Resident*") which have been issued and are displaying a Yellow sticker on their watercraft valid for the current year; and

- Watercraft in Category 2 (all other watercraft from any location) which previously passed an inspection and been issued a Red sticker for the current time period, and if the watercraft is trailered, has the tamper-proof band intact which ties the watercraft to the trailer. All Category 2 boats which are not banded are subject to this inspection prior to launch.

Following are the process steps and instructions to complete an inspection:

(a) Record the watercraft owner/operator and state boating identification number (CF#).

(b) Check the database (or paper records if database not created) to determine if a watercraft has previously been denied access during an inspection. All watercraft that have been denied access will remain on the "quarantined" list, thereby allowing the inspector to check the date that entry was denied. If the denial date is within the established quarantine period (5 or 12 days if in July or August depending on where the boat will be the next 5 days; or 30 days at all other times of the year), access will be denied.

(c) Request that the watercraft owner/operator complete the "Watercraft Survey" form. The owner/operator is voluntarily signing this Survey under penalty of perjury that he/she is not from, and that the watercraft has not been in, any of the *high-risk* water bodies, access to Ruth Lake shall be denied and the watercraft placed on the quarantine list for 30 days. Complete the "Watercraft Inspection Failure Notice" and provide a copy to the owner/operator.

(d) Provide educational material to the watercraft owner/operator (and any members of the public who may be interested in receiving it).

(e) Request that the owner/operator of the watercraft open all compartments. The owner/operator is requested to open the compartments due to safety concerns and respect for personal property.

(f) Inform the owner/operator that you will be completing an inspection, and that HBMWD and Ruth Lake CSD have a zero tolerance policy for any water, debris, or growth found on the watercraft, trailer or vehicle towing the watercraft due to possible transportation of invasive species. By informing the owner/operator of this policy he/she should not be surprised if the watercraft is denied access.

(g) Complete an inspection of the watercraft using tools such as stepping stools and flashlights when needed. Please be safety conscious during the inspection. Areas to be mindful of include: slippery surfaces, sharp surfaces, hooks and lures on boats and rods. Also, be mindful of personal property on the watercraft (fishing rods may break easily if stepped on).

Abbreviations listed in Watercraft Inspection are defined as follows: Propulsion Type: IB= Inboard OB=Outboard I/O= Inboard/Outboard J=Jet Drive Non-motorized watercraft: C/RB/K=Canoe/Rowboat/Kayak FT=Float Tube IF=Inflatable S=Sailboat

Inspect the watercraft, trailer and vehicle for water, mud, debris or growth on or in any inspected area. Touch hard surfaces to determine if growth or mussels may be attached. Complete the "Ruth Lake Watercraft Inspection Checklist", checking the appropriate box for each question.

The following summarizes what you should be looking for and documenting on the inspection checklist. If any of the following areas or components show positive signs of water, debris, mud, or growth, access to Ruth Lake shall be denied. In such a case, complete the "Watercraft Inspection Failure Notice" with the minimum required quarantine time (5 or 12 days if in July or August depending on where the boat will be the next 5 days; or 30 days at all other times of the year). Provide a copy of the form to owner/operator, and place the watercraft on quarantine list.

- Vehicle Rear: Check vehicle bumper, tailgate or spare tire for mud, grass, weeds or other debris.

- Trailer Structure, Railings and Spare Tire: Check trailer, railings and spare tire for mud, grass, weeds, debris or standing water.

- Watercraft Hull: Check watercraft hull for growth and debris. Growth may be visible if it has recently been in the water for an extended period of time. Small mussels attached to a boat can feel like sandpaper or sesame seeds. If a watercraft's hull has any type of growth or debris, then the watercraft will not be allowed to launch.

- Transom: The transom is at the back of the watercraft that the engine is attached to. The transom may have several areas that the mussels can attach to including the out drive, trim tabs, transducers, bilge plug area and through hull fittings. Check the transom to make sure the surface is smooth and visibly clear of all debris and growth. If there are any such positive signs, the watercraft will not be allowed to launch.

- Outdrive: The outdrive is attached to the transom on stern drive watercraft and the lower unit on outboard watercraft. It has intricate parts that make it easy for mussels to attach, hide and grow. Feel and look for any signs of growth, debris or texture of sandpaper. If there are any such positive signs, then the watercraft will not be allowed to launch.

- Propeller/Shafts: Mussels can attach and live where the propeller attaches to the lower unit of the drive shaft. Mussels can also attach to the shaft or connecting points of the watercraft. These can be hard to see and should be inspected with a flashlight to verify whether any mussels, debris or water is present. If these areas have any such positive signs, the watercraft will not be allowed to launch.

- Trim Tabs: Trim tabs are located on the lower portion of the transom and are usually metal plates that help stabilize the watercraft while underway. The inspector should feel corners and edges, and look on the underside of the trim tabs for debris and growth. If there are such positive signs, then the watercraft will not be allowed to launch.

- Transducers: These are located on the transom or bottom of the hull near the stern of the watercraft. They are used in conjunction with a computer to determine depth, speed and water temperature. Growth or debris can appear on them. If they have any such positive signs, the watercraft will not be allowed to launch.

- Bilge Plug: If the bilge plug is pulled when the watercraft arrives at the lake, there should be no fluid or debris coming from it. Carefully feel inside the plug hole to determine if debris is blocking water from exiting. If the bilge plug is not pulled, have the owner/operator pull the plug. If water exits, place the plug back in to prevent it from coming out. If it has positive signs of debris, or water coming from it, the watercraft will not be allowed to launch.

- Through-Hull Fittings: Through-hull fittings in all boats have the potential to store mussels. Check these fittings with a flashlight inside and feel for any irregularities. If water or debris is observed or felt, the watercraft will not be allowed to launch.

- Bait Tank/Live Well/Compartments: Bait tanks, live wells and compartments should be dry and clear of all water and debris. Some compartments do not drain completely due to the way they are manufactured. Any water or debris in compartments is not acceptable. Common debris found includes: fish scales, weeds, small pebbles and trash. If there are any positive signs of the previous, then the watercraft will not be allowed to launch.

- Bilge: The bilge is at the bottom of the inside stern of the watercraft. It may not be visible in all boats due to various boat designs. The bilge should be dry and clean from all debris. If there are any such positive signs, the watercraft will not be allowed to launch.

- Anchor and Lines: Anchors and lines that have been in the water for an extended period of time may have debris attached (or mussels if from an infested water body). Check these items for mud, growth and debris. If there are any such positive signs, the watercraft will not be allowed to launch.

- Trolling Motor: Trolling motors can pick up plants and debris while being used and must be inspected. Check these items for mud, growth and debris. If there are any positive signs, the watercraft will not be allowed to launch.

Final Disposition:

If any of the inspected areas or components show positive signs of water, debris, mud or growth, access to Ruth Lake shall be denied.

- Complete the "Watercraft Inspection Failure Notice" and note the minimum required quarantine time (5 or 12 days if in July or August depending on where the boat will be the next 5 days; or 30 days at all other times of the year)

- If watercraft fails for suspected presence of invasive mussels, notify the California Department of Fish and Game

- Provide a copy of the "Watercraft Inspection Failure Notice" to the owner/operator

- Add the watercraft to the quarantine list with the appropriate quarantine time

If the watercraft is not from nor has been in a *high risk* area, and if all inspected areas are clean and dry, the watercraft will be allowed to launch at Ruth Lake

- Complete the bottom portion of the checklist, including the number of the Red sticker issued (or already present if previously issued)

- For watercraft in Category 2 which have been issued a Red sticker, inform the owner/operator that, upon exiting the lake, he/she may have the watercraft banded to the trailer. If the band is intact upon return to Ruth Lake he/she will be allowed to launch without another inspection.

If a watercraft which has passed inspection and has been issued a Red sticker, will be at Ruth Lake for a multi-day stay (without leaving) in one on the Ruth Lake CSD or USFS campgrounds, or on a Ruth Lake CSD Lease Site, a "Duration Pass" may be issued to allow that watercraft to launch at any authorized site during that time period without further inspection. The "Duration Pass" will consist of either 1) an electronic card key programmed for the duration of the stay (if a trailered water craft that will be entering through one of the electronic gates) or 2) a Blue sticker

(for other watercraft such as kayaks, canoes or jet skis). When issued, the sticker must note the duration of the stay as well as where the watercraft is staying (campground and site number or Lease Site number).

RUTH LAKE WATERCRAFT INSPECTION CHECKLIST

(To be Completed by Inspector)

Owner/Operator (Print Name) _____Phone No._____CF No. _____

_____

City State Zip County

Process:

- ☐ Check to see if watercraft has been previously denied entry
- ☐ Have owner/operator complete and sign the Watercraft Survey. If owner/operator is from or has been in any high risk water bodies, deny entry to the watercraft
- ☐ Provide informational handouts
- ☐ Request watercraft owner/operator to open all compartments and have bilge plug pulled
- ☐ Inform owner/operator that Ruth Lake has a "no-tolerance" policy for any water, debris, or growth found on any watercraft due to the possible transportation of invasive species by watercraft and trailers

Watercraft Inspection:

- ☐ Type of motor/watercraft: (circle all pertinent) Propulsion Type: IB OB I/O J
  Non-motorized watercraft type: C/RB/K FT IF S
- ☐ Evidence of recent mooring (growth/stains on hull, wet material): Y N
- ☐ Evidence of mussels or other aquatic organisms? Y N If yes, describe:_____
- ☐ Standing/pooling water visible? Y N If yes, describe:_____

Clear of Water, Debris and/or Growth?: Check appropriate box below

Yes	No	N/A (Non-Motorized Craft)	
☐	☐	☐	Vehicle rear
☐	☐	☐	Trailer structure, railings, spare tire
☐	☐	☐	Watercraft hull
☐	☐	☐	Transom
☐	☐	☐	Outdrive
☐	☐	☐	Propeller & shaft (or rudder if kayak)
☐	☐	☐	Trim tabs (located on back of hull near engine. Not all watercraft have them)
☐	☐	☐	Transducers
☐	☐	☐	Bilge plug (pulled and no fluid or debris)
☐	☐	☐	Through-Hull fittings
☐	☐	☐	Internal compartments (bait tank/live well on motorized watercraft), storage on kayaks
☐	☐	☐	Bilge
☐	☐	☐	Anchor and line
☐	☐	☐	Trolling Motor

Is Boat Cleared for Launch? YES NO If no, Complete Watercraft Inspection Failure Notice

If yes, provide RED sticker Sticker #_____ Blue Sticker #_____

Duration Period (blue) _____

Where will watercraft be overnight during this period?_____

Date:_____ Time:_____ Inspector:_____

Print Name

RUTH LAKE
WATERCRAFT SURVEY
(To Be Completed by Watercraft Owner/Operator)

Please complete and submit this form to the Inspector at the Watercraft Inspection Station. This form is required along with visual and physical watercraft inspection before you may launch any watercraft at Ruth Lake. Failure to comply with the inspection may result in revocation of your boating permit and you may be subject to citation and/or eviction from Ruth Lake.
(Please print clearly. If you do not understand any question, please ask staff for clarification.)

Watercraft Owner/Operator Information			
Name:			
Address			
City:	State:	Zip:	County:

Watercraft Information	Trailer Number:	
Watercraft Type:	Make/Model:	CF Number:
Is the boat registered? Y N	What State and County?	

History of Where Watercraft Has Been
Are you from, or has watercraft been operated or moored in, any of the following water bodies: Lake Mead, Lake Havasu, Lake Mojave, Lake Skinner, San Justo Reservoir, San Benito County or any waterway south of the Tehachapi Mountains in Southern California, or other water body outside of California? **NO** **YES**
If Yes, Where and When?
Is your watercraft kept in water or on land when not in use? WATER LAND If kept in water, where is it kept?
Do you clean your watercraft and trailer between launchings? YES NO

Under penalty of perjury, I attest to the truthfulness of the information that I have submitted on this form. Furthermore, I voluntarily consent to an inspection of the watercraft and trailer by an Inspector for the sole purpose of detecting aquatic invasive species, particularly Zebra or Quagga mussels.

_____ _____

Signature of watercraft owner/operator Date

Red Sticker No. _____ Blue Sticker No. _____

Ruth Lake

Watercraft Inspection Failure Notice

(To Be Completed by Inspector)

Date: _____

Owner/Operator:_____

Watercraft CF#:_____

Humboldt Bay Municipal Water District (HBMWD) and Ruth Lake Community Services District (RLCSD) are dedicated to preventing an infestation of invasive aquatic species in Ruth Lake. After completing an evaluation of your Watercraft Survey and/or an inspection of your watercraft, it has been determined that you may not launch your watercraft at Ruth Lake. The reason for this restriction is as follows:

___ Upon inspection, it was determined that this watercraft is *from a high risk area or has been used in a high risk area.* Areas identified as high risk include San Benito County, any areas south of the Tehachapi Mountains in Southern California, or outside the State of California. Permission to launch at Ruth Lake has been revoked for a period of **thirty (30) days** from the date of your last visit to any high risk waterway. You may return to launch on _____provided that you meet all inspection criteria.

___ Upon inspection, this watercraft was determined to have (circle all that apply): standing water in the live wells, bait wells, bilge area or contained mud/debris/growth on the watercraft (list where) _____. You must clean, drain, dry and let stand dry any of the identified areas.

Permission to launch at Ruth Lake has been revoked for a period of (Circle One):

- **Five (5) or Twelve (12) days** (if during months of July or August), depending on where watercraft is stored, or
- **Thirty (30) days** (all months except for July/August) from the inspection date indicated on this form.

You may return to launch on _____provided you meet all inspection criteria.

___ Upon inspection, this watercraft is determined to have Quagga Mussels or Zebra Mussels. Permission to launch at Ruth Lake has been revoked indefinitely. HBMWD/RLCSD will report the result of this inspection to California State Department of Fish and Game (CDFG) and you are requested to contact CDFG at 1-866-440-9530 to report this infestation as well. CDFG will have information regarding steps you must take to decontaminate your watercraft and prevent the spread to other waterways. California Fish and Game Code Section 2301 makes it a crime to transport dreissenid mussels.

I _____have read and understand the aforementioned reason(s) for the revocation or denial of my launching privileges. I agree to not launch this watercraft at Ruth Lake for the time period specified. I understand that failure to comply by these instructions will lead to citation and/or extension of the period during which launching privileges may be denied.

_____ _____

Signature of watercraft owner/operator Date

RUTH LAKE MARINA / RLCSD
8990 Mad River Rd., Mad River, CA 95552 • (707) 574-6194
Fax (707) 574-6195 • ruthlakemarina@yahoo.com • www.ruthlakecsd.org
7am-7pm Seven Days a Week May 1 - October 31

Stickers, Bands and Card Keys

Watercraft Inspections required due to the threat of invasive species

STICKERS: THREE COLORS

Yellow

- Local boats: *for people residing within Southern Trinity County School District*
- No inspection required
- Cannot leave area ***except when banded***
- Old Ruth Launch Ramp: *for local boats only, no additional charge*
- Can use any launch ramp with valid Card Key (check rates below)

Red

- ALL non-local boats
- Inspection required (check rates below)
- Price for initial inspection varies (check rates below)
- Can get a Card Key (check rates below)

Blue

- Kayaks, canoes, inflatables and non-trailered watercraft
- Must be inspected for each duration period at lake
- Can be launched anywhere once registered

FEES

Inspection Fee		
Ski / Patio / Bass Boats / Open Fish	$ 10.00	
Jet Skis	10.00	
Kayaks / Canoes	0.00	Inspections done at Ruth Lake only
Float Tubes / Other	0.00	Inspections done at Ruth Lake only
Sticker Fees		
Yellow or Red Stickers: boats	$ 10.00	
Yellow Sticker: canoe, kayak	3.00	
Blue Stickers	3.00	Charged for EACH duration period
Other Fees		
Boat-to-Trailer Band	$ 3.00	Charged EACH TIME boat leaves water
Card Key	5.00	$2 refund or discount on next card if returned

For more information contact the Ruth Lake Community Services District (RLCSD) Office

(707) 574-6332 · ruthlakecsd@yahoo.com
12200 Mad River Rd., Mad River, CA 95552

DEFINITIONS
Band: strap for boat-to-trailer connection
Card Key: swipe card for gate access
Sticker: numbered or dated ID for boat

Appendix D

Quarantine Time Estimation for Zebra-Mussel Contaminated Boats

For Coastal & Inland Communities of Northern California

The 100th Meridian Initiative was set up to provide information to the public and help stop the spread of aquatic evasive species such as the Quagga and Zebra mussels. On their Website, www.100thmeridian.org, they have an online tool that helps to estimate the "quarantine" time for boats that have launched in a Zebra mussel infested area and plan to launch in waters that are not infested. Typically, the recommendation is to keep the boats out of water and let it dry for a minimum of 30 days after cleaning all equipment and draining all possible sources of water. But the recommended quarantine time may be reduced depending on local temperatures and relative humidity.

According to the 100th Meridian Initiative, Zebra mussels generally survive "longer out of water if local conditions are cold and humid than if conditions are hot and dry." The Quagga mussel, according to discussions with Department of Fish & Game staff, has been more aggressive than Zebra mussels as far as infestations go, but they behave similarly to Zebra mussels out of water. Therefore, information from the 100th Meridian initiative has been used to determine recommended quarantine times for both Zebra and Quagga mussels. If new information becomes available, recommended quarantine times may be adjusted.

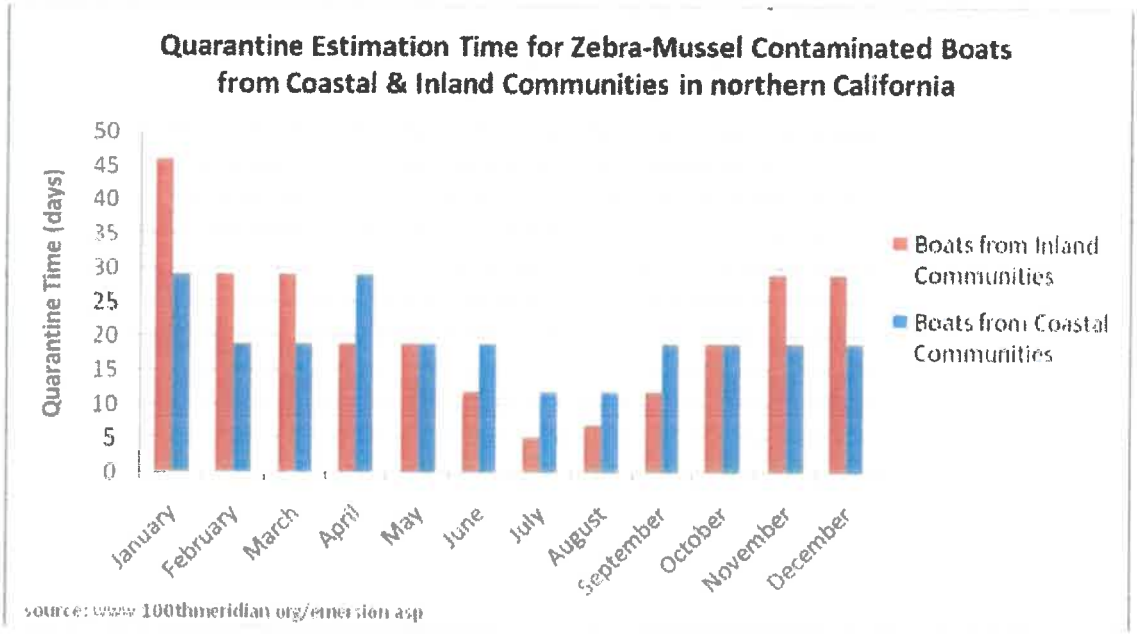
The following page includes a table and graph presenting quarantine times by month for coastal and inland communities in northern California. Following that, introductory material from the 100th Meridian website is included, along with two maps which present the recommended quarantine times for July. These maps are included for illustrative purposes – maps for each month of the year are available on-line.

Quarantine Estimation Time for Zebra-Mussel Contaminated Boats
For Coastal & Inland Areas in Northern California

	Boats from Coastal Communities		Boats from Inland Communities	
Month	Ave. Min Temp (degrees F)	Recommended Quarantine Time (days)	Ave. Min Temp (degrees F)	Recommended Quarantine Time (days)
January	40	29	30	46
February	50	19	40	29
March	50	19	40	29
April	40	29	50	19
May	50	19	50	19
June	50	19	60	12
July	60	12	80	5
August	60	12	70	7
September	50	19	60	12
October	50	19	50	19
November	50	19	40	29
December	50	19	40	29

(or 3 days if continually freezing)

Source: www.100thmeridian.org/emersion.asp



Quarantine Estimator for Zebra-Mussel Contaminated Boats

If a boat moved from a zebra-mussel infested area will be launched in waters that are not infested with zebra mussels, the general recommendation is to keep the boat out of water and let it dry for a minimum of 30 days after cleaning all equipment and draining all possible sources of standing water. However, such "quarantine" times may be reduced depending on local temperatures and relative humidities.

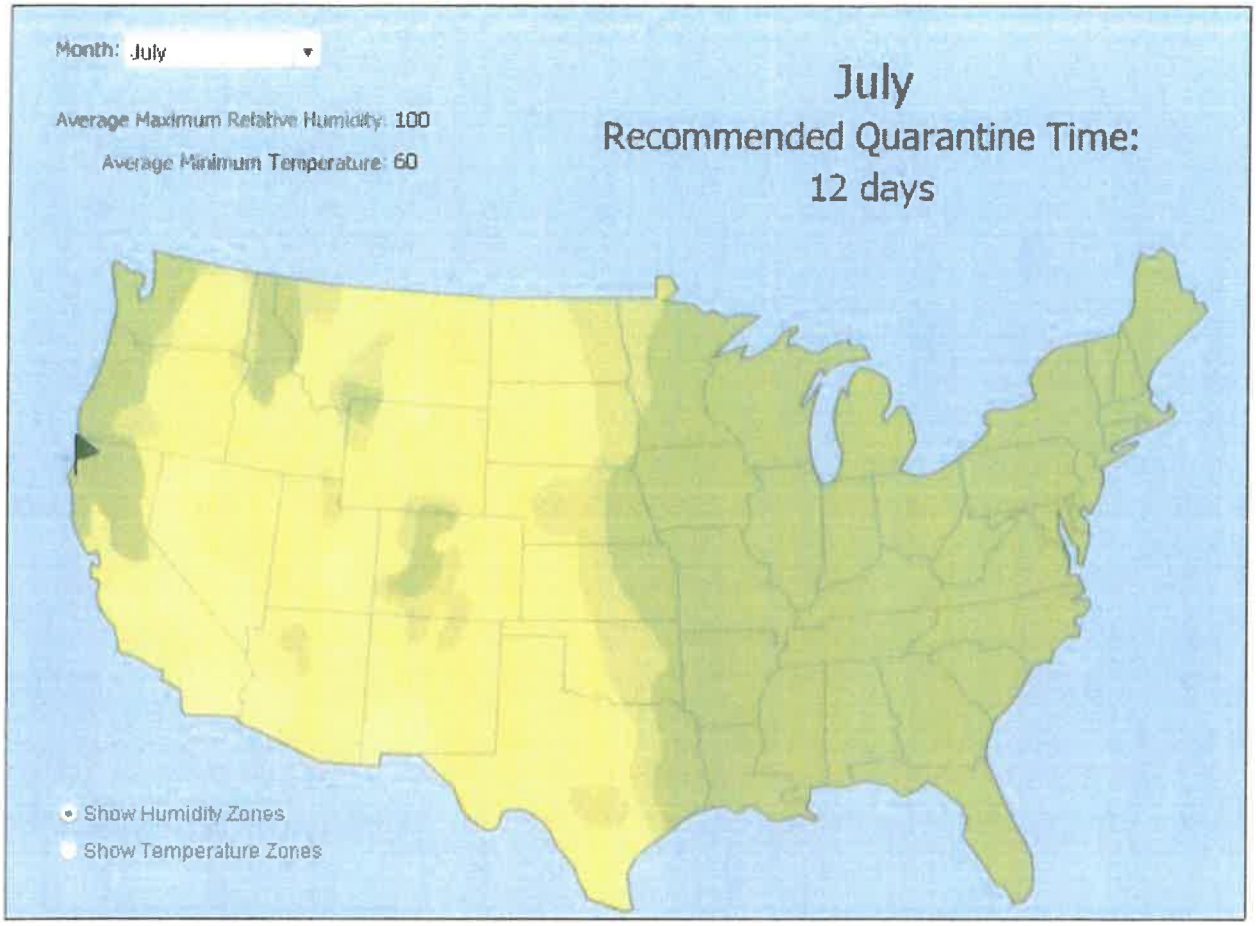
In general, zebra mussels can survive longer out of water if local conditions are cold and humid than if conditions are hot and dry. This tool estimates recommended quarantine times based on average humidity and temperature zones in the 48 contiguous United States.

If a boat has been in zebra-mussel waters, please use this tool to estimate the minimum time it should remain out of water (after being cleaned thoroughly), before launching in uninfested waters. Recommendations are only guidelines for average conditions and are based on evidence from *laboratory* experiments where other factors are held constant. Thus, recommended quarantine times may not produce 100% zebra-mussel mortality under *real-world* conditions where unidentified, yet contributing factors are free to vary. This tool will provide a minimum quarantine time that you may need to adjust upward if your situation includes additional contributing factors that may be important.

Along with this tool, please use your best judgment before launching a potentially contaminated boat in uninfested waters.

Select a month in the drop-down box below and then click anywhere on the map to get an estimated quarantine time for that location and time.

COASTAL AREA



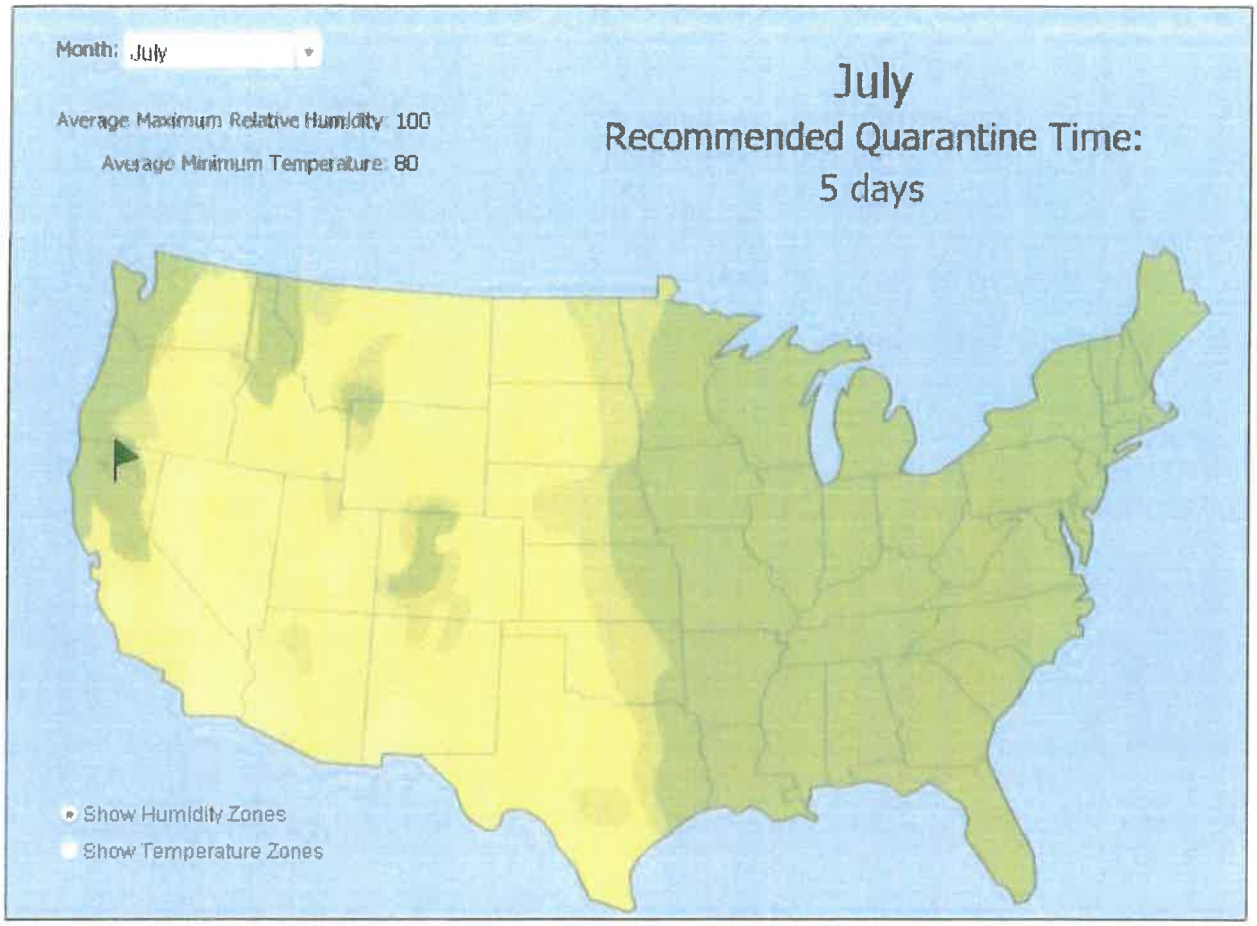
Note: both layers (temperature and humidity) are used in the estimation regardless of which one is currently showing

Recommendations are based on U.S. Army Corps of Engineers Contract Report EL-93-1, June 1993, "Use of Emersion as a Zebra Mussel Control Method" by Robert F. McMahon, Thomas A. Ussery, and Michael Clarke, The University of Texas at Arlington.

Humidity Zones are based on the United Nations Environment Program's *World Atlas of Desertification,* 2nd Edition, 1977. Nick Middleton & David Thomas (Editors).

Temperature Zones are based on archived 2005 data from NOAA/National Weather Service, Climate Prediction Center.

INLAND AREA



Note: both layers (temperature and humidity) are used in the estimation regardless of which one is currently showing

Recommendations are based on U.S. Army Corps of Engineers Contract Report EL-93-1, June 1993, "Use of Emersion as a Zebra Mussel Control Method" by Robert F. McMahon, Thomas A. Ussery, and Michael Clarke, The University of Texas at Arlington.

Humidity Zones are based on the United Nations Environment Program's *World Atlas of Desertification,* 2nd Edition, 1977. Nick Middleton & David Thomas (Editors).

Temperature Zones are based on archived 2005 data from NOAA/National Weather Service, Climate Prediction Center.

Appendix E

INVASIVE MUSSEL GUIDEBOOK FOR RECREATIONAL WATER MANAGERS AND USERS

Strategies for Local Involvement

California Natural Resources Agency
September 2010

TABLE OF CONTENTS

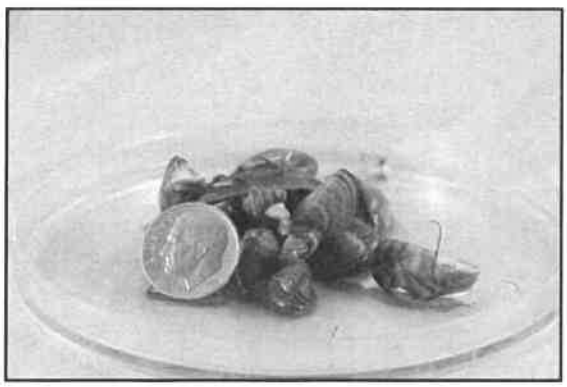
INTRODUCTION

This guidebook provides an overview of the threat Quagga and Zebra mussels pose to California's water managers and users and recommends measures they can take to prevent the introduction of these invasive species into water bodies. Managers are advised to implement early-detection monitoring for mussels and users to take responsibility by checking boats, trailers and vehicles for mussels. Information presented in this guidebook deals exclusively with prevention and containment of invasive mussels and does not address control or eradication.

GENERAL INFORMATION ABOUT QUAGGA AND ZEBRA MUSSELS

Invasive Quagga and Zebra mussels were first detected in the Great Lakes in the late 1980s and since then have spread, largely unchecked by natural predators, throughout much of the eastern United States.

In addition to the Great Lakes basin, the mollusks currently infest much of the St. Lawrence Seaway and the Mississippi River drainage system and have begun to spread up the Missouri and Arkansas rivers. The mussels were first detected in the Colorado River system in January 2007 and were later found in San Diego, Riverside and Orange counties by state and local water agencies. Zebra mussels were discovered in San Justo Reservoir in San Benito County in January 2008.



Zebra mussels from San Justo Reservoir, San Benito County.

Both species of non-native aquatic mollusks wreak havoc on the environment by disrupting the natural food chain and can contribute to the release of harmful bacteria that affect other aquatic species. Quagga and Zebra mussels are filter feeders that consume large portions of the microscopic plants and animals that form the base of the food web. Their consumption of significant amounts of phytoplankton from the water decreases zooplankton and can cause disruption to the ecological balance of entire bodies of water. The mussels can displace native species, further upsetting the natural food web.

In addition to devastating the natural environment, Quagga and Zebra mussels pose an economic threat to California. The greatest impact will be on infrastructure and water conveyances. Mussels attach to surfaces such as piers, pilings, water intakes and fish screens. These invasives spawn multiple times a year and, as a result, intake structures can become clogged, hampering the flow of water threatening municipal water supply, agricultural irrigation and power plant operations. U.S. Congressional researchers have estimated that Zebra mussel infestation in the Great Lakes area cost the power industry $3.1 billion between 1993-1999,[1][1] with an economic impact to industries, businesses and communities of more than $5 billion.[2][2]

Mussels can also negatively impact recreational boating by colonizing the hulls, engines and steering components of boats and other recreational equipment, and can damage boat motors and restrict cooling. Boats are the primary transporters of Quagga and Zebra mussels to uninfected areas either as adults attached to vessels or as larvae in engine, bilge or live well water.

Biology of the Quagga and Zebra Mussel

Quagga and Zebra mussels are freshwater mollusks with D-shaped, triangular shells. The shells are smooth or shallowly ridged and can be variable in color, from solid light to dark brown, or have alternating dark and light concentric stripes. At various stages of life mussels range in size from microscopic to the size of a fingernail and can attach to most surfaces.

Color variation in Zebra and Quagga mussels.

Adult mussels release eggs and sperm into the water column where fertilization and larva development takes place. Adults may spawn multiple times within a single year and have the potential to produce millions of offspring per spawning season. Free-floating microscopic larval mussels, called veligers, float for weeks before firmly attaching to substrates at the surface of the water down to depths of 180 feet (Zebra mussels) and 400 feet (Quagga mussels).

Organisms Often Mistaken for Quagga and Zebra Mussels

Click here for information about organisms often mistaken for invasive aquatic mussels.

[1][1] New York Sea Grant. (1994). "Policy issues." Dreissena polymorpha information review (Zebra Mussel Clearinghouse, 250 Hartwell Hall, SUNY College at Brockport, Brockport, NY 14420-2928), 5(1), 14-15.
[2][2] Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 (§1002(a)(4)).

Threat of Mussel Infestation

The State of California is working to advance understanding about Quagga and Zebra mussels and their potential impacts, but it is local communities, water districts, boating enthusiasts and other recreationalists who must take the necessary steps to address this important issue. Local officials and residents have the highest stake when it comes to preventing the spread of invasive species.

Most areas of the state are vulnerable to future transport and contamination by Quagga and Zebra mussels. Because mussels are primarily transported by watercraft, water managers are encouraged to create policies that ensure invasive mollusks are not moved via boats or ballast water. Precautions must be taken to keep uninfested waters "mussel-free."

The California Department of Fish and Game (DFG) coordinates with the U.S. Geological Survey (USGS) to generate a map of known locations of Quagga and Zebra mussels in the state. New locations are posted as soon as samples are positively identified. View the map **here**.

USGS also generates a map of known locations of Quagga and Zebra mussels in the United States. New locations are posted as soon as samples are positively identified. View the USGS map **here**.

A map of counties with suitable environmental conditions for mussel establishment was developed using existing water quality data. Water quality parameters included temperature, calcium, pH, dissolved oxygen and salinity. Given suitable environmental conditions, Quagga and Zebra mussels colonize where there is adequate calcium in the water. Counties determined to be vulnerable to colonization include those with sites with calcium concentrations of 15mg/L or greater or that already have an established mussel population. Find this map **here**.

PREVENTION TECHNIQUES

To truly prevent the spread of Quagga and Zebra infestation, assume all boats entering a water body have come from infested waters.

The following five sections outline techniques for prevention of the spread of Quagga and Zebra mussels into uninfested water bodies. The techniques detailed here include: How to Clean, Drain and Dry a Boat; Refusal to Launch; Water Body Inspections; Boat Inspection Training and Public Education.

How to Clean, Drain and Dry a Boat

This **downloadable book** teaches recreational watercraft users how to properly clean, drain and dry any type of watercraft. It is important to drain watercraft immediately after leaving a water body to prevent runoff that could potentially contain mussels or mussel larvae from reaching storm drains that meet California's rivers and streams.

Washing and Complete Drying

Washing to disinfect involves cleaning procedures detailed in the link above, followed by complete drying – the time necessary to ensure that there is no water on or within any recess of a vessel. This level of drying can be accomplished by towel-drying and/or allowing water to evaporate and will take at least five days to ensure that all absorbent materials such as carpeting, upholstery, ropes, etc. are also dry. Complete drying is necessary because it eliminates any water that may harbor larval mussels – larvae cannot survive in the absence of water. Settled adult mussels, on the other hand, need to be "dried" for extended periods of time because they have protective shells that they can close to maintain moisture, allowing them to survive out of water. Adults can live out of water for five days in California heat, and up to 30 days in cooler, moist or wet weather.

The actual time necessary for drying will depend on temperature and humidity, both of which vary seasonally, regionally and even daily. Under high humidity or low temperature, complete drying may be prolonged and disinfection by decontamination may be necessary.

To view an interactive demonstration of how season, relative humidity and geography can influence recommended drying times, please visit the 100th Meridian Initiative's **Quarantine Estimator**. Results generated from this site carry the disclaimer of being estimates, as actual circumstances will vary.

For more information about the 100th Meridian Initiative, a cooperative effort between state, provincial and federal agencies to prevent the westward spread of invasive mussels and other aquatic nuisance in North America, visit **www.100thmeridian.org**.

Wash Stations: An Alternative to Drying

If sufficient drying time is not available for water in recesses to evaporate and/or attached adult mussels to die, decontamination is required. Decontamination is accomplished by washing the boat, trailer and all equipment with scalding hot water of at least 140 degrees Fahrenheit. Working with hot water is potentially dangerous, so water managers are urged to take all necessary safety precautions.

Wash stations that use hot and high-pressure water are effective at killing and removing mussels that could become attached to boat trailers, cooling systems, boat hulls and steering equipment. In some areas, water managers have identified car washes near their lake or reservoir that will achieve this effect.

Other water managers have invested in wash stations designed to help prevent the spread of Quagga and Zebra mussels. These stations vary in size and price, but can include chemicals or hot water to kill mussels. Water managers can obtain portable wash stations by contacting local farm equipment dealers and all-terrain vehicle dealers.

Refusal to Launch

If a boat owner refuses inspection, water managers should have protocol in place to refuse them the right to utilize the water body. Additionally, a watercraft found to have Quagga or Zebra mussels must be reported to DFG as possession of live mussels is a violation of the Fish and Game Code. To report mussels, water managers can call the department's confidential CalTip line, (888) 334-2258, or contact the appropriate DFG Regional staff person listed below.

Watercraft Inspections at Water Bodies

In order to be most effective, all watercraft and vehicles entering a waterway should be subject to inspection prior to launching.

The watercraft inspector should ask permission prior to conducting the inspection. Inspectors should also ask watercraft owners a series of questions that will help determine the vessel's prior locations; similarly, inspectors should be aware of the known Quagga and Zebra mussel locations in California and neighboring states by referencing the maps listed above.

If a watercraft is suspected of having Quagga or Zebra mussels, the vessel should not be granted access to the waterway and inspectors should be prepared to notify DFG personnel immediately. Regional contact information can be found **here**.

During the inspection process, inspectors should explain to boat owners how to effectively clean watercraft and equipment each time the boat leaves a waterway. Education material should also be distributed (see Public Education and Outreach section below).

Upon exiting a waterway, the watercraft owner should clean, drain and dry their vessel. Watercraft owners should ensure there are no mussels or plant material attached to the vessel or trailer and that all water has been properly drained.

Recommended Uniform Minimum Protocols and Standards for Watercraft Inspection Programs

The Western Regional Panel on Aquatic Nuisance Species has adopted "Recommended Uniform Minimum Protocols and Standards for Watercraft Inspection Program for Dreissenid Mussels in the Western United States," prepared by Pacific States Marine Fisheries Commission. DFG assisted in the review of this document and supports the use of the recommended protocols and standards for use in California. The document can be found at http://www.aquaticnuisance.org/wordpress/wp-content/uploads/2009/01/Recommended-Protocols-and-Standards-for-Watercraft-Interception-Programs-for-Dreissenid-Mussels-in-the-Western-United-States-September-8.pdf.

Boat Inspection Training

To learn more about boat inspections, watch the 100th Meridian Initiative's "Don't Move a Mussel" video:

Windows Media Player

Don't Move a Mussel, Part I

Don't Move a Mussel, Part II

Apple QuickTime

Don't Move a Mussel, Part I

Don't Move a Mussel, Part II

Additionally, DFG regional staff is available to train local communities about how to properly inspect boats. In order to schedule a training session, a community representative must contact the appropriate regional contact from the list linked above. A date, venue and time should be selected and the community will be responsible for providing local outreach for the event. At least 10 people must attend the training session but attendance should not exceed 50 people. DFG regional staff can each offer up to two trainings a month per region.

Once trained, inspectors will be able to examine equipment for Quagga and Zebra mussels.

Watercraft Inspection Guidelines

Inspection Training Power Point Presentation

Quagga/Zebra State Biologist Contacts by Region

Public Education and Outreach

There is no better prevention technique than proper education of and outreach to water body users. Materials have been created to educate the public about invasive Quagga and Zebra mussels and are available for download and self-printing for distribution and posting in local communities. All materials were created in an electronic PDF format and are camera ready for printers. It is recommended that these materials be distributed at park kiosks, chambers of commerce, local businesses and at any point of entry to a water body. The material should also be provided to each vessel operator at the time of inspection.

Materials

Informational cards provide facts about the threat of non-native species and explain how to best clean, drain and dry watercraft to help prevent their spread. The cards are designed to be handed out at informational kiosks or events and can also be inserted in direct mailings. Click **here for English** and **here for Spanish**.

A poster has been developed to encourage boaters and water users to think about the Quagga and Zebra mussel threat. This **poster** can be hung at kiosks, boat ramps and other locations where the public can review proper cleaning techniques and boat care. The design can be used for paper, synthetic papers (tyvek, polyart synthetic, Teslin, etc.), or hard vinyl signs (PVC). It is suggested that standard paper posters be laminated.

Publications

Below are links to DFG publications that further detail the threat of the Quagga and Zebra mussels to the state.

Fact Sheet
Frequently Asked Questions
What Boaters Can Do

Additionally, this **downloadable book** teaches recreational watercraft users how to properly clean, drain and dry any type of watercraft.

Trainings

DFG regional staff is available to train local communities about how to properly inspect boats. See more information on the previous page.

HOW TO DETERMINE IF A WATER BODY HAS QUAGGA OR ZEBRA MUSSELS

Survey Protocols

To determine if a water body has Quagga or Zebra mussels, there are a number of survey protocols that can be followed. Most are highly scientific, so it is suggested that a scientist, biologist, or water quality specialist be utilized to employ the following survey protocols.

Zebra and Quagga Mussel Surface Survey Protocol

Zebra and Quagga Mussel Surface Survey Data Sheet

Zebra and Quagga Mussel Artificial Substrate Monitoring Protocol

Zebra and Quagga Mussel Veliger Sampling Protocol Vertical Tow

Contact DFG to Initiate Plan

After following the survey protocols:

If Quagga or Zebra mussels are found, contact DFG immediately at **invasives@dfg.ca.gov** to initiate a management plan.

If Quagga or Zebra mussels have not been found but water managers would like to initiate a prevention plan, please contact DFG at **invasives@dfg.ca.gov**.

RELATED LINKS

Additional information about Quagga and Zebra mussels is available by visiting these links:

- **DFG Quagga/Zebra Mussel Fact Sheet**
- **DFG Frequently Asked Questions About Quagga/Zebra Mussels**
- **U.S. Fish & Wildlife Service Western Quagga Mussel Background Information Sheet**
- **100th Meridian Initiative**

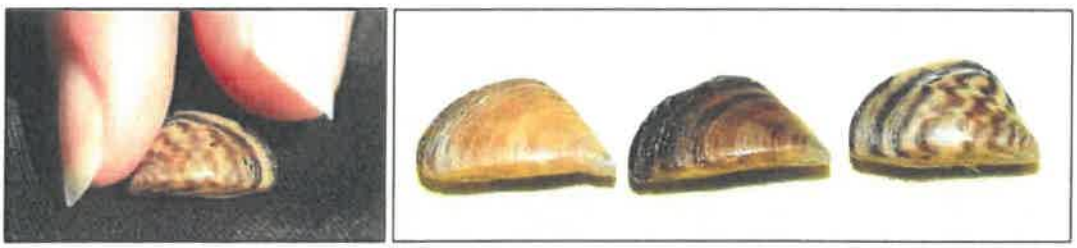
Quagga/Zebra Mussel Artificial Substrate Monitoring Protocol*
California Department of Fish and Wildlife

*This protocol was adapted from the California Department of Water Resources *Monitoring Instructions for Zebra/Quagga Mussel Plate Samplers*, April 2, 2008.

Description of Quagga and Zebra Mussels

The quagga mussel, *Dreissena rostriformis bugensis*, and the zebra mussel, *Dreissena polymorpha*, are small mussels found only in freshwater. They look very similar to each other. They commonly have alternating light and dark brown stripes, but can also be solid light brown or dark brown. They have 2 smooth shells that are shaped a little bit like the letter "D". These mussels are usually less than 2 inches in length. In new populations, most mussels are young and therefore very small (under ¼ -inch long).

Quagga Mussel *Dreissena bugensis*	**Zebra Mussel** *Dreissena polymorpha*
	
• Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or dark concentric rings; paler near hinge • Attaches to hard and soft surfaces	• Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or striped • Attaches to hard surfaces

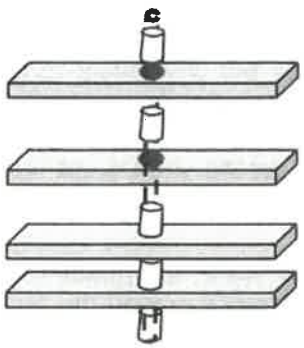


Color variation in quagga and zebra mussels

Quagga and zebra mussels are freshwater mussels that can physically attach onto hard substrates. Like the mussels found clinging to the rocks along the California coastline, quagga and zebra mussels attach onto hard surfaces (e.g. pipes, screens, rock, logs, boats, etc.). They form colonies made up of many individuals attached onto an object and even onto each other. Small newly settled mussels feel like gritty sandpaper when attached to a smooth surface. Larger mussels will feel coarser (like a small pebble or sunflower seed) or be visually apparent.

~25 ft plastic coated cable or rope
Some form of attachment to keep plates from floating up
Weight
Laminated label with your contact information

To assemble the substrate, run the cable or rope through the 8.5" tube and secure at one end. From the loose end of the rope string on the remaining pieces, alternating between the short segments of tube and the plates, beginning and ending with the short tubes (see figure). Secure the top tube to the rope to prevent the pieces from floating up. If necessary, attach a weight to the bottom of the assembly. Attach the label to the cable where the cable is secured to the structure.



California Department of Fish and Wildlife
Biological Research

PLEASE DO NOT DISTURB

For information about this study please contact:
Bob Smith, Environmental Scientist
(XXX) XXX-XXXX

Example of a label

Selection of Monitoring Site

Quagga and zebra mussels are transported between waterbodies by watercraft (e.g., boats, wave runners, etc.), water diversions, and the natural downstream flow of a river system. Monitoring sites are selected with these factors in mind. Prime sites are areas with high boat traffic and downstream of source water. If you are sampling at a waterbody that allows boating, select a site that has a lot of boat traffic. Examples are boat ramps, gas docks or dockside marina stores. Then find a location with low flow and protection from vandalism. Marinas often offer all of these features. Within a marina, find a location with restricted public access. Avoid placing the artificial substrate at unsupervised boat ramps because of tampering by the general public and entanglement with the dock cabling system when the water level changes or the ramp is moved. If these types of structures are not available, find a site downstream of the boat traffic that offers as much protection from vandalism as possible. Examples include water quality monitoring stations or towers and government agency boathouses. Always ask for permission before attaching artificial substrates to structures. Again, find a location that

identify the specimens from the photographs, but may request the actual specimen(s) to make a positive identification.

If the entire artificial substrate needs to be retained for laboratory processing, place the entire unit in a large Ziplock bag or small garbage bag and keep it in a cooler with ice while in the field. Store the substrate in the freezer until ready to mail. Mail it "overnight delivery" on ice.

Replacement of Artificial Substrate

Replace a missing or broken artificial substrate with a new one. If the substrate is repeatedly lost or damaged look for a new deployment site that offers more protection. Report any incidents and the action(s) taken.

To prevent any possibility of contamination between monitoring sites (should mussels be present and not yet detected), never take a substrate from one site and place it at a different site (even within a single waterbody).

Data Recording and Reporting

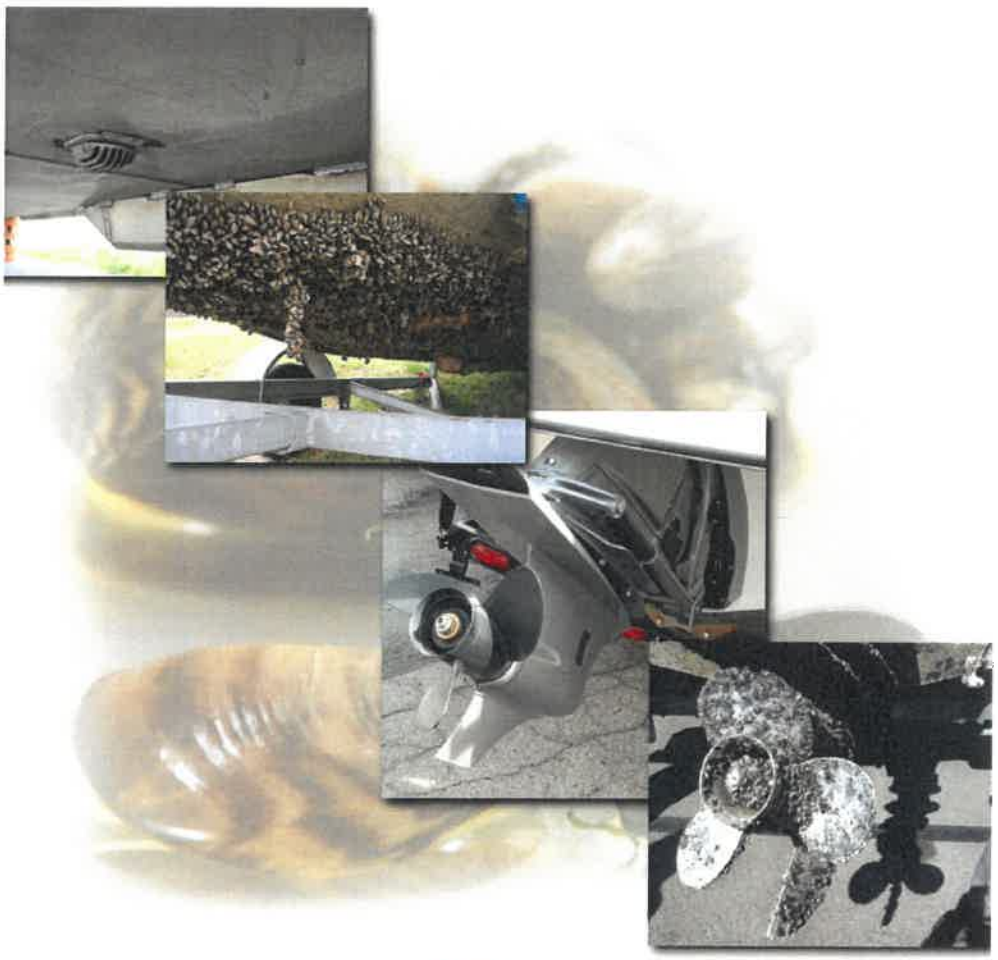
Every time an artificial substrate is checked the data must be recorded on a datasheet before leaving the field. Absence data is as important to document as presence, so complete and submit a datasheet even if no mussels were found. Send datasheets to the appropriate CDFW regional contact. All data will be entered into a data reporting system and the datasheets will be retained on-site.

CDFW Regional Scientist Contacts

For the current list of CDFW's Regional Quagga/Zebra Mussel Scientists and their contact information, please visit CDFW's quagga/zebra mussel webpage at www.wildlife.ca.gov/mussels, or download the contact list here: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=4955.

PROTECT YOUR BOAT!
FIGHT QUAGGA AND ZEBRA MUSSELS

A GUIDE TO CLEANING BOATS



AND PREVENTING MUSSEL DAMAGE

DON'T MOVE A MUSSEL

2009

What is being done to contain the Quagga/Zebra?

State and federal agencies have joined forces to avert further infestations of Quagga/Zebra mussels and are urging boaters to help stop the spread of Quagga/Zebra mussels in California.

A multi-agency taskforce, including the California Departments of Fish and Game, Boating and Waterways, Water Resources, Parks and Recreation, and Food and Agriculture as well as the U.S. Fish and Wildlife Service, U.S. Bureau of Reclamation, National Park Services, and many local governments and water agencies, has launched a statewide outreach campaign to alert the public – and particularly boat owners – about the Quagga/Zebra mussel threat.

Boaters should be aware that laws now make it illegal to transport Quagga/Zebra mussels. Boats found with evidence of the mussels may be quarantined and boat owners may face fines in some states. Many local authorities have instituted mandatory inspection programs at their lakes and reservoirs. Contaminated or suspect boats are being turned away.

California Department of Fish and Game
1416 9th Street, 12th Floor
Sacramento, CA 95814
(866) 440-9530

www.dfg.ca.gov/invasives/quaggamussel

Thanks to Utah State Parks for their photographic contributions.

Protect Your Boat!
Keep Freshwaters Open to Boating and Fishing!

How can you help fight the Quagga/Zebra mussel invasion?

Boater and watercraft users can stop the mussels from spreading.

This guide was compiled specifically for boat owners and watercraft users. The information contains general guidelines for all boaters and a basic checklist for inspecting and cleaning boats and recreational equipment for Quagga/Zebra mussels. There are also additional inspection and cleaning checklists for specific types of boats and equipment. By taking the time to inspect and clean your boat, you can:

- Protect your boat, the aquatic environment, and the boating facilities you use (marinas, gas docks, piers).
- Keep waterways open for recreational boating and fishing.
- Prevent an economic disaster resulting in millions of dollars in damage to water transport facilities.
- Comply with state and federal laws regarding the spread of Quagga/Zebra mussels.

Quagga/Zebra mussels have invaded the West!

California's waterways currently face an enormous challenge: an invasion by Quagga mussels (*Dreissena rostriformis bugensis*) and Zebra mussels (*Dreissena polymorpha*). Zebra mussels, a native species of Eastern Europe, were first introduced in the United States through ballast water released into the Great Lakes in the late-1980s. Quagga mussels soon followed.

Great efforts were made to prevent the spread of these fresh water mollusks west of the 100th Meridian. In January 2007, Quagga mussels were discovered in Lake Mead and later in other reservoirs of the Lower Colorado River. Now they infest water bodies in Riverside, San Diego, Imperial and Orange counties. In January 2008, Zebra mussels were discovered in San Justo Reservoir in San Benito County. The spread of these mussels to additional California waters will seriously impact the state's aquatic environment and water delivery systems, endangering recreational boating and fishing.

What do they look like?

Quagga/Zebra mussels vary in color and often have dark and light stripes on their shells. They differ in size, from microscopic young to adults an inch or two in length. These invasive mussels cluster in huge colonies.

Zebra mussels next to dime.

Zebra mussels at San Justo Reservoir (right/below)

Photos San Benito County Water District

Various sizes of Quagga/Zebra mussels.

Quagga/Zebra mussels could severely reduce recreational boating and fishing activities if more waters become infested.

Quagga/Zebra mussels pose serious threats

Quagga/Zebra mussels may be tiny, but are highly destructive in freshwater systems because they can:

- Reproduce quickly and in very large numbers, up to 1 million larvae per spawning season.
- Colonize on both hard and soft surfaces, from the water's surface to more than 400 feet down, including boat hulls, propellers, anchors, docks, and boat trailers.
- Coat submerged surfaces such as piers, pilings, rocks, cables, boat ramps, docks, lines, pipes and fish screens, increasing maintenance costs.
- Infiltrate and damage boat engines, bilges, live wells, and steering components.
- Threaten the state's water treatment plants, hydroelectric plants, and reservoirs.
- Clog municipal water intake structures and obstruct the flow of drinking water.
- Cost taxpayers millions of dollars to repair damaged pipes and water transport facilities.
- Wreak havoc on the environment by disrupting the food chain by filtering the water column of phytoplankton and out-competing other species, including sport fish and endangered species.
- Change water conditions, causing heavier aquatic plant growth, oxygen loss, and fish kills.
- Result in infested waters being closed to boating and fishing altogether.

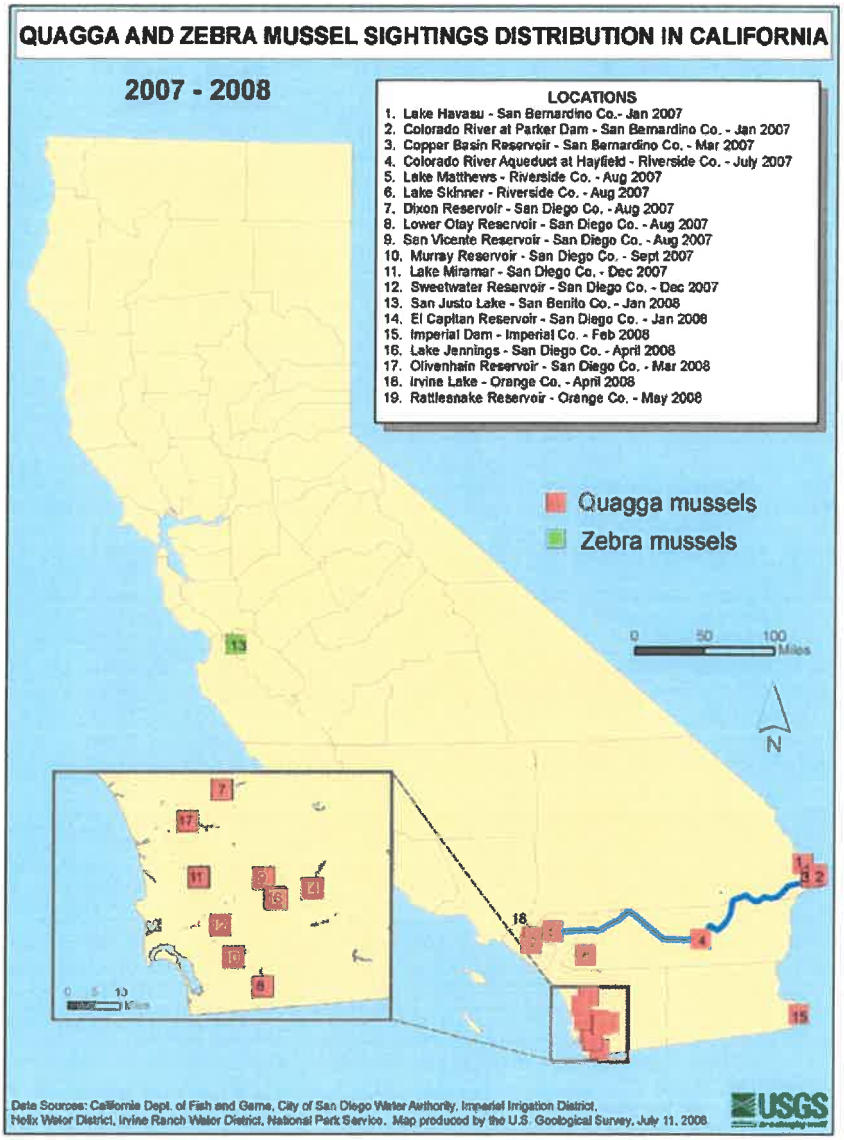
Once Quagga/Zebra mussels are established, in most cases it is impossible to eradicate them with current techologies.

How do Quagga/Zebra mussels ruin boats?

Quagga/Zebra mussels produce larvae (called veligers) too small to see with the naked eye. Newly settled young feel like sandpaper on smooth surfaces. As they quickly grow larger, Quagga/Zebra can be seen on boat hulls, especially around trim tabs and transducers along keels, and on trailers, anchors, and propellers. The mussels can also be found in or on boat bilges, ballast water, live wells, motors, fenders, life jackets, ropes – basically anything that comes into contact with infested water and can serve as a reservoir or "pocket" in which they can survive.

Quagga/Zebra mussels pose serious risks and costs to you as a boat owner because they can:

- Ruin your engine by blocking the cooling system and causing overheating.
- Increase drag on the bottom of your boat, reducing speed, and wasting fuel.
- Jam your boat's steering equipment.
- Require you to scrape and repaint your boat's hull.



The California Department of Fish and Game coordinates with the U.S. Geological Survey to generate a map of known locations of Quagga/Zebra mussels in the state. New locations are posted as soon as samples are positively identified. View the most current map:
http://nas.er.usgs.gov/taxgroup/mollusks/zebramussel/maps/CaliforniaDreissenaMap.jpg

General Guidelines: All Boaters

It is important for all boaters to cooperate with vessel inspections conducted at California Department of Food and Agriculture Border Protection Stations and on waterways around the state. Remember, you do not want to transport any Quagga/Zebra mussels from an infested water body to another location currently free of Quagga/Zebra mussels. In addition, California law makes it illegal to transport these aquatic species, even if done so unintentionally.

Trailered boats are the primary way that Quagga/Zebra mussels are introduced to unconnected water bodies.

After boating in any freshwater system:

- Carefully inspect, clean, and drain your boat when you leave the water, using the checklists provided in this guide.
- All areas must be dry (including live wells) and clear of debris, and no standing water should be on board your boat in any manner (including bait cans or buckets).

Before traveling to any freshwater for boating:

- Inspect your boat for Quagga/Zebra mussels, which can survive five days out of water in California's hot summer and up to 30 days in cool, wet weather.
- If any residual water or mussels are discovered upon an inspection, clean your boat and all equipment using the same checklist procedures and let the vessel dry for five to 30 days, depending on the weather, before you enter the water.

Calculate your drying time at:
http://www.100thmeridian.org/Emersion.asp

Failure to clean your vessel can result in it being quarantined.

Quagga mussels on boat hull found at California Border Protection Station.

Photo California Dept. of Fish and Game

Basic Inspection and Cleaning Checklist: All Watercraft

Whenever you leave freshwater, take the following actions:

1. **Remove the boat from the water** and **away from the launch ramp** for vessel inspection and cleaning.
2. **Thoroughly inspect all exposed surfaces on your vessel and trailer.** If you find any mussels, scrape them off and kill them by crushing them. Dispose of the remains in the trash. Alert the Department of Fish and Game at 866-440-9530.
3. **Remove all plants and mud** from your boat, trailer, and all equipment. Dispose of all material in the trash.
4. **Carefully feel your boat's hull** for any rough or gritty spots, which may be young mussels that have settled on your vessel and cannot be seen. Microscopic Quagga/Zebra mussels will feel like sandpaper.
5. **Away from the waterway, wash your boat's hull**, trailer, equipment, bilge, and any other exposed surfaces with high-pressure, hot water. When possible use water at a temperature of 140° F (60° C) at the hull – or about 155° (68° C) at the nozzle – which will kill the mussels. Dry the boat as much as possible.
6. **Drain all water from your boat** (pull all plugs) and **dry all areas**, including the motor, motor cooling system, live wells, ballast tanks, bladders, bilges, and lower outboard units. Make sure that all life jackets, water skis or other items that have been in the water, including anchors, ropes, etc., are inspected, cleaned, and dried.
7. **Empty and dry all buckets** and **dispose of all bait** in trash receptacles before you leave. Do not take bait home, or leave it on the ground or dump it in any waterway.
8. **Thoroughly clean all fishing and recreational equipment** (fishing nets, etc).
9. **Clean and dry personal belongings, clothing, and footwear** that have come in contact with the water.
10. **Wash, dry, and brush pets** that have been in the water.
11. **Keep your watercraft dry for at least five days in warm, dry weather and up to 30 days in cool, moist weather** before launching into a freshwater.

Day boats or those that "come and go" and spend only a few hours in the water are still at risk for picking up and transporting mussels that may be attached to aquatic weeds. The basic cleaning steps apply to any and all watercraft.

Additional steps for specific boats follow.

Vessels that are slipped and moored at infested waters run greater risk of having settlers and adult mussels.

General Inspection and Cleaning

Boat Exterior: Entire hull, floor, transom wall, ballast tanks, ropes and lines, anchors, lights, pitot tube, depth sounders, trim tabs, cavitation plates, thru-hull fittings, depth transducers, water intakes and outlets

Motor: Entire exterior housing, propeller, propeller shaft, propeller shaft support, propeller guards, propulsion units, lower unit, gimbal area, water intakes and outlets

Boat Equipment and Contents: All fishing nets and other fishing equipment, lines and ropes, float belts, life jackets, float cushions, water skis and tow ropes, ski gloves, equipment lockers, waterfowl decoys and camouflage blinds, clothing and footwear, floats, fenders, dock guards inner tubes and other inflatable items, downriggers and other fishing equipment, bait containers/buckets and live wells, trolling motors, and internal ballast tanks

Trailer: Trailer frame, axles, license plate and holders, lights and wiring, fenders, hangers, trailer tires and wheels, rollers and bunks, wiring, springs, pockets and hollow spaces

Photos Utah State Parks and California Department of Fish and Game

Drain the engine, dry the motor well, check the prop and system components, clean trolling motors, make sure everything is drained and dried. Remove all aquatic weeds.

Be sure to check the trailer for aquatic weeds and other areas on the boat like bow lights.

All vessels should be cleaned, drained, and dried!

Photos Utah State Parks

Check all areas listed under general inspection and cleaning. Feel the hull and check the trim tabs to ensure no standing water (veligers) or adults have taken hold. Check for weeds and other material as well.

Vessels should be thoroughly cleaned. Those contaminated with mussels should be scraped, washed, drained and dried. Dry time may be between five days in hot, dry California summers and up to 30 days in cool moist weather.

Photos California Department of Fish and Game

Check, clean, drain and dry live wells, all drains, and any other area where water might collect.

Remember: Most storm drains flow directly into rivers and other waters. Do not wash your vessel or drain it near a storm drain.

To prevent illegal discharge of oil when draining or flushing the bilge, use oil absorbents where possible. Oil absorbents should be disposed of as hazardous waste in California. Call 800-253-2687 for drop off locations.

Water Ski Boats

1. **After completing the basic checklist, drain water** from every internal ballast tank system as much as possible.

2. **Resume normal ballast system operation** when you go boating again. Be sure to winterize the vessel when boating season ends.

Ski boat covers open.

Ballast system water pump, water lines, and caps should all be flushed and cleaned.

Ski boat ballast water lines.

Trim tabs on transom.

Follow these actions to stop mussels from growing inside the entire system. Failure to do so could result in restriction of water lines, overheating and pump damage, as well as the increased likelihood of needing to replace expensive system components.

Houseboats, Pontoon Boats, and Other Large Vessels

1. **After completing the basic checklist, completely drain and dry all water systems that use lake water** including air conditioning, personal sanitation, and washdown systems. Note: Vessel sewage must be disposed of at a pump-out facility or dump station. The longer the boat has been in the water, the higher the chance these systems have been contaminated.

2. **Take special care to protect system components** including water supply and discharge lines, filter screens, pumps, valves, and associated parts. Small passages in the air conditioning radiator core are highly susceptible to being plugged by mussels.

Southern California Marine Association

All areas that can hold water should be drained and dried. Pontoons should be inspected for mussels, settlers, and aquatic weeds that may have mussels attached.

Photos Utah State Parks

Vessels should be thoroughly cleaned. Those contaminated with mussels should be washed, scraped, drained and dried. Dry time may be between five days in hot, dry California summers and up to 30 days in cool moist weather.

Vessels that are slipped and moored at infested waters run greater risk of having settlers and adult mussels.

Hulls should be inspected; all motors, intakes and any equipment that comes into contact with the water should be flushed, washed, drained and dried whether the equipment is attached to the boat (like a slide) or unattached like skis or floatation devices.

Since large vessel water systems are located deep within the hull, they require extra effort to access, clean, and dry to protect them. Failure to properly clean could result in costly replacement of system components if infestation occurs.

Large Vessels continued *Sailboats (over)*

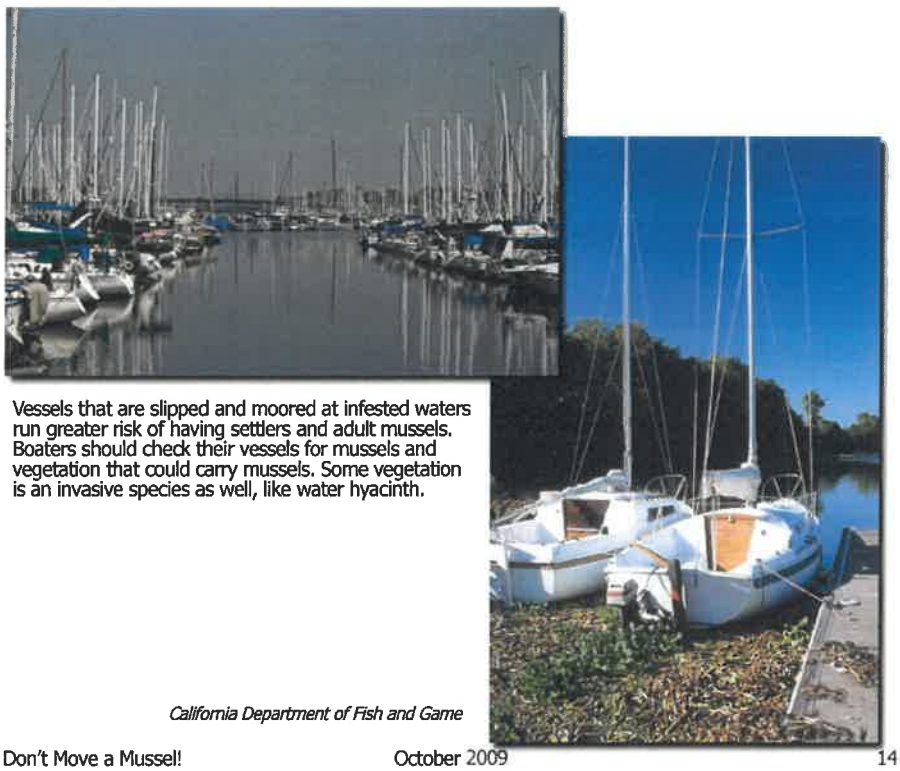
Sailboats

1. **After completing the basic checklist, completely drain and dry all water systems that use lake water**, including your air conditioning, personal sanitation, and washdown systems. Note: Vessel sewage must be disposed of at a pump-out facility or dump station. The longer your boat has been in the water, the more likely the chance these systems have been contaminated.

2. **Take special care to protect system components** including water supply and discharge lines, filter screens, pumps, valves, and associated parts. Small passages in the air conditioning radiator core are highly susceptible to being plugged by mussels.

3. **Give special attention to the centerboard trunk**, including the rudder and transom, keel and fittings, which is a major concern.

4. **Of special concern on sailboats is the removal of aquatic weeds.** Remove all vegetation from the vessel.



Vessels that are slipped and moored at infested waters run greater risk of having settlers and adult mussels. Boaters should check their vessels for mussels and vegetation that could carry mussels. Some vegetation is an invasive species as well, like water hyacinth.

California Department of Fish and Game

High Performance Speed Boats

1. **After completing the basic checklist, make sure that you flush your 'external' cooling system.** Flushing your system when retrieving your boat with fresh water supplied by the marina or boat ramp you use may help eliminate the Quagga/Zebra Mussel invasion.

2. **If your boat is not currently equipped with a 'flush kit' visit your local marine service center for details.** It is important for boat owners to recognize that the 'external' system for cooling is the problem area and although many engine suppliers equip new boats with a 'flush system', not all do. Having a 'flush kit' installed correctly (typically by a marine engine service center) would address the problem. Many older boats likely do not have a 'flush kit', but could have one installed.

Closed cooling system.

Photo Mercury Marine

Photos Southern California Marine Association

Personal Watercraft

1. **Avoid running craft through aquatic plants** because this may damage the craft, plug water intakes, and increase mussel contamination.

2. **Stop the engine** when water activities cease.

3. **Push or winch craft** onto the trailer, without running the engine.

4. **Remove the craft from the water** and **away from the launch ramp** for vessel inspection and cleaning.

5. **After completing the basic checklist, inspect and clean** all of the systems and components that apply specifically to the craft.

6. **Start and run the engine** for five to 10 seconds to blow out water and contaminants from the underbody jet drive system.

7. **Stop the engine** and **remove all plants, mud, and other contaminants** from the steering nozzle and the rest of the hull.

8. **Check underneath the craft for Quagga/Zebra mussels**, especially the water intake area (including the edges of the intake grate).

9. **Dry any pockets** that may be wet or holding water.

10. **Drain any ballasts** on the craft, **rinse with hot water,** and **allow to dry**.

Photos Utah State Parks

Personal watercraft should be drained of all water, washed, and dried.

The steering nozzle should be inspected for aquatic weeds that might have mussels.

Kayaks, Canoes, and Inflatable Rafts

1. **After completing the basic checklist, inspect and clean** any components that apply specifically to the craft.
2. **Allow the craft to dry thoroughly** before using it in any other water body.
3. **Take special care to dry inflatables** before rolling them up.

Photo California State Parks

Photo Utah State Parks

Kayaks, canoes and all inflatables need to be cleaned, drained, and dried.

Any equipment that goes into the water needs to be inspected and cleaned.

Photo California Department of Fish and Game

Dive Gear

1. **Check all gear that could potentially hide any water (veligers)** (include regulators, buoyancy compensation device, wetsuits, masks, gloves, boots, snorkels, and any other dive gear).

2. **Thoroughly clean all regulators, BCDs, wetsuits, masks, snorkels, and any other dive gear,** making sure to clean both the inside and outside of the BCD to ensure that no mud or organic matter is present – use a brush to scrub if necessary.

3. **After cleaning, rinse your suit, equipment and inside of BCD with hot (<40° C or 104°F) or salt water (1/2 cup salt/gallon).** Note, if you use the salt-water solution, it is very important to thoroughly rinse the equipment in freshwater after your cleaning because the salt crystals can harm your equipment. Divers can also use potassium at 100mg/liter at a temperature of >30° C, or using commercially available dive equipment cleaning compound that contains ammonia, vinegar, or chlorine. Dispose of cleaning solution properly.

4. **Allow gear, suit, and other equipment to dry** before diving in different waters. Veligers can survive on a wetsuit if left damp.

5. **If feasible, consider freezing** your equipment overnight to kill any veligers.

Remember: Most storm drains flow directly into rivers and other waters. Do not wash your vessel, equipment or gear or drain it near a storm drain. Stop the spread of mussels!

Additional Resources

For more information:

- General information on Quagga/Zebra mussels:
  http://www.dfg.ca.gov/invasives/quaggamussel/
- Boat cleaning tips: http://100thmeridian.org/
- General invasive species information:
  http://www.fws.gov/contaminants/Issues/InvasiveSpecies.cfm

You may also contact the following state departments for additional information or assistance:

- Department of Fish and Game: 866-440-9530
- Department of Boating and Waterways: 888-326-2822
- Department of Water Resources: 916-653-9712
- Department of Parks and Recreation: 916-654-7538

If you discover mussels in a new location, report it to the Quagga/Zebra hotline 866-440-9530

California Codes that Apply to Quagga/Zebra Mussels

- Fish and Game Code § 2301
  - Specific to Dreissenid Mussels
  - Includes both adults and water that may contain them
- Title 14 CCR § 671 (F&G Code § 2118)
  - Places restrictions on Importation, Possession and Transportation of Live Animals
- Title 14 CCR §230 (f) and (h)
  - Special conditions on tournaments to provide for welfare of fish

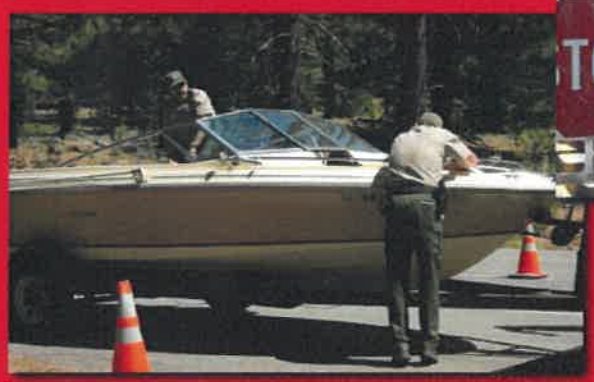
The law gives the California Department of Fish and Game the authority to:

- Stop and inspect conveyances
  - vehicles
  - boats and other watercraft
  - containers
  - trailers
- Order conveyances that contain water be drained, dried, or decontaminated
- Impound or quarantine conveyances
- Revoke or deny permits for failure to comply

DON'T MOVE A MUSSEL

Enjoy the water and the fishing!

Support checkpoints!



STOP AQUATIC HITCHIKERS!

Prevent the transport of nuisance species.
Clean all recreational equipment.

www.ProtectYourWaters.net

Help keep our waters clean!

Appendix F

Quagga/Zebra Mussel Artificial Substrate Monitoring Protocol*
California Department of Fish and Wildlife

*This protocol was adapted from the California Department of Water Resources Monitoring Instructions for Zebra/Quagga Mussel Plate Samplers, April 2, 2008.

Description of Quagga and Zebra Mussels

The quagga mussel, Dreissena rostriformis bugensis, and the zebra mussel, Dreissena polymorpha, are small mussels found only in freshwater. They look very similar to each other. They commonly have altemating light and dark brown stripes, but can also be solid light brown or dark brown. They have 2 smooth shells that are shaped a little bit like the letter "D". These mussels are usually less than 2 inches in length. In new populations, most mussels are young and therefore very small (under % -inch Ion

Quagga Mussel Dreissena bugensis	Zebra Mussel Dreissena olymorpha
	
• Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or dark concentric rings; paler near hinge • Attaches to hard and soft surfaces	• Shell: D-shaped and triangular; thin, fragile; smooth or shallowly ridged; solid light to dark brown or striped • Attaches to hard surfaces

Color variation in quagga and zebra mussels

Quagga and zebra mussels are freshwater mussels that can physically attach onto hard substrates. Like the mussels found clinging to the rocks along the California coastline, quagga and zebra mussels attach onto hard surfaces (e.g. pipes, screens, rock, logs, boats, etc.). They form colonies made up of many individuals attached onto an object and even onto each other. Small newly settled mussels feel like gritty sandpaper when attached to a smooth surface. Larger mussels will feel coarser (like a small pebble or sunflower seed) or be visually apparent.

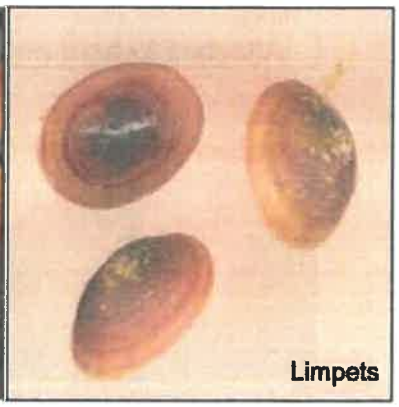
Other Organisms Mistaken for Quagga/Zebra Mussels

Asian clam, Corbiculafluminea

People often mistake the very common Asian clam (also introduced) for quagga or zebra mussels. The Asian clam is widespread and abundant in California. It is brown and has ridges in concentric rings on its shells. The shells of older clams or of dead clams are white at the hinge (where the two shells join together). These clams do not attach onto surfaces. They live in mud or sand.

Snails and Freshwater Limpets

Small snails and freshwater limpets cling to hard substrates and can be mistaken for small juvenile mussels. They are similar in color and size to small quagga and zebra mussels. Snails have a spiral shape. Limpets have one shell and are flat. Quagga and zebra mussels attach on the edge of their shell and stick up and away from the surface.



Artificial Substrate Construction and Assembly

To construct the artificial substrate you will need the following materials cut to size:

(4) 6" x 6" x 0.25" black/grey PVC with 1" hole through center

(5) 1.5" x 1.375" (35mm) exterior diameter PVC or ABS tube

(1) 8.5" x 0.8125" (21 mm) exterior diameter PVC or ABS tube

-25 ft plastic coated cable or rope

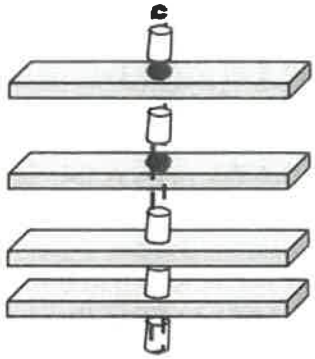
Some form of attachment to keep plates from floating up

Weight

Laminated label with your contact information

To assemble the substrate, run the cable or rope through the 8.5" tube and secure at one end. From the loose end of the rope string on the remaining pieces, alternating

between the short segments of tube and the plates, beginning and ending with the short tubes (see figure). Secure the top tube to the rope to prevent the pieces from floating up. If necessary, attach a weight to the bottom of the assembly. Attach the label to the cable where the cable is secured to the structure.



Califomia Department of Fish and Wildlife
Biological Research
PLEASE DO NOT DISTURB
For information about this study please contact:
Bob Smith, Environmental Scientist xxx-xxxx

Example of a label

Selection of Monitoring Site

Quagga and zebra mussels are transported between waterbodies by watercraft (e.g., boats, wave runners, etc.), water diversions, and the natural downstream flow of a river system. Monitoring sites are selected with these factors in mind. Prime sites are areas with high boat traffic and downstream of source water. If you are sampling at a waterbody that allows boating, select a site that has a lot of boat traffic. Examples are boat ramps, gas docks or dockside marina stores. Then find a location with low flow and protection from vandalism. Marinas often offer all of these features. Within a marina, find a location with restricted public access. Avoid placing the artificial substrate at unsupervised boat ramps because of tampering by the general public and entanglement with the dock cabling system when the water level changes or the ramp is moved. If these types of structures are not available, find a site downstream of the boat traffic that offers as much protection from vandalism as possible. Examples include water quality monitoring stations or towers and government agency boathouses. Always ask for permission before attaching artificial substrates to structures. Again, find a location that

offers protection from vandalism and has low flow.

Deployment and Inspection of the Artificial Substrate

Depending on water clarity and depth, the artificial substrate should be set below the euphotic zone (below the depth of light penetration) or 6 feet, whichever is deeper, and at least two few feet above the bottom. One to two substrates are deployed per site. If the site is shallower than 2 m, then raise the substrate about 0.5 m (2 ft) off of the bottom. Record the actual sampling depth. At sites that are deep and have little vertical mixing, a second substrate is installed at a depth of approximately 15 meters (50 feet) below the surface (or 1 meter off the bottom if the depth is less than 15 meters).

A visual and tactile examination of the artificial substrate is conducted every month for attached quagga and zebra mussels. When mussels first attach they are very small (invisible to the naked eye) and are very delicate (shells are thin and easily crushed). A single mussel may feel like a grain of sand. If many mussels cover a surface, the surface feels gritty like sandpaper. In approximately 1 to 2 months a mussel grows large enough (1/4 inch) to be seen upon close inspection, but the shell is still very delicate. At this size it feels like a small pebble or sunflower seed.

To check an artificial substrate, first carefully lift it out of the water and place it in a large plastic tub (the tub will capture any mussels that fall off). Avoid knocking the substrate as you pull it out of the water because you may dislodge or crush any attached mussels. First visually inspect each plate (top, bottom, and sides), the spacers, the cable and the weight. After looking closely, attempt to gently push any attached organism that might be a mussel. Freshwater limpets and snails easily move or slide across the plate. Quagga and zebra mussels stick in place or are more securely attached. In all cases, if in doubt, bag it.

If no mussels are detected, lower the substrate back into the water and check again in a month. Quagga and zebra mussels are more likely to attach to a substrate that has some algal growth, however if the substrate becomes too heavily coated it may be unsuitable for mussel settlement. As necessary, gently remove heavy accumulations of algae to maintain suitable conditions for settlement.

Specimen Collection

If you suspect you have found a mussel immediately contact the appropriate CDFW regional mussel contact. To aid identification, first take a close-up digital photograph of each specimen. Next, collect the specimen(s) and place in a vial with 70% ethanol. Label the vial with location, date, and name of collector. If ethanol is not available, place the sample in a rigid container (to prevent crushing) without water, label, and refrigerate. E-mail the photos to the CDFW contact and they will attempt to identify the specimens from the photographs, but may request the actual specimen(s) to make a positive identification.

If the entire artificial substrate needs to be retained for laboratory processing, place the entire unit in a large Ziplock bag or small garbage bag and keep it in a cooler with

ice while in the field. Store the substrate in the freezer until ready to mail. Mail it "overnight delivery" on ice.

Replacement of Artificial Substrate

Replace a missing or broken artificial substrate with a new one. If the substrate is repeatedly lost or damaged look for a new deployment site that offers more protection. Report any incidents and the action(s) taken.

To prevent any possibility of contamination between monitoring sites (should mussels be present and not yet detected), never take a substrate from one site and place it at a different site (even within a single waterbody).

Data Recording and Reporting

Every time an artificial substrate is checked the data must be recorded on a datasheet before leaving the field. Absence data is as important to document as presence, so complete and submit a datasheet even if no mussels were found. Send datasheets to the appropriate CDFW regional contact. All data will be entered into a data reporting system and the datasheets will be retained on-site.

CDFW Regional Scientist Contacts

For the current list of CDFW's Regional Quagga/Zebra Mussel Scientists and their contact information, please visit CDFW's quagga/zebra mussel webpage at www.wildlife.ca.gov/mussels, or download the contact list here: http://nrm.dfg.ca.gov/FileHandler.ashx?DocumentID=4955.

Artificial Substrate Datasheet

California Department of Fish and Wildlife

(One datasheet for each artificial substrate)

Collection Information	
Date:	
Waterbody:	
Substrate location (GPS or site description):	
Substrate depth (meters):	
Collector(s):	Affiliation:
Contact information (email or phone # if not CDFW):	
Substrate	
Substrate (circle one): Present	Missing
Condition (circle one): Intact	Damaged
Comments:	
Mussels	

Mussels (circle one): Present Absent	Species (circle one): Quagga Zebra Unknown
Where (circle all that apply):	Total # of mussels on each part of substrate
Plate surface	_____
edge	_____
rs	_____ Plate edge
(depth _____)	_____
(_____)	_____
Plate dimensions (units): ____ x ____(__)	Plate area
Spacers	
Rope (depth	
other	

Plate area (multiply plate dimensions):

Plates:	Number of mussels	Density (# of mussels + area)
Side 1 (top side of top plate)		
Side 2 (bottom side of top plate)		
Side 3 (top side of second plate)		
Side 4 (bottom side of second plate)		
Side 5 (top side of third plate)		
Side 6 (bottom side of third plate)		
Side 7 (top side of bottom plate)		
Side 8 (bottom side of bottom plate)		

[redacted]

Side 8 (bottom side of bottom plate)

[redacted]

Other organisms present:

Comments:

Return completed datasheets to the appropriate California Department of Fish and Wildlife Regional office.

Appendix G

Water Quality Assessment for Colonization of Quagga Mussels and *Microcystis Aeruginosa* in Ruth Lake, California

Prepared for
Humboldt Bay Municipal Water District
828 Seventh Street/P.O. Box 95
Eureka, CA 95502

Prepared by
Stillwater Sciences
850 G Street Suite K
Arcata, CA 95521

July 2009

Stillwater Sciences

Suggested citation:
Stillwater Sciences. 2009. Water Quality Assessment for Colonization of Quagga Mussels and *Microcystis Aeruginosa* in Ruth Lake, California. Final. Prepared by Stillwater Sciences, Arcata, California for the Humboldt Bay Municipal Water District, Eureka California. July.

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1 INTRODUCTION

Ruth Lake is a 48,000 acre-foot water storage reservoir formed by the impoundment of the Mad River at the R.W. Matthew's Dam, near river mile (RM) 80. The dam is owned and operated by the Humboldt Bay Municipal Water District (HBMWD) for municipal and industrial uses as well as hydro-electric power production (FERC Project No. 3450) in the Humboldt Bay and Eureka, California area. Construction of Mathews Dam was completed in 1962, impounding the approximately 77,000 acres upstream of Ruth Lake within Trinity County. Because of concerns over two aquatic organisms, the quagga mussel (*Dreissena bugensis*) and the blue green algae Microcystis *aeruginosa* (MSAE), Stillwater Sciences prepared a water quality monitoring plan to assess potential occurrence of these two species in Ruth Lake (Stillwater Sciences 2008). Winzler & Kelly field staff conducted water quality sampling in Ruth Lake during summer and fall 2008 and winter 2009. Results of the water quality sampling are presented below, along with data analysis and a threat assessment regarding colonization of quagga mussel and MSAE in Ruth Lake.

1.1 Quagga Mussel Background

The quagga mussel, a close relative to the zebra mussel (*D. polymorpha*), is an exotic bivalve found in many waters in the eastern United States, where it has caused considerable economic and environmental damage. Unlike zebra mussels, which typically colonize hard surfaces, quagga mussels can also live on sand and silt substrates and have the capacity to spread rapidly, causing fouling of infrastructure such as pipes and pumps. Both species are efficient filter feeders and have been shown to displace native species due to disruption of the aquatic food web. Quagga mussels can be spread when boats are transferred from one body of water to another (California Science Advisory Panel 2007). In early 2007, quagga mussels were detected for the first time in Lake Mead within the Colorado River Basin, with follow-up surveys identifying low numbers of quagga during August in Lake Dixon and San Vicente Reservoir in San Diego County (Coate 2008). In January 2008, the first confirmed colonization of zebra mussels in California occurred at San Justo Reservoir in San Benito County (CDFG 2009).

Since recreational boating is common in Ruth Lake, HBMWD elected to study lake water quality to gauge the potential for quagga mussel colonization. Establishment of quagga mussels has been shown to be limited by water temperature, calcium levels, and pH (Whittier et al. 2008, Cohen and Weinstein 1998 and 2001). Table 1 shows literature values for water quality parameters thought to limit quagga mussel distribution. Variations in local conditions and differing populations of quagga mussels may, of course, alter these risk factors.

Table 1. *Literature assessments of risk of quagga mussel colonization for various water quality conditions.*

Parameter	Risk Level for Colonization by Quagga Mussels[1]			Reference
	Low	Moderate	High	
Mean Summer Temperature	N/A	0–15 °C	15–31 °C	Cohen and Weinstein 1998 and 2001
Maximum Temperature	<10 °C or > 31 °C	10–31 °C	10–31 °C	Cohen and Weinstein 1998 and 2001
pH	<7.3 or >9.0	7.3–7.5 or 8.7-9.0	7.5–8.7	Cohen and Weinstein 1998 and 2001
Dissolved Oxygen (D.O.)	<4 mg/L	4-8 mg/L	>8 mg/L	Cohen and Weinstein 1998 and 2001
Calcium	<20 mg/L (very low: <12 mg/L)	20–28 mg/L	>28 mg/L	Whittier et al. (2008)
	<15 mg/L	15–25 mg/L	>25 mg/L	Cohen and Weinstein 1998 and 2001

[1]Available information for zebra mussel is presented in some cases where quagga mussel specificity is unknown.

1.2 Blue Green Algae Background

Microcystis aeruginosa (MSAE) is a cyanobacteria that can produce the hepatoxin microcystin, which has been shown to cause human health problems, including death from liver or respiratory failure (Chorus and Bartram 1999, Chorus 2001). MSAE and has been found in high concentrations in the nearby Klamath River Basin (Kann 2006). Since Ruth Lake is used both for contact recreation and for municipal water supply, this study evaluated MSAE and microcystin levels in the lake and assesses the potential threat to public health from the toxin. Direct measurement of MSAE and microcystin levels will allow assessment of any potential health risks; World Health Organization (WHO) guidelines for MSAE and microcystin levels are presented in Table 2.

In general, algal growth is limited by light, nutrients and water temperature. Light levels and water transparency can affect MSAE growth and toxin production (Jacoby et al. 2000) and growth is enhanced by water column stability during summer stratification (Oberholster et al. 2004). Growth is limited at temperatures <15 °C, and optimal growth occurs at >25 °C (Robarts and Zohary, 1987). However, microcystin production by MSAE has been found to occur at temperatures lower than those for optimal growth (~20 °C) (Amé and Wunderlin 2005).

Cyanobacteria such as MSAE dominate most freshwater lakes with total nitrogen levels from 2.3–3.5 mg/L and total phosphorus levels from 0.2 to 0.8 mg/L (Schreurs 1992). MSAE does not fix atmospheric nitrogen as does other blue green algae, and growth and toxin production can be limited by either nitrogen or phosphorus levels (Jacoby et al. 2000, Vézie et. al. 2002). Evidence exists that iron levels can affect both MSAE growth and toxin production rates, so iron concentrations are also measured by this study. However, there is no consensus in the current

literature regarding the magnitude of the effects of iron concentration or the concentrations at which these effects may take place *in situ* (Amé and Wunderlin 2005, Amé et al. 2003, Lyck et al. 1996, Lutkilen and Gjølme 1995).

Table 2. *WHO[1] guidelines for Microcystis aeruginosa (MSAE) and microcystin*

Parameter	Risk Level for Human Contact Recreation		
	Low	Moderate	Severe
MSAE (cells/mL)	20,000	100,000	10,000,000 or visible scum
Microcystin (ug/L)	4	20	200

[1] Chorus I and Bartram 1999, Chorus 2001

2 STUDY DESIGN

In situ and analytical water quality data were collected in Ruth Lake during summer and fall 2008 and winter 2009 to provide information on thermal stratification in the lake, periods and locations of limited air-water exchanges and zonation of water quality conditions affecting quagga mussel and algal colonization. Differences in water quality parameters between sites were examined to help determine the extent of palustrine, lacustrine, and riverine environments, as well as potential differences in conditions suitable for quagga mussel and algal growth.

2.1 Monitoring Sites

Because Ruth Lake lies above a relatively narrow valley in the Mad River watershed, with a maximum water surface elevation of 150 feet above the former river bed, a longitudinal sampling design was employed with additional monitoring sites located along the shoreline and coves of the lake. Three monitoring sites along the longitudinal center line of the reservoir ("centerline sites") and two sites in side arms or coves of Ruth Lake ("cove sites") were identified (Table 3) to characterize the potential longitudinal and areal variations in water quality conditions associated with MSAE and quagga mussel colonization.

Table 3. *Monitoring Sites*

Site	Longitude (NAD83)	Latitude (NAD83)
Centerline sites		
RLCL1	40.36638275 N	123.4314187 W
RLCL2	40.33924681 N	123.4075147 W
RLCL3	40.31527605 N	123.3808317 W
Cove sites		
RLCV1	40.35429722 N	123.4263889 W
RLCV2	40.31578889 N	123.3927472 W

Centerline sites RLCL1, RLCL2, and RLCL3, located along the longitudinal center line of the lake, were intended to characterize conditions in deepest portion of the lake, and capture longitudinal variation in water quality parameters as the conditions shift from riverine conditions upstream to more lacustrine conditions downstream.

Sites RLCV1 and RLCV2 were located in coves, intended to characterize conditions in a portion of the lake not along the main axis where the water may have longer residence times and acquire different water quality characteristics. Previous studies of MSAE and microcystin in the region have found that levels of both the algae and the toxin can be several orders of magnitude higher in coves and along downwind portions of the shoreline than in open water (Kann and Corum 2006 and Kann and Corum 2007). If concentrations of algae had been noted during routine visits to Ruth Lake, algal samples would have been collected opportunistically at the accessible location with the largest visible concentration of algae. As no such algal concentrations were noted during the scheduled sampling events, only *in situ* profiles were collected at the cove sites.

2.2 Sampling Schedule

Water quality monitoring was conducted during three sampling events (August and October 2008 and February 2009). Table 4 shows the sampling schedule, sampling sites, and included activities for each event.

Table 4. *Sampling schedule*

Site	August 2008	October 2008	December 2009	April 2009
RLCL1	IS, CO, AN[1], AL	IS, AN[1], AL	IS, AN[1]	IS, AN[1]
RLCL2	IS, AN, AL	IS, AN, AL	IS, AN	IS, AN
RLCL3	IS, AN, AL	IS, AN, AL	IS, AN	IS, AN
RLCV1	IS, AL[2]	IS, AL[2]	IS, AL[2]	IS, AL[2]
RLCV2	IS, AL[2]	IS, AL[2]	IS, AL[2]	IS, AL[2]

[1] With the exception of chl-a, analytical samples at RLCL1 were collected from the surface layer (upper 10 m of water column), and 3 m above the reservoir bottom. Chl-a was collected as an integrated vertical sample from the from the surface layer only.

[2] Opportunistic samples were planned if high algal concentrations had been observed.

AL Algae samples for identification and enumeration.

AN Analytical samples included Ca, Mg, hardness, alkalinity, Fe, TKN, NH3, NO3+NO2, PO4, TP (all grab samples), and chl-a (integrated vertical sample).

CO Continuous monitoring of *in situ* parameters (water temperature, dissolved oxygen, pH, turbidity) using water quality sondes for 2 or more days.

IS *In situ* profile (water temperature, dissolved oxygen, pH, turbidity).

3 METHODS

3.1 Sampling Methods

Monitoring sites were located using handheld Global Positioning System (GPS) equipment for each survey. All sampling was conducted from a boat.

3.1.1 In-situ Sampling Methods

In-situ water quality parameters (temperature, specific conductivity, pH, and dissolved oxygen) were measured at centerline and cove sites by Winzler & Kelly field staff using portable YSI multi-parameter water quality probes (Yellow Springs Instruments, Yellow Springs, OH) with a 200 ft cable and a YSI 650 multi-parameter display. A YSI 6920 was rented from EQUIPCO

(Concord, California), who calibrated the unit according to manufacturer specifications. As a quality control measure, dissolved oxygen calibration was checked in water aerated with an aquarium pump at the beginning and end of each sampling effort.

Profile data was collected during each survey at approximately 1 m intervals from the surface to 10 m depth, and approximately 3 m intervals from 10 m depth to the reservoir bottom. Continuous *in situ* data was collected during August 2008 at site RLCL1 using two YSI 6920 mulitiprobes deployed for 48 hours. One probe was deployed at a depth of 2 m, and one probe was deployed at a depth of 20 m. The probes were programmed to collect *in situ* data (temperature, specific conductivity, pH, and dissolved oxygen) every 15 minutes.

Table 5. *In-situ water quality parameter methods and instrument accuracy levels.*

Parameter	Units	Range.	Resolution	Accuracy
Temperature 6560 Sensor	°C	-5 to 50	0.01	±0.15
Dissolved Oxygen 6562 Rapid Pulse Sensor	mg/L	0 to 50	0.01	The greater of ±0.2 or 2% of reading
Specific Conductivity 6560 Sensor	uS/cm	0 to 100,000	1 to 100 (range dependent)	±0.5% of reading +1
pH 6561 Sensor	pH units	0 to 14	0.01	±0.2

3.1.2 Analytical Sample Collection

Samples for nutrients and minerals were collected during August and October 2008 and February 2009 at centerline sites (RLCL1, RLCL2, RLCL3) and stored in ice coolers for shipment to the laboratory. At site RLCL1, two samples were collected: a surface grab sample and a sample collected 3 m above the bottom of the reservoir using a Van Dorn style sampler. At sites RLCL2 and RLCL3, only surface samples were collected. Each sampling effort, duplicate samples were taken at one site and sent to the laboratory as a quality control measure. Equipment blank samples from the Van Dorn and water column samplers were also taken in the field and then shipped along with the rest of the samples to test for potential sample contamination during collection. All nutrient and mineral samples were packaged with ice in coolers and shipped overnight to Basic Laboratory (Redding, CA) for analysis using the methods shown in Table 6.

Table 6. *Analytical methods with reporting and detection limits*

Parameter/Constituent	Method	Units	MDL[1]	MRL[2]
Nutrients and Minerals (Basic Laboratory, Redding, CA)				
Total Alkalinity	SM 2320B	mg/L as $CaCO_3$	1.00	5.00
Calcium	EPA 200.7	mg/L	0.200	1.00
Hardness	SM 2340C	mg/L as $CaCO_3$	2.00	5.00
Magnesium	EPA 200.7	mg/L	0.200	1.00
Chlorophyll-a	SM 10200H	mg/L	0.0500	0.100
Iron	EPA 200.8	ug/L	3	10
Total Kjeldahl Nitrogen as N	EPA 351.3	mg/L	0.1	0.2
Total Ammonia as N	EPA 350.1	mg/L	0.0200	0.0500
Nitrate + Nitrite as N	EPA 353.2	mg/L	0.0100	0.0500
Orthophosphate as P	SM 4500P	mg/L	0.0100	0.0500
Total Phosphorous	SM 4500P	mg/L	0.0200	0.0500
Phytoplankton (GreenWater Laboratories, Palatka, FL)				
Phytoplankton analysis	Algal ID	Cells/mL	N/A	N/A

[1] The MDL (Method Detection Limit) is defined as the concentration at which the laboratory can report with 99 percent confidence that the analytical result is not actually zero.

[2] The MRL (Method Reporting Limit) is defined by the laboratory for each method, and is an estimate of the minimum concentration at which the laboratory is confident in reporting a numerical value.

3.1.3 Algal Sample Collection

In addition to chlorophyll-a collection (Section 3.1.2), enumeration and identification of MSAE and other phytoplankton species were determined by microscopy using water samples collected with a Van Dorn sampler at 5–10 ft depth at centerline sites (RLCL1, RLCL2, RLCL3). Phytoplankton samples were collected during August and October 2008 (not February 2009). No opportunistic surface samples of phytoplankton were collected as described in the study plan, because algal accumulation was not observed along the downwind lakeshore during the study period.

Algal samples were stored in ice coolers and preserved within 4 hrs of collection using one part Lugol's solution for each 100 parts of sample for sample preservation. Samples for microcystin analysis were immediately placed in a cooler with ice and kept refrigerated until laboratory analysis. Phytoplankton samples were packaged with ice in coolers and shipped by two-day mail, for arrival within two weeks of the sampling date, to GreenWater Laboratories (Palatka, FL) for analysis. Duplicate samples were taken at one site each sampling effort and sent to the laboratory as a quality control measure. Equipment blank samples from the Van Dorn sampler were also taken in the field and then shipped along with the rest of the samples.

3.2 Analysis Methods

Quality control review was performed on all data from collected samples, equipment blanks and duplicates. The accuracy of the analytical methods was estimated using the results from duplicate samples and data correction or exclusion was performed where necessary.

Quagga mussel colonization potential in Ruth Lake was assessed by comparing collected *in situ*, and analytical data to quagga mussel habitat requirements established in the literature (Table 1). Nutrient levels and *in situ* parameters were compared to values in the literature associated with MSAE growth and microcystin production to determine the potential for MSAE growth and toxin production in the lake. In addition, spatial and temporal patterns in all data were analyzed to assess the stratification pattern in the lake and any potential effects on quagga mussels or MSAE/ microcystin. Temporal and spatial patterns in MSAE/ microcystin or other phytoplankton were also analyzed to assess whether MSAE blooms may be occurring at time scales smaller than those measured, or in localized areas within the lake.

4 RESULTS

In situ and analytical water quality results are shown in Tables 7–11, with diel and laboratory data reports included as Appendices A and B. Algal species identification is presented in Table 12 and included as Appendix C.

4.1 Seasonal variations in water quality and lake structure

Total water column depth at the reservoir sampling sites varied significantly across seasons, as reservoir water levels decreased from August to October, and increased in February following the addition of winter precipitation. During the study period, the deep centerline site nearest the dam face (Site RLCL1, ~20 m depth) exhibited lacustrine characteristics, stratifying during the summer survey period and fully mixing during fall and winter survey periods (Table 7, Figures 2a, 3a, 4a). In August 2008, Site RLCL1 displayed a well-developed seasonal thermocline at roughly 9–12 m, along with a small apparent daily thermocline from 0–1 m (Figure 2a). Dissolved oxygen and pH remained constant in the epilimnion, while D.O. values slowly but steadily decreased in the hypolimnion to a low of 6 mg/L. pH decreased with increasing depth in the hypolimnion during the August survey. In October 2008 and February 2009, site RLCL1 was well-mixed (Figures 3a, 4a) with only slight changes in water temperature (0.5–1°C), D.O. (0–1 mg/L), and pH (0–0.5 pH units) over the roughly 20 m depth.

The upstream centerline sites (RLCL2, RLCL3) were shallower, exhibiting transitional characteristics between riverine and lacustrine throughout the study, with no clear seasonal stratification during summer and fall (Table 7, Figures 2b,c and 3b,c). RLCL3 exhibited a shallow daily thermocline in October, and a steadily declining 2 °C difference between surface and bottom waters, but no true thermocline, in February 2009 (Figure 3b). pH varied with depth during August 2008, increasing to pH 9 between 2.5 and 3.5 m depth at sites RLCL2 and RLCL3. Although pH levels this high are suggestive of high photosynthetic activity, no D.O. data is reported for the August 2008 sampling event at sites RLCL2 and RLCL3. Inspections of water quality sondes indicate potential problems with water leakage at the sensor connection following the first deep water deployment at Site RLCL1. For this reason, all D.O. data collected other than the RLCL1 profile in August 2008 is not reported (Table 7, Table 8).

Of the two cove sites, RLCV1 most closely exhibited the characteristics of a lacustrine environment with a small thermocline evident at 8–9 m depth in August 2008 (Figure 2d) and well-mixed conditions during October and February (Figure 3d, 4d). In contrast, the shallower cove site RLCV2 possessed seasonally consistent small water temperature differences (1–2 °C) between surface and bottom waters, but did not clearly stratify during any of the sampling seasons (Figure 2e, 3e, 4e). During fall and winter survey periods, both cove sites were well-

mixed. RLCV2 was only approximately 1 m deep at the time of the October 2008 survey (Figure 3e). While D.O. data is displayed for Site RLCV2 in August 2008 (see Figure 2e; 11 mg/L at 0 m to approximately 6 mg/L at the reservoir bottom [4.5 m]), we are not confident in the values due to the instrument malfunction described above.

4.2 Diel water quality variations

To examine the potential for nutrient release at the sediment/water interface of Ruth Lake under anoxic conditions, continuous (diel) monitoring of DO and other in situ water quality parameters was conducted at two depths during August 2008 when reservoir stratification typically limits air/water exchanges to the deeper hypolimnion. Although water leakage in the sonde deployed at depth resulted in data loss, the remaining sonde exhibited high DO levels with minimal variations between over the 48 hr monitoring period (Appendix A). Reservoir profiles at site RLCL1 during this event also indicated DO above 6 mg/L at the reservoir bottom during daytime sampling. The high DO conditions in the hypolimnion samples and low variability of the diel data collected in the epilimnion suggest low algal productivity and that internal cycling of algal nutrients due to reservoir anoxia was not occurring.

Table 7. *Ruth Lake in situ parameter data for 2008 and 2009 sampling events at centerline sites.*

Sites:	RLCL1					RLCL2						RLCL3					
Depth (m)	Temp (°C)	SpC (uS/cm)	DO (mg/L)	DO (%)	pH (s.u.)	Depth (m)	Temp (°C)	SpC (uS/cm)	DO (mg/L)	DO (%)	pH (s.u.)	Depth (m)	Temp (°C)	SpC (uS/cm)	DO (mg/L)	DO (%)	pH (s.u.)
August 2008																	
Barometric Pressure: 691.1 mm Hg						**Barometric Pressure: 695.0 mm Hg**						**Barometric Pressure: 695.0 mm Hg**					
0.2	23.3	NR	8.7	101	8.2	0.2	22.6	81	9.5	109	8.3	0.2	24.0	NR	NR	NR	8.2
0.9	22.4	NR	8.7	100	8.2	0.9	22.7	81	9.4	110	8.3	0.6	22.8	NR	NR	NR	8.7
1.8	22.4	NR	8.7	100	8.2	1.9	22.7	81	9.5	109	8.5	1.6	22.6	81	NR	NR	8.8
2.7	22.4	NR	8.7	101	8.2	2.6	22.7	81	9.4	110	8.7	2.5	22.5	81	NR	NR	9.0
3.6	22.4	NR	8.7	101	8.2	3.6	22.6	81	NR	NR	8.9	3.7	22.5	81	NR	NR	8.8
4.5	22.4	80	8.8	102	8.2	4.4	22.7	81	NR	NR	9.1	4.7	22.0	80	NR	NR	8.5
5.4	22.4	82	8.8	101	8.2	6.4	22.2	80	NR	NR	8.7						
6.2	22.4	83	8.8	101	8.2												
7.1	22.4	84	8.8	101	8.2												
8.1	22.2	79	8.9	102	8.2												
9.0	21.7	78	8.9	101	8.1												
11.8	18.3	70	8.1	86	7.8	Bottom at approximately 6.5 m[b]						Bottom at approximately 5.5 m[b]					
14.7	15.9	66	7.4	75	7.6												
17.4	14.9	65	7.1	70	7.7												
20.0	14.5	67	6.1	60	7.6												
Bottom at approximately 20.5 m[a]																	
October 2008																	
Barometric Pressure: 695.0 mm Hg						**Barometric Pressure: 696.0 mm Hg**						**Barometric Pressure: 695.0 mm Hg**					
0.2	15.7	NR	8.8	94	7.8	0.2	15.8	72	9.1	92	8.0	0.2	15.1	71	9.3	92	8.1
0.9	15.7	71	8.8	89	7.5	0.9	15.7	71	9.2	93	7.9	0.9	14.7	72	9.4	93	8.0
1.8	15.6	71	8.8	89	7.8	1.8	15.7	71	9.2	92	7.9	1.8	14.4	72	9.5	93	8.0
2.7	15.6	71	8.9	89	7.8	2.7	15.6	71	9.1	92	7.8	2.7	14.4	72	9.5	93	7.9
3.7	15.6	71	8.8	89	7.7	3.7	15.6	71	9.1	91	7.9	Bottom at approximately 3 m[a]					
4.6	15.6	71	8.8	88	7.7	4.6	15.6	71	9.0	90	7.9						
5.5	15.6	71	8.8	89	7.7	5.5	15.6	71	9.0	90	7.9						
6.4	15.6	71	8.8	89	7.7	6.4	15.6	71	9.0	90	7.9						
7.3	15.6	71	8.8	89	7.7	7.3	15.6	71	9.0	90	7.9						
8.2	15.6	71	8.8	89	7.7	8.2	15.6	71	9.0	90	7.9						

Sites:	RLCL1					RLCL2						RLCL3					
Depth (m)	**Temp (°C)**	**SpC (uS/cm)**	**DO (mg/L)**	**DO (%)**	**pH (s.u.)**	**Depth (m)**	**Temp (°C)**	**SpC (uS/cm)**	**DO (mg/L)**	**DO (%)**	**pH (s.u.)**	**Depth (m)**	**Temp (°C)**	**SpC (uS/cm)**	**DO (mg/L)**	**DO (%)**	**pH (s.u.)**
9.1	15.6	71	8.8	89	7.7	9.1	15.5	71	9.0	90	7.9						
12.2	15.6	71	8.8	88	7.7	12.2	15.5	71	9.0	90	7.7						
15.2	15.6	71	8.8	88	7.7	Bottom at approximately 12.5 m[b]											
18.3	15.6	71	8.7	87	7.7												
Bottom at approximately 18.5 m[a]																	
February 2009																	
Barometric Pressure: 694.0 mm Hg						**Barometric Pressure: 694.5 mm Hg**						**Barometric Pressure: 695.0 mm Hg**					
0.2	5.9	90	12.5	100	7.5	0.2	6.23	76	11.4	92	7.5	0.2	6.9	75	10.8	90	7.4
2.0	5.8	90	12.5	100	7.4	1.4	5.82	76	11.3	90	7.4	2.1	6.6	75	11.0	89	7.3
2.9	5.7	90	12.6	100	7.3	2.3	5.77	77	11.2	89	7.3	2.8	6.5	74	10.9	89	7.3
3.7	5.7	91	12.6	101	NR	4.0	5.62	82	11.2	89	7.3	3.7	6.4	74	10.9	89	7.2
4.9	5.6	90	12.5	100	7.3	5.5	5.47	83	11.2	89	7.3	4.6	6.3	73	10.9	89	7.2
6.6	5.5	91	12.5	99	7.3	6.6	5.42	83	11.2	89	7.3	5.5	6.3	73	10.9	88	7.2
7.9	5.5	91	12.5	99	7.1	7.4	5.54	86	11.1	88	7.2	6.6	6.2	72	10.9	88	7.1
9.1	5.5	91	12.2	96	7.1	8.5	5.47	83	11.1	88	7.3	7.3	6.0	72	10.9	88	7.1
10.4	5.4	91	12.2	97	7.1	10.1	5.36	85	11.1	88	7.3	8.4	5.7	72	11.0	87	7.1
13.9	5.4	91	11.8	93	7.1	13.1	5.27	86	11.0	87	7.3	9.4	5.4	76	10.8	86	7.1
17.4	5.4	91	11.6	92	7.1	Bottom at approximately 13.5 m[b]						10.7	5.4	75	10.2	81	7.0
20.6	5.3	91	11.5	91	7.1							Bottom at approximately 11 m[a]					
Bottom at approximately 21 m[a]																	

[a] Reservoir bottom estimated at nearest 0.5 m using last depth reading present in the field notes.
[b] Reservoir bottom recorded in field notes.
NR data not reported due to QA exclusion.

Table 8. *Ruth Lake in situ parameter data for 2008 and 2009 sampling events at cove sites.*

Sites:	RLCV1					RLCV2					
Depth (m)	Temp (°C)	SpC (uS/cm)	DO (mg/L)	DO (%)	pH (s.u.)	Depth (m)	Temp (°C)	SpC (uS/cm)	DO (mg/L)	DO (%)	pH (s.u.)
August 2008											
Barometric Pressure: 695.0 mm Hg						**Barometric Pressure: 695.0 mm Hg**					
0.2	23.3	82	NR	NR	8.6	0.2	23.0	47	11.1	129	8.8
1.8	22.7	81	NR	NR	8.5	0.8	22.7	45	10.7	124	8.9
2.7	22.7	81	NR	NR	8.5	1.8	22.4	46	11.2	130	9.1
3.7	22.6	81	NR	NR	8.5	2.8	22.2	47	10.9	125	9.1
4.6	22.6	81	NR	NR	8.4	3.7	22.2	80	10.4	120	9.1
5.5	22.5	81	NR	NR	8.4	4.3	22.2	80	6.1	84	9.0
6.4	22.3	81	NR	NR	8.3	Bottom at approximately 4.9 m[b]					
7.3	22.2	80	NR	NR	8.2						
8.2	21.3	78	NR	NR	7.9						
9.1	19.3	72	6.0	81	7.7						
10.0	18.6	72	3.4	36	7.4						
11.1	18.6	72	3.3	36	7.3						
Bottom at approximately 11.6 m[b]											
October 2008											
Barometric Pressure: 695.7 mm Hg						**Barometric Pressure: 694.8 mm Hg**					
0.2	15.9	71	9.1	93	7.8	0.2	15.3	71	9.2	91	8.0
0.9	15.8	72	8.9	90	7.8	0.9	14.2	72	11.0	108	8.3
1.8	15.8	72	8.9	90	7.8	Bottom at approximately 1 m[a]					
2.7	15.8	72	9.0	90	7.8						
3.7	15.7	71	8.8	89	7.8						
4.6	15.7	71	9.0	90	7.8						
4.9	15.7	71	9.0	91	7.8						
Bottom at approximately 5 m[a]											
February 2009											
Barometric Pressure: 693.0 mm Hg						**Barometric Pressure: 695.1 mm Hg**					
0.2	6.0	89	11.7	94	7.6	0.2	6.6	73	11.2	92	7.5
0.9	5.9	85	11.3	91	7.5	1.1	6.1	71	11.4	92	7.4
2.1	5.9	89	11.3	90	7.5	2.0	6.0	72	11.3	91	7.4
3.0	5.8	90	11.3	90	7.5	2.2	5.9	71	11.3	90	7.3
4.5	5.8	90	11.3	90	7.5	3.2	5.9	71	11.2	90	7.3
5.3	5.8	90	11.2	90	7.5	4.0	5.7	71	11.3	90	7.2
6.7	5.8	89	11.2	89	7.5	4.9	5.6	72	11.3	90	7.2
7.7	5.8	90	11.2	89	7.5	5.9	5.4	75	11.3	90	7.2
9.1	5.8	90	11.2	89	7.5	6.9	5.4	76	11.3	89	7.1
10.5	5.7	90	11.1	89	7.5	7.9	5.4	80	11.1	88	7.0
13.4	5.7	90	10.9	87	7.5	Bottom at approximately 8 m[a]					
16.5	5.7	90	10.8	86	7.5						
Bottom at approximately 17m[a]											

[a] Reservoir bottom estimated at nearest 0.5 m using last depth reading present in the field notes.
[b] Reservoir bottom recorded in field notes.
NR data not reported due to QA exclusion.

Alkalinity, hardness and minerals (calcium and magnesium) did not vary spatially or seasonally in Ruth Lake (Table 9). Hardness, calcium, and magnesium levels were generally low, consistent with relatively high elevation natural waters of the northern California, southern Oregon regional geology (Omernik and Powers 1983). Alkalinity was also consistently low (<35 mg/L as $CaCO_{3(s)}$) indicating a water column that is poorly buffered against changes in pH, including those caused by photosynthesis and respiration (Stumm and Morgan, 1996). Calcium, hardness, and alkalinity levels are discussed further in Section 4.4 in relation to water quality conditions that are expected to affect quagga mussel colonization.

Nutrients did not exhibit a clear pattern with sampling location or season (Table 10, Table 11). Phosphorus and nitrogen in Ruth Lake were generally low, equaling or slightly exceeding EPA reference concentrations for the 25th percentile of the observed range of concentrations for lakes and reservoirs in Aggregate Ecoregion II, Western Forested Mountains and Level III Ecoregion, Klamath Mountains (USEPA 2001). Total phosphorus in Ruth Lake during the study period ranged 0.02–0.06 mg/L TP, and with the exception of February 2009, all measured ortho-phosphorus levels were below the method detection limit (<0.05 mg/L PO_4^{3-}). For the most part, ammonia and organic nitrogen (as measured by TKN) were the dominant forms of nitrogen measured in Ruth Lake during the study period. Nitrate+nitrite was consistently the lowest of measured nitrogen species, ranging 0.02–0.08 mg/L, while ammonia and organic nitrogen (as measured by TKN) were each roughly an order of magnitude greater (Table 10) throughout the study period. The predominance of ammonia and organic nitrogen suggests that the primary nitrogen source to the reservoir is algal derived. Overall though, calculated total nitrogen (nitrate+nitrite + TKN) was relatively low and ranged from roughly 0.1 to 0.8 mg/L for the study period, again within the range of observed values for Aggregate Ecoregion II (0.01–4.4 mg/L TN) and only slightly exceeding the 25th percentile reference concentration itself (0.18 mg/L TN) (USEPA 2001).

Total iron concentrations were variable with location and season, ranging two orders of magnitude over the study period (Table 11) and often exceeding the range of typical iron concentrations measured in neutral or alkaline inland surface waters (50-200 ug/L [Wetzel 2001]). Total iron at Site RLCL1 was consistently greater 3 m from the bottom compared with levels measured in the top 10 m of the water column. In medium to high-productivity lakes (i.e., mesotrophic to eutrophic) this pattern would likely reflect decreasing redox potential with depth and indicate fluxes of soluble iron from bottom sediments during periods of low D.O. However, at Site RLCL1 the highest iron concentrations in reservoir bottom waters did not correspond to low D.O. occurrences, even during August 2008 when the reservoir was stratified. During October 2008, total iron in bottom waters at Site RLCL1 increased to 1,170 ug/L despite a well-mixed water column and D.O. concentrations at >85% saturation (Table 7, Figure 3a). Although high iron levels are often linked to low D.O. conditions at the sediment-water interface, the elevated levels seen in Ruth Lake may be related to the absence of complexing agents. For example, in 'soft' waters, such as those found in Ruth Lake, a lack of sufficient sulfate has been linked to total iron accumulation in deep ponds (Wetzel 2001). In any case, the observed iron levels in Ruth Lake suggest that algal growth is not limited by iron as a micronutrient. Further investigation would be required to determine the relative role of iron, nitrogen, and phosphorus in limiting algal productivity in Ruth Lake.

4.3 Chlorophyll-a and blue green algae patterns

Chlorophyll-a levels were below the MDL at all centerline sites for the duration of the study (Table 12). No MSAE was found during the August and October 2008 sampling events, although other blue green algae were identified at relatively low numbers, including Anabaena spp., Aphanizomenon spp., and other blue green algal species (Table 12). As discussed in Section 3.1.3, sample collection for chlorophyll-a and blue-green algae enumeration was not conducted at the cove sites because no surface blooms were observed.

The moderately low overall cell counts (<3,000 cells/mL, see Appendix C) as well as low counts for blue-green algal species and non-detectable chlorophyll-a levels in the surface water samples are surprising considering the availability of iron and the ability of blue-green algae to directly fix atmospheric nitrogen sources. Because many blue green algae species can change position in the water column (Horne and Goldman, 1994), it is possible that sampling was not conducted at the appropriate depth to capture the highest algal density.

Table 9. *Alkalinity, hardness and minerals by station and season in Ruth Lake during 2008 and 2009.*

Site	Total Alkalinity (mg/L)			Calcium (mg/L)			Hardness as CaCO3 (mg/L)			Magnesium (mg/L)		
	Aug-08	Oct-08	Feb-09	Aug-08	Oct-08	Feb-09	Aug-08	Oct-08	Feb-09	Aug-08	Oct-08	Feb-09
RLCL1 (upper 10m)	36	40	37	12	12	11	36	41	35	2	2	2
RLCL1 (3m above bottom)	37	39	37	11	12	11	49	37	36	2	3	2
RLCL2 (upper 10m)	39	39	34	12	12	10	43	35	31	2	2	2
RLCL3 (upper 10m)	-	40	32	-	12	9	-	39	27	-	2	2

Notes:

- No sample collected.

Table 10. *Nitrogen by station and season in Ruth Lake during 2008 and 2009.*

Site	Nitrate + Nitrite (mg/L)			Ammonia Nitrogen (mg/L)			Total Kjeldahl Nitrogen (mg/L)		
	Aug-08	Oct-08	Feb-09	Aug-08	Oct-08	Feb-09	Aug-08	Oct-08	Feb-09
RLCL1 (upper 10m)	0.02^{J}	0.02^{J}	0.04^{J}	0.11	0.10	0.07	0.2	0.2	0.2
RLCL1 (3m above bottom)	0.02^{J}	0.02^{J}	0.08	0.06	0.03^{J}	0.15	0.1^{J}	0.2	0.7
RLCL2 (upper 10m)	0.02^{J}	0.02^{J}	0.04^{J}	0.1	0.03^{J}	0.05	0.3	0.1^{J}	0.2
RLCL3 (upper 10m)	-	0.02^{J}	0.04^{J}	-	0.08	0.06	-	0.2	0.2

Notes:

-	No sample collected.
X^{J}	Result below laboratory method reporting limit (MRL), but above method detection limit (MDL) and reported here as a J-flag.

Table 11. *Phosphorus and iron by station and season in Ruth Lake during 2008 and 2009.*

Site	Total Phosphorus (mg/L)			Orthophosphate (mg/L)			Total Iron (ug/L)		
	Aug-08	Oct-08	Feb-09	Aug-08	Oct-08	Feb-09	Aug-08	Oct-08	Feb-09
RLCL1 (upper 10m)	ND	ND	0.05	ND^{H}	ND^{H}	ND^{H}	102	71	368
RLCL1 (3m above bottom)	0.03^{J}	0.04^{J}	0.06	0.01$^{H, J}$	ND^{H}	ND^{H}	752	1170	492
RLCL2 (upper 10m)	0.02^{J}	ND	0.05	ND^{H}	ND^{H}	ND^{H}	137	27	949
RLCL3 (upper 10m)	-	ND	0.06	-	ND^{H}	0.02$^{H, J}$	-	301	227

Notes:

-	No sample collected.
ND	Result below laboratory MDL.
X^{H}	Sample was received past the EPA recommended holding time and actual results may be higher than reported due to bacterial uptake.
X^{J}	Result below laboratory method reporting limit (MRL), but above method detection limit (MDL) and indicates <1% probability that the reported result is not actually zero..

Table 12. *Ruth Lake chlorophyll-a and blue-green algae (Cyanophyta) data for 2008 sampling events.*

Site	Aug-08	Oct-08	Feb-09	Blue-green algae (Cyanophyta)	Aug-08	Oct-08	Feb-09
	Chlorophyll-a (ug/L)				Species (cells/mL)		
RLCL1	-	ND	ND[H]	*Aphanizomenon spp.*	9	4	-
				Anabaena spp.	601	0	-
				Microcystis aeruginosa	0	0	-
				Misc. cyanophyte cells	72	1,636	-
				Group Total	683	1,640	-
RLCL2	-	ND	-	*Aphanizomenon spp.*	32	6	-
				Anabaena spp.	69	15	-
				Microcystis aeruginosa	0	0	-
				Misc. cyanophyte cells	544	980	-
				Group Total	644	1,001	-
RLCL3	ND	ND	ND[H]	*Aphanizomenon spp.*	-	55	-
				Anabaena spp.	-	15	-
				Microcystis aeruginosa	-	0	-
				Misc. cyanophyte cells	-	409	-
				Group Total	-	469	-

Notes:

- No sample collected.

ND Result below laboratory MDL.

X^H Sample was received past the EPA recommended holding time and actual results may be higher than reported due to bacterial decomposition.

4.4 Quagga mussel colonization potential

In situ parameters observed during the study period, including mean summer water temperature, maximum annual water temperature, pH, and D.O., represent favorable conditions for colonization of quagga mussel in Ruth Lake (Table 14). Despite this, calcium, a key limiting factor for *Dreissena* colonization (Cohen and Weinstein 1998 and 2001, Whittier et al. 2008), was measured across all three sampling seasons at levels below published thresholds required for basic metabolic function and shell building (Table 13).

Table 13. *Comparison of risk factors for quagga mussel colonization to Ruth Lake in situ and calcium results during summer and fall 2008 and winter 2009.*

Parameter	Risk Level for Colonization by Quagga Mussels[1]			Ruth Lake during Summer, Fall 2008 and Winter 2009	
	Low	Moderate	High	Sample size (n)	Result[2]
Mean Summer Temperature	N/A	0–15 °C	15–31 °C	46	21.7 °C
Maximum Temperature	<10 °C or >31°C	10–31 °C	10–31 °C	140	24.0 °C
pH	<7.3 or >9.0	7.3–7.5 or 8.7–9.0	7.5–8.7	139	63% pH 7.5–8.7 32% pH 7.3–7.5 or 8.7–9.0 16% pH <7.3 or >9.0
Dissolved Oxygen	<4 mg/L	4–8 mg/L	>8 mg/L	140	1% D.O. <4mg/L 4% D.O. 4–8 mg/L 94% D.O. >8 mg/L
Calcium	<20 mg/L	20–28 mg/L	>28 mg/L	11	9–12 mg/L
	<12 mg/L)				
	<15 mg/L	15–25 mg/L	>25 mg/L		

[1] References given in Table 1.

[2] Shading indicates literature-based risk level corresponding to observed conditions in Ruth Lake during the study period.

In an ecoregion based assessment of over 3,000 U.S. streams and river sites, Whittier et al. (2008) suggest that the Ruth Lake watershed lies within a 'highly variable' risk class of *Dreissena* species colonization, along with a large portion of the Klamath and Trinity mountain ranges in northern California and southern Oregon, where invasion risk is dependent on watershed-specific characteristics such as the presence of geological formations containing high calcium deposits. Ruth Lake's calcium levels (9–12 mg/L) fall within a low to very low risk class (Table 1) using criteria presented by Whitter et al (2008) and Cohen and Weinstein (1998, 2001). The low calcium levels consistently measured in Ruth Lake suggest that its local watershed does not currently supply sufficient calcium to Ruth Lake to support quagga mussel colonization. Although the majority of available data on calcium requirements for *Dreissena* species is based on zebra (*D. polymorpha*) rather than quagga mussel investigations, Whittier et al (2008) suggest that in quagga mussel requirements do not differ greatly from those of zebra mussels.

In summary, despite supportive *in situ* water temperature, pH, and dissolved oxygen levels, consistently low calcium levels measured during seasonal surveys in 2008 and 2009 indicate that the threat of colonization by quagga mussel in Ruth Lake is currently low. As available data indicate that quagga mussels spread more slowly than zebra mussels, but can eventually become dominant (Stoeckmann 2003; Jones and Ricciardi 2005), periodic monitoring of calcium levels or periodic quagga veliger monitoring should be considered to identify future shifts in water chemistry that would be more supportive of quagga colonization. As a precautionary measure, the District may consider development of a voluntary or mandatory inspection and wash down of boats arriving from out of State or particular lakes (See California Natural Resources Agency, 2008). Failing these precautions, while it is possible that import of veligers or adults via recreational boating in Ruth Lake may promote a founder population of quagga mussels, if calcium levels remain consistently low any such population is not likely to be self-sustaining.

4.5 MSAE growth and microcystin production potential

While it is possible that sampling in the surface layer (upper 10 m) may have missed any MSAE present, zero MSAE cells/mL were found in both summer and fall 2008 at centerline sites suggesting that the algal community currently established in Ruth Lake does not include MSAE. As cove sites were not sampled for algal composition or quantification, blooms may be occurring in localized areas of Ruth Lake or at time scales smaller than those measured; additional data is needed to confirm this conclusion. If MSAE is present in Ruth Lake, it currently does not appear to be established at populations large enough to approach microcystin levels of concern and therefore the potential for toxicity is low.

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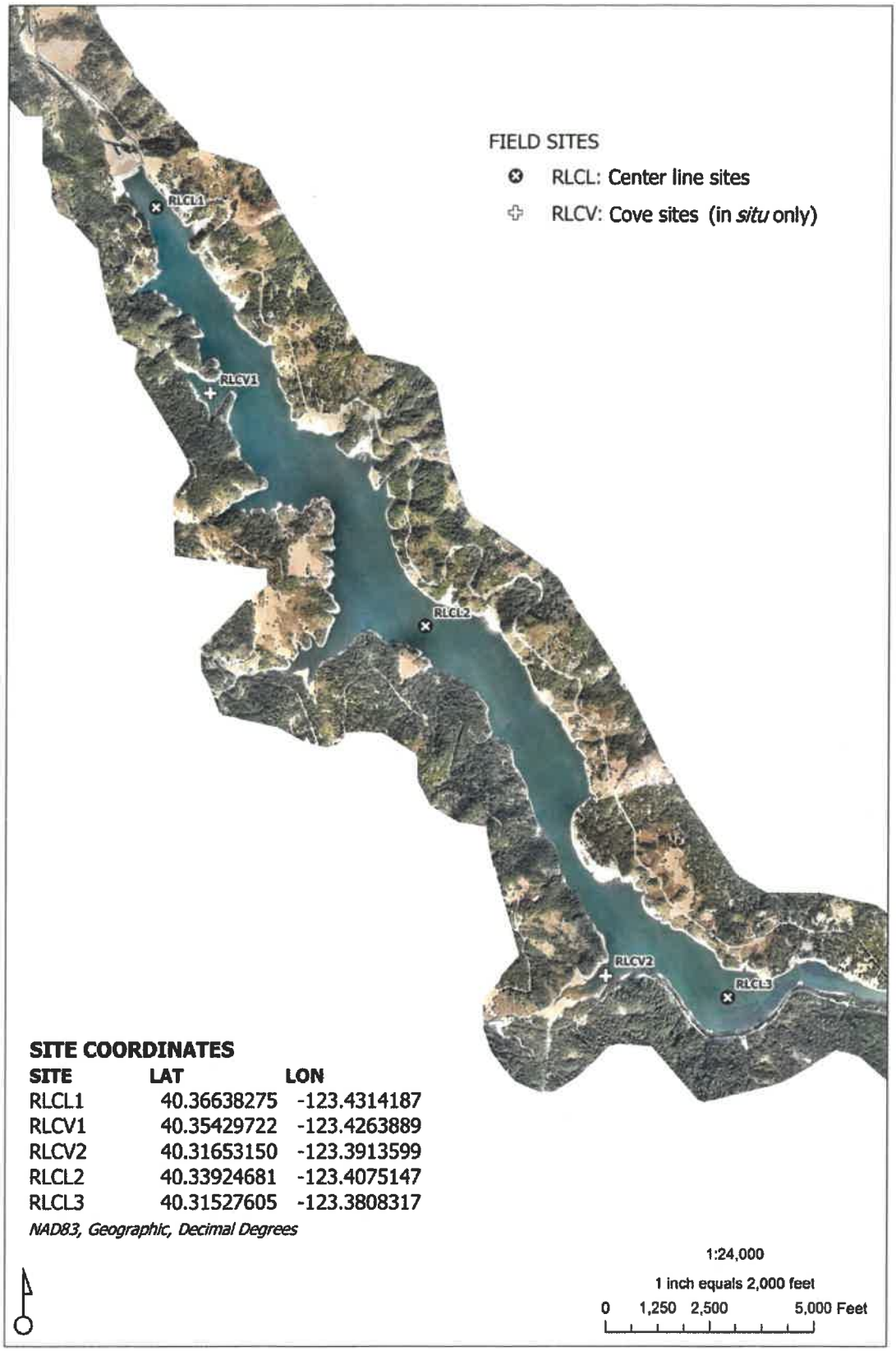

Figure 1. Ruth Lake Monitoring Sites

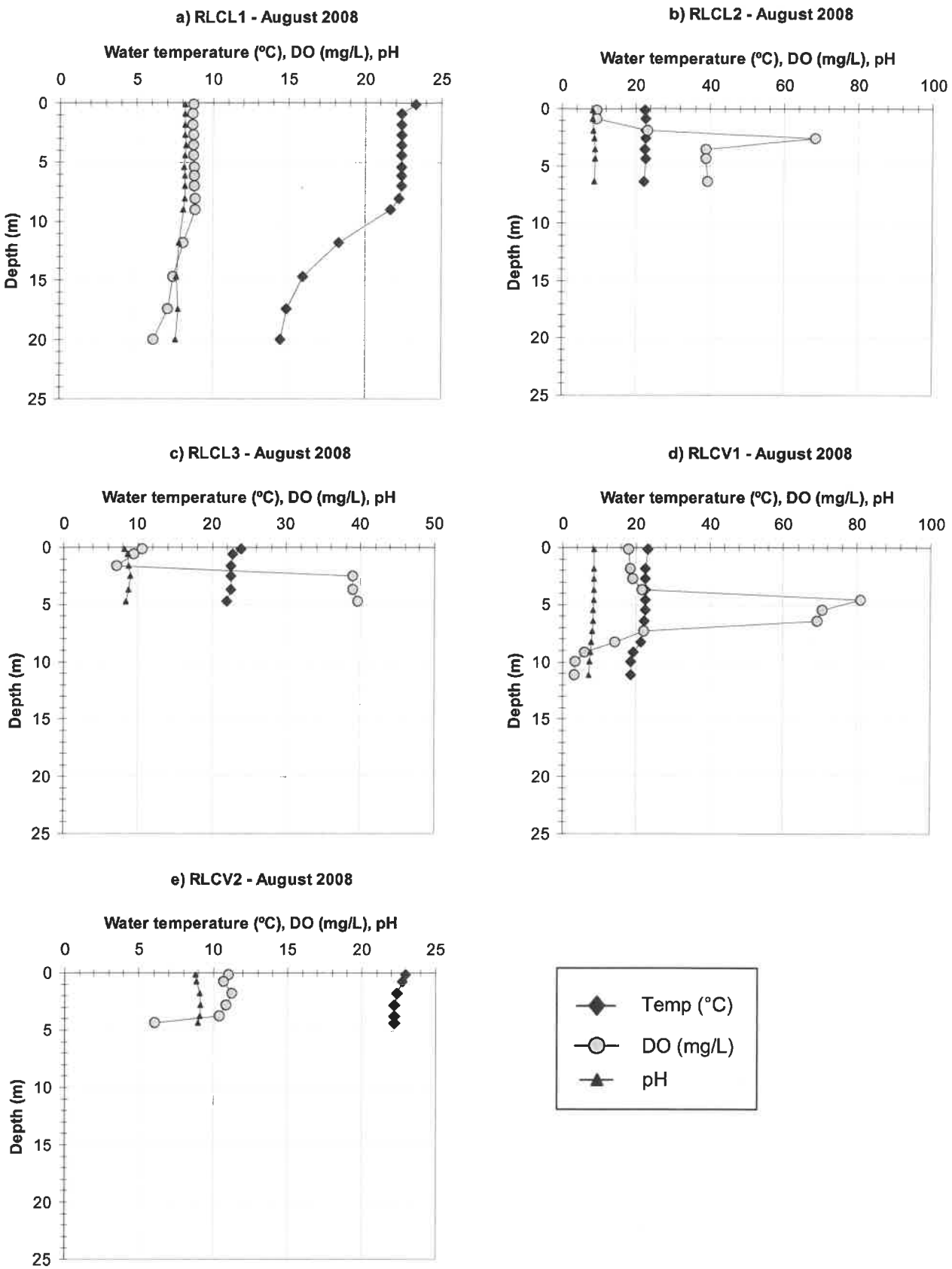

Figure 2. In situ water quality profiles in Ruth Lake, August 2008.

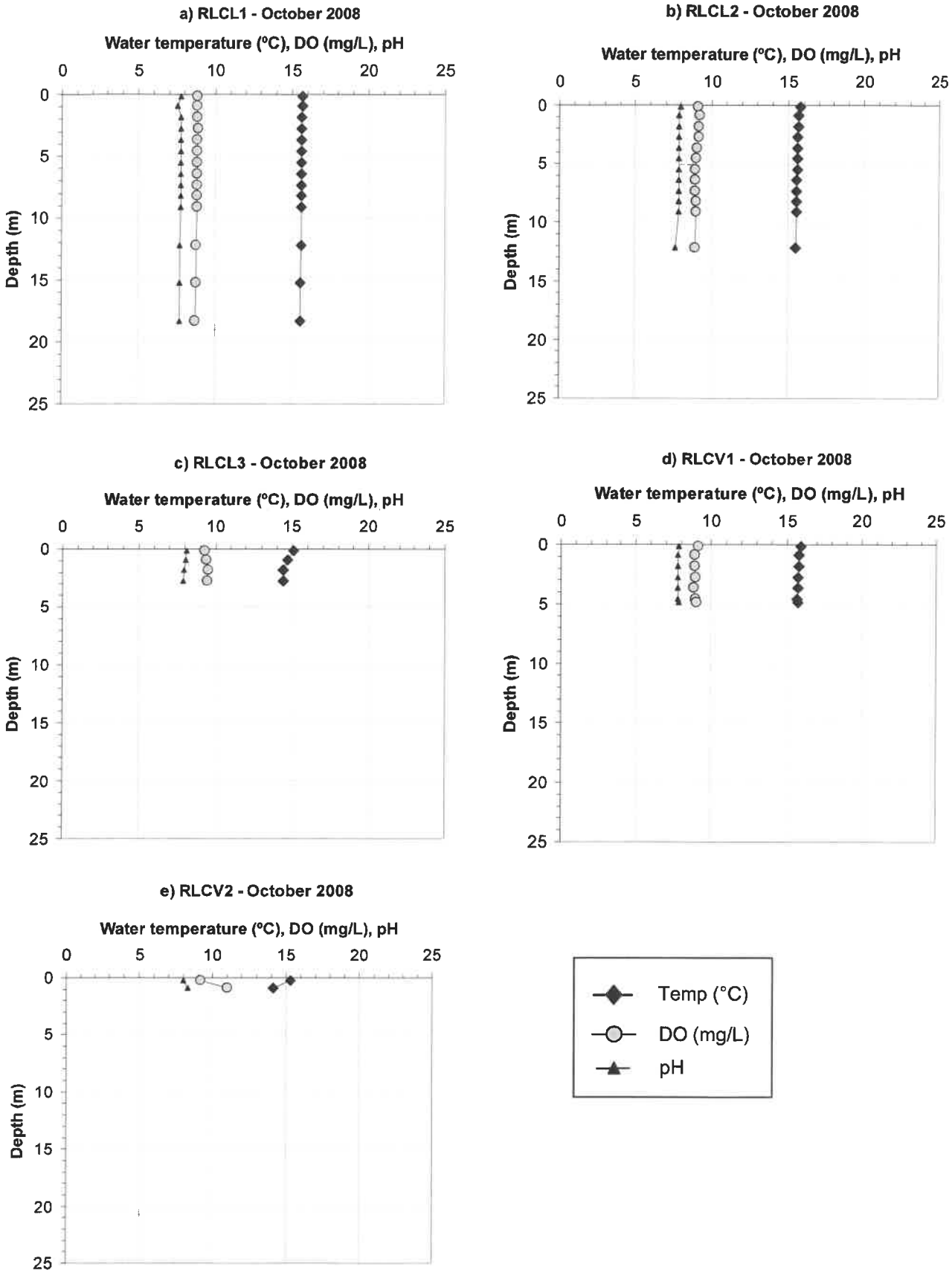

Figure 3. In situ water quality profiles in Ruth Lake, October 2008.

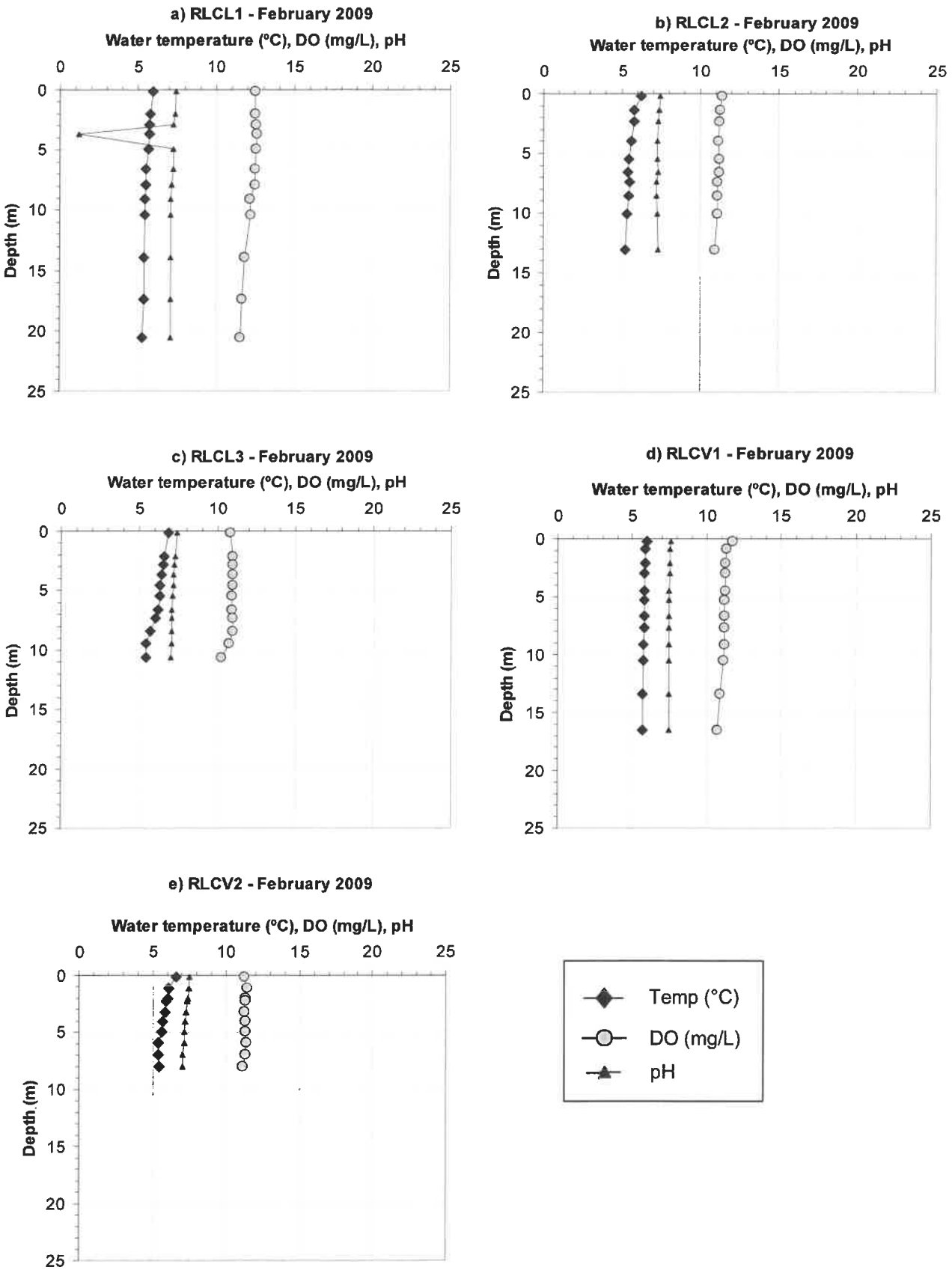

Figure 4. In situ water quality profiles in Ruth Lake, February 2009.

APPENDIX A
In situ water quality at site RLCL1 near Mathews Dam
August 20-22, 2008

In situ WQ Data Collected at Mathews Dam (Site RLCL1) August 20, 2008
YSI 6920 DataSonde

Date M/D/Y	Time hh:mm:ss	Temp C	SpCond mS/cm	DO Conc mg/L	DO Charge	Depth m	pH	pHmV mV	ORP mV	Turbidity NTU
8/20/2008	16:45:40	22.9	0.076	8.93	69	1.751	7.98	-100.3	38	-0.2
8/20/2008	17:00:40	22.85	0.076	8.5	67	1.755	7.97	-99.9	37	0
8/20/2008	17:15:40	22.86	0.076	8.41	67	1.705	8.04	-103.5	34	-0.1
8/20/2008	17:30:40	22.87	0.076	8.39	67	1.659	8.06	-105	33	-0.1
8/20/2008	17:45:40	22.86	0.076	8.36	67	1.68	8.05	-104	34	-0.1
8/20/2008	18:00:40	22.86	0.076	8.32	67	1.709	8.05	-104.4	34	0
8/20/2008	18:15:40	22.84	0.076	8.32	67	1.747	8.03	-103.1	35	-0.1
8/20/2008	18:30:40	22.83	0.076	8.31	67	1.747	8.07	-105.5	32	0
8/20/2008	18:45:40	22.84	0.076	8.38	67	1.756	8.07	-105.4	33	0
8/20/2008	19:00:40	22.85	0.076	8.38	67	1.701	8.14	-109.3	30	0
8/20/2008	19:15:40	22.85	0.076	8.37	67	1.71	8.15	-109.6	30	-0.1
8/20/2008	19:30:40	22.84	0.076	8.36	67	1.727	8.1	-107.1	32	-0.1
8/20/2008	19:45:40	22.83	0.076	8.38	67	1.714	8.12	-108.3	31	-0.1
8/20/2008	20:00:40	22.82	0.076	8.36	67	1.761	8.1	-106.9	32	0
8/20/2008	20:15:40	22.81	0.076	8.31	67	1.771	8.11	-107.5	32	0
8/20/2008	20:30:40	22.81	0.076	8.35	67	1.772	8.12	-108	32	-0.1
8/20/2008	20:45:40	22.8	0.076	8.38	67	1.763	8.12	-108.1	32	0
8/20/2008	21:00:40	22.75	0.076	8.38	67	1.757	8.12	-108.3	32	-0.1
8/20/2008	21:15:40	22.73	0.076	8.35	67	1.725	8.15	-109.7	31	-0.1
8/20/2008	21:30:40	22.74	0.076	8.38	67	1.724	8.15	-109.5	31	0
8/20/2008	21:45:40	22.74	0.076	8.37	67	1.75	8.13	-108.7	32	0
8/20/2008	22:00:40	22.74	0.076	8.36	67	1.752	8.13	-108.8	32	-0.1
8/20/2008	22:15:40	22.74	0.076	8.33	67	1.765	8.14	-108.9	32	0
8/20/2008	22:30:40	22.73	0.076	8.33	67	1.774	8.14	-108.9	32	0.1
8/20/2008	22:45:40	22.73	0.076	8.41	67	1.768	8.15	-109.5	32	0
8/20/2008	23:00:40	22.73	0.076	8.42	67	1.772	8.14	-109.4	32	-0.1
8/20/2008	23:15:40	22.72	0.076	8.42	67	1.77	8.15	-109.6	32	0
8/20/2008	23:30:40	22.72	0.076	8.38	67	1.748	8.15	-109.7	32	0
8/20/2008	23:45:40	22.71	0.076	8.37	67	1.767	8.15	-109.6	32	-0.1
8/21/2008	0:00:40	22.71	0.076	8.43	67	1.768	8.15	-109.8	31	-0.1
8/21/2008	0:15:40	22.71	0.076	8.38	66	1.765	8.15	-109.8	31	-0.1
8/21/2008	0:30:40	22.7	0.076	8.43	67	1.772	8.14	-109.3	32	0.1
8/21/2008	0:45:40	22.7	0.076	8.39	67	1.77	8.14	-109.3	32	-0.1
8/21/2008	1:00:40	22.7	0.076	8.42	67	1.771	8.15	-109.6	32	-0.1
8/21/2008	1:15:40	22.69	0.076	8.48	66	1.763	8.13	-108.8	32	-0.1
8/21/2008	1:30:40	22.69	0.076	8.48	66	1.737	8.15	-109.8	32	0.1
8/21/2008	1:45:40	22.66	0.076	8.46	67	1.718	8.14	-109.4	32	0
8/21/2008	2:00:40	22.67	0.076	8.47	67	1.721	8.14	-109.1	32	0
8/21/2008	2:15:40	22.66	0.076	8.48	67	1.718	8.15	-109.4	32	0
8/21/2008	2:30:40	22.65	0.076	8.48	66	1.752	8.13	-108.3	34	-0.1
8/21/2008	2:45:40	22.64	0.076	8.5	66	1.749	8.14	-109.1	33	-0.1
8/21/2008	3:00:40	22.64	0.076	8.5	67	1.727	8.16	-110.2	32	-0.1
8/21/2008	3:15:40	22.64	0.076	8.48	67	1.732	8.14	-109	33	0
8/21/2008	3:30:40	22.63	0.076	8.51	67	1.762	8.14	-109	33	0
8/21/2008	3:45:40	22.62	0.076	8.5	66	1.764	8.14	-109.1	33	-0.1
8/21/2008	4:00:40	22.62	0.076	8.52	66	1.768	8.14	-109.1	33	0
8/21/2008	4:15:40	22.61	0.076	8.48	66	1.769	8.14	-109.3	33	0

Date	Time	Temp	SpCond	DO Conc	DO Charge	Depth	pH	pHmV	ORP	Turbidity
M/D/Y	hh:mm:ss	C	mS/cm	mg/L		m		mV	mV	NTU
8/21/2008	4:30:40	22.6	0.076	8.51	66	1.769	8.14	-109.3	33	-0.1
8/21/2008	4:45:40	22.61	0.076	8.51	66	1.764	8.15	-109.4	33	0
8/21/2008	5:00:40	22.61	0.076	8.53	66	1.768	8.15	-109.5	33	0
8/21/2008	5:15:40	22.6	0.076	8.59	67	1.757	8.15	-109.4	33	0
8/21/2008	5:30:40	22.6	0.076	8.62	66	1.76	8.14	-109.3	33	-0.1
8/21/2008	5:45:40	22.59	0.076	8.64	67	1.766	8.14	-109	34	0
8/21/2008	6:00:40	22.59	0.076	8.62	66	1.768	8.14	-109	34	0
8/21/2008	6:15:40	22.58	0.076	8.71	67	1.767	8.13	-108.7	34	0
8/21/2008	6:30:40	22.58	0.076	8.76	66	1.767	8.13	-108.5	34	0
8/21/2008	6:45:40	22.57	0.076	8.74	66	1.767	8.13	-108.4	34	-0.1
8/21/2008	7:00:40	22.57	0.076	8.76	66	1.764	8.13	-108.4	34	-0.1
8/21/2008	7:15:40	22.57	0.076	8.87	65	1.743	8.13	-108.4	34	0
8/21/2008	7:30:40	22.57	0.076	8.88	66	1.742	8.12	-108.2	35	0
8/21/2008	7:45:40	22.58	0.076	8.89	66	1.739	8.13	-108.7	34	-0.1
8/21/2008	8:00:40	22.58	0.076	8.88	66	1.736	8.12	-107.8	35	0.1
8/21/2008	8:15:40	22.55	0.076	8.92	65	1.722	8.11	-107.5	35	-0.1
8/21/2008	8:30:40	22.56	0.076	8.89	66	1.746	8.11	-107.2	36	-0.1
8/21/2008	8:45:40	22.56	0.076	8.9	65	1.753	8.12	-108	35	-0.1
8/21/2008	9:00:40	22.59	0.076	8.94	65	1.757	8.12	-108.2	35	-0.1
8/21/2008	9:15:40	22.56	0.076	9.02	65	1.714	8.12	-108	35	-0.1
8/21/2008	9:30:40	22.59	0.076	9.02	65	1.739	8.11	-107.4	36	-0.1
8/21/2008	9:45:40	22.56	0.076	9.05	65	1.718	8.11	-107.3	36	-0.1
8/21/2008	10:00:40	22.63	0.076	9	65	1.753	8.12	-107.8	36	-0.1
8/21/2008	10:15:40	22.58	0.076	9.05	66	1.732	8.12	-108.3	35	0
8/21/2008	10:30:40	22.65	0.076	9.1	65	1.733	8.13	-108.8	35	-0.1
8/21/2008	10:45:40	22.6	0.076	9.1	66	1.737	8.1	-106.9	36	-0.2
8/21/2008	11:00:40	22.64	0.076	9.12	65	1.76	8.09	-106.3	37	0
8/21/2008	11:15:40	22.65	0.076	9.17	66	1.752	8.13	-108.8	35	-0.1
8/21/2008	11:30:40	22.68	0.076	9.11	65	1.773	8.11	-107.4	37	0
8/21/2008	11:45:40	22.67	0.076	9.16	65	1.702	8.15	-109.5	35	0
8/21/2008	12:00:40	22.63	0.076	9.18	66	1.716	8.13	-108.3	36	-0.1
8/21/2008	12:15:40	22.63	0.076	9.2	65	1.719	8.12	-108.2	37	-0.1
8/21/2008	12:30:40	22.67	0.076	9.2	66	1.719	8.14	-109.1	36	-0.1
8/21/2008	12:45:40	22.66	0.076	9.21	66	1.735	8.12	-108.3	37	-0.2
8/21/2008	13:00:40	22.67	0.076	9.27	65	1.675	8.15	-109.7	36	-0.2
8/21/2008	13:15:40	22.69	0.076	9.28	65	1.67	8.13	-108.8	36	-0.1
8/21/2008	13:30:40	22.7	0.076	9.28	66	1.663	8.13	-108.5	37	-0.2
8/21/2008	13:45:40	22.72	0.076	9.3	66	1.663	8.13	-108.6	37	-0.2
8/21/2008	14:00:40	22.72	0.076	9.32	65	1.651	8.13	-108.8	37	-0.1
8/21/2008	14:15:40	22.77	0.076	9.32	65	1.649	8.13	-108.8	37	-0.1
8/21/2008	14:30:40	22.92	0.076	9.31	66	1.64	8.14	-109	36	-0.2
8/21/2008	14:45:40	22.84	0.076	9.31	65	1.643	8.13	-108.8	36	-0.2
8/21/2008	15:00:40	22.93	0.076	9.31	66	1.638	8.15	-109.7	35	-0.1
8/21/2008	15:15:40	22.88	0.076	9.34	65	1.639	8.15	-109.5	36	-0.2
8/21/2008	15:30:40	22.9	0.076	9.34	65	1.621	8.16	-110.4	35	-0.1
8/21/2008	15:45:40	22.88	0.076	9.34	65	1.633	8.14	-109.1	36	-0.2
8/21/2008	16:00:40	22.84	0.076	9.38	66	1.623	8.15	-109.5	36	-0.1
8/21/2008	16:15:40	22.83	0.076	9.38	65	1.62	8.14	-109.1	36	-0.2
8/21/2008	16:30:40	22.84	0.076	9.38	66	1.615	8.15	-109.9	36	-0.1
8/21/2008	16:45:40	22.77	0.076	9.42	66	1.616	8.14	-109.4	36	-0.1

Date	Time	Temp	SpCond	DO Conc	DO Charge	Depth	pH	pHmV	ORP	Turbidity
M/D/Y	hh:mm:ss	C	mS/cm	mg/L		m		mV	mV	NTU
8/21/2008	17:00:40	22.79	0.076	9.4	66	1.62	8.14	-109.1	37	-0.2
8/21/2008	17:15:40	22.73	0.076	9.41	65	1.61	8.13	-108.8	37	-0.2
8/21/2008	17:30:40	22.71	0.076	9.42	65	1.614	8.14	-109.1	37	-0.2
8/21/2008	17:45:40	22.65	0.076	9.41	65	1.623	8.12	-108.2	37	-0.1
8/21/2008	18:00:40	22.65	0.076	9.4	65	1.615	8.13	-108.6	37	-0.2
8/21/2008	18:15:40	22.42	0.075	9.41	65	1.616	8.08	-105.9	39	-0.2
8/21/2008	18:30:40	22.38	0.075	9.42	65	1.624	8.06	-104.7	40	-0.2
8/21/2008	18:45:40	22.39	0.075	9.4	65	1.624	8.06	-104.7	40	-0.2
8/21/2008	19:00:40	22.33	0.075	9.41	65	1.622	8.06	-104.7	40	-0.2
8/21/2008	19:15:40	22.17	0.075	9.41	65	1.627	7.96	-99.2	43	-0.2
8/21/2008	19:30:40	22.24	0.075	9.4	65	1.627	7.95	-98.6	43	-0.2
8/21/2008	19:45:40	22.06	0.075	9.41	65	1.633	7.94	-98.3	44	-0.2
8/21/2008	20:00:40	22.01	0.075	9.41	64	1.637	7.96	-99.4	43	0
8/21/2008	20:15:40	21.98	0.075	9.43	65	1.648	7.97	-99.6	43	-0.2
8/21/2008	20:30:40	21.93	0.075	9.42	65	1.633	7.97	-99.9	43	-0.2
8/21/2008	20:45:40	21.87	0.075	9.42	65	1.65	7.95	-98.6	44	-0.2
8/21/2008	21:00:40	21.82	0.075	9.43	65	1.649	7.95	-98.8	44	-0.2
8/21/2008	21:15:40	21.78	0.075	9.42	65	1.649	7.94	-98	44	-0.2
8/21/2008	21:30:40	21.73	0.075	9.44	64	1.685	7.91	-96.4	46	-0.3
8/21/2008	21:45:40	21.69	0.075	9.4	65	1.693	7.89	-95.6	46	-0.3
8/21/2008	22:00:40	21.68	0.075	9.43	64	1.689	7.91	-96.3	45	-0.2
8/21/2008	22:15:40	21.67	0.075	9.42	65	1.707	7.93	-97.5	44	-0.3
8/21/2008	22:30:40	21.65	0.075	9.46	65	1.707	7.94	-98	44	-0.2
8/21/2008	22:45:40	21.63	0.075	9.45	64	1.735	7.94	-98	45	-0.2
8/21/2008	23:00:40	21.67	0.075	9.47	65	1.736	7.94	-98.1	45	-0.2
8/21/2008	23:15:40	21.7	0.075	9.47	65	1.718	7.99	-101	42	-0.2
8/21/2008	23:30:40	21.75	0.075	9.47	65	1.714	8	-101.5	42	-0.2
8/21/2008	23:45:40	21.73	0.075	9.48	64	1.719	8	-101.3	42	-0.2
8/22/2008	0:00:40	21.82	0.075	9.48	65	1.72	8	-101.5	42	-0.2
8/22/2008	0:15:40	21.83	0.075	9.52	64	1.735	8.02	-102.2	42	-0.2
8/22/2008	0:30:40	21.82	0.075	9.51	65	1.701	8.05	-103.8	41	-0.1
8/22/2008	0:45:40	21.82	0.075	9.53	65	1.685	8.04	-103.3	41	-0.2
8/22/2008	1:00:40	21.8	0.075	9.54	64	1.688	8.03	-103	42	-0.2
8/22/2008	1:15:40	21.79	0.075	9.55	64	1.683	8.05	-103.8	41	-0.2
8/22/2008	1:30:40	21.76	0.075	9.52	65	1.686	8.04	-103.3	42	-0.1
8/22/2008	1:45:40	21.75	0.075	9.52	65	1.691	8	-101.3	43	-0.2
8/22/2008	2:00:40	21.76	0.075	9.52	64	1.698	8	-101.3	43	-0.2
8/22/2008	2:15:40	21.73	0.075	9.48	64	1.731	7.97	-99.5	44	-0.2
8/22/2008	2:30:40	21.73	0.075	9.45	65	1.77	7.94	-98.3	45	-0.1
8/22/2008	2:45:40	21.73	0.075	9.48	64	1.775	7.95	-98.8	45	-0.2
8/22/2008	3:00:40	21.71	0.075	9.45	65	1.775	7.94	-98	45	-0.2
8/22/2008	3:15:40	21.73	0.075	9.41	64	1.772	7.93	-97.4	45	-0.2
8/22/2008	3:30:40	21.77	0.075	9.41	64	1.771	7.92	-97.2	45	-0.2
8/22/2008	3:45:40	21.77	0.075	9.4	64	1.768	7.92	-96.9	45	-0.2
8/22/2008	4:00:40	21.86	0.075	9.46	64	1.771	7.93	-97.3	44	-0.2
8/22/2008	4:15:40	21.89	0.075	9.47	64	1.774	7.93	-97.7	44	-0.1
8/22/2008	4:30:40	21.9	0.075	9.48	64	1.771	7.95	-98.8	43	-0.1
8/22/2008	4:45:40	21.91	0.075	9.49	64	1.77	7.95	-98.8	44	-0.1
8/22/2008	5:00:40	21.91	0.075	9.48	64	1.77	7.96	-99.1	43	-0.1
8/22/2008	5:15:40	21.91	0.075	9.49	65	1.772	7.94	-98.1	45	-0.2

Date	Time	Temp	SpCond	DO Conc	DO Charge	Depth	pH	pHmV	ORP	Turbidity
M/D/Y	hh:mm:ss	C	mS/cm	mg/L		m		mV	mV	NTU
8/22/2008	5:30:40	21.92	0.075	9.47	65	1.774	7.97	-99.5	43	-0.1
8/22/2008	5:45:40	21.92	0.075	9.5	64	1.774	7.95	-98.8	44	-0.2
8/22/2008	6:00:40	21.91	0.075	9.49	65	1.775	7.97	-99.6	44	-0.1
8/22/2008	6:15:40	21.88	0.075	9.48	64	1.775	7.97	-99.7	44	-0.2
8/22/2008	6:30:40	21.89	0.075	9.48	65	1.776	7.97	-99.6	45	-0.1
8/22/2008	6:45:40	21.89	0.075	9.47	65	1.778	7.97	-99.5	45	-0.1
8/22/2008	7:00:40	21.88	0.075	9.48	65	1.779	7.98	-100.3	44	-0.2
8/22/2008	7:15:40	21.88	0.075	9.48	64	1.778	7.98	-100.2	44	-0.1
8/22/2008	7:30:40	21.87	0.075	9.5	65	1.776	7.98	-100.3	44	-0.2
8/22/2008	7:45:40	21.85	0.075	9.48	64	1.773	7.98	-100.3	44	-0.2
8/22/2008	8:00:40	21.87	0.075	9.53	64	1.776	7.97	-99.7	45	-0.2
8/22/2008	8:15:40	21.87	0.075	9.47	64	1.774	7.99	-100.7	44	-0.2
8/22/2008	8:30:40	21.87	0.075	9.55	64	1.774	7.99	-100.6	44	-0.2
8/22/2008	8:45:40	21.89	0.075	9.53	65	1.777	7.99	-100.6	44	-0.2
8/22/2008	9:00:40	21.92	0.075	9.54	64	1.773	8	-101.3	44	-0.2
8/22/2008	9:15:40	21.91	0.075	9.58	64	1.762	8.01	-101.7	43	-0.2
8/22/2008	9:30:40	21.93	0.075	9.58	65	1.749	8	-101.3	44	-0.2
8/22/2008	9:45:40	21.95	0.075	9.6	65	1.763	8	-101.3	44	-0.2
8/22/2008	10:00:40	21.97	0.075	9.63	64	1.75	8.03	-103	43	-0.1
8/22/2008	10:15:40	22.04	0.075	9.6	64	1.753	8.03	-103.2	42	-0.2
8/22/2008	10:30:40	22.09	0.075	9.62	64	1.744	8.05	-103.8	42	-0.1
8/22/2008	10:45:40	22.15	0.075	9.65	64	1.747	8.04	-103.4	42	-0.2
8/22/2008	11:00:40	22.21	0.075	9.65	65	1.764	8.04	-103.6	42	-0.2
8/22/2008	11:15:40	22.26	0.075	9.66	64	1.773	8.04	-103.8	42	-0.1
8/22/2008	11:30:40	22.28	0.075	9.69	64	1.775	8.05	-104	40	0
8/22/2008	11:45:40	22.35	0.075	9.67	65	1.75	8.07	-105.3	39	-0.2
8/22/2008	12:00:40	22.38	0.075	9.66	65	1.755	8.06	-104.9	41	-0.2
8/22/2008	12:15:40	22.41	0.075	9.69	64	1.751	8.06	-104.5	41	-0.1
8/22/2008	12:30:40	22.43	0.075	9.7	64	1.751	8.05	-104.1	41	-0.2
8/22/2008	12:45:40	22.36	0.075	9.72	64	1.749	8.04	-103.6	42	-0.1
8/22/2008	13:00:40	22.4	0.075	9.7	65	1.75	8.08	-105.7	40	0
8/22/2008	13:15:40	22.41	0.075	9.72	65	1.757	8.06	-104.8	41	-0.1
8/22/2008	13:30:40	22.54	0.075	9.7	65	1.769	8.08	-105.7	40	-0.2
8/22/2008	13:45:40	22.54	0.075	9.72	64	1.771	8.05	-104.3	41	-0.2
8/22/2008	14:00:40	22.57	0.075	9.75	65	1.697	8.09	-106.6	39	-0.2
8/22/2008	14:15:40	22.68	0.075	9.73	65	1.629	8.06	-104.7	41	-0.2
8/22/2008	14:30:40	22.68	0.075	9.72	65	1.634	8.07	-105.1	40	-0.2
8/22/2008	14:45:40	22.66	0.075	9.76	65	1.618	8.1	-107.1	39	0
8/22/2008	15:00:40	22.64	0.075	9.75	65	1.618	8.09	-106.4	39	-0.2
8/22/2008	15:15:40	22.63	0.075	9.75	65	1.632	8.09	-106.6	40	-0.2
8/22/2008	15:30:40	22.53	0.075	9.75	64	1.636	8.09	-106.4	40	-0.2
8/22/2008	15:45:40	22.81	0.075	9.69	65	1.624	8.08	-106	40	-0.2
8/22/2008	16:00:40	22.58	0.075	9.77	64	1.629	8.07	-105.3	41	-0.2
8/22/2008	16:15:40	22.7	0.075	9.74	65	1.651	8.08	-105.7	40	-0.2
8/22/2008	16:30:40	22.64	0.075	9.74	65	1.659	8.07	-105.2	41	-0.2

APPENDIX B
Algal Species Identification

Winzler and Kelly/HBMWD Data Report

Prepared: November 7, 2008
Prepared By: GreenWater Laboratories

Project #:0105508005

Samples: 4 (Collected on 8/20/08)

1. RLCL-1
2. RLCL-2
3. RLCL-2a
4. Equipment Blank

Sample 1: RLCL-1

Total cell numbers in the RLCL-1 sample collected on 8/20/08 were 1,139 cells/mL. Blue-green algae (Cyanobacteria; 683 cells/mL) and green algae (Chlorophyta; 289 cells/mL) were the dominant algae in the sample accounting for 60.0% and 25.4% of total cell numbers respectively. Other algal groups in the sample were diatoms (Bacillariophyta; 121 cells/mL), golden-brown algae (Chrysophyta; 18 cells/mL), cryptophytes (Cryptophyta; 0.2 cells/mL), unknown small unicells (Miscellaneous; 18 cells/mL) and dinoflagellates (Pyrrophyta; 10 cells/mL)). The most abundant alga in the sample was a species of the filamentous blue-green *Anabaena* (599 cells/mL). A total of 30 species were observed in the sample with green algae being the most diverse group with 12 taxa present. Total numbers of potentially toxigenic cyanobacteria (PTOX Cyano) were 610 cells/mL, accounting for 53.6% of total cell numbers. PTOX Cyano species in the sample included *Anabaena* spp. and *Aphanizomenon* sp.

Sample 2: RLCL-2

Total cell count in the RLCL-2 sample collected on 8/20/08 was 1,007 cells/mL. Blue-green algae (Cyanobacteria; 644 cells/mL) and green algae (Chlorophyta; 214 cells/mL) were the dominant algae in the sample accounting for 64.0% and 21.3% of total cell numbers respectively. Other algal groups in the sample included diatoms (Bacillariophyta; 140 cells/mL), golden-brown algae (Chrysophyta; 9 cells/mL) and dinoflagellates (Pyrrophyta; 0.2 cells/mL). The most abundant species in the sample was a species of the colonial blue-green alga *Aphanothece* (544 cells/ml). A total of 28 species were observed in the sample with green algae being the most diverse algal group with 16 taxa present. Total numbers of potentially toxigenic cyanobacteria (PTOX Cyano) were 101 cells/mL, accounting for 10.0% of total cell numbers. PTOX Cyano species in the sample included *Anabaena* sp. and *Aphanizomenon* sp.

Sample 3: RLCL-2a

Total cell count in the RLCL-2a sample collected on 8/20/08 was 2,757 cells/mL. Blue-green algae (Cyanobacteria; 2,167 cells/mL) were the dominant algae in the sample accounting for 78.6% of total cell numbers. Other algal groups in the sample included diatoms (Bacillariophyta; 373 cells/mL), green algae (Chlorophyta; 199 cells/mL), unknown small unicells (Miscellaneous; 18 cells/mL) and dinoflagellates (Pyrrophyta; 0.2 cells/mL). The most abundant species in the sample was a species of the colonial blue-green alga *Aphanothece* (1,633 cells/ml). A total of 39

species were observed in the sample with diatoms, green algae and blue-green algae being the most diverse algal groups with 15, 11 and 11 taxa respectively. Total numbers of potentially toxigenic cyanobacteria (PTOX Cyano) were 350 cells/mL, accounting for 12.7% of total cell numbers. PTOX Cyano species in the sample included *Anabaena* spp., *Oscillatoria* cf. *limosa*, *Aphanizomenon* sp. and *Anabaena/Aphanizomenon* sp.

Sample 4: Equipment Blank

Total cell numbers in the Equipment Blank sample collected on 8/20/08 were 6 cells/mL. Only one colony of blue-green algae (Cyanobacteria) was observed.

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Sample	Date	Genus	Species	Algal Group	No. Counted (units)	Unit	Cells/ Unit	Magn.	Field Area (mm^2)	No. Fields	Settl. Vol. (mL)	Dil. Fact.	Species Units/mL	Species Cells/mL	Group Total Units/mL	Group Total Cells/mL	Sample Total Units/mL	Sample Total Cells/mL
RLCL-1	8/20/2008	centric diatom	sp.	Bacillariophyta	2	cell	1	400	0.0625	50	5	1	36	36	88	121	544	1,139
RLCL-1	8/20/2008	Fragilaria	crotonensis	Bacillariophyta	9	chain	14	100	283.53	1	5	1	2	25				
RLCL-1	8/20/2008	Stephanodiscus	sp.	Bacillariophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-1	8/20/2008	Asterionella	formosa	Bacillariophyta	2	colony	2	200	0.25	50	5	1	9	18				
RLCL-1	8/20/2008	Asterionella	formosa	Bacillariophyta	4	cell	1	200	0.25	50	5	1	18	18				
RLCL-1	8/20/2008	Navicula	sp.	Bacillariophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-1	8/20/2008	Navicula	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-1	8/20/2008	chlorophyte unicell, oval 2.5-5um	spp.	Chlorophyta	5	cell	1	400	0.0625	50	5	1	91	91	246	289		
RLCL-1	8/20/2008	Oocystis	lacustris	Chlorophyta	2	colony	2	400	0.0625	50	5	1	36	73				
RLCL-1	8/20/2008	chlorophyte unicell, sphere 2.5-5um	spp.	Chlorophyta	3	cell	1	400	0.0625	50	5	1	54	54				
RLCL-1	8/20/2008	Schroederia	setigera	Chlorophyta	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-1	8/20/2008	chlorophyte unicell, sphere 5-7.5um	spp.	Chlorophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-1	8/20/2008	chlorophyte	sp.	Chlorophyta	1	colony	2	200	0.25	50	5	1	5	9				
RLCL-1	8/20/2008	Cosmarium	sp.	Chlorophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-1	8/20/2008	Willea	sp.	Chlorophyta	1	colony	10	100	283.53	1	5	1	0.2	2				
RLCL-1	8/20/2008	Pediastrum	tetras	Chlorophyta	1	colony	4	100	283.53	1	5	1	0.2	1				
RLCL-1	8/20/2008	Elakatothrix	viridis	Chlorophyta	1	colony	2	100	283.53	1	5	1	0.2	0.4				
RLCL-1	8/20/2008	chlorophyte unicell	sp.	Chlorophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-1	8/20/2008	Oocystis	solitaria	Chlorophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-1	8/20/2008	Dinobryon	bavaricum	Chrysophyta	1	cell	1	400	0.0625	50	5	1	18	18	18	18		
RLCL-1	8/20/2008	Cryptomonas	sp.	Cryptophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2	0.2	0.2		
RLCL-1	8/20/2008	Anabaena	sp.	Cyanobacteria	4	filament	8	400	0.0625	50	5	1	73	581	164	683		
RLCL-1	8/20/2008	cyanophyte unicell, oval/rod 2.5-5um	spp.	Cyanobacteria	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-1	8/20/2008	cyanophyte unicell	sp.	Cyanobacteria	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-1	8/20/2008	Anabaena	sp.	Cyanobacteria	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-1	8/20/2008	cyanophyte unicell, sphere 2.5-5um	spp.	Cyanobacteria	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-1	8/20/2008	Aphanizomenon	sp.	Cyanobacteria	1	filament	47	100	283.53	1	5	1	0.2	9				
RLCL-1	8/20/2008	Anabaena	sp.	Cyanobacteria	1	filament	9	100	283.53	1	5	1	0.2	2				
RLCL-1	8/20/2008	unicell, oval 5-7.5um	spp.	Miscellaneous	1	cell	1	400	0.0625	50	5	1	18	18	18	18		
RLCL-1	8/20/2008	Peridinium	umbonatum	Pyrrophyta	2	cell	1	200	0.25	50	5	1	9	9	10	10		
RLCL-1	8/20/2008	Ceratium	hirundinella	Pyrrophyta	4	cell	1	100	283.53	1	5	1	1	1				
RLCL-2	8/20/2008	Stephanodiscus	sp.	Bacillariophyta	4	cell	1	400	0.0625	50	5	1	73	73	102	140	344	1,007
RLCL-2	8/20/2008	Fragilaria	crotonensis	Bacillariophyta	1	chain	9	200	0.25	50	5	1	5	41				
RLCL-2	8/20/2008	centric diatom	sp.	Bacillariophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-2	8/20/2008	Navicula	sp.	Bacillariophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2	8/20/2008	Asterionella	formosa	Bacillariophyta	4	colony	3	100	283.53	1	5	1	1	2				
RLCL-2	8/20/2008	Asterionella	formosa	Bacillariophyta	5	cell	1	100	283.53	1	5	1	1	1				
RLCL-2	8/20/2008	Epithemia	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2	8/20/2008	chlorophyte unicell, oval 2.5-5um	spp.	Chlorophyta	4	cell	1	400	0.0625	50	5	1	73	73	179	214		
RLCL-2	8/20/2008	chlorophyte unicell, sphere 2.5-5um	spp.	Chlorophyta	3	cell	1	400	0.0625	50	5	1	54	54				
RLCL-2	8/20/2008	Oocystis	lacustris	Chlorophyta	1	colony	5	200	0.25	50	5	1	5	23				
RLCL-2	8/20/2008	chlorophyte unicell	sp.	Chlorophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-2	8/20/2008	Oocystis	pusilla	Chlorophyta	1	colony	4	200	0.25	50	5	1	5	18				
RLCL-2	8/20/2008	Schroederia	setigera	Chlorophyta	2	cell	1	200	0.25	50	5	1	9	9				
RLCL-2	8/20/2008	Monoraphidium	minutum	Chlorophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2	8/20/2008	chlorophyte unicell	sp.	Chlorophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2	8/20/2008	chlorophyte unicell	sp.	Chlorophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2	8/20/2008	Willea	sp.	Chlorophyta	2	colony	6	100	283.53	1	5	1	0.4	2				
RLCL-2	8/20/2008	Dictyosphaerium	pulchellum	Chlorophyta	1	colony	8	100	283.53	1	5	1	0.2	2				
RLCL-2	8/20/2008	Planktosphaeria	gelatinosa	Chlorophyta	1	colony	4	100	283.53	1	5	1	0.2	1				
RLCL-2	8/20/2008	Monoraphidium	sp.	Chlorophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2	8/20/2008	Monoraphidium	tortile	Chlorophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2	8/20/2008	Staurastrum	sp.	Chlorophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2	8/20/2008	Oocystis	solitaria	Chlorophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2	8/20/2008	Epipyxis	sp.	Chrysophyta	2	cell	1	200	0.25	50	5	1	9	9	9	9		
RLCL-2	8/20/2008	Aphanothece	sp.	Cyanobacteria	2	colony	15	400	0.0625	50	5	1	36	544	54	644		
RLCL-2	8/20/2008	Anabaena	sp.	Cyanobacteria	2	filament	7	200	0.25	50	5	1	9	64				
RLCL-2	8/20/2008	Aphanizomenon	sp.	Cyanobacteria	1	filament	7	200	0.25	50	5	1	5	32				
RLCL-2	8/20/2008	Anabaena	sp.	Cyanobacteria	1	cell	1	200	0.25	50	5	1	5	5				

Sample	Date	Genus	Species	Algal Group	No. Counted (units)	Unit	Cells/ Unit	Magn.	Field Area (mm^2)	No. Fields	Settl. Vol. (mL)	Dil. Fact.	Species Units/mL	Species Cells/mL	Group Total Units/mL	Group Total Cells/mL	Sample Total Units/mL	Sample Total Cells/mL
RLCL-2	8/20/2008	Ceratium	hirundinella	Pyrrophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2	0.2	0.2		
RLCL-2a	8/20/2008	Fragilaria	crotonensis	Bacillariophyta	3	chain	14	200	0.25	50	5	1	14	191	191	373	634	2,757
RLCL-2a	8/20/2008	Nitzschia	sp.	Bacillariophyta	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-2a	8/20/2008	Stephanodiscus	sp.	Bacillariophyta	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-2a	8/20/2008	Epithemia	sp.	Bacillariophyta	7	cell	1	200	0.25	50	5	1	32	32				
RLCL-2a	8/20/2008	centric diatom	sp.	Bacillariophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-2a	8/20/2008	Asterionella	formosa	Bacillariophyta	3	cell	1	200	0.25	50	5	1	14	14				
RLCL-2a	8/20/2008	Nitzschia	sp.	Bacillariophyta	2	cell	1	200	0.25	50	5	1	9	9				
RLCL-2a	8/20/2008	Asterionella	formosa	Bacillariophyta	1	colony	2	200	0.25	50	5	1	5	9				
RLCL-2a	8/20/2008	Nitzschia	sp.	Bacillariophyta	2	cell	1	200	0.25	50	5	1	9	9				
RLCL-2a	8/20/2008	pennate diatom	sp.	Bacillariophyta	2	cell	1	200	0.25	50	5	1	9	9				
RLCL-2a	8/20/2008	Nitzschia	acicularis	Bacillariophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2a	8/20/2008	Rhopalodia	gibba	Bacillariophyta	12	cell	1	100	283.53	1	5	1	2	2				
RLCL-2a	8/20/2008	Epithemia	sp.	Bacillariophyta	11	cell	1	100	283.53	1	5	1	2	2				
RLCL-2a	8/20/2008	Navicula	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2a	8/20/2008	pennate diatom	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2a	8/20/2008	Navicula	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-2a	8/20/2008	chlorophyte unicell, sphere 2.5-5um	spp.	Chlorophyta	4	cell	1	400	0.0625	50	5	1	73	73	192	199		
RLCL-2a	8/20/2008	chlorophyte unicell, oval 2.5-5um	spp.	Chlorophyta	3	cell	1	400	0.0625	50	5	1	54	54				
RLCL-2a	8/20/2008	chlorophyte unicell, oval 5-7.5um	spp.	Chlorophyta	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-2a	8/20/2008	Schroederia	setigera	Chlorophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-2a	8/20/2008	chlorophyte unicell	sp.	Chlorophyta	2	cell	1	200	0.25	50	5	1	9	9				
RLCL-2a	8/20/2008	Dictyosphaerium	pulchellum	Chlorophyta	1	colony	16	100	283.53	1	5	1	0.2	3				
RLCL-2a	8/20/2008	Willea	sp.	Chlorophyta	1	colony	11	100	283.53	1	5	1	0.2	2				
RLCL-2a	8/20/2008	Oedogonium	sp.	Chlorophyta	1	filament	6	100	283.53	1	5	1	0.2	1				
RLCL-2a	8/20/2008	Pediastrum	tetras	Chlorophyta	1	colony	4	100	283.53	1	5	1	0.2	1				
RLCL-2a	8/20/2008	Oocystis	lacustris	Chlorophyta	1	colony	4	100	283.53	1	5	1	0.2	1				
RLCL-2a	8/20/2008	Mougeotia	sp.	Chlorophyta	1	filament	3	100	283.53	1	5	1	0.2	1				
RLCL-2a	8/20/2008	Aphanothece	sp.	Cyanobacteria	6	colony	15	400	0.0625	50	5	1	109	1,633	233	2,167		
RLCL-2a	8/20/2008	Anabaena	sp.	Cyanobacteria	4	filament	12	200	0.25	50	5	1	18	218				
RLCL-2a	8/20/2008	Anabaena	sp.	Cyanobacteria	2	filament	8	200	0.25	50	5	1	9	73				
RLCL-2a	8/20/2008	Calothrix	sp.	Cyanobacteria	4	filament	89	100	283.53	1	5	1	1	71				
RLCL-2a	8/20/2008	cyanophyte unicell, oval/rod 2.5-5um	spp.	Cyanobacteria	3	cell	1	400	0.0625	50	5	1	54	54				
RLCL-2a	8/20/2008	Pseudanabaena	sp.	Cyanobacteria	1	filament	9	200	0.25	50	5	1	5	41				
RLCL-2a	8/20/2008	Oscillatoria	cf. limosa	Cyanobacteria	1	filament	120	100	283.53	1	5	1	0.2	24				
RLCL-2a	8/20/2008	cyanophyte unicell, sphere 2.5-5um	spp.	Cyanobacteria	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-2a	8/20/2008	Aphanizomenon	sp.	Cyanobacteria	1	filament	4	200	0.25	50	5	1	5	18				
RLCL-2a	8/20/2008	Anabaena	sp.	Cyanobacteria	3	cell	1	200	0.25	50	5	1	14	14				
RLCL-2a	8/20/2008	Anabaena/Aphanizomenon	sp.	Cyanobacteria	1	filament	16	100	283.53	1	5	1	0.2	3				
RLCL-2a	8/20/2008	unicell, sphere 5-7.5um	spp.	Miscellaneous	1	cell	1	400	0.0625	50	5	1	18	18	18	18		
RLCL-2a	8/20/2008	Ceratium	hirundinella	Pyrrophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2	0.2	0.2		
Equip. Blank	8/20/2008	cyanophyte colony	sp.	Cyanobacteria	1	colony	30	100	283.53	1	5	1	0.2	6	0.2	6	0.2	6

Winzler and Kelly/HBMWD Data Report

Prepared: November 29, 2008
Prepared By: GreenWater Laboratories

Project #:0105508005.11001
Project Name: Ruth Lake

Samples: 3 (Collected on 10/23/08)

1. RLCL-1
2. RLCL-2
3. RLCL-3

Sample 1: RLCL-1

Total cell numbers in the RLCL-1 sample collected on 10/23/08 were 4,010 cells/mL. Blue-green algae (Cyanobacteria; 1,640 cells/mL) and green algae (Chlorophyta; 1,184 cells/mL) were the dominant algae in the sample accounting for 40.9% and 29.5% of total cell numbers respectively. Other algal groups in the sample were diatoms (Bacillariophyta; 611 cells/mL), golden-brown algae (Chrysophyta; 99 cells/mL), cryptophytes (Cryptophyta; 349 cells/mL) and unknown small flagellates and unicells (Miscellaneous; 127 cells/mL). The most abundant algae in the sample were small (2.5-5um) oval/rod shaped cyanobacteria unicells (871 cells/mL) and a small species of centric diatom (599 cells/mL). A total of 37 species were observed in the sample with green algae being the most diverse group with 12 taxa present. Total numbers of potentially toxigenic cyanobacteria (PTOX Cyano) were 4 cells/mL, accounting for 0.1% of total cell numbers. PTOX Cyano species in the sample included *Aphanizomenon* cf. *flos-aquae*.

Sample 2: RLCL-2

Total cell count in the RLCL-2 sample collected on 10/23/08 was 1,926 cells/mL. Blue-green algae (Cyanobacteria; 1,001 cells/mL) were the dominant algae in the sample accounting for 52.0% of total cell numbers. Other algal groups in the sample included diatoms (Bacillariophyta; 326 cells/mL), green algae (Chlorophyta; 326 cells/mL), golden-brown algae (Chrysophyta; 196 cells/mL), cryptophytes (Cryptophyta; 59 cells/mL) and microflagellates (Miscellaneous; 18 cells/mL). The most abundant algae in the sample were small (2.5-5um) oval/rod shaped cyanobacteria unicells (454 cells/mL), a species of the colonial blue-green alga *Aphanothece* (308 cells/ml) and a small species of centric diatom (290 cells/mL). A total of 31 species were observed in the sample with diatoms, green algae and blue-green algae being the most diverse algal groups with 8, 8 and 7 taxa present respectively. Total numbers of potentially toxigenic cyanobacteria (PTOX Cyano) were 69 cells/mL, accounting for 3.6% of total cell numbers. PTOX Cyano species in the sample included *Anabaena* sp. and *Aphanizomenon* cf. *flos-aquae*.

Sample 3: RLCL-3

Total cell count in the RLCL-3 sample collected on 10/23/08 was 1,544 cells/mL. Diatoms (Bacillariophyta; 702 cells/mL) and blue-green algae (Cyanobacteria; 469 cells/mL) were the dominant algae in the sample accounting for 45.5% and 30.4% of total cell numbers respectively. Other algal groups in the sample included green algae (Chlorophyta; 55 cells/mL), golden-brown

algae (Chrysophyta; 46 cells/mL), cryptophytes (Cryptophyta; 254 cells/mL) and unknown unicells (Miscellaneous; 18 cells/mL). The most abundant species in the sample was a species of small centric diatom (690 cells/ml). A total of 28 species were observed in the sample with diatoms being the most diverse algal group with 11 taxa present. Total numbers of potentially toxigenic cyanobacteria (PTOX Cyano) were 70 cells/mL, accounting for 4.5% of total cell numbers. PTOX Cyano species in the sample included *Aphanizomenon* cf. *flos-aquae* and *Anabaena* sp.

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Sample	Date	Genus	Species	Algal Group	No. Counted (units)	Unit	Cells/ Unit	Magn.	Field Area (mm^2)	No. Fields	Settl. Vol. (mL)	Dil. Fact.	Species Units/mL	Species Cells/mL	Group Total Units/mL	Group Total Cells/mL	Sample Total Units/mL	Sample Total Cells/mL
RLCL-1	10/23/2008	centric diatom	sp.	Bacillariophyta	33	cell	1	400	0.0625	50	5	1	599	599	602	611	2,669	4,010
RLCL-1	10/23/2008	Fragilaria	crotonensis	Bacillariophyta	1	chain	44	100	283.53	1	5	1	0	9				
RLCL-1	10/23/2008	centric diatom	sp.	Bacillariophyta	7	cell	1	100	283.53	1	5	1	1	1				
RLCL-1	10/23/2008	Tabellaria	fenestrata	Bacillariophyta	1	colony	4	100	283.53	1	5	1	0	1				
RLCL-1	10/23/2008	Stephanodiscus	niagarae	Bacillariophyta	2	cell	1	100	283.53	1	5	1	0	0				
RLCL-1	10/23/2008	Asterionella	formosa	Bacillariophyta	1	colony	2	100	283.53	1	5	1	0	0				
RLCL-1	10/23/2008	Nitzschia	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0.2				
RLCL-1	10/23/2008	Fragilaria	crotonensis	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-1	10/23/2008	chlorophyte colony	sp.	Chlorophyta	5	colony	10	400	0.0625	50	5	1	91	907	259	1,184		
RLCL-1	10/23/2008	Tetrastrum	staurogeniae	Chlorophyta	1	colony	4	400	0.0625	50	5	1	18	73				
RLCL-1	10/23/2008	chlorophyte unicell, sphere 5-7.5um	spp.	Chlorophyta	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-1	10/23/2008	chlorophyte unicell, oval 2.5-5um	spp.	Chlorophyta	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-1	10/23/2008	chlorophyte	sp.	Chlorophyta	1	colony	2	400	0.0625	50	5	1	18	36				
RLCL-1	10/23/2008	Eutetramorus	fottii	Chlorophyta	3	colony	56	100	283.53	1	5	1	1	34				
RLCL-1	10/23/2008	chlorophyte unicell, sphere 2.5-5um	spp.	Chlorophyta	1	cell	1	400	0.0625	50	5	1	18.1	18				
RLCL-1	10/23/2008	Oocystis	sp.	Chlorophyta	1	cell	1	400	0.0625	50	5	1	18.1	18				
RLCL-1	10/23/2008	Ankyra	judayi	Chlorophyta	3	cell	1	200	0.25	50	5	1	13.6	13.6				
RLCL-1	10/23/2008	chlorophyte unicell	sp.	Chlorophyta	1	cell	1	200	0.25	50	5	1	4.5	4.5				
RLCL-1	10/23/2008	Tetraselmis	sp.	Chlorophyta	1	cell	1	200	0.25	50	5	1	4.5	4.5				
RLCL-1	10/23/2008	chlorophyte colony	sp.	Chlorophyta	1	colony	11	100	283.53	1	5	1	0	2				
RLCL-1	10/23/2008	Dinobryon	sp.	Chrysophyta	3	cell	1	400	0.0625	50	5	1	54.4	54.4	96.5	98.9		
RLCL-1	10/23/2008	Mallomonas	sp.	Chrysophyta	5	cell	1	200	0.25	50	5	1	23	23				
RLCL-1	10/23/2008	Mallomonas	sp.	Chrysophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-1	10/23/2008	Dinobryon	sp.	Chrysophyta	6	colony	3	100	283.53	1	5	1	1	4				
RLCL-1	10/23/2008	Rhodomonas	minuta	Cryptophyta	17	cell	1	400	0.0625	50	5	1	308	308	349	349		
RLCL-1	10/23/2008	cryptophyte	sp.	Cryptophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-1	10/23/2008	Cryptomonas	cf. ovata	Cryptophyta	4	cell	1	200	0.25	50	5	1	18.1	18				
RLCL-1	10/23/2008	Cryptomonas	sp.	Cryptophyta	1	cell	1	200	0.25	50	5	1	4.5	5				
RLCL-1	10/23/2008	cyanophyte unicell, oval/rod 2.5-5um	spp.	Cyanobacteria	48	cell	1	400	0.0625	50	5	1	871	871	1,235	1,640		
RLCL-1	10/23/2008	cyanophyte colony	sp.	Cyanobacteria	1	colony	17	400	0.0625	50	5	1	18	308				
RLCL-1	10/23/2008	cyanophyte cell pair	spp.	Cyanobacteria	6	colony	2	400	0.0625	50	5	1	109	218				
RLCL-1	10/23/2008	cyanophyte unicell, sphere 2.5-5um	spp.	Cyanobacteria	11	cell	1	400	0.0625	50	5	1	200	200				
RLCL-1	10/23/2008	cyanophyte	sp.	Cyanobacteria	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-1	10/23/2008	Aphanizomenon	cf. flos-aquae	Cyanobacteria	2	filament	9	100	283.53	1	5	1	0	4				
RLCL-1	10/23/2008	cyanophyte filament	sp.	Cyanobacteria	1	filament	17	100	283.53	1	5	1	0	3				
RLCL-1	10/23/2008	microflagellate	spp.	Miscellaneous	4	cell	1	400	0.0625	50	5	1	73	73	127	127		
RLCL-1	10/23/2008	unknown unicell	sp.	Miscellaneous	2	cell	1	400	0.0625	50	5	1	36	36				
RLCL-1	10/23/2008	unicell, sphere 5-7.5um	spp.	Miscellaneous	1	cell	1	400	0.0625	50	5	1	18.1	18.1				
RLCL-1	10/23/2008	unknown unicell	sp.	Miscellaneous	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-2	10/23/2008	centric diatom	sp.	Bacillariophyta	16	cell	1	400	0.0625	50	5	1	290	290	301	326	1,366	1,926
RLCL-2	10/23/2008	Fragilaria	crotonensis	Bacillariophyta	3	chain	40	100	283.53	1	5	1	1	24				
RLCL-2	10/23/2008	Urosolenia	eriensis	Bacillariophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2	10/23/2008	centric diatom	sp.	Bacillariophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2	10/23/2008	Tabellaria	fenestrata	Bacillariophyta	1	colony	7	100	283.53	1	5	1	0	1				
RLCL-2	10/23/2008	Asterionella	formosa	Bacillariophyta	1	colony	2	100	283.53	1	5	1	0	0				
RLCL-2	10/23/2008	Tabellaria	fenestrata	Bacillariophyta	2	cell	1	100	283.53	1	5	1	0	0				
RLCL-2	10/23/2008	Stephanodiscus	niagarae	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-2	10/23/2008	Nitzschia	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0				
RLCL-2	10/23/2008	chlorophyte colony	sp.	Chlorophyta	1	colony	9	400	0.0625	50	5	1	18.1	163	169	326		
RLCL-2	10/23/2008	chlorophyte unicell, oval 2.5-5um	spp.	Chlorophyta	5	cell	1	400	0.0625	50	5	1	90.7	91				
RLCL-2	10/23/2008	chlorophyte unicell, sphere 2.5-5um	spp.	Chlorophyta	3	cell	1	400	0.0625	50	5	1	54.4	54.4				
RLCL-2	10/23/2008	Eutetramorus	fottii	Chlorophyta	3	colony	20	100	283.53	1	5	1	0.6	12.0				
RLCL-2	10/23/2008	Ankyra	judayi	Chlorophyta	1	cell	1	200	0.25	50	5	1	4.5	4.5				
RLCL-2	10/23/2008	Cosmarium	sp.	Chlorophyta	2	cell	1	100	283.53	1	5	1	0.4	0.4				
RLCL-2	10/23/2008	Elakatothrix	viridis	Chlorophyta	1	colony	2	100	283.53	1	5	1	0	0				
RLCL-2	10/23/2008	chlorophyte unicell	sp.	Chlorophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-2	10/23/2008	Mallomonas	sp.	Chrysophyta	5	cell	1	400	0.0625	50	5	1	91	91	164	196		
RLCL-2	10/23/2008	Dinobryon	sp.	Chrysophyta	3	cell	1	400	0.0625	50	5	1	54	54				
RLCL-2	10/23/2008	Dinobryon	sp.	Chrysophyta	3	colony	3	200	0.25	50	5	1	14	41				

Sample	Date	Genus	Species	Algal Group	No. Counted (units)	Unit	Cells/ Unit	Magn.	Field Area (mm^2)	No. Fields	Settl. Vol. (mL)	Dil. Fact.	Species Units/mL	Species Cells/mL	Group Total Units/mL	Group Total Cells/mL	Sample Total Units/mL	Sample Total Cells/mL
RLCL-2	10/23/2008	Dinobryon	bavaricum	Chrysophyta	1	colony	2	200	0.25	50	5	1	4.5	9.1				
RLCL-2	10/23/2008	Mallomonas	sp.	Chrysophyta	3	cell	1	100	283.53	1	5	1	1	1				
RLCL-2	10/23/2008	Rhodomonas	minuta	Cryptophyta	3	cell	1	400	0.0625	50	5	1	54	54	59	59		
RLCL-2	10/23/2008	cryptophyte	sp.	Cryptophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-2	10/23/2008	Cryptomonas	cf. ovata	Cryptophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-2	10/23/2008	cyanophyte unicell, oval/rod 2.5-5um	spp.	Cyanobacteria	25	cell	1	400	0.0625	50	5	1	454	454	654	1,001		
RLCL-2	10/23/2008	Aphanothece	sp.	Cyanobacteria	1	colony	17	400	0.0625	50	5	1	18	308				
RLCL-2	10/23/2008	cyanophyte	sp.	Cyanobacteria	5	cell	1	400	0.0625	50	5	1	91	91				
RLCL-2	10/23/2008	cyanophyte cell pair	spp.	Cyanobacteria	2	colony	2	400	0.0625	50	5	1	36	73				
RLCL-2	10/23/2008	cyanophyte unicell, sphere 2.5-5um	spp.	Cyanobacteria	3	cell	1	400	0.0625	50	5	1	54	54				
RLCL-2	10/23/2008	Anabaena	sp.	Cyanobacteria	2	filament	38	100	283.53	1	5	1	0	15				
RLCL-2	10/23/2008	Aphanizomenon	cf. flos-aquae	Cyanobacteria	2	filament	16	100	283.53	1	5	1	0	6				
RLCL-2	10/23/2008	microflagellate	spp.	Miscellaneous	1	cell	1	400	0.0625	50	5	1	18	18	18	18		
RLCL-3	10/23/2008	centric diatom	sp.	Bacillariophyta	38	cell	1	400	0.0625	50	5	1	690	690	701	702	1,436	1,544
RLCL-3	10/23/2008	Nitzschia	sp.	Bacillariophyta	1	cell	1	200	0.25	50	5	1	4.5	4.5				
RLCL-3	10/23/2008	pennate diatom	sp.	Bacillariophyta	1	cell	1	200	0.25	50	5	1	4.5	4.5				
RLCL-3	10/23/2008	Asterionella	formosa	Bacillariophyta	1	colony	5	100	283.53	1	5	1	0.2	1.0				
RLCL-3	10/23/2008	Fragilaria	crotonensis	Bacillariophyta	3	cell	1	100	283.53	1	5	1	1	1				
RLCL-3	10/23/2008	Melosira	varians	Bacillariophyta	1	chain	2	100	283.53	1	5	1	0	0				
RLCL-3	10/23/2008	centric diatom	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-3	10/23/2008	Aulacoseira	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-3	10/23/2008	Nitzschia	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-3	10/23/2008	Pinnularia	sp.	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0				
RLCL-3	10/23/2008	Nitzschia	acicularis	Bacillariophyta	1	cell	1	100	283.53	1	5	1	0.2	0				
RLCL-3	10/23/2008	chlorophyte colony	sp.	Chlorophyta	1	colony	2	400	0.0625	50	5	1	18.1	36	36	55		
RLCL-3	10/23/2008	chlorophyte unicell, oval 2.5-5um	spp.	Chlorophyta	1	cell	1	400	0.0625	50	5	1	18.1	18				
RLCL-3	10/23/2008	Mougeotia	sp.	Chlorophyta	1	cell	1	100	283.53	1	5	1	0.2	0				
RLCL-3	10/23/2008	Mallomonas	sp.	Chrysophyta	1	cell	1	400	0.0625	50	5	1	18.1	18	41	46		
RLCL-3	10/23/2008	Dinobryon	sp.	Chrysophyta	3	cell	1	200	0.25	50	5	1	14	14				
RLCL-3	10/23/2008	Dinobryon	sp.	Chrysophyta	1	colony	2	200	0.25	50	5	1	5	9				
RLCL-3	10/23/2008	chrysophyte flagellate	sp.	Chrysophyta	1	cell	1	200	0.25	50	5	1	5	5				
RLCL-3	10/23/2008	Dinobryon	bavaricum	Chrysophyta	1	colony	2	100	283.53	1	5	1	0	0				
RLCL-3	10/23/2008	Dinobryon	bavaricum	Chrysophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-3	10/23/2008	Mallomonas	sp.	Chrysophyta	1	cell	1	100	283.53	1	5	1	0	0				
RLCL-3	10/23/2008	Rhodomonas	minuta	Cryptophyta	13	cell	1	400	0.0625	50	5	1	235.9	236	254	254		
RLCL-3	10/23/2008	cryptophyte	sp.	Cryptophyta	1	cell	1	400	0.0625	50	5	1	18	18				
RLCL-3	10/23/2008	cyanophyte unicell, oval/rod 2.5-5um	spp.	Cyanobacteria	13	cell	1	400	0.0625	50	5	1	236	236	386	469		
RLCL-3	10/23/2008	cyanophyte unicell, sphere 2.5-5um	spp.	Cyanobacteria	6	cell	1	400	0.0625	50	5	1	109	109				
RLCL-3	10/23/2008	Aphanizomenon	cf. flos-aquae	Cyanobacteria	21	filament	13	100	283.53	1	5	1	4.2	55				
RLCL-3	10/23/2008	cyanophyte cell pair	spp.	Cyanobacteria	1	colony	2	400	0.0625	50	5	1	18	36				
RLCL-3	10/23/2008	cyanophyte	sp.	Cyanobacteria	1	cell	1	400	0.0625	50	5	1	18.1	18.1				
RLCL-3	10/23/2008	Anabaena	sp.	Cyanobacteria	2	filament	38	100	283.53	1	5	1	0.4	15				
RLCL-3	10/23/2008	unknown unicell	sp.	Miscellaneous	4	cell	1	200	0.25	50	5	1	18	18	18	18		

APPENDIX C
Laboratory Results

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October 01, 2008

Lab ID: 8080819

PAT KASPARI
WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
RE: HBMWD-RUTH LAKE 0105508005

Dear PAT KASPARI,

Enclosed are the analysis results for Work Order number 8080819. All analysis were performed under strict adherence to our established Quality Assurance Plan. Any abnormalities are listed in the qualifier section of this report.

If you have any questions regarding these results, please feel free to contact us at any time. We appreciate the opportunity to service your environmental testing needs.

Sincerely,

For

Ricky D. Jensen
Laboratory Director
California ELAP Certification Number 1677

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2218 Railroad Avenue
Redding, California 96001

Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8080819
Reported: 10/01/08
Phone: (707) 443-8326
P.O. #

General Chemistry

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-1 (UPPER 10M) Water (8080819-01) Sampled:08/20/08 11:00 Received:08/22/08 10:29									
Hardness	mg/l	36		2	5	SM 2340C	08/26/08	08/26/08	B8H0651
Alkalinity as CaCO3	"	36		1	5	SM 2320B	08/22/08	08/22/08	B8H0555
Bicarbonate	"	44		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.2	QR-04	0.1	0.2	EPA 351.2	09/01/08	09/01/08	B8I0005
Ammonia as N	"	0.11		0.02	0.05	EPA 350.1	09/04/08	09/04/08	B8I0101
Nitrate+Nitrite as N	"	0.02	J	0.01	0.05	EPA 353.2	08/23/08	08/23/08	B8H0600
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	08/24/08	08/24/08	B8H0606
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	08/22/08	08/22/08	B8H0590
RLCL-1 (3M ABOVE BOTTOM) Water (8080819-02) Sampled:08/20/08 11:25 Received:08/22/08 10:29									
Hardness	mg/l	49		2	5	SM 2340C	08/26/08	08/26/08	B8H0651
Alkalinity as CaCO3	"	37		1	5	SM 2320B	08/22/08	08/22/08	B8H0555
Bicarbonate	"	45		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.1	J, QR-04	0.1	0.2	EPA 351.2	09/01/08	09/01/08	B8I0005
Ammonia as N	"	0.06		0.02	0.05	EPA 350.1	09/04/08	09/04/08	B8I0101
Nitrate+Nitrite as N	"	0.02	J	0.01	0.05	EPA 353.2	08/23/08	08/23/08	B8H0600
Total Phosphorus as P	"	0.03	J	0.02	0.05	SM 4500P-BE	08/24/08	08/24/08	B8H0606
Orthophosphate as P	"	0.01	I-03, J	0.01	0.05	SM 4500P-E	08/22/08	08/22/08	B8H0590
RLCL-2 (UPPER 10M) Water (8080819-03) Sampled:08/20/08 13:00 Received:08/22/08 10:29									
Hardness	mg/l	43		2	5	SM 2340C	08/26/08	08/26/08	B8H0651
Alkalinity as CaCO3	"	39		1	5	SM 2320B	08/22/08	08/22/08	B8H0555
Bicarbonate	"	48		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.3	QR-04	0.1	0.2	EPA 351.2	09/01/08	09/01/08	B8I0005
Ammonia as N	"	0.10		0.02	0.05	EPA 350.1	09/04/08	09/04/08	B8I0101
Nitrate+Nitrite as N	"	0.02	J	0.01	0.05	EPA 353.2	08/23/08	08/23/08	B8H0600
Total Phosphorus as P	"	0.02	J	0.02	0.05	SM 4500P-BE	08/24/08	08/24/08	B8H0606
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	08/22/08	08/22/08	B8H0590
RLCL-2A (UPPER 10M) Water (8080819-04) Sampled:08/20/08 13:20 Received:08/22/08 10:29									
Hardness	mg/l	38		2	5	SM 2340C	08/26/08	08/26/08	B8H0651
Alkalinity as CaCO3	"	39		1	5	SM 2320B	08/22/08	08/22/08	B8H0555
Bicarbonate	"	48		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.1	J, QR-04	0.1	0.2	EPA 351.2	09/01/08	09/01/08	B8I0005
Ammonia as N	"	0.04	J	0.02	0.05	EPA 350.1	09/04/08	09/04/08	B8I0101
Nitrate+Nitrite as N	"	0.02	J	0.01	0.05	EPA 353.2	08/23/08	08/23/08	B8H0600
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	08/24/08	08/24/08	B8H0606
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	08/22/08	08/22/08	B8H0590
RLCL-3 (SURFACE LAYER) Water (8080819-05) Sampled:08/20/08 16:30 Received:08/22/08 10:29									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	09/12/08	08/22/08	B8I0509
EQUIPMENT BLANK Blank (8080819-06) Sampled:08/20/08 17:30 Received:08/22/08 10:29									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	09/12/08	08/22/08	B8I0509
Hardness	"	ND		2	5	SM 2340C	08/26/08	08/26/08	B8H0651
Alkalinity as CaCO3	"	ND		1	5	SM 2320B	08/22/08	08/22/08	B8H0555
Bicarbonate	"	ND		1	5	"	"	"	"

Approved By
Basic Laboratory, Inc.
California D.O.H.S. Cert #1677

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Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8080819
Reported: 10/01/08
Phone: (707) 443-8326
P.O. #

General Chemistry

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
EQUIPMENT BLANK Blank (8080819-06) Sampled:08/20/08 17:30 Received:08/22/08 10:29									
Carbonate	"	ND		1	5	"	"	08/22/08	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	ND	QR-04	0.1	0.2	EPA 351.2	09/01/08	09/01/08	B8I0005
Ammonia as N	"	**0.03**	J	0.02	0.05	EPA 350.1	09/04/08	09/04/08	B8I0101
Nitrate+Nitrite as N	"	**0.02**	J	0.01	0.05	EPA 353.2	08/23/08	08/23/08	B8H0600
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	08/24/08	08/24/08	B8H0606
Orthophosphate as P	"	ND		0.01	0.05	SM 4500P-E	08/22/08	08/22/08	B8H0590

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Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8080819
Reported: 10/01/08
Phone: (707) 443-8326
P.O. #

Metals - Total

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-1 (UPPER 10M) Water (8080819-01) Sampled:08/20/08 11:00 Received:08/22/08 10:29									
Calcium	mg/l	12		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
Iron	ug/l	102		4	12	EPA 200.8	08/28/08	08/27/08	B8H0684
Magnesium	mg/l	2		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
RLCL-1 (3M ABOVE BOTTOM) Water (8080819-02) Sampled:08/20/08 11:25 Received:08/22/08 10:29									
Calcium	mg/l	11		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
Iron	ug/l	752		4	12	EPA 200.8	08/28/08	08/27/08	B8H0684
Magnesium	mg/l	2		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
RLCL-2 (UPPER 10M) Water (8080819-03) Sampled:08/20/08 13:00 Received:08/22/08 10:29									
Calcium	mg/l	12		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
Iron	ug/l	137		4	12	EPA 200.8	08/28/08	08/27/08	B8H0684
Magnesium	mg/l	2		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
RLCL-2A (UPPER 10M) Water (8080819-04) Sampled:08/20/08 13:20 Received:08/22/08 10:29									
Calcium	mg/l	12		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
Iron	ug/l	64		4	12	EPA 200.8	08/28/08	08/27/08	B8H0684
Magnesium	mg/l	2		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
EQUIPMENT BLANK Blank (8080819-06) Sampled:08/20/08 17:30 Received:08/22/08 10:29									
Calcium	mg/l	ND		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614
Iron	ug/l	25		4	12	EPA 200.8	08/28/08	08/27/08	B8H0684
Magnesium	mg/l	ND		0.2	1	EPA 200.7	08/26/08	08/25/08	B8H0614

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California D.O.H.S. Cert #1677

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Redding, California 96001

Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8080819
Reported: 10/01/08
Phone: (707) 443-8326
P.O. #

Quality Control Data

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
General Chemistry										
Batch B8H0555 - General Prep - GC										
Blank										
Alkalinity as CaCO3	ND	5	mg/l							
Bicarbonate	ND	5	mg/l							
Carbonate	ND	5	mg/l							
Hydroxide	ND	5	mg/l							
LCS										
Alkalinity as CaCO3	52		mg/l	50.0		104	80-120			
Duplicate **Source: 8080798-01**										
Alkalinity as CaCO3	138	5	mg/l		139			0.722	20	
Batch B8H0590 - General Prep - GC										
Blank										
Orthophosphate as P	ND	0.05	mg/l							
LCS										
Orthophosphate as P	0.797		mg/l	0.800		99.6	80-120			
Duplicate **Source: 8080819-01**										
Orthophosphate as P	ND	0.05	mg/l		ND				20	
Matrix Spike **Source: 8080819-01**										
Orthophosphate as P	0.55	0.05	mg/l	0.500	ND	110	75-125			
Batch B8H0600 - General Prep - GC										
Blank										
Nitrate+Nitrite as N	0.010	0.05	mg/l							J
LCS										
Nitrate+Nitrite as N	0.940	0.05	mg/l	1.00		94.0	90-110			
Duplicate **Source: 8080819-01**										
Nitrate+Nitrite as N	0.020	0.05	mg/l		0.020			0.00	20	J
Matrix Spike **Source: 8080819-01**										
Nitrate+Nitrite as N	1.05	0.05	mg/l	1.00	0.020	103	90-110			
Batch B8H0606 - General Prep - GC										
Blank										
Total Phosphorus as P	ND	0.05	mg/l							
LCS										
Total Phosphorus as P	0.81	0.05	mg/l	0.800		101	80-120			
Duplicate **Source: 8080819-01**										
Total Phosphorus as P	ND	0.05	mg/l		ND				20	
Matrix Spike **Source: 8080819-01**										
Total Phosphorus as P	0.52	0.05	mg/l	0.500	ND	104	75-125			
Batch B8H0651 - General Prep - GC										

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Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8080819
Reported: 10/01/08
Phone: (707) 443-8326
P.O. #

Quality Control Data

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
General Chemistry										
Batch B8H0651 - General Prep - GC										
Blank										
Hardness	ND	5	mg/l							
LCS										
Hardness	80.0		mg/l	80.0		100	80-120			
Duplicate Source: 8080705-01										
Hardness	118	5	mg/l		116			1.71	20	
Duplicate Source: 8080819-02										
Hardness	47.0	5	mg/l		49.0			4.17	20	
Matrix Spike Source: 8080705-01										
Hardness	218	5	mg/l	100	116	102	75-125			
Matrix Spike Source: 8080819-02										
Hardness	145	5	mg/l	100	49.0	96.0	75-125			
Batch B8I0005 - General Prep - GC										
Blank										
Total Kjeldahl Nitrogen	ND	0.2	mg/l							
LCS										
Total Kjeldahl Nitrogen	3.00	0.2	mg/l	3.00		100	90-110			
Duplicate Source: 8080819-01										
Total Kjeldahl Nitrogen	0.100	0.2	mg/l		0.186			60.1	20	J, QR-04
Matrix Spike Source: 8080819-01										
Total Kjeldahl Nitrogen	2.20	0.2	mg/l	2.00	0.186	101	75-125			
Batch B8I0101 - General Prep - GC										
Blank										
Ammonia as N	0.03	0.05	mg/l							J
LCS										
Ammonia as N	1.99	0.05	mg/l	2.00		99.6	90-110			
Duplicate Source: 8080798-01										
Ammonia as N	0.51	0.05	mg/l		0.44			14.1	20	
Duplicate Source: 8080826-02										
Ammonia as N	0.82	0.05	mg/l		0.87			6.16	20	
Matrix Spike Source: 8080798-01										
Ammonia as N	2.77	0.05	mg/l	2.00	0.44	117	90-110			QM-07
Matrix Spike Source: 8080826-02										
Ammonia as N	3.06	0.05	mg/l	2.00	0.87	110	90-110			
Batch B8I0509 - General Prep - GC										
Blank										
Chlorophyll a	ND	0.006	mg/l							

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Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8080819
Reported: 10/01/08
Phone: (707) 443-8326
P.O. #

Quality Control Data

Metals - Total

Analyte	Result	RL	Units	Spike Level	Source Result	%REC	%REC Limits	RPD	RPD Limit	Qualifier
Batch BSH0614 - EPA 200 Series										
Blank										
Calcium	ND	1	mg/l							
Magnesium	ND	1	mg/l							
LCS										
Calcium	55.0	1	mg/l	50.0		110	85-115			
Magnesium	53.3	1	mg/l	50.0		107	85-115			
Duplicate **Source: 8080819-01**										
Calcium	11.9	1	mg/l		11.5			3.42	20	
Magnesium	2.30	1	mg/l		2.20			4.44	20	
Matrix Spike **Source: 8080819-01**										
Calcium	65.3	1	mg/l	50.0	11.5	108	75-125			
Magnesium	55.3	1	mg/l	50.0	2.20	106	75-125			
Batch BSH0684 - EPA 200 Series										
Blank										
Iron	7.28	12	ug/l							J
LCS										
Iron	5090	12	ug/l	5000		102	85-115			
Duplicate **Source: 8080819-01**										
Iron	110	12	ug/l		102			7.53	20	
Matrix Spike **Source: 8080819-01**										
Iron	4960	12	ug/l	5000	102	97.1	75-125			

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Notes and Definitions

QR-04	Duplicate results are within one reporting limit and pass all necessary QC criteria.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag). The J flag is equivalent to the DNQ Estimated Concentration flag.
I-03	Sample was received past the EPA recommended holding time.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the detection limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
<	Less than reporting limit
≤	Less than or equal to reporting limit
>	Greater than reporting limit
≥	Greater than or equal to reporting limit
MDL	Method Detection Limit
RL/ML	Minimum Level of Quantitation
MCL/AL	Maxium Contaminant Level/Action Level
mg/kg	Results reported as wet weight
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
TCLP	Toxicity Characteristic Leachate Procedure

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BASIC LABORATORY CHAIN OF CUSTODY RECORD

2218 Railroad Avenue, Redding, CA 96001 (530) 243-7234 FAX (530) 243-7494

LAB #: 8080819

PAGE 1 OF 2

CLIENT NAME: Winzler + Kelly / HBMWD	PROJECT NAME: Ruth Lake	PROJECT #: 010550805	
MAILING ADDRESS: 633 Third St, Eureka, CA 95501	REPORT DUE DATE: 8/29/08	TURN AROUND TIME: Standard / Rush	# OF SAMPLES: 6
PROJECT MANAGER: Pat Kasparl			MATRIX / TYPE: W
PHONE: (707) 443-5326	EMAIL:		CUSTODY SEAL INTACT? Yes No N/A
FAX: (707) 444-8330	RESULTS SENT: Email Fax EDD Mail		SYSTEM #:
INVOICE TO: HBMWD	PO#:		EDD TYPE:
			QC: Standard Level II

ANALYSIS REQUESTED

SAMPLE DATE	SAMPLE TIME	WATER	COMP	SOLID	SAMPLE LOCATION / IDENTIFICATION	NUMBER OF BOTTLES	Orthophosphate as P (SM 4500-P)	Nitrate+Nitrite as N (EPA 353.2)	Total Ammonia as N (EPA 350.1)	Total Kjeldahl Nitrogen as N (EPA 351.3)	Total Kjeldahl Nitrogen (EPA 200.8)	Iron (EPA 200.8)	Magnesium (EPA 200.7)	Hardness (SM 2340 C)	Calcium (EPA 200.7)	Total Minerals (SM 2320B)	LAB ID	CHLORINE RESIDUAL OR COMMENTS
8/20/08	11:00	✓			RLCL-1 (upper 10m)	3	X	X	X	X	X	X	X	X	X	X	1	
	11:25	✓			RLCL-1 (3m above bottom)	3	X	X	X	X	X	X	X	X	X	X	2	
	13:00	✓			RLCL-2 (upper 10 m)	3	X	X	X	X	X	X	X	X	X	X	3	
	13:20	✓			RLCL-2A (upper 10m)	3	X	X	X	X	X	X	X	X	X	X	4	
	16:30	✓			RLCL-3 (surface layer)	2	See page 2 of 2										5	
	17:30	✓			Equipment Blank	4	X	X	X	X	X	X	X	X	X	X	6	

* According to bottle order everything was listed on the COC except for the ALK - AW.

PRESERVED WITH: (HNO_3) (H_2SO_4) NaOH ZnAce/NaOH HCL NaThio OTHER_____

PHK2 PHK2

SAMPLED BY (PRINT): Carlos Acu	SAMPLE DATE/TIME: 8/20/08	RELINQUISHED BY: Carlos Acu	DATE/TIME: 8/21/08 14:40
RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY (LAB): Dmiddee	DATE/TIME: 8/22/08 1029	PROCESSED AND VERIFIED BY: Dmiddee	DATE/TIME: 8/22/08 1029
LOGGED IN BY: Dmiddee	DATE/TIME: 8/22/08 1029	CARRIER: _____	COOLER TEMPERATURE: 10.8 °c

INSTRUCTIONS, TERMS AND CONDITIONS ON BACK.

SAMPLE TYPE: 1 = ROUTINE, 2 = REPEAT, 3 = REPLACEMENT, 4 = SPECIAL 5 = RAW

BASIC LABORATORY CHAIN OF CUSTODY RECORD

2218 Railroad Avenue, Redding, CA 96001 (530) 243-7234 FAX (530) 243-7494

LAB #: 080819

PAGE 2 OF 2

CLIENT NAME: Winzler + Kelly / HBMWD

MAILING ADDRESS: 633 Third St, Eureka, CA 95501

PROJECT MANAGER: Pat Kasparl

PHONE: (707) 443-8326

EMAIL:

FAX: (707) 444-8330

RESULTS SENT: Email Fax EDD Mail

INVOICE TO: HBMWD

PO#:

PROJECT NAME: Ruth Lake

PROJECT #: 01055 03005

REPORT DUE DATE: 8/29/08

TURN AROUND TIME: (Standard) Rush

OF SAMPLES: 6

MATRIX / TYPE: W

CUSTODY SEAL INTACT? Yes No N/A

SYSTEM #:

EDD TYPE:

QC: Standard Level II

ANALYSIS REQUESTED

SAMPLE DATE	SAMPLE TIME	WATER	COMP	SOLID	SAMPLE LOCATION / IDENTIFICATION	NUMBER OF BOTTLES	(SM 4500 P)	Total phosphorus	Chlorophyll a (SM 10200 H)	LAB ID	CHLORINE RESIDUAL OR COMMENTS
	16:30	✓			RLCL-3 (Surface Layer)	2			X	5	
	11:00	✓			RLCL-1 (upper 10m)		X	X		1	
	11:25	✓			RLCL-1 (3m above bottom)		X	X		2	
	13:00	✓			RLCL-2 (upper 10m)		X	X		3	
	13:20	✓			RLCL-2A (upper 10m)		X	X		4	
	17:30	✓			Equipment Blank		X	X	X	6*	

* Chlorophyll A added for Equipment blank per Pat Kasparl, we had received bottle but had not been checked for analysis-AC

PRESERVED WITH: (HNO3) (H2SO4) NaOH ZnAce/NaOH HCL NaThio OTHER PH<2 PH<2

SAMPLED BY (PRINT): Carlos Acu	SAMPLE DATE/TIME: 8/21/08	RELINQUISHED BY: Carlos Acu	DATE/TIME: 8/21/08 14:40
RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY (LAB):	DATE/TIME: 8/22/08 1029	PROCESSED AND VERIFIED BY:	DATE/TIME: 8/22/08 1029
LOGGED IN BY:	DATE/TIME: 8/22/08 1029	CARRIER:	COOLER TEMPERATURE: 10.8 °c

INSTRUCTIONS, TERMS AND CONDITIONS ON BACK.

SAMPLE TYPE: 1 = ROUTINE, 2 = REPEAT, 3 = REPLACEMENT, 4 = SPECIAL 5 = RAW

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2218 Railroad Avenue
Redding, California 96001

November 21, 2008

Lab ID: 8100861

PAT KASPARI
WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
RE: HBMWD-RUTH LAKE 0105508005

Dear PAT KASPARI,

Enclosed are the analysis results for Work Order number 8100861. All analysis were performed under strict adherence to our established Quality Assurance Plan. Any abnormalities are listed in the qualifier section of this report.

If you have any questions regarding these results, please feel free to contact us at any time. We appreciate the opportunity to service your environmental testing needs.

Sincerely,

For

Ricky D. Jensen
Laboratory Director
California ELAP Certification Number 1677

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2218 Railroad Avenue
Redding, California 96001

Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8100861
Reported: 11/21/08
Phone: (707) 443-8326
P.O. #

General Chemistry

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-1 (15') Water (8100861-01) Sampled:10/23/08 11:45 Received:10/27/08 10:08									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	11/13/08	11/27/08	B8K0415
Hardness	"	**41**		2	5	SM 2340C	10/31/08	10/31/08	B8J0839
Alkalinity as CaCO3	"	**40**		1	5	SM 2320B	10/27/08	10/27/08	B8J0692
Bicarbonate	"	**49**		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	**0.2**		0.1	0.2	EPA 351.2	11/02/08	11/02/08	B8K0016
Ammonia as N	"	**0.10**	QM-07	0.02	0.05	EPA 350.1	10/30/08	10/28/08	B8J0713
Nitrate+Nitrite as N	"	**0.02**	J, QM-07	0.01	0.05	EPA 353.2	11/01/08	11/01/08	B8K0006
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	11/02/08	11/02/08	B8K0015
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	10/28/08	10/28/08	B8J0736
RLCL-1 (50') Water (8100861-02) Sampled:10/23/08 11:50 Received:10/27/08 10:08									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	11/13/08	11/27/08	B8K0415
Hardness	"	**37**		2	5	SM 2340C	10/31/08	10/31/08	B8J0839
Alkalinity as CaCO3	"	**39**		1	5	SM 2320B	10/27/08	10/27/08	B8J0692
Bicarbonate	"	**47**		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	**0.2**		0.1	0.2	EPA 351.2	11/02/08	11/02/08	B8K0016
Ammonia as N	"	**0.03**	J, QM-07	0.02	0.05	EPA 350.1	10/30/08	10/28/08	B8J0713
Nitrate+Nitrite as N	"	**0.02**	J, QM-07	0.01	0.05	EPA 353.2	11/01/08	11/01/08	B8K0006
Total Phosphorus as P	"	**0.04**	J	0.02	0.05	SM 4500P-BE	11/02/08	11/02/08	B8K0015
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	10/28/08	10/28/08	B8J0736
RLCL-2 (15') Water (8100861-03) Sampled:10/23/08 13:09 Received:10/27/08 10:08									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	11/13/08	11/27/08	B8K0415
Hardness	"	**35**		2	5	SM 2340C	10/31/08	10/31/08	B8J0839
Alkalinity as CaCO3	"	**39**		1	5	SM 2320B	10/27/08	10/27/08	B8J0692
Bicarbonate	"	**47**		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	**0.1**	J	0.1	0.2	EPA 351.2	11/02/08	11/02/08	B8K0016
Ammonia as N	"	**0.03**	J, QM-07	0.02	0.05	EPA 350.1	10/30/08	10/28/08	B8J0713
Nitrate+Nitrite as N	"	**0.02**	J, QM-07	0.01	0.05	EPA 353.2	11/01/08	11/01/08	B8K0006
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	11/02/08	11/02/08	B8K0015
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	10/28/08	10/28/08	B8J0736
RLCL-2a (15') Water (8100861-04) Sampled:10/23/08 13:19 Received:10/27/08 10:08									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	11/13/08	11/27/08	B8K0415
Hardness	"	**35**		2	5	SM 2340C	10/31/08	10/31/08	B8J0839
Alkalinity as CaCO3	"	**40**		1	5	SM 2320B	10/27/08	10/27/08	B8J0692
Bicarbonate	"	**48**		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	**0.4**		0.1	0.2	EPA 351.2	11/02/08	11/02/08	B8K0016
Ammonia as N	"	**0.04**	J, QM-07	0.02	0.05	EPA 350.1	10/30/08	10/28/08	B8J0713
Nitrate+Nitrite as N	"	**0.02**	J, QM-07	0.01	0.05	EPA 353.2	11/01/08	11/01/08	B8K0006
Total Phosphorus as P	"	**0.11**		0.02	0.05	SM 4500P-BE	11/02/08	11/02/08	B8K0015
Orthophosphate as P	"	**0.04**	I-03, J	0.01	0.05	SM 4500P-E	10/28/08	10/28/08	B8J0736
RLCL-3 (4') Water (8100861-05) Sampled:10/23/08 13:50 Received:10/27/08 10:08									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	11/13/08	11/27/08	B8K0415
Hardness	"	**39**		2	5	SM 2340C	10/31/08	10/31/08	B8J0839
Alkalinity as CaCO3	"	**40**		1	5	SM 2320B	10/27/08	10/27/08	B8J0692

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2218 Railroad Avenue
Redding, California 96001

Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8100861
Reported: 11/21/08
Phone: (707) 443-8326
P.O. #

General Chemistry

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-3 (4') Water (8100861-05) Sampled:10/23/08 13:50 Received:10/27/08 10:08									
Bicarbonate	"	**49**		1	5	"	"	10/27/08	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	**0.2**		0.1	0.2	EPA 351.2	11/02/08	11/02/08	B8K0016
Ammonia as N	"	**0.08**	QM-07	0.02	0.05	EPA 350.1	10/31/08	10/31/08	B8J0797
Nitrate+Nitrite as N	"	**0.02**	J, QM-07	0.01	0.05	EPA 353.2	11/01/08	11/01/08	B8K0006
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	11/02/08	11/02/08	B8K0015
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	10/28/08	10/28/08	B8J0736
EQUIPMENT BLANK Blank (8100861-06) Sampled:10/23/08 14:30 Received:10/27/08 10:08									
Chlorophyll a	mg/l	ND		0.002	0.006	SM 10200H	11/13/08	11/27/08	B8K0415
Hardness	"	ND		2	5	SM 2340C	10/31/08	10/31/08	B8J0839
Alkalinity as CaCO3	"	ND		1	5	SM 2320B	10/27/08	10/27/08	B8J0692
Bicarbonate	"	ND		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	ND		0.1	0.2	EPA 351.2	11/02/08	11/02/08	B8K0016
Ammonia as N	"	**0.08**	QM-07	0.02	0.05	EPA 350.1	10/31/08	10/31/08	B8J0797
Nitrate+Nitrite as N	"	**0.02**	J, QM-07	0.01	0.05	EPA 353.2	11/01/08	11/01/08	B8K0006
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	11/02/08	11/02/08	B8K0015
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	10/28/08	10/28/08	B8J0736

Approved By
Basic Laboratory, Inc.
California D.O.H.S. Cert #1677

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2218 Railroad Avenue
Redding, California 96001

Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501

Attention: PAT KASPARI

Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8100861
Reported: 11/21/08
Phone: (707) 443-8326
P.O. #

Metals - Total

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-1 (15') Water (8100861-01) Sampled:10/23/08 11:45 Received:10/27/08 10:08									
Calcium	mg/l	12		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
Iron	ug/l	71		4	12	EPA 200.8	10/31/08	10/27/08	B8J0683
Magnesium	mg/l	2		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
RLCL-1 (50') Water (8100861-02) Sampled:10/23/08 11:50 Received:10/27/08 10:08									
Calcium	mg/l	12		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
Iron	ug/l	1170		4	12	EPA 200.8	10/31/08	10/27/08	B8J0683
Magnesium	mg/l	3		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
RLCL-2 (15') Water (8100861-03) Sampled:10/23/08 13:09 Received:10/27/08 10:08									
Calcium	mg/l	12		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
Iron	ug/l	27		4	12	EPA 200.8	10/31/08	10/27/08	B8J0683
Magnesium	mg/l	2		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
RLCL-2a (15') Water (8100861-04) Sampled:10/23/08 13:19 Received:10/27/08 10:08									
Calcium	mg/l	12		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
Iron	ug/l	6720		4	12	EPA 200.8	10/31/08	10/27/08	B8J0683
Magnesium	mg/l	5		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
RLCL-3 (4') Water (8100861-05) Sampled:10/23/08 13:50 Received:10/27/08 10:08									
Calcium	mg/l	12		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
Iron	ug/l	301		4	12	EPA 200.8	10/31/08	10/27/08	B8J0683
Magnesium	mg/l	2		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
EQUIPMENT BLANK Blank (8100861-06) Sampled:10/23/08 14:30 Received:10/27/08 10:08									
Calcium	mg/l	ND		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767
Iron	ug/l	ND		4	12	EPA 200.8	10/31/08	10/27/08	B8J0683
Magnesium	mg/l	ND		0.2	1	EPA 200.7	11/05/08	10/29/08	B8J0767

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2218 Railroad Avenue
Redding, California 96001

Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 8100861
Reported: 11/21/08
Phone: (707) 443-8326
P.O. #

Notes and Definitions

QR-04	Duplicate results are within one reporting limit and pass all necessary QC criteria.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag). The J flag is equivalent to the DNQ Estimated Concentration flag.
I-03	Sample was received past the EPA recommended holding time.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the detection limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
<	Less than reporting limit
≤	Less than or equal to reporting limit
>	Greater than reporting limit
≥	Greater than or equal to reporting limit
MDL	Method Detection Limit
RL/ML	Minimum Level of Quantitation
MCL/AL	Maxium Contaminant Level/Action Level
mg/kg	Results reported as wet weight
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
TCLP	Toxicity Characteristic Leachate Procedure

Approved By
Basic Laboratory, Inc.
California D.O.H.S. Cert #1677

BASIC LABORATORY CHAIN OF CUSTODY RECORD

2218 Railroad Avenue, Redding, CA 96001 (530) 243-7234 FAX (530) 243-7494

LAB #: 810081.01

CLIENT NAME: Winzler + Kelly

PROJECT NAME: Ruth Lake

PROJECT #: 0105508005

PAGE 1 OF 1

MAILING ADDRESS: 633 Third St, Eureka, CA 95501

REPORT DUE DATE: 11/10/08

TURN AROUND TIME: (Standard) Rush

OF SAMPLES: 6

ANALYSIS REQUESTED

MATRIX / TYPE: W

PROJECT MANAGER: Pat Kasparik

CUSTODY SEAL INTACT? Yes No N/A

PHONE: (707) 443-8326

EMAIL:

SYSTEM #:

FAX: (707) 444-8330

RESULTS SENT: Email Fax EDD Mail

EDD TYPE:

INVOICE TO: Humboldt Bay Municipal Water Dist.

PO#:

QC: Standard Level II

SAMPLE DATE	SAMPLE TIME	WATER	COMP.	SOLID	SAMPLE LOCATION / IDENTIFICATION	NUMBER OF BOTTLES	Total Phosphorus (SM4500-P)	Ortho-phosphate as P (EPA 365.2)	Nitrate-Nitrite as N (EPA 353.2)	Total Ammonia as N (EPA 350.1)	Total Kjeldahl Nitrogen as N (EPA 351.2)	Chlorophyll a (SM 10200 H)	Magnesium (EPA 200.7)	Hardness (SM 2340 C)	Calcium (EPA 200.7)	Total Alkalinity (SM 2320B)	LAB ID	CHLORINE RESIDUAL OR COMMENTS
10-23-08	11:45	X			RLCL1 (~15')	4	X	X	X	X	X	X	X	X	X	X	1	
	11:50				RLCL-1 (~50')												2	
	13:09				RLCL-2 (15')												3	
	13:19				RLCL-2a (~15')												4	
	13:50				RLCL-3 (4')												5	
	14:30				Equipment Blank												6	

PRESERVED WITH: HNO_3 H_2SO_4 NaOH ZnAce/NaOH HCL NaThio OTHER

SAMPLED BY (PRINT):	SAMPLE DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
Carlos Acu	10-23-08 15:00		
RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY (LAB):	DATE/TIME: 10/28/08 1008	PROCESSED AND VERIFIED BY:	DATE/TIME: 10/28/08 1008
LOGGED IN BY:	DATE/TIME: 10/28/08 1008	CARRIER:	COOLER TEMPERATURE: 18.9 °c

INSTRUCTIONS, TERMS AND CONDITIONS ON BACK. 10/27/08

SAMPLE TYPE: 1 = ROUTINE, 2 = REPEAT, 3 = REPLACEMENT, 4 = SPECIAL 5 = RAW

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March 27, 2009

Lab ID: 9030097

PAT KASPARI
WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
RE: HBMWD-RUTH LAKE 0105508005

Dear PAT KASPARI,

Enclosed are the analysis results for Work Order number 9030097. All analysis were performed under strict adherence to our established Quality Assurance Plan. Any abnormalities are listed in the qualifier section of this report.

If you have any questions regarding these results, please feel free to contact us at any time. We appreciate the opportunity to service your environmental testing needs.

Sincerely,

For

Ricky D. Jensen
Laboratory Director
California ELAP Certification Number 1677

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Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 9030097
Reported: 03/27/09
Phone: (707) 443-8326
P.O. #

General Chemistry

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-1 UPPER 10M Water (9030097-01) Sampled:02/27/09 10:45 Received:03/03/09 11:44									
Chlorophyll a	mg/l	ND	I-03	0.002	0.006	SM 10200H	03/20/09	03/20/09	B9C0780
Hardness	"	35		2	5	SM 2340C	03/05/09	03/05/09	B9C0083
Alkalinity as CaCO3	"	37		1	5	SM 2320B	03/05/09	03/05/09	B9C0159
Bicarbonate	"	45		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.2		0.1	0.2	EPA 351.2	03/10/09	03/10/09	B9C0214
Ammonia as N	"	0.07		0.02	0.05	EPA 350.1	03/09/09	03/04/09	B9C0094
Nitrate+Nitrite as N	"	0.04	J	0.01	0.05	EPA 353.2	03/06/09	03/06/09	B9C0197
Total Phosphorus as P	"	0.05		0.02	0.05	SM 4500P-BE	03/07/09	03/07/09	B9C0225
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	03/04/09	03/04/09	B9C0109
RLCL-1 3M ABOVE BOTTOM Water (9030097-02) Sampled:02/27/09 11:03 Received:03/03/09 11:44									
Hardness	mg/l	36		2	5	SM 2340C	03/05/09	03/05/09	B9C0083
Alkalinity as CaCO3	"	37		1	5	SM 2320B	03/05/09	03/05/09	B9C0159
Bicarbonate	"	45		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.7		0.1	0.2	EPA 351.2	03/10/09	03/10/09	B9C0214
Ammonia as N	"	0.15		0.02	0.05	EPA 350.1	03/09/09	03/04/09	B9C0094
Nitrate+Nitrite as N	"	0.08		0.01	0.05	EPA 353.2	03/06/09	03/06/09	B9C0197
Total Phosphorus as P	"	0.06		0.02	0.05	SM 4500P-BE	03/07/09	03/07/09	B9C0225
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	03/04/09	03/04/09	B9C0109
RLCL-2 UPPER 10M Water (9030097-03) Sampled:02/27/09 12:31 Received:03/03/09 11:44									
Hardness	mg/l	31		2	5	SM 2340C	03/05/09	03/05/09	B9C0083
Alkalinity as CaCO3	"	34		1	5	SM 2320B	03/05/09	03/05/09	B9C0159
Bicarbonate	"	41		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.2		0.1	0.2	EPA 351.2	03/10/09	03/10/09	B9C0214
Ammonia as N	"	0.05		0.02	0.05	EPA 350.1	03/09/09	03/04/09	B9C0094
Nitrate+Nitrite as N	"	0.04	J	0.01	0.05	EPA 353.2	03/06/09	03/06/09	B9C0197
Total Phosphorus as P	"	0.05		0.02	0.05	SM 4500P-BE	03/07/09	03/07/09	B9C0225
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	03/04/09	03/04/09	B9C0109
RLCL-2A UPPER 10M Water (9030097-04) Sampled:02/27/09 12:38 Received:03/03/09 11:44									
Hardness	mg/l	31		2	5	SM 2340C	03/07/09	03/07/09	B9C0192
Alkalinity as CaCO3	"	34		1	5	SM 2320B	03/05/09	03/05/09	B9C0159
Bicarbonate	"	41		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	0.2		0.1	0.2	EPA 351.2	03/10/09	03/10/09	B9C0214
Ammonia as N	"	0.05		0.02	0.05	EPA 350.1	03/09/09	03/04/09	B9C0094
Nitrate+Nitrite as N	"	0.04	J	0.01	0.05	EPA 353.2	03/06/09	03/06/09	B9C0197
Total Phosphorus as P	"	0.05		0.02	0.05	SM 4500P-BE	03/07/09	03/07/09	B9C0225
Orthophosphate as P	"	0.01	I-03, J	0.01	0.05	SM 4500P-E	03/04/09	03/04/09	B9C0109
RLCL-3 SURFACE LAYER Water (9030097-05) Sampled:02/27/09 13:33 Received:03/03/09 11:44									
Chlorophyll a	mg/l	ND	I-03	0.002	0.006	SM 10200H	03/20/09	03/20/09	B9C0780
Hardness	"	27		2	5	SM 2340C	03/07/09	03/07/09	B9C0192
Alkalinity as CaCO3	"	32		1	5	SM 2320B	03/05/09	03/05/09	B9C0159
Bicarbonate	"	38		1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"

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Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 9030097
Reported: 03/27/09
Phone: (707) 443-8326
P.O. #

General Chemistry

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-3 SURFACE LAYER Water (9030097-05) Sampled:02/27/09 13:33 Received:03/03/09 11:44									
Total Kjeldahl Nitrogen	"	**0.2**		0.1	0.2	EPA 351.2	03/10/09	03/10/09	B9C0214
Ammonia as N	"	**0.06**		0.02	0.05	EPA 350.1	03/09/09	03/04/09	B9C0094
Nitrate+Nitrite as N	"	**0.04**	J	0.01	0.05	EPA 353.2	03/06/09	03/06/09	B9C0197
Total Phosphorus as P	"	**0.06**		0.02	0.05	SM 4500P-BE	03/07/09	03/07/09	B9C0225
Orthophosphate as P	"	**0.02**	I-03, J	0.01	0.05	SM 4500P-E	03/04/09	03/04/09	B9C0109
EQUIPMENT BLANK Blank (9030097-06) Sampled:02/27/09 14:25 Received:03/03/09 11:44									
Chlorophyll a	mg/l	ND	I-03	0.002	0.006	SM 10200H	03/20/09	03/20/09	B9C0780
Hardness	"	ND		2	5	SM 2340C	03/07/09	03/07/09	B9C0192
Alkalinity as CaCO3	"	**2**	J	1	5	SM 2320B	03/05/09	03/05/09	B9C0159
Bicarbonate	"	**2**	J	1	5	"	"	"	"
Carbonate	"	ND		1	5	"	"	"	"
Hydroxide	"	ND		1	5	"	"	"	"
Total Kjeldahl Nitrogen	"	ND		0.1	0.2	EPA 351.2	03/10/09	03/10/09	B9C0214
Ammonia as N	"	**0.04**	J	0.02	0.05	EPA 350.1	03/09/09	03/04/09	B9C0094
Nitrate+Nitrite as N	"	**0.32**		0.01	0.05	EPA 353.2	03/06/09	03/06/09	B9C0197
Total Phosphorus as P	"	ND		0.02	0.05	SM 4500P-BE	03/07/09	03/07/09	B9C0225
Orthophosphate as P	"	ND	I-03	0.01	0.05	SM 4500P-E	03/04/09	03/04/09	B9C0109

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California ELAP Cert #1677 and #2718

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Report To: WINZLER & KELLY
633 THIRD STREET
EUREKA, CA 95501
Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 9030097
Reported: 03/27/09
Phone: (707) 443-8326
P.O. #

Metals - Total

Analyte	Units	Results	Qualifier	MDL	RL	Method	Analyzed	Prepared	Batch
RLCL-1 UPPER 10M Water (9030097-01) Sampled:02/27/09 10:45 Received:03/03/09 11:44									
Calcium	mg/l	11		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
Iron	ug/l	368		4	12	EPA 200.8	03/11/09	03/05/09	B9C0157
Magnesium	mg/l	2		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
RLCL-1 3M ABOVE BOTTOM Water (9030097-02) Sampled:02/27/09 11:03 Received:03/03/09 11:44									
Calcium	mg/l	11		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
Iron	ug/l	492		4	12	EPA 200.8	03/11/09	03/05/09	B9C0157
Magnesium	mg/l	2		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
RLCL-2 UPPER 10M Water (9030097-03) Sampled:02/27/09 12:31 Received:03/03/09 11:44									
Calcium	mg/l	10		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
Iron	ug/l	949		4	12	EPA 200.8	03/11/09	03/05/09	B9C0157
Magnesium	mg/l	2		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
RLCL-2A UPPER 10M Water (9030097-04) Sampled:02/27/09 12:38 Received:03/03/09 11:44									
Calcium	mg/l	10		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
Iron	ug/l	994		4	12	EPA 200.8	03/11/09	03/05/09	B9C0157
Magnesium	mg/l	2		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
RLCL-3 SURFACE LAYER Water (9030097-05) Sampled:02/27/09 13:33 Received:03/03/09 11:44									
Calcium	mg/l	9		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
Iron	ug/l	227		4	12	EPA 200.8	03/11/09	03/05/09	B9C0157
Magnesium	mg/l	2		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
EQUIPMENT BLANK Blank (9030097-06) Sampled:02/27/09 14:25 Received:03/03/09 11:44									
Calcium	mg/l	0.5	J	0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113
Iron	ug/l	ND		4	12	EPA 200.8	03/11/09	03/05/09	B9C0157
Magnesium	mg/l	ND		0.2	1	EPA 200.7	03/11/09	03/06/09	B9C0113

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Attention: PAT KASPARI
Project: HBMWD-RUTH LAKE 0105508005

Lab No: 9030097
Reported: 03/27/09
Phone: (707) 443-8326
P.O. #

Notes and Definitions

QR-04	Duplicate results are within one reporting limit and pass all necessary QC criteria.
QM-07	The spike recovery was outside acceptance limits for the MS and/or MSD. The batch was accepted based on acceptable LCS recovery.
J	Detected but below the Reporting Limit; therefore, result is an estimated concentration (CLP J-Flag). The J flag is equivalent to the DNQ Estimated Concentration flag.
I-03	Sample was received past the EPA recommended holding time.
DET	Analyte DETECTED
ND	Analyte NOT DETECTED at or above the detection limit
NR	Not Reported
dry	Sample results reported on a dry weight basis
RPD	Relative Percent Difference
<	Less than reporting limit
≤	Less than or equal to reporting limit
>	Greater than reporting limit
≥	Greater than or equal to reporting limit
MDL	Method Detection Limit
RL/ML	Minimum Level of Quantitation
MCL/AL	Maxium Contaminant Level/Action Level
mg/kg	Results reported as wet weight
TTLC	Total Threshold Limit Concentration
STLC	Soluble Threshold Limit Concentration
TCLP	Toxicity Characteristic Leachate Procedure

Approved By
Basic Laboratory, Inc.
California ELAP Cert #1677 and #2718

BASIC LABORATORY CHAIN OF CUSTODY RECORD

2218 Railroad Avenue, Redding, CA 96001 (530) 243-7234 FAX (530) 243-7494

LAB #: 9030097

PAGE 1 OF 1

CLIENT NAME: Winzler & Kelly / HBMWD	PROJECT NAME: Ruth Lake	PROJECT #: 0105508005	
MAILING ADDRESS: 633 Third St, Eureka, CA 95501	REPORT DUE DATE: 3-31-09	TURN AROUND TIME: (Standard) Rush	# OF SAMPLES: 6
PROJECT MANAGER: Pat Kaspari			MATRIX / TYPE: W
PHONE: (707) 443-8326	EMAIL:		CUSTODY SEAL INTACT? Yes No N/A
FAX: (707) 444-8330	RESULTS SENT: Email Fax EDD Mail		SYSTEM #:
INVOICE TO: HBMWD	PO#:		EDD TYPE:
			QC: Standard Level II

SAMPLE DATE	SAMPLE TIME	WATER	COMP	SOLID	SAMPLE LOCATION / IDENTIFICATION	NUMBER OF BOTTLES	Chlorophyll-a (SM 10200 H)	Total phosphorus (SM 4500P)	Orthophosphate as P (SM 4500P)	Nitrate + Nitrite as N (EPA 353.2)	Total Ammonia as N EPA (350.1)	Total Kjeldahl Nitrogen as N EPA (351.3)	Iron (EPA 200.8)	Magnesium (EPA 200.7)	Hardness (SM 2340C)	Calcium (EPA 200.7)	Total Alkalinity (SM 2320B)	LAB ID	CHLORINE RESIDUAL OR COMMENTS
2.27.09	10:45	✓			RLCL-1 (upper 10m)	4	X	X	X	X	X	X	X	X	X	X	X	1	
	11:03	✓			RLCL-1 (3m above bottom)	3	X	X	X	X	X	X	X	X	X	X	X	2	
	12:31	✓			RLCL-2 (upper 10m)	4	X	X	X	X	X	X	X	X	X	X	X	3	-3 6.
	12:38	✓			RLCL-2A (upper 10m)	4	X	X	X	X	X	X	X	X	X	X	X	4	*-4 Chlorop
	13:33	✓			RLCL-3 (Surface Layer)	4	X	X	X	X	X	X	X	X	X	X	X	5	broken dur
	12:45	✓			Equipment Blank	4	X	X	X	X	X	X	X	X	X	X	X	6	shipment

Chlorophyll & OP04 received past hold.

pH<2 pH<2

PRESERVED WITH: (HNO3) (H2SO4) NaOH ZnAce/NaOH HCL NaThio OTHER

SAMPLED BY (PRINT): Carlos Acu	SAMPLE DATE/TIME: 2-27-09	RELINQUISHED BY: Carlos Acu	DATE/TIME: 3-2-09 11:45
RECEIVED BY:	DATE/TIME:	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY (LAB): P. Ocl	DATE/TIME: 3-3-09 11:44	PROCESSED AND VERIFIED BY: P. Ocl	DATE/TIME: 3-3-09 11:44
LOGGED IN BY: P. Ocl	DATE/TIME: 3-3-09 11:44	CARRIER: _____	COOLER TEMPERATURE: 5.1 °c

INSTRUCTIONS, TERMS AND CONDITIONS ON BACK.

SAMPLE TYPE: 1 = ROUTINE, 2 = REPEAT, 3 = REPLACEMENT, 4 = SPECIAL 5 = RAW

Appendix H

HUMBOLDT BAY MUNICIPAL WATER DISTRICT

ORDINANCE NO. 19

AN ORDINANCE OF THE BOARD OF DIRECTORS OF HUMBOLDT BAY MUNICIPAL WATER DISTRICT ADOPTING A REGISTRATION AND INSPECTION PROGRAM FOR ALL WATERCRAFT AT RUTH LAKE

The Board of Directors of Humboldt Bay Municipal Water District do hereby ordain, find and determine as follows:

SECTION I. Findings:

Whereas, the Humboldt Bay Municipal Water District ("District" or "HBMWD") owns and operates a regional water system, including Ruth Lake, the primary function of which is to provide water to municipal and industrial users in Humboldt County; and

Whereas, Ruth Lake represents a continuing, important recreational feature of Trinity County; and

Whereas, maintaining and preserving the water quality in Ruth Lake is of critical importance for HBMWD's water supply; and

Whereas, the ability of HBMWD to fulfill its primary function and responsibility is threatened because of the real potential of the introduction of certain invasive animal species that are not native to the United States, California or to Ruth Lake and Mad River; and

Whereas, HBMWD's responsibility requires that it take action to avoid the introduction of dreissenid mussels; and

Whereas, Quagga Mussels are currently found in California in the Colorado River aqueduct and river system, several municipal reservoirs that are supplied with Colorado River water, and in other lakes and reservoirs in southern California; and

Whereas, Zebra Mussels are currently found in central California in San Justo Reservoir; and

Whereas scientific and technical evidence has shown that once a water body is infested with Quagga or Zebra Mussels, there are few possibilities for eradicating said species, and attempts to eradicate these species are both problematic and expensive; and

Whereas, scientific and technical evidence has shown that one of the most common means of transportation of these Mussel species from one water body, lake or reservoir to another is by the species being attached to, or included with, watercraft, boat trailers, hulls, anchors, vegetation caught on vehicles or outboard motors, and by the species being carried in water found in wet wells, built-in or removable bait tanks, associated plumbing, engine cooling systems, pumps and bilges; and

Whereas, dreissenid mussel infestation could result in conditions that would reduce Ruth Lake leaseholder and private property values; and

Whereas, dreissenid mussel infestation could adversely affect fishery and sport values at Ruth Lake and Mad River; and

Whereas, dreissenid mussels may attach themselves to almost all hard surfaces, causing extreme maintenance problems for the water delivery system, including intake structures, pipes, pump stations and other infrastructure, and can result in drastic impacts to lake water quality and the aquatic environment; and

Whereas, the HBMWD, based on its research, consultation and communication with other Federal, State and local agencies is aware of the critical and imminent situation facing the District due to the proximity of actual or potential dreissenid mussel infestations at water bodies throughout California, and the fact that potentially infected and unquarantined water bodies are within a reasonable driving distance to Ruth Lake; and

Whereas this Ordinance is authorized by numerous authorities, including but not limited to, Water Code Section 71590, Water Code Section 71660, Health & Safety Code Section 117105 and the general police powers of the District; and

Whereas, the Master Lease between the County of Trinity and HBMWD dated December 31, 1964 and assigned by the County of Trinity to the Ruth Lake Community Services District on July 20, 1966 provides that the lessee thereof:

> "[S]hall not nor shall any of them in any way interfere with Lessor's lake and dam, the water therein, or the beneficial enjoyment and use thereof or the quantity thereof. The parties hereto recognize that the waters impounded in said lake are intended for both human and industrial consumption and that every effort must be taken and maintained in order to preserve the purity and quantity thereof" and

Whereas,the Sublease entered into between the Ruth Lake Community Services District ("RLCSD") and its sublessees provides that:

> "Subleasee acknowledges that Ruth Lake is an artificial impoundment of water created primarily for municipal and industrial purposes and that any recreational use of the water is subordinate to such uses" and

Whereas, in compliance with Fish & Game Code Section 2302 (AB 2065), the HBMWD and RLCSD jointly formulated a "Prevention Plan for Quagga and Zebra Mussels at Ruth Lake" ("Prevention Plan"). The Prevention Plan was approved by the RLCSD on January 8, 2009 and by the HBMWD on January 15, 2009; and

Whereas, the HBMWD hereby restates and incorporates by reference the entire Prevention Plan as though stated in full herein, and as it may be amended from time to time.

SECTION II. Definitions.

For purposes of this Ordinance, the following words and phrases shall have the following meanings:

A. "All other watercraft" means the same as Category 2 Watercraft as defined in the Prevention Plan.

B. "Inspection Procedures" means the program of registration and inspection required by this Ordinance to ensure that all Watercraft launching onto Ruth Lake are in compliance with this Ordinance and the Prevention Plan.

C. "Inspector" means an individual who has received the necessary training approved by the State Department of Fish and Game or other agency to conduct inspections of Watercraft for the purpose of determining whether said vessels are in compliance with this Ordinance and the Prevention Plan.

D. "Launch Site" or "Launch Sites" shall be those locations approved for the Launch of Watercraft in this Ordinance or the Prevention Plan.

E. "Live bait" means any fish, or other organisms used in conjunction with fishing.

F. "Registration Sticker" means the sticker issued by an Inspector evidencing the fact that the vessel to which the sticker is affixed has satisfied the Inspection Procedures.

G. "Sworn Affidavit" or "Affidavit" means any document submitted by any person

signed under penalty of perjury attesting to the truth of the statements contained therein.

H. "Watercraft" means any boat, trailer, kayak, raft, jet ski, float plane, or other device capable of being launched onto Ruth Lake. "Watercraft" includes all motorized and non-motorized Watercraft.

I. "Watercraft Resident to Ruth Lake" means the same as Category 1 Watercraft as defined in the Prevention Plan.

SECTION III. Applicability.

This Ordinance shall be applicable to any Watercraft intending to launch onto Ruth Lake.

SECTION IV. Registration Stickers.

A. Each Watercraft must be affixed with a Registration Sticker issued by an Inspector showing compliance with the Inspection Procedures prior to launching that Watercraft onto Ruth Lake.

B. Each Registration Sticker shall be valid for the time period and conditions as set forth in the Prevention Plan.

SECTION V. Inspection and Registration.

A. Inspection Procedures are required on all Watercraft to be launched onto Ruth Lake, except for :

1. Watercraft approved in Category 1 which have been issued a Yellow Inspection Sticker for the current year, and
2. Watercraft in Category 2 which previously passed Inspection Procedures and have been issued a Red Inspection Sticker for the current year and have either (i) an intact tamper-proof band issued by an Inspector which ties the Watercraft to the trailer, or (ii) a valid duration pass issued by an Inspector.

B. Owners of Watercraft Resident to Ruth Lake (Category 1) as defined in the Prevention Plan shall register their Watercraft and submit a sworn affidavit in a form to be provided by the Inspector. Only Category 1 Watercraft that exhibit a valid Registration Sticker shall be allowed to launch onto Ruth Lake. In the event of an occurrence necessitating Inspection

Procedures as set forth in the Prevention Plan, that Watercraft then shall be subject to the Inspection Procedures as set forth in the Prevention Plan.

C. Owners of all Other Watercraft (Category 2) shall submit a sworn affidavit in a form to be provided by the Inspector and their Watercraft shall undergo an inspection by the Inspector. Only Watercraft that pass the Inspection Procedures and exhibit a valid Registration Sticker shall be allowed to launch onto Ruth Lake.

D. Any Watercraft owner/operator who desires to participate in the electronic card key entry system shall submit an additional sworn affidavit and pay the fee to be set by RLCSD

E. A Watercraft owner or operator may refuse to consent to the Inspection Procedures. If the Watercraft owner or operator refuses to consent to Inspection Procedures, or refuses to comply with a request of an Inspector, that Watercraft shall not be allowed to launch onto Ruth Lake and shall be in violation of this Ordinance if he/she should nonetheless attempt to do so.

F. Said Inspection Procedures shall consist of, among other items, a verification by the Inspector that the Watercraft is clean, drained and dry and a thorough search of the exterior and interior of the Watercraft, including but not limited to bilge pumps, motors, live wells, bait wells, ballast tanks, bladders and all areas are free of standing water.

G. If for any reason in the judgment of the Inspector, the Watercraft does not pass Inspection Procedures, that Watercraft shall not be allowed on the waters of Ruth Lake. The Watercraft will be ordered into quarantine by the Inspector for the period of time specified in the Prevention Plan.

H. If, in the judgment of the Inspector, a Watercraft passes Inspection Procedures, the Inspector shall affix a Registration Sticker on the Watercraft which signifies that the Watercraft may be launched onto Ruth Lake in accordance with the provisions of this Ordinance and the Prevention Plan.

I. In the event a Watercraft with a Yellow Registration Sticker or a Red Registration Sticker wishes to leave the Ruth Lake area it shall be reinspected upon arrival unless it has an intact tamperproof band connecting the Watercraft to the trailer.

SECTION VI. Launch Sites.

A. Motorized Watercraft shall not be permitted to launch at Hobart Creek

Campground and Hetton Cove, or at any other location at Ruth Lake, except as set forth below.

B. Motorized Watercraft displaying valid Registration Stickers shall be allowed to launch only at three approved locations. These locations are:

1. Old Ruth Day-Use Area (Category 1 only, with a valid Yellow Registration Sticker).
2. Ruth Rec Campground (All valid stickers, with a card key).
3. RLCSD Marina (All valid stickers, with a card key).

C. Launch of motorized Watercraft at any other location shall be unlawful and a violation of this Ordinance and the Prevention Plan.

D. Non-motorized Watercraft may launch at any location if displaying a valid Registration Sticker, and if required by the Prevention Plan, a duration pass.

SECTION VII. Fees.

Fees for all official activities covered by this Ordinance and the Prevention Plan shall be as established from time to time by RLCSD.

SECTION VIII. Live Bait.

Disposing of Live Bait into Ruth Lake is prohibited. It shall be unlawful to dispose of any live bait and/or any liquid containing live bait or any liquid which previously contained live bait into Ruth Lake.

SECTION IX. Penalties.

A. Any person violating any provision of this Ordinance shall be guilty of an infraction or misdemeanor as hereinafter specified. Such individual shall be deemed guilty of a separate offense for each launch in a water body into Ruth Lake.

B. Any individual convicted of a violation of this Ordinance shall be:

1. Guilty of an infraction and punished by a fine of one hundred dollars ($100.00) for the first offense.
2. Guilty of an infraction and punished by a fine of not less than two hundred dollars ($200.00) for the second offense;
3. The third and subsequent offenses shall constitute a misdemeanor and

shall be punishable by a fine of not less than five hundred dollars ($500.00) but not to exceed one thousand dollars ($1,000.00) and/or up to six months in the county jail or both.

C. Notwithstanding subparagraphs 1 and 2 above, the first or second offense may be charged and prosecuted as misdemeanor.

D. Notwithstanding subparagraphs 1 and 2 above, the following offenses are considered to be egregious and may be punished as a misdemeanor and/or separately subject the offender to permanently losing the privilege of coming onto HBMWD property at Ruth Lake upon the first offense:

1. Giving out any combination or key to any unauthorized person at Old Ruth Day-Use area.

2. Moving or breaching any barrier without authorization.

3. Giving out any card key/duration pass to any unauthorized person.

4. Avoiding Inspection Procedures by, among other things, launching after hours when no Inspector is present.

5. Submitting a false, incomplete or misleading statement on an Affidavit.

6. Making a false, incomplete or misleading statement to any Inspector.

7. Failing to leave the property of HBMWD when ordered to do so by an Inspector or law enforcement officer.

E Any person may be denied access to Ruth Lake for such time and under such conditions as determined by the General Manager of HBMWD. Any such person may appeal this determination by appeal to the Board of Directors of HBMWD at the next available regularly scheduled public Board meeting.

F. A Watercraft unlawfully launched into Ruth Lake may be subject to impound if, pursuant to a misdemeanor arrest for violation of this Ordinance, an Inspector or law enforcement officer determines that circumstances necessitate law enforcement custody of the Watercraft.

G. Payment of any fine or penalty herein shall not relieve any individual from the responsibility of correcting the violations as found by the Inspector or law enforcement officer.

H. Any person found not in compliance with this Ordinance is subject to citation, immediately shall be ordered off the property of the HBMWD, and shall be subject to any other

legal action as deemed necessary by the HBMWD.

SECTION X. Public Nuisance Declaration.

Any violation of this Ordinance is hereby declared to be unlawful and a public nuisance and may be abated by any law enforcement personnel or Inspector or any other person authorized by the Humboldt Bay Municipal Water District, irrespective of any other remedy provided in this Ordinance.

SECTION XI. California Environmental Quality Act Compliance.

A. This Ordinance is not a "project" because the California Environmental Quality Act (CEQA) defines a project as "an activity which may cause either a direct physical change in the environment or a reasonably foreseeable indirect physical change in the environment" (California Public Resources Code Section 21065); and

B. Even if this Ordinance is determined to be a "project" this Ordinance would be categorically exempt from CEQA under CEQA Guidelines Section 15307 as a Class 7 Categorical Exemption which "consists of actions taken by regulatory agencies as authorized by State law or local ordinance to assure the maintenance, restoration or enhancement of a natural resource where the regulatory process involves procedures for protection of the environment," and a Class 8 Categorical Exemption, CEQA Guidelines Section 15308, which exempts "actions taken by regulatory agencies, as authorized by State or local ordinance, to assure the maintenance, restoration, enhancement or protection of the environment where the regulatory process involves procedures for protection of the environment."

SECTION XII: Effective Date:

This Ordinance shall take effect on the 12th of July, 2009.

PASSED AND ADOPTED THIS 11th day of June, 2009, by the following vote:

Director Sopoci-Belknap voted: Aye
Director Rupp voted: Aye
Director Laird voted: Aye

Director Hecathorn voted: Aye

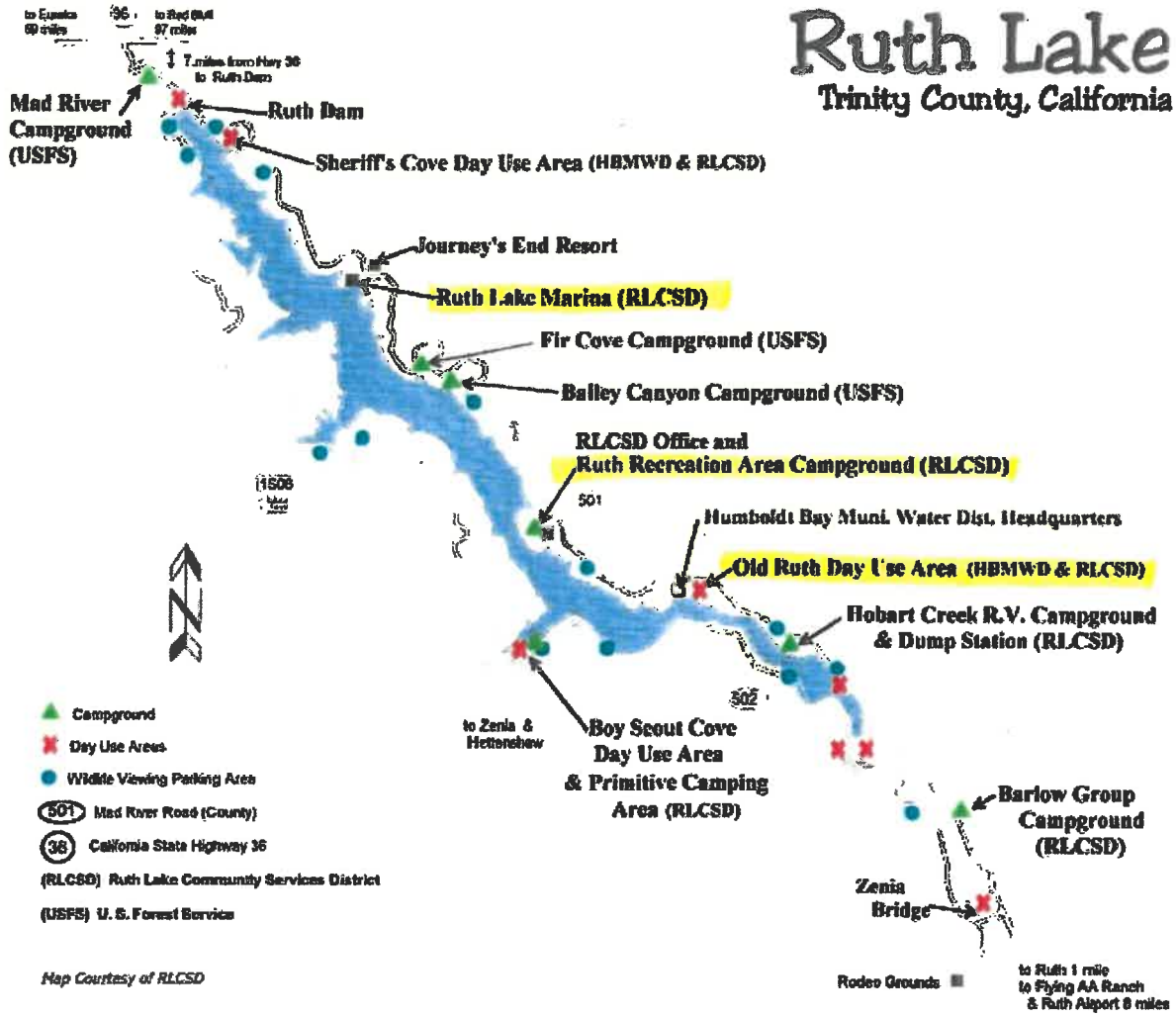
Director Prucha voted: Aye

ATTEST:

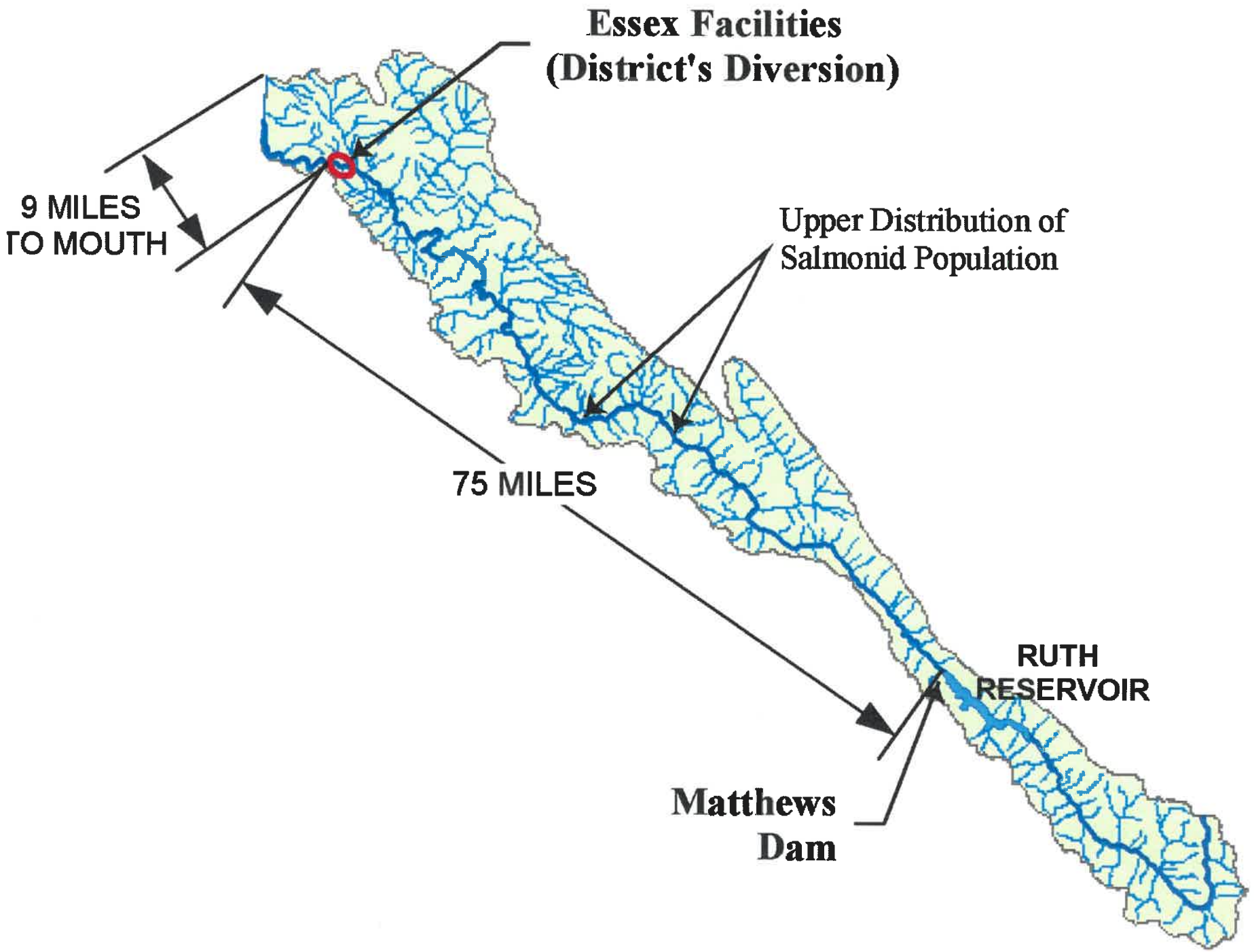
Barbara Hecathorn

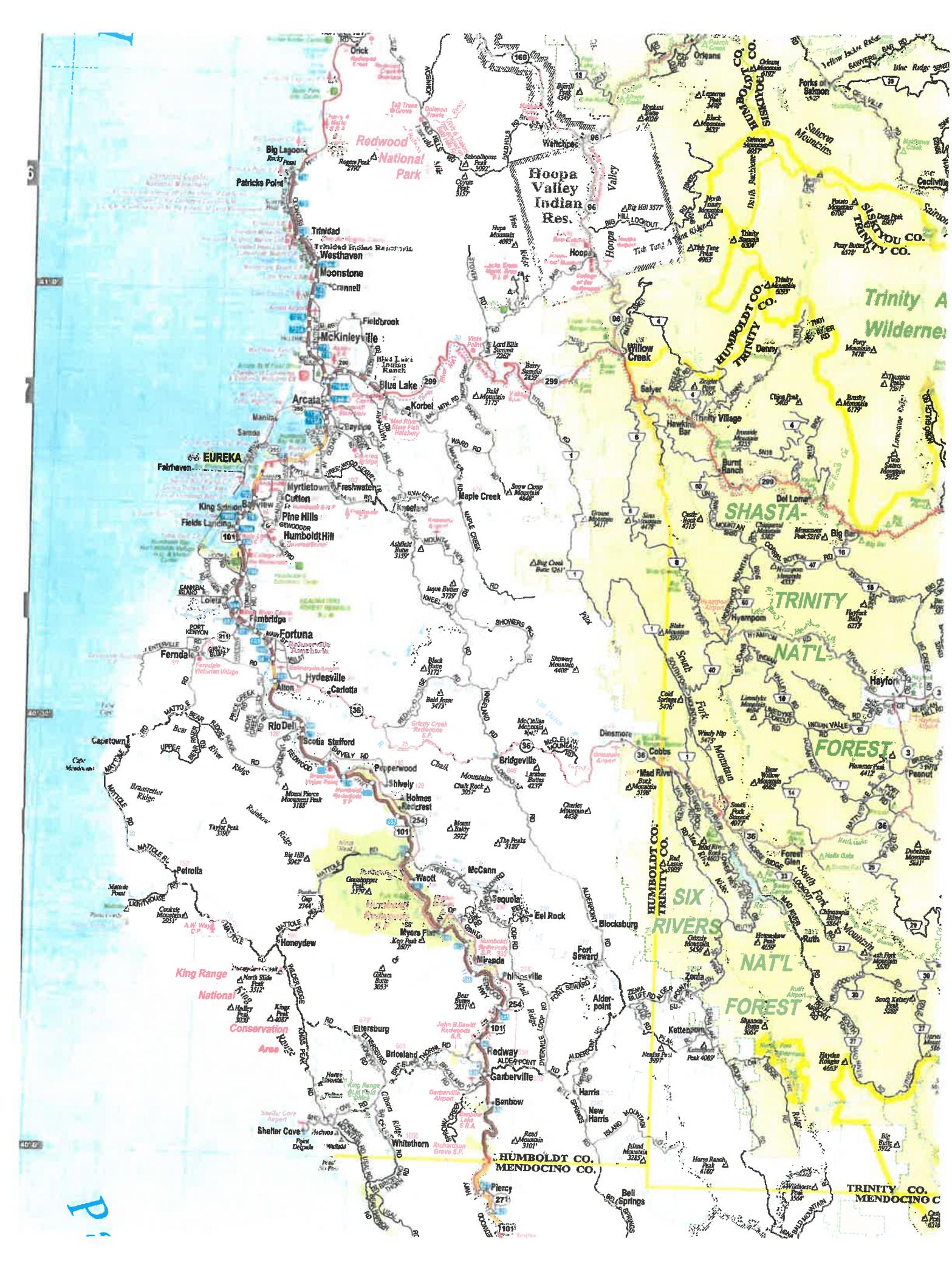
Secretary/Treasurer, HBMWD

Appendix I



= Quagga/Zebra Mussel Inspection sites


Essex Facilities
(District's Diversion)
9 MILES
TO MOUTH
Upper Distribution of
Salmonid Population
75 MILES
RUTH
RESERVOIR
Matthews
Dam


Orick
Redwood National Park
Big Lagoon
Patricks Point
Trinidad
Trinidad Indian Reservation
Westhaven
Moonstone
Crannell
Fieldbrook
McKinleyville
Blue Lake
Arcata
Korbel
Bayside
Samoa
EUREKA
Fairhaven
Myrtletown
Freshwater
Cutten
Eureka
King Salmon
Bayview
Pine Hills
Fields Landing
Humboldt Hill
Loleta
Fernbridge
Fortuna
Ferndale
Hydesville
Alton
Carlotta
Rio Dell
Scotia
Stafford
Capetown
Pepperwood
Shively
Holmes
Redcrest
Bridgeville
Petrolia
McCann
Weott
Sequoia
Eel Rock
Myers Flat
Honeydew
Miranda
Phillipsville
Fort Seward
Blocksburg
Alderpoint
King Range National Conservation Area
Ettersburg
Briceland
Redway
Garberville
Benbow
Harris
New Harris
Shelter Cove
Whitethorn
Pierce
Bell Springs
Island Mountain
Hoopa Valley Indian Res.
Hoopa
Willow Creek
Salyer
Hawkins Bar
Trinity Village
Burnt Ranch
Denny
Del Loma
Big Bar
Hyampom
Hayfork
Dinsmore
Cobbs
Mad River
Forest Glen
Ruth
Zenia
Kettenpom
Peanut
Orleans
Forks of Salmon
Cecilville
Salmon Mountains
Trinity Alps Wilderness
HUMBOLDT CO.
TRINITY CO.
SISKIYOU CO.
SHASTA-TRINITY NAT'L FOREST
SIX RIVERS NAT'L FOREST
MENDOCINO CO.