DIAGNOSING SOURCES OF TOXICITY IN PULP AND PAPER MILL EFFLUENT:

A CASE STUDY OF THE PINE FALLS PAPER MILL WASTEWATER TREATMENT FACILITY

by

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A Thesis submitted to the Faculty of Graduate Studies of The University of Manitoba
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Abstract

All pulp and paper mills in Canada are required to conduct regular toxicity testing under the federal Pulp and Paper Effluent Regulations. According to the regulations, toxicity testing must be conducted weekly for *Daphnia magna* (daphnia) and monthly for *Oncorhynchus mykiss* (rainbow trout). A test failure is designated by greater than 50% mortality in daphnia or trout in 100% effluent concentration for a 48 or 96 hour period; respectively. Diagnosing the specific cause of toxicity is a difficult process, as there are often many contributing factors. During this study, previous toxicity events (January 2002 to December 2006) were examined using a three phase methodology to provide a basis for investigations of future toxicity events. The three phase methodology included: graphical representation of the primary growth parameters versus toxicity data to identify trends, multiple regression analyses to identify correlations between these variables, and a review of mill and wastewater treatment plant operating records. During this period, toxicity episodes were attributed to various sources; specifically: low dissolved oxygen, high temperature, nitrogen deficiency, denitrification, high total suspended solids, dramatic swings in BOD loading, high hydraulic flows, chemical releases from the mill, and septic material entering the system during mill shutdowns and while bringing the equalization (EQ) basin into service. In conclusion, the three phase methology was developed to assist in the investigation of future toxicity events at the Pine Falls facility. The methodology will be added to the wastewater treatment facility operating procedures.

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1.0 INTRODUCTION

1.1 Statement of the Problem

Under the federal Pulp and Paper Effluent Regulations, mills in Canada are required to treat wastewaster prior to discharge to receiving waters and conduct regular toxicity testing, since January 1996, on final mill effluent (Kovacs, 2003). *Daphnia magna* (daphnia) and *Oncorhynchus mykiss* (rainbow trout) are the selected toxicity test organisms. Compliance with the regulations requires a 50 percent survival rate of daphnia and rainbow trout exposed to 100 % effluent for a 48 and 96 hour period; respectively. Daphnia toxicity testing, which acts as a preliminary indicator of toxicity issues, is conducted on a weekly basis and rainbow trout testing is conducted on a monthly basis. In the event of greater than 50% mortality in either species, a trout toxicity test is required. Following the event of a trout toxicity failure (greater than 50% mortality exposed to 100% effluent for a 96 hour period), three more consecutive weekly passing trout tests must be conducted, as defined by the Canadian Pulp and Paper Effluent Regulations.. Requirements to pass these tests are the same as the monthly trout toxicity tests. Identifying the cause of toxicity is necessary to rapidly stabilize a wastewater treatment system and prevent future toxicity issues. However, analyzing the cause of toxicity is a difficult process, as there are often many factors contributing to a failure within a system. Consideration must also be given to the combined effects of these factors, and the health of the treatment plant microbiology at the onset of toxicity. If the health of the treatment plant microbiology is compromised at the onset of a toxicity event, the ability of the system to survive a toxic event and effectively treat wastewater decreases. This may allow wastewater to bypass the system without adequate treatment.

1.2 Objectives of the Study

Although episodes of toxicity in mill effluent have declined at mills operating in Canada, approximately 10 to 25% of mills experience one or more toxicity episodes per year (Kovacs, 2003). Despite this fact, there is limited research available in regards to diagnosing the causes of toxicity in mill effluent. The objective of this study is to produce guidelines to assist wastewater operators at the Pine Falls Paper Mill in rapidly identifying causes of toxicity in the future, by reviewing conditions surrounding previous toxicity episodes at the Pine Falls site; including, mill operating conditions and toxicological properties.

1.3 Background

1.3.1 Mill Operations

The Pine Falls paper mill wastewater treatment facility was examined as a case study in relation to diagnosing the causes of mill effluent toxicity. The Pine Falls paper mill is located in the town of Pine Falls on the Winnipeg River (Appendix A, Figure 1). The mill was constructed in 1925, and has approximately 400 employees. The thermomechanical paper mill produces an average of 500 tonnes of newsprint daily from softwood furnish (spruce and pine). Approximately 25,000 m^3/day (0.28 m^3/s) process effluent is treated at the on-site wastewater treatment plant (WWTP) and is released to the Winnipeg River via a bank outfall. The Winnipeg River originates in the Lake of the Woods in Ontario, flowing 320 km to Lake Winnipeg in Manitoba. The mean annual flow of the Winnipeg River is 695 m^3/s, with peaks of 800 m^3/s in June and July, and low flows of 500 m^3/s in the fall season (Luoma, 2004).

Globally, the activated sludge treatment system is the most common form of secondary treatment (Jenkins, 1993). Tembec Pine Falls operation uses an activated sludge treatment system, as it is the most effective and cost efficient method to treat wastewater and ensure compliance with regulations. To understand the operation of the wastewater treatment facility at Tembec Pine Falls, it is necessary to examine the three principle stages of wastewater treatment: preliminary and primary, secondary (biological), and sludge treatment, as illustrated using a design model (Appendix A, Figure 2).

1.3.2 Preliminary Treatment

Preliminary treatment removes coarser material from incoming effluent. The bar screen is a device consisting of a series of parallel bars uniformly spaced, which allow wastewater to flow through while retaining large solids and debris. The bar screen filters the Pine Falls facility influent (maximum design of 30,000 m^3/day) on a continuous basis and is mechanically cleaned.

1.3.3 Primary Treatment

The primary basin is a circular, gravity clarifier, which collects and removes material from the wastewater that settles or floats (Appendix A, Figure 3). Prior to entering the primary basin, the wastewater enters an agitated tank in the neutralization system where a lime slurry is added to raise the pH of the effluent to a range of 8 to 10.

This range accounts for pH depression to neutral that occurs in the primary clarifier. The wastewater then enters the primary clarifier via a center well. The velocity of the wastewater is reduced as it enters the clarifier, allowing heavier solids (primary sludge) to settle on the bottom. A collector arm circles the bottom of the basin, collecting the primary sludge, which is pumped to a sludge blend chest. Lighter solids float to the top of the clarifier where a skimmer rotates and collects the floating solids to be sent to the sludge blend chest (Marshall, 1999). From the blend chest, the sludge is dewatered as described in Section 1.4.7. After primary treatment, the effluent only contains suspended solids and is referred to as primary effluent.

1.3.4 Secondary Treatment

The primary effluent contains soluble or suspended organic material, which is not removed in the primary process. Biological oxygen demand (BOD) is the measurement of oxygen used by microorganisms in the oxidation of organic matter. BOD measurements are used to measure the amount organic matter in wastewater (Kerri, 2004). For the purpose of this study, the term BOD will be used to refer to the amount of organic material entering the WWTP from the mill process. The purpose of secondary treatment is to biologically convert toxic effluent to a non-toxic form and suspended material to a solid form which will settle for removal as sludge (Klopping, 1995). During secondary treatment, microorganisms within the system consume waste material in the process of respiration. The microorganisms consuming the waste consist of a wide variety of bacteria; including, genera *Pseudomonas, Achromobacter, Flavobacteriuum, Alcaligenes, Arthrobacter, Citomonas, and Zoogloea* (Jenkins et al., 1993). Bacteria may

be categorized according to the oxygen required for growth aerobic, anaerobic, and faculative. Aerobic organisms survive in the presence of oxygen, anaerobic in the absence of dissolved oxygen, and faculative organisms can survive in an aerobic or anaerobic environment (Klopping, 1995). The presence of facultative bacteria increases the resilience of the system to stressors. The wastewater treatment facility at the Pine Falls paper mill is an activated sludge system where the bacteria consume contaminants in an aerobic environment.

Wastewater treatment occurs when microorganisms are introduced to the primary effluent in the presence of nutrients and oxygen in the aeration basin. Although small amounts of nutrients are present in the primary effluent, nitrogen and phosphorous are added in the aeration basin to assist in respiration. The secondary treatment system at the Pine Falls wastewater treatment facility consists of an aeration basin, secondary clarifier and a selector.

1.3.5 Aeration Basin

During summer months, the primary effluent enters an equalization basin prior to entering the aeration basin to lower the temperature of the incoming effluent to a range conducive to the survival of the bacteria. The majority of the bacteria are mesophylic, thriving in a temperature of approximately 20° to 38° C (Klopping, 1995). The equalization (EQ) basin is a rectangular basin which employs spray coolers and mixers to cool the effluent (Appendix A, Figure 4). Prior to 2004, effluent remained stagnant in the EQ basin throughout the winter months. Prior to the basin being brought on-line in the

spring, the stagnant effluent was first treated with hypochlorite and aerated with spray coolers, to reduce septic material and discourage excessive growth of filaments. In 2004, the operation was changed to empty and clean the EQ basin in the fall season, preventing the potential for septic material entering the system when brought on-line in the following spring. In addition, the bottom of the basin was originally lined with rip rap. In 2005, it was relined with cement to decrease surface area for septic material to accumulate.

Depending on the season, the primary effluent leaves the EQ basin or primary clarifier and enters the aeration basin. The aeration basin is a large circular tank where the microorganisms biodegrade the organic wastes. Nitrogen and phosphorous is added in the aeration basin, which is mixed and aerated by four recirculation pumps and four air blowers. This system disperses air evenly into the tank and keeps all particles in suspension. The metabolizing microorganisms at the Pine Falls treatment plant are mesophyllic, aerobic, single celled, floc forming bacteria (Klopping, 1995).

1.3.5.1 The Biomass

The floc formers, the non-floc formers, and the filamentous bacteria in the wastewater treatment system constitute the biomass. In addition, protozoa, metazoa, and other organic particles are considered part of the biomass. Microscopic examinations are conducted on a regular basis to determine the health of the biomass and indicate potential toxicity issues. The biomass is evaluated for three different components: floc formation, the presence of filamentous bacteria and higher life forms (i.e. protozoa, metazoa).

1.3.5.2 Floc Formation

Healthy flocs are large and irregular in shape, with higher density and an abundance of different bacteria (Appendix A, Figure 5). Pin flocs are smaller flocs of <50 um in diameter (Marshall, 1999). Pin flocs have a tendency to wash out of the secondary clarifier, causing higher turbidity in the final effluent. During microscopic examinations by the operators, the general size and shape of flocs are noted. Floc size is evaluated by diameter, ranging from small (<150 um), medium (150 um to 500 um), to large (>500 um) (Jenkins, 1993). Operators record the general floc shape, including whether round, irregular, compact, or diffuse (Jenkins, 1993).

1.3.5.3 Filamentous Bacteria

Depending on characteristics of the effluent, filaments may thrive and out-compete floc forming bacteria. Due to a greater, elongated surface area, an abundance of filaments in the biomass will decrease compaction of sludge and result in poor settleability. However, some filaments are desirable. An appropriate inventory of filaments will act as a framework on which flocs can form, resulting in a strong, irregular shaped floc (Jenkins et. al. , 1993). This will prevent pin flocs and higher turbidity in the effluent. During microscopic examination, the quantity of filaments and the effect on the floc structure are noted. Typically, one to five filaments per floc are observed in effluent at the Pine Falls facility. If the numbers of filaments are having a negative effect on sludge settling, the species of filament present will be identified to determine the likely

cause of the filament bloom.

1.3.5.4 Protozoa

In addition to floc forming bacteria and filamentous bacteria, protozoa and other higher life forms are typically present in the aeration basin, representing approximately 5% of the microbial population (Jenkins et al., 1993). This group is represented by approximately 200 species and is classified to six basic groups based on motility: amoeba, flagellates, free-swimming ciliates, stalked ciliates, rotifers, and higher invertebrates (i. e. nematodes) (Marshall, 1995). Protozoans and other higher life forms remove non-floc forming bacteria from the effluent, and are a good indicator of a healthy treatment system. The absence of higher life forms may indicate the onset of a toxic event, and initiate an investigation to identify abnormal operating parameters or other stressors. Common stressors include: low dissolved oxygen, pH outside of a neutral range, or high temperatures. During the microscopic examinations, the presence, quantity, and type of organism is noted. Typically one to five protozoa per floc are observed in effluent at the Pine Falls facility.

1.3.6 Secondary Clarifier

The secondary clarifier is a circular basin similar to that of the primary basin (Appendix A, Figure 6). The effluent flows from the aeration basin to the secondary clarifier where the biomass settles from the wastewater on the floor of the basin in the form of a sludge blanket (Marshall, 1999). Return activated sludge (RAS) is collected

from the sludge blanket and is returned to the aeration basin to maintain an inventory of biomass. At the Pine Falls facility, the RAS also enters an aerobic selector basin, where it is aerated prior to entering the aeration basin. The remaining sludge is removed from the secondary clarifier by pumps and sent to the sludge blend chest for dewatering as described in Section 1.3.8. This excess sludge is referred to as waste activated sludge (WAS). The aeration basin creates floating sludge and foam, which flows to the secondary clarifier where it can accumulate on the surface. The floating material is collected via two surface skimmers and sent to the sludge blend chest with the primary sludge and WAS. From the secondary clarifier, the treated effluent enters the Winnipeg River.

1.3.7 Selector

The aerated selector is a circular basin that was originally designed as an intermediate step between the primary clarifier and the aeration basin to introduce the microbiology to the BOD load. The selector was intended to allow operators to accurately control the food to mass (F/M) ratio during treatment by controlling the retention time in the basin. However, due to the size of the selector, the retention time was too long to create a favourable F/M ratio. An appropriate retention time for the Pine Falls selector is approximately 20 minutes, where the actual selector retention time is 90 minutes. Consequently, the selector could not be used for the intended purpose. However, it is currently used to increase the retention time of secondary treatment. Return activated sludge is sent to the selector from the secondary clarifier to allow the biology additional time to consume the BOD. This has proven an effective method to

improve treatment.

1.3.8 Sludge Treatment

By removing excess water, liquid sludge is converted into a solid material for disposal. Sludge waste from the primary and secondary clarifiers is blended in the sludge blend chest with sludge from other mill processes to create a homogenous mixture. Polymer is added to the mixed sludge to assist in the release of water and to form a mass of solids (Marshall, 1999). Polymers are compounds of high molecular weight, comprised of a large number of simpler molecules. The blended sludge is passed over a gravity table to separate water that was released with the addition of polymer. The gravity table is a moving belt which allows the released water to flow through a porous fabric (Marshall, 1999). It is further dewatered by passing through a belt press. Sludge enters the belt press and is manipulated between two fabrics and a set of rollers under pressure. In the final stage of dewatering, sludge is released to the screw press. The screw press operates with pressure and will typically yield sludge of approximately 35 to 40 percent solids. From the screw press, the sludge blower forces the dewatered sludge through a pipe to the mill boiler. The sludge is incinerated and used as an energy source, replacing the use of coal.

2.0 LITERATURE REVIEW

Klopping et al (1995), Kerri et al (2004), and Marshall (1995) provide comprehensive training manuals designed to assist wastewater treatment operators in the operation of activated sludge treatment systems. The manuals examine all aspects of the operation; including, the microbiology, growth parameters, sludge wasting, and WWTP design.

Sithole and Milanova (1996) conducted a survey involving 88 pulp and paper mills across Canada in March 1992 in regards to chemical additive use in the pulp and paper industry. The objective of the study was to develop a database that provides toxicity information on additives commonly recognized in the industry. For the purpose of the survey, participating mills provided information regarding chemical additive use at each site. Information included the name and supplier of the product, the rate and points of addition in the process, and the equipment used to apply the additive. Additives were separated into categories; including, additives to improve basic sheet properties, process aids for wet end operations, fillers and pigments, microbiocides, detergents, cleaner and dispersants, dyes, colored pigments and related additives, additives for special effects, and coatings. The active ingredients were identified in the each of the additives. Toxicity information was collected from material safety data sheets and product technical data sheets for each additive, and was complied in the database. Thirty-three mills responded, providing an opportunity to build a database of more common chemicals found in the industry.

Kovacs et al. (2002a) conducted a survey involving 73 pulp and paper mills requesting information regarding toxicity episodes for the year 2000. Participants provided the total number of *Daphnia magna* (daphnia) and *Oncorhynchus mykiss* (rainbow trout) tests conducted during the year, and the number of tests that failed regulatory requirements. In addition, cases of lower mortality rates (10% to 50%) were examined. Mills were requested to include the cause of toxicity for each event. The second section of the questionnaire requested information regarding water usage; including, whether cooling waters were discharged separately from effluent. Participants were asked to indicate whether they participated in a water reduction program in 2000 and if a corresponding increase in mortality was observed. Responding mills were categorized by the process type (i.e. mechanical pulping, groundwood), and the type of secondary treatment (i.e. activated sludge, aerated lagoons). Results were as follows:

- Ninety percent of mills consistently met rainbow trout toxicity testing in 2000. Of the nine mills that experienced at least one toxicity episode, three provided explanations. The three mills provided the following potential causes of toxicity: malfunctions in the biotreatment system, a mill upset, and hydrogen sulphide.
- Seventy-five percent of mills consistently met *Daphnia magna* toxicity testing in 2000. Three of the 19 mills provided identified polymers as the causative agent. One mill indicated additional causes of toxicity; including, inadequate biotreatment due to high effluent flows, low dissolved oxygen levels and contamination by a cleaning product.
- There was no trend established between water use and toxicity events.

- Greater than 50% of mills experienced some degree of mortality (10% to 50%) of Trout or Daphnia, indicating a potential for toxicity test failure.

Kovacs et al (2002b) and Kovacs et al (2004) summarize the highlights of the 29th Annual Aquatic Toxicity Workshop and the 31st Annual Aquatic Toxicity Workshop. Ammonia toxicity was an area of focus of the reports. Kovacs et al discuss pH increases observed during the 96-hour toxicity test period. The increase in pH is a result of the release of CO^2 during aeration of the trout effluent sample. The increase in pH corresponds with an increase in the proportion of un-ionized ammonia in effluent. Un-ionized ammonia is more toxic than the un-ionized form, and may result in trout toxicity. An excess of un-ionized ammonia may accumulate in trout, increasing body pH and altering metabolism (Oram, 2004). It is difficult to determine whether mortality would be caused by the increase in un-ionized ammonia, increase in pH, or the toxic effluent. As municipal effluents contain higher concentrations of ammonia, pH is controlled for these toxicity tests.

According to Kovacs et al (2003a), 10% to 25 % of mills in Canada experience at least one yearly failure of Rainbow trout or *Daphnia magna* toxicity testing. Kovacs et al reviewed 84 toxicity events occurring at 32 pulp and paper mills in Canada. Investigations began with review of toxicity test reports and other relevant chemical analyses, interviews with mill staff, and site visits in some cases. Based on this information, a hypothesis regarding the cause of toxicity was developed. An effluent sample was then collected and sent to the Paprican lab, to verify the hypothesis. Trout

toxicity testing at the lab involved three fish, as opposed to the regulatory standard of 10 fish. This was done to make manipulations more manageable, however, the results were comparable to the regulatory trout tests in over 90% of the cases (Kovacs, 2003a). Diagnostic tests from the U.S EPA toxicity identification evaluation (TIE) protocols were used to verify hypotheses (Kovacs, 2003a). Forty-nine of the episodes involved only trout, 29 involved only Daphnia, and 6 involved both species. Results were as follows:

- In approximately 20% of the cases of trout toxicity (11 of 49), the Paprican sample did not show toxicity. It was assumed that the previously noted toxicity was a one-time event or a laboratory related problem (Kovacs, 2003a). The cause of toxicity in the remaining samples was identified 60% of the time (22 of 38). The cause of trout toxicity in most cases (18 of 22) was poor biotreatment operating conditions or performance (i.e. ammonia, carbon dioxide, resin acids). In the remaining 4 samples, the cause of toxicity was determined to be related to non-biotreatment factors, such as metals and polymeric formulations.
- In approximately 40% of the cases of daphnia toxicity (13 of 29), the Paprican sample did not show toxicity. The cause of toxicity in the remaining samples was identified 90% of the time (14 of 16). In all of the cases of daphnia toxicity, the cause of toxicity was the misuse of polymeric formulations.
- In two of the six samples involving both trout and daphnia toxicity, the Paprican sample did not show toxicity. The cause of toxicity in the remaining samples was identified. The causes of toxicity were due to more than one compound (i.e. volatile carbon dioxide and total reduced sulphur compounds), stearic acid (as a result of a large amount cleaning product), and high resin acid concentration.

The use of toxicity identification evaluation (TIE) approach in identifying the causes of toxicity at the Pine Falls facility was previously considered. However, it was determined not feasible due to budgetary constraints. In addition, toxicity events typically do not persist at the Pine Falls facility. As there is typically a delay of five days in receiving sample results, the toxicity episode has usually passed through the wastewater treatment system before notification of a test failure is received.

Kovacs et al (2003b) developed a two-phase methodology to diagnose the causes of mill effluent toxicity. The first phase involves forming a hypothesis regarding the cause of toxicity. A summary of eight common causes of toxicity were provided by Kovacs et al including, resin acids, ammonia, nitrate, carbon dioxide, trace metals (copper and manganese), polymeric formulations, dimethyl sulphide, and non effluent related factors. A criteria for selection, based upon toxicological properties (i.e. pH, hardness), toxicity test observations (i.e. time of mortality, species sensitivity), and mill operating conditions, were provided to assist in identification of the cause of toxicity. The second phase of the process involves diagnostic testing, where effluent samples were manipulated to remove/reduce effluent components or alter their chemical structure. The hypothesized source of the toxic event is confirmed with the reduction of toxicity during these tests.

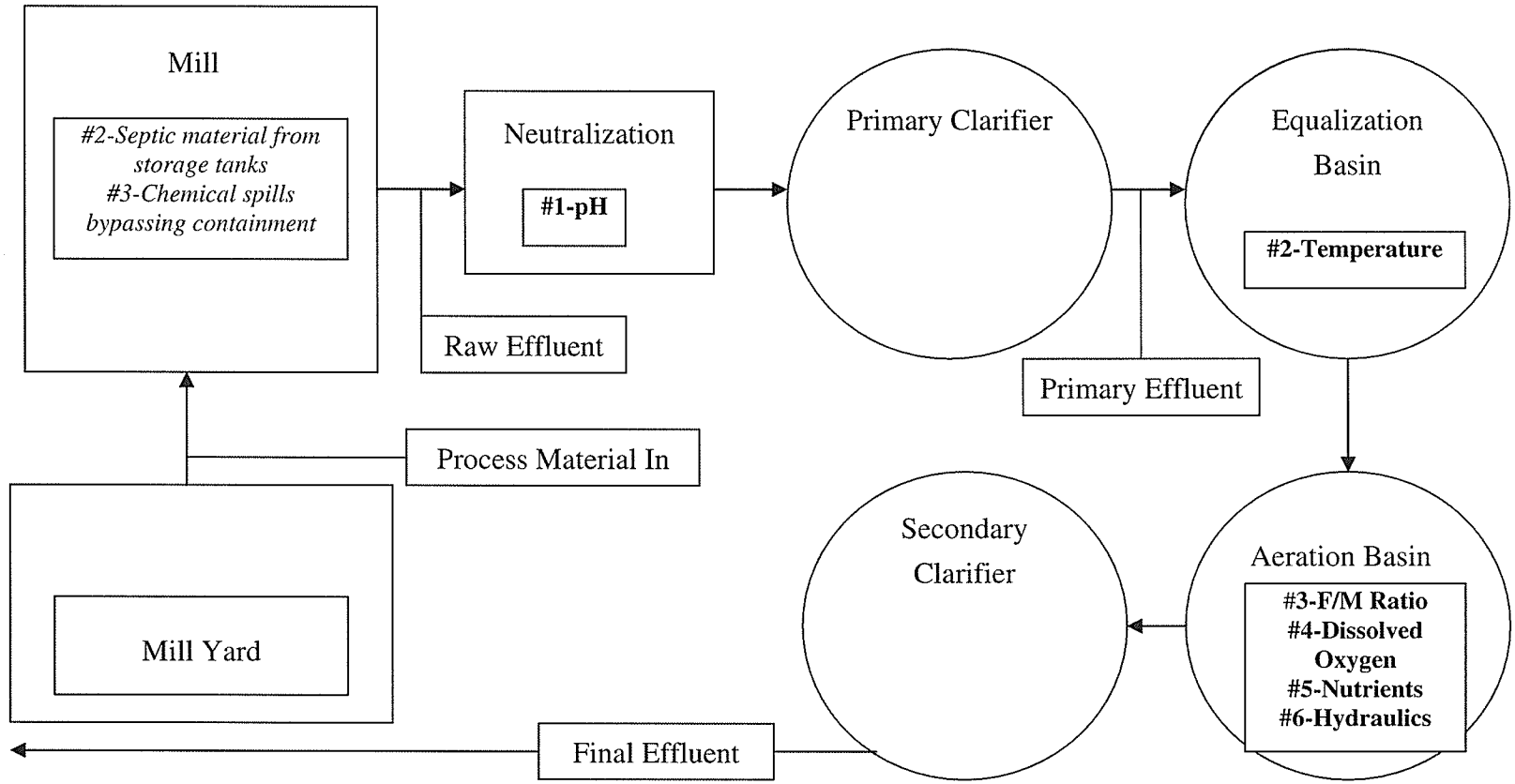
3.0 METHODS

For the purpose of this study, the factors contributing to toxic events that occurred at the Pine Falls wastewater treatment facility have been identified as the independent variables, and episodes of mill effluent toxicity test failures has been identified as the dependent variable. To commence the study, toxicity events from January 2002 to December 2006 will be examined. For the purpose of this study, the term toxicity event or episode refer to occasions where sampled final effluent caused mortality in daphnia or trout. It does not describe the status of the WWTP. Major operational changes occurred in 2001, making data prior to 2002 not applicable to current operations. As the purpose of this study is to assist in the identification of future toxicity event, only data reflecting current operations will be analyzed. The toxicity episodes will be categorized by the affected species and the degree of toxicity. In addition, toxicity test observations such as percent of mortality and other symptoms of toxicity will be reviewed.

In diagnosing the cause of the toxic event, potential contributing factors will be examined. In addition, consideration will be given to the combined effects of these factors, and the health of the treatment plant bacteria at the onset of toxicity. Potential sources of toxicity are categorized into those resulting indirectly from the operation of the mill, and those directly from the operation of the wastewater treatment plant. Sources of toxicity resulting from mill operation included, mill shut-downs, draining of process tanks, and chemical spills. Sources of toxicity resulting from wastewater treatment plant operation included primary growth pressures. Essentially, a growth pressure is anything

that can affect the health or growth of the bacteria. These are the parameters that operators monitor and control to create an environment conducive to the growth of the bacteria. The primary growth pressures are: food to microorganism ratio, temperature, pH, dissolved oxygen, nutrients, toxics and hydraulics. Correlations between variables and toxicity events will be examined. Figure 7 illustrates the variables analyzed from direct and indirect sources.

Figure 7: Direct and Indirect Sources of Mill Effluent Toxicity



Note: Direct sources of toxicity indicated in italics, indirect sources of toxicity indicated in bold.

3.1 Toxicity Events - Dependent Variable

ALS laboratories in Winnipeg, Manitoba, are contracted to conduct weekly daphnia and monthly trout toxicity tests. Final effluent samples for daphnia toxicity testing are collected every Monday, and final effluent samples for trout toxicity testing are collected on the first Monday of the month. Samples are collected by the wastewater treatment plant operators. The daphnia toxicity test is conducted using undiluted effluent samples, and effluent samples diluted to 6.3%, 12.5%, 25%, and 50% in standard dilution water. Ten randomly selected daphnia are placed in each chamber at 20° Celsius with 16 hours of light and eight hours of darkness. Observations are made for any signs of stress or mortality at three, 24, and 48 hours. All of these results are reported, however, a test failure only involves 100% effluent concentration for a 48 hour period. The rainbow trout toxicity test is conducted using undiluted effluent samples, and effluent samples diluted to 6.3%, 12.5%, 25%, and 50% in standard dilution water. Ten randomly selected trout are placed in each 20 litre sample chamber, and temperature, pH and dissolved oxygen are monitored. Observations are made for any signs of stress or mortality at 24, 48, 72, and 96 hours. All of these results are reported, however, a test failure only involves 100% effluent concentration for a 96 hour period. The wastewater treatment plant operators are notified of the test results immediately uon completion of the test.

3.2 WWTP and Mill Operation - Independent Variables

3.2.1 Indirect Sources of Mill Effluent Toxicity

There are potentially many indirect sources of toxicity resulting from operation of

the mill, as all process chemicals and materials can potentially enter the mill sewers and waste stream to the WWTP. The primary contributing factors are outlined below.

3.2.1.1 Septic Material

Unaerated basins or storage tanks with long detention times or without agitators will produce anaerobic conditions. Septicity occurs when organic material decomposes in the anaerobic conditions, producing organic acids (i.e. acetic acid) (Kerri, 2004). Septic materials may enter the waste stream to the WWTP during draining of storage tanks or spills. The production of organic acids may lower the pH of the effluent outside of the optimal range for the bacteria (6.5 to 8.5). In addition, the presence of organic acids promotes growth of filamentous bacteria (*Thiothrix spp., Nocardia spp.*). The presence of these bacteria typically corresponds with a decrease in floc-forming bacteria. The floc-forming bacteria will consume organic acids; however, not at the same rate as the filamentous bacteria. (Although some filaments are required for the floc forming bacteria to adhere to, an excess will result in poor sludge settling and higher TSS in the final effluent.) A change in operations (i.e agitators in storage tanks, decreased storage tank detention time) or chemical additions of sodium hypochlorite to storage tanks or sewers may be required to return the system to healthy operation. In addition, sodium hypochlorite can be added at the primary clarifier inlet or to the aeration basin to selectively reduce filamentous bacteria. Septicity is measured on a daily basis with an oxygen reduction potential (ORP) meter. ORP readings are collected in the aeration tank, the selector and the primary clarifier. The presence of volatile organic acids (VOAs) are an indicator of septic or anaerobic conditions. Samples for VOAs are

collected twice daily and are composited into weekly samples, for analyses through distillation and titration Samples are collected from the primary influent, the primary effluent and from the waste activated sludge.

3.2.1.2 Process and Other Chemicals

Although there are controls in place to prevent spills, equipment failures or human error can result in mill chemicals (i.e. biocides, dyes, polymeric formulations, detergents) entering the mill sewers. Depending on the amount and type of substance released, toxicity can result. A regular inspection of equipment and adequate environmental training are required to reduce the risk of spills. Spills are recorded in a spill prevention database. Follow-up actions and prevention plans are documented in the database.

3.2.2 Direct Sources of Mill Effluent Toxicity

Directly, chemical additions and operating practices of the wastewater treatment system affect growth pressures associated with a healthy biomass. Failure to control growth pressures can easily result in an unhealthy biomass that is unable to effectively treat mill effluent, particularly if there are issues with chemicals releases or septic material from the mill. It is imperative for a treatment plant operator to have full control of growth pressures. As previously discussed, the primary growth pressures are: food to microorganism ratio, temperature, pH, dissolved oxygen, nitrogen, phosphorous, and hydraulic flow rates. The Pine Falls WWTP technicians and operators are responsible for

monitoring growth pressures.

3.2.2.1 Food to Microorganism Ratio (F/M Ratio)

The ratio between the amount of food (BOD) in a system and the amount of biomass (bacteria) is important in the growth of the bacteria, and sludge and effluent quality. In the absence of other limiting factors, when the food to microorganism ratio is high, reproduction occurs at a logarithmic rate until the food is depleted (Klopping, 1995). During the logarithmic growth, the floc-forming bacteria can become dispersed and flow from the secondary clarifier with the final effluent. As the food source is depleted, reproduction ceases and eventually the bacteria will die. As BOD loading to the WWTP can vary greatly, the F/M ratio is controlled by adjusting the amount of secondary sludge wasting (WAS). The mixed liquor suspended solids (MLSS) value is an indicator of the mass of microbiology in system. This is calculated using the total suspended solids (TSS) value collected from the aeration tank 4 times a day. High MLSS values correspond with high TSS values. In the event of a high MLSS value, it is necessary to increase the amount of sludge wasted. Chemical oxygen demand (COD) at the outlet of the primary is an indicator of the amount of BOD loading to the system. A high COD typically indicates a higher load of BOD coming into the system, which may require an increase in nutrients and dissolved oxygen into the system. If the COD values are high for greater than 24 hours, a decrease in sludge wasting may be required. The food to mass ratio is calculated by dividing the mixed liquor volatile suspended solid (MLVSS) value by the biological oxygen demand (BOD) as follows:

$$F/M = \frac{BOD\ (kg/day)}{}$$

MLVSS (kg)

The MLVSS is calculated using the volatile suspended solids (VSS) value collected from the aeration tank. The residue from the total suspended solids test is ignited to a constant weight at 550°C. The remaining solids represent the suspended solids while the weight lost on ignition is the volatile solids. This is an approximation of the amount of organic matter present in the solid fraction of the wastewater and activated sludge.

3.2.2.2 Temperature

Temperature has a direct effect on the metabolic rate of the microorganisms. Cell growth and reproduction will increase with increasing temperatures until a limiting temperature is reached. Generally, the growth rate of the microorganisms doubles for every 10° C increase in temperature (Klopping, 1995). Once the limiting temperature is reached, growth ceases and the microorganisms cannot survive. At the Pine Falls wastewater treatment plant, the temperature of the effluent is cooled during the summer months in an equalization basin prior to entry into the system. Temperature is measured by on-line probes in the aeration basin, the outfall, and incoming effluent. High temperature alarms are connected to these sites.

3.2.2.3 pH

The majority of bacteria survive in a neutral pH range of 6.0 to 8.0. If pH is outside of this neutral range, it can reduce the ability of a treatment system to remove organic wastes and may promote growth of less desirable bacteria. For example, a low

pH will encourage the growth of filamentous bacteria, displacing floc-forming bacteria. At the Pine Falls treatment facility, incoming wastewater undergoes neutralization prior to entry to the primary clarifier, and is adjusted after it leaves the primary clarifier. pH is measured by online meters throughout the system. Samples are collected to verify results of the online meters twice daily.

3.2.2.4 Dissolved Oxygen (D.O.)

The amount of oxygen in a system will dictate the type of bacteria (aerobic, anaerobic, facultative) present. In an aerobic system, sufficient aeration must be provided in the aeration basin for the microbiology to metabolize BOD. An oxygen residual of 1 to 2 mg/L is typically recommended for the aeration basin to maintain BOD removal and prevent the growth of filamentous bacteria. However, this is dependent on the F/M ratio. If the F/M ratio is high, higher dissolved oxygen residuals may be required. If the F/M ratio is low, the aeration basin may only require an oxygen residual as low as 0.5 to 1.0 mg/L. D.O. is measured by on-line probes in the aeration basin and selector. In addition, D.O. is measured twice daily using hand held meters to verify the on-line meters.

3.2.2.5 Nutrients (Nitrogen & Phosphorous)

Growth and reproduction of microorganisms require nutrients; primarily carbon, nitrogen, and phosphorous. These nutrients must be available in the correct proportion. The C:N:P ratio (mg/L) for wastewater treatment is 100 BOD/5 N/ 1 P mg/L (Marshall,

1999). These nutrients may be provided in the BOD the microorganisms will metabolize; however, the addition of nitrogen and phosphorous is often required. A nutrient deficiency will encourage the growth of filamentous bacteria, and may contribute to the production of a gelatinous material (polysaccharide), which will inhibit dewatering of sludge and increases TSS in the final effluent (Marshall, 1999). High effluent nitrogen concentrations (5 to 10 mg/L) may cause denitrification (Jenkins, 1993), resulting in nitrogen bubbles floating the flocs in the secondary clarifier and increasing TSS in the final effluent. Balancing the nutrient ratio will help ensure optimal operation of the treatment system. Grab samples are collected in the aeration basin and phosphorous, nitrate and ammonia are measured four times daily using a photometer and a specific ion meter.

3.2.2.6 Hydraulics (retention time)

Appropriate retention times must be established to ensure adequate treatment of effluent. Retention times are calculated by dividing the tank volume by the flow (Marshall, 1999). The retention times and tank volumes for basins at the Pine Falls wastewater treatment facility are as follows:

Retention Times (based on design flow of 25,000m^3/day)

Primary Clarifier	5,550 m^3	5.3 hrs
Equalization Pond	4,070 m^3	3.9 hrs
Selector	1,700 m^3	1.6 hrs
Aeration tank	23,380 m^3	22.4 hrs

Secondary Clarifier 9,300 m^3 8.9 hrs

Water reduction programs increase the concentration of BOD coming into the treatment facility. The increased concentration will result in an increased food/microorganism ratio, which may have a negative impact on final effluent quality. Conversely, high flows result in a low food/microorganism ratio and a declining population of floc-forming bacteria. High flows also reduce retention times, therefore, reducing treatment time. Flows are measured continuously at the Pine Falls facility using a mag meter on the influent and Parshall flume on the effluent.

3.3 Correlation of Variables

3.3.1 Analysis of Global Data – Full Data Set (2002-2006)

3.3.1.1 Multiple Regression Analysis of Global Data

All growth parameters will be recorded and missing values extrapolated to provide an average daily value for each parameter. The daily values will be used for all regression analyses throughout the study. Growth parameters will be tested for normal distribution (one to one linear function) using normal probability plots. Log functions will be used for growth parameter displaying curvilinear plots for all regression analyses throughout the study.

A multiple regression analysis will be conducted on the growth parameters and toxicity data for the full data set to determine if there are any correlations between variables over a five year period. Scatterplots of the toxicity data and growth parameters

will be visually reviewed to identify correlations or trends. Multiple regression coefficients will be obtained using Pearson Product and reviewed to identify correlations between parameters. The significance of the correlation coefficient (r) will be assessed according to the following:

- r 0 to .20 no or negligible correlation
- r .20 to .40 low degree of correlation
- r .40 to .60 moderate degree of correlation
- r .60 to .80 a marked degree of correlation
- r .80 to 1.00 a high degree of correlation

(Franblau, 1958) For the purpose of this study only values of greater than .40 will be considered.

3.3.2 Analysis of Data Surrounding Toxicity Event

3.3.2.1 Graphical Representation of Data Surrounding Toxicity Event

Each growth parameter will be graphed against trout and daphnia toxicity for a period of 4 weeks prior and one week after each toxicity episode. A visual examination will be conducted to identify any correlation or trends during each toxicity event. In addition, parameters outside of target ranges will be noted during periods of toxicity. The target ranges for growth pressures at the Pine Falls facility are as follows:

- Food to Mass Ratio 0.1 to 0.3
- Temperature <35° C
- pH 6.5 to 8.5

- Dissolved Oxygen 1.0 to 2.0 mg/L
- Nitrogen 0.5 to 1.0 mg/L
- Phosphorous 2.5 to 5.0 mg/L
- Hydraulic Flow <30,000 m^3/day

The target ranges are based on the design of the facility, operating standards in wastewater treatment and site specific operating conditions

3.3.2.2 Multiple Regression Analysis of Data Surrounding Toxicity Event

Data will be extrapolated and transformed as described in Section 3.3.1.2. A multiple regression analysis will be conducted on the growth parameters and toxicity data surrounding each toxicity event to identify correlations between variables. Data will be analyzed for a period of 4 weeks prior and one week after the toxicity event. Multiple regression coefficients will be obtained using Pearson Product and interpreted according to Section 3.3.1.2.

3.3.2.3 Records Review

A review of mill records, log books, and databases will be conducted to identify mill or wastewater treatment operating issues during a toxicity episode. Information will be reviewed for a period of 4 weeks prior and one week after the toxic event, to identify the following:

- Spill information; including type of spill, quantity released, and source of spill.
- Mill departmental shut-down and maintenance completed; including, draining of

storage tanks.

- Records of wastewater treatment plant operators and technicians observations during toxicity episodes; including visual assessments, olfactory indicators, and, microscopic examinations.

Observations may indicate sources not reflected in the data, due to the time of sampling.

3.4 Limitations

The causes of toxicity on mill effluent is dependent on the type of mill process (i.e. mechanical pulping, groundwood, kraft, chemical/mechanical) and the type of secondary treatment (i.e. aerated lagoons, air-activated sludge, oxygen-activated sludge or sequential batch reactors). Therefore, data collected during this study will only be applicable to other sites depending on the mill process and type of treatment.

4.0 RESULTS

4.1 Mill Effluent Toxicity Episodes

Toxicity episodes experienced at the Pine Falls paper mill from January 2002 to December 2006 were categorized by the species affected, the degree of mortality, and the time of mortality, as described in Section 3.1. In addition, toxicity test observations; including, species sensitivity, percent of mortality, immobility, abnormal swimming behaviour, and other symptoms were noted. The results of this characterization are summarized in Table 1 below.

Table 1: Mill Effluent Toxicity Episodes - January 2002 and December 2006.

[1]: Abnormal behaviour includes any swimming or morphological abnormalities.
[2]: Bolded text indicates compliance failures of greater than 50% mortality in 100% concentration.
[3]: Bold italicized text indicates greater than 50% mortality in lower concentrations.

Date	Species	Mortality (100% Effluent)	Additional Information	Test Observations
January 7, 2002	Trout	20%	25% mortality at 25% and 50% effluent.	No abnormal behaviour.[1]
January 21, 2002	Daphnia	5%	10% mortality at 50 % and 20% mortality at 25% effluent.	No abnormal behaviour.[1]
March 4, 2002	Trout	10%	20% mortality at 50% effluent	No abnormal behaviour.[1]
March 4, 2002	Daphnia	0%	5% mortality at 6.3%, 12.5%, and 25% effluent.	No abnormal behaviour.[1]
March 11, 2002	Daphnia	10%	10% mortality at 25% effluent and 5% mortality at 12.5 and 50% effluent.	No abnormal behaviour.[1]
March 25, 2002	Daphnia	5%	5, 15, 20, and 20% mortality at 50, 25, 12.5, and 6.5% effluent; respectively.	No abnormal behaviour.[1]
April 1, 2002	Daphnia	10%	10% and 5% mortality at 50% and 6.5% effluent.	No abnormal behaviour.[1]
April 8, 2002	Daphnia	10%	5% mortality at 6.3% effluent.	No abnormal behaviour.[1]
April 15, 2002	Daphnia	5%	5% mortality at 50% and 6.3% effluent. 10% mortality at 12.5% and 25% effluent.	No abnormal behaviour.[1]
April 22, 2002	Daphnia	5%	10% mortality at 6.3% effluent.	No abnormal behaviour.[1]
April 29, 2002	Daphnia	15%	No mortality at lower concentrations.	No abnormal behaviour.[1]
May 6, 2002	Daphnia	0%	5% mortality at 6.3, 25, and 50% concentration.	No abnormal behaviour.[1]
May 13, 2002 [2]	**Daphnia**	**100%**	**100%, 60% and 90% mortality at 50%, 25%, and 12.5% effluent; respectively.**	**No abnormal behaviour[1].**
May 16, 2002	Daphnia	0%	5% mortality at 50% and 12.5% effluent, 10% mortality at 25% effluent.	No abnormal behaviour.[1]
May 20, 2002	Daphnia	0%	5% mortality at 12.5% effluent.	No abnormal behaviour.[1]
May 27, 2002 [2]	**Daphnia**	**70%**	**65% mortality at 50% effluent.**	**No abnormal behaviour[1].**

Table 1: Mill Effluent Toxicity Episodes - January 2002 and December 2006.

[1]: Abnormal behaviour includes any swimming or morphological abnormalities.
[2]: Bolded text indicates compliance failures of greater than 50% mortality in 100% concentration.
[3]: Bold italicized text indicates greater than 50% mortality in lower concentrations.

Date	Species	Mortality (100% Effluent)	Additional Information	Test Observations
May 30, 2002	Daphnia	0%	5% mortality at 25% and 12.5% effluent.	No abnormal behaviour. [1]
May 31, 2002	Daphnia	5%	5% mortality at 12.5% effluent.	No abnormal behaviour. [1]
June 1, 2002	Daphnia	5%	5% mortality at 25% effluent.	No abnormal behaviour. [1]
June 10, 2002	Daphnia	5%	N/A	No abnormal behaviour. [1]
June 24, 2002	Daphnia	10%	N/A	No abnormal behaviour. [1]
July 2, 2002	Trout	0	10% mortality at 50% and 12.5 effluent, 20% mortality at 25% effluent.	No abnormal behaviour. [1]
July 2, 2002	Daphnia	5%	N/A	No abnormal behaviour. [1]
July 8,2002	Daphnia	5%	N/A	No abnormal behaviour. [1]
July 15, 2002	Daphnia	0%	10% mortality at 25% effluent.	No abnormal behaviour. [1]
July 22, 2002	Daphnia	30%	15% mortality at 50% effluent.	No abnormal behaviour. [1]
July 29, 2002	Daphnia	20%	15% mortality at 50%, 25%, 12.5%, and 6.3% effluent.	Some surviving daphnids exposed to higher concentrations displayed little movement and a low heart rate.
August 6, 2002	Daphnia	35%	45% mortality at 50% effluent, and 40% mortality at 25% effluent.	Displayed little movement and had a large amount of fibrous and granular particles adhering to their external surfaces.

Table 1: Mill Effluent Toxicity Episodes - January 2002 and December 2006.

[1]: Abnormal behaviour includes any swimming or morphological abnormalities.
[2]: Bolded text indicates compliance failures of greater than 50% mortality in 100% concentration.
[3]: Bold italicized text indicates greater than 50% mortality in lower concentrations.

Date	Species Sensitivity	Mortality (100% Effluent)	Additional Information	Test Observations
August 12, 2002	Daphnia	20%	10%, 5%, 20%, and 30% mortality at 50%, 25%, 12.5% and 6.3% effluent; respectively.	Some surviving daphnids exposed to higher concentrations displayed little movement and a low heart rate.
August 19, 2002	Daphnia	20%	10%, 15%, and 5% mortality at 50%, 25%, and 6.3% effluent; respectively.	No abnormal behaviour. [1]
August 26, 2002	Daphnia	20%	10%, 5%, 15%, and 5% mortality at 50%, 25%, 12.5%, and 6.3% effluent; respectively.	No abnormal behaviour. [1]
September 9, 2002	Daphnia	5%	5% mortality at 25% and 12.5% effluent. 15% mortality at 6.3% effluent.	No abnormal behaviour. [1]
September 16, 2002	Daphnia	5%	5% mortality at 25% and 12.5% effluent. 15% mortality at 6.3% effluent.	No abnormal behaviour. [1]
September 23, 2002 [3]	***Daphnia***	***20%***	***30%, 60%, 80% and 65% mortality at 50%, 25%, 12.5%, and 6.3% effluent; respectively.***	***No abnormal behaviour***[1]**.**
October 7, 2002	Daphnia	5%	5% mortality at 12.5% effluent. 15% mortality at 6.3% effluent.	No abnormal behaviour. [1]
October 14, 2002	Daphnia	0%	5% mortality at 6.3% effluent.	No abnormal behaviour. [1]
October 28, 2002	Daphnia	0%	5% mortality at 50%, 25%, and 6.3% effluent.	No abnormal behaviour. [1]
November 4, 2002	Daphnia	45%	15% mortality in 25% and 12.5% effluent and 5% mortality in 6.3% effluent.	Surviving daphnids were highly immobile.

Table 1: Mill Effluent Toxicity Episodes - January 2002 and December 2006.

[1]: Abnormal behaviour includes any swimming or morphological abnormalities.
[2]: Bolded text indicates compliance failures of greater than 50% mortality in 100% concentration.
[3]: Bold italicized text indicates greater than 50% mortality in lower concentrations.

Date	Species Sensitivity	Mortality (100% Effluent)	Additional Information	Test Observations
November 19, 2002	Daphnia	5%	N/A	No abnormal behaviour. [1]
November 26, 2002	Daphnia	0%	5% mortality at 50% effluent.	No abnormal behaviour. [1]
December 3, 2002	Daphnia	5%	N/A	No abnormal behaviour. [1]
December 31, 2002	Daphnia	10%	10% mortality at 50% effluent.	No abnormal behaviour. [1]
January 6, 2003	Daphnia	15%	5% mortality at 50% effluent.	No abnormal behaviour. [1]
January 10, 2003	Daphnia	0%	5% mortality at 25% effluent.	No abnormal behaviour. [1]
January 20, 2003	Daphnia	0%	5% mortality at 25% effluent.	No abnormal behaviour. [1]
February 3, 2003	Trout	10%	N/A	No abnormal behaviour [1]
March 3, 2003	Trout	20%	20%, 50%, 30%, and 30% mortality at 50%, 25%, 12.5% and 6.3% effluent; respectively.	No abnormal behaviour [1]
March 17, 2003	Trout	0%	10% mortality at 12.5% effluent.	No abnormal behaviour. [1]
March 24, 2003	Daphnia	25%	10% mortality at 12.5% effluent.	No abnormal behaviour. [1]
March 31, 2003	Daphnia	10%	15% mortality at 25% effluent.	No abnormal behaviour. [1]
April 7, 2003	Trout	0%	10% mortality at 50%, 12.5%, and 6.3% effluent.	No abnormal behaviour. [1]
April 21, 2003	Daphnia	0%	10% mortality at 12.5% effluent.	No abnormal behaviour. [1]
May 26, 2003 [2]	**Daphnia**	**100%**	**90%, 50%, and 10% mortality at 50%, 25%, and 12.5% effluent; respectively.**	**100% mortality**
May 27, 2003 [2]	**Trout**	**100%**	**Tested only in 100% effluent.**	**100% mortality**
May 27, 2003 [2]	**Daphnia**	**100%**	**Tested only in 100% effluent.**	**100% mortality**
May 28, 2003	Daphnia	10%	10% mortality at 25% effluent.	No abnormal behaviour. [1]
June 3, 2003	Trout	0%	10% mortality at 6.25% effluent.	No abnormal behaviour. [1]
June 9, 2003 [2]	**Trout**	**100%**	**No mortality observed at lesser concentrations.**	**100% mortality**

Table 1: Mill Effluent Toxicity Episodes - January 2002 and December 2006.

[1]: Abnormal behaviour includes any swimming or morphological abnormalities.
[2]: Bolded text indicates compliance failures of greater than 50% mortality in 100% concentration.
[3]: Bold italicized text indicates greater than 50% mortality in lower concentrations.

Date	Species Sensitivity	Mortality (100% Effluent)	Additional Information	Test Observations
October 6, 2003	Daphnia	5%	20%, 30%, 20%, and 10% mortality at 75%, 50%, 25%, and 12.5% effluent; respectively.	Slight toxicity observed.
October 20, 2003 [2]	**Daphnia**	**95%**	**40% mortality at 75% effluent, 30% mortality at 50% effluent.**	**Slight toxicity observed.**
October 23, 2003	Daphnia	40%	30% mortality at 75% effluent, 20% mortality at 50% effluent.	Slight toxicity observed.
October 24, 2003	Daphnia	30%	40% mortality at 75% effluent.	Slight toxicity observed.
October 24, 2003	Daphnia	45%	20% mortality at 75% effluent, 10% mortality at 50% effluent.	Slight toxicity observed.
October 25, 2003 [2]	**Daphnia**	**90%**	**No mortality observed at lesser concentrations.**	**90% mortality, 100% immobility**
October 27, 2003	Daphnia	25%	30%, 20%, 10%, and 10% mortality at 75%, 50%, 25%, and 12.5% effluent; respectively.	Slight toxicity observed.
October 30, 2003	Daphnia	40%	30% mortality at 75% effluent.	Slight toxicity observed at 75% and 100%.
October 31, 2003	Daphnia	20%	20% mortality at 75% effluent.	Slight toxicity observed.
November 3, 2003[2]	**Daphnia**	**55%**	**30%, 10%, and 10% mortality at 75%, 50%, and 25% effluent; respectively.**	**Slight toxicity observed.**
November 10, 2003	Daphnia	5%	10% mortality at 25% effluent.	Slight toxicity observed.
December 1, 2003	Daphnia	25%	10% mortality at 75% effluent.	Cannot detect immobility, due to high turbidity.

Table 1: Mill Effluent Toxicity Episodes - January 2002 and December 2006.

[1]: Abnormal behaviour includes any swimming or morphological abnormalities.
[2]: Bolded text indicates compliance failures of greater than 50% mortality in 100% concentration.
[3]: Bold italicized text indicates greater than 50% mortality in lower concentrations.

Date	Species Sensitivity	Mortality (100% Effluent)	Additional Information	Test Observations
December 22, 2003	Daphnia	0%	N/A	Two Daphnia could not be detected due to turbidity.
January 19, 2004	Daphnia	5%	10% mortality at 75% effluent/	Too turbid to detect toxicity.
February 9, 2004	Daphnia	15%	Mortality not observed at any other concentration.	Mild toxicity observed at 100% concentration.
April 4, 2005	Trout	0%	10% mortality at 50% effluent. 20% mortality at 12.5% and 6.25% effluent.	Slight toxicity observed 12.5% and 6.25% concentrations.
April 19, 2005 [3]	***Daphnia***	***0%***	***80%, 90%, 100%, 100% mortality at 75%, 50%, 25%, and 12.5% effluent.***	***Slight toxicity observed in 75%, 50%, 25%, and 12.5% concentrations.***
May 2, 2005	Trout	0%	10% mortality at 25% and 6.25% effluent.	No toxicity observed.
May 30, 2005	Daphnia	15%	30% mortality at 75%, 50%, and 25% effluent. 40% mortality at 12.5% effluent.	Slight toxicity observed in all concentrations.
June 6, 2005 [2]	**Daphnia**	**70%**	**80%, 90%, 80%, and 90% mortality at 75%, 50%, 25%, and 12.5% effluent, respectively.**	**Toxicity observed in all concentrations.**
June 13, 2005	Daphnia	15%	40%, 30%, 10%, and 10% mortality at 75%, 50%, 25%, and 12.5% effluent, respectively.	Slight toxicity observed in 50%, 75%, and 100%,
July 4, 2005	Trout	0%	20% mortality in 50% effluent, 10% mortality in 25% and 12.5% effluent.	Slight toxicity observed in 50% concentration.

Table 1: Mill Effluent Toxicity Episodes - January 2002 and December 2006.

[1]: Abnormal behaviour includes any swimming or morphological abnormalities.
[2]: Bolded text indicates compliance failures of greater than 50% mortality in 100% concentration.
[3]: Bold italicized text indicates greater than 50% mortality in lower concentrations.

Date	Species Sensitivity	Mortality (100% Effluent)	Additional Information	Test Observations
July 4, 2005	Daphnia	50%	40%, 50%, 40%, and 30% mortality at 75%, 50%, 25%, and 12.5% effluent, respectively.	Slight toxicity observed. Considered a pass.
December 5, 2005	Trout	0%	20% mortality at 6.25% effluent.	Slight toxicity at 6.25% concentration.
January 2, 2006	Trout	0%	10% mortality at 6.25% effluent.	No abnormal behaviour.[1]
January 2, 2006	Daphnia	0%	10% mortality at 6.25% effluent.	No abnormal behaviour.[1]
February 6, 2006	Trout	0%	10% mortality at 6.25% effluent.	No toxicity observed.
February 27, 2006	Daphnia	10%	40%, 20%, and 10% mortality at 75%, 50%, and 25% effluent; respectively.	Slight toxicity observed.
March 6, 2006	Daphnia	20%	10%, 40%, 30%, and 50% mortality at 75%, 50%, 25%, and 12.5% effluent.	Slight toxicity observed in all concentrations.

There were 8 Daphnia and 2 trout toxicity test failures between January 1, 2002 and December 31, 2006. These 10 toxicity episodes will be the focus of the remainder of the study.

4.2 WWTP and Mill Operation

4.2.1 Analysis of Global Data – Full Data Set (2002-2006)

4.2.1.1 Multiple Regression Analysis of Global Data

Growth parameters were recorded and missing values extrapolated to provide an average daily value for each parameter (Appendix C). Normal probability plots indicated all the variables were normally distributed, with the exception of nitrogen. As the plot of nitrogen was more curvelinear the log of nitrogen was used in all regression analysis. A multiple regression analysis was conducted on the growth parameters and toxicity data for the full data set (2002 to 2006). Scatterplots of the toxicity data and growth parameters indicated the variables act independently of one another over the five year period (Appendix) Multiple regression coefficients were calculated using Pearson Product-Moment Correlation and reviewed to identify correlations between parameters. The regression coefficients are presented in Table 2.

Table 2: Correlation coefficients for global data (2002 – 2006).

Pearson Product-Moment Correlation									
	Daphnia	**Trout**	**LN**	**Flow**	**F/M**	**P**	**D.O.**	**pH**	**Temp**
Daphnia	1.000								
Trout	0.580	1.000							
LN	-0.058	-0.092	1.000						
Flow	0.141	0.009	-0.205	1.000					
F/M	0.224	0.164	0.026	0.075	1.000				
P	0.101	-0.090	0.035	0.003	0.205	1.000			
D.O.	0.033	0.207	0.155	-0.096	-0.067	0.094	1.000		
pH	0.061	0.056	-0.167	0.065	0.186	0.305	0.056	1.000	
Temp	0.098	0.124	-0.033	0.170	-0.075	0.046	-0.004	-0.013	1.000

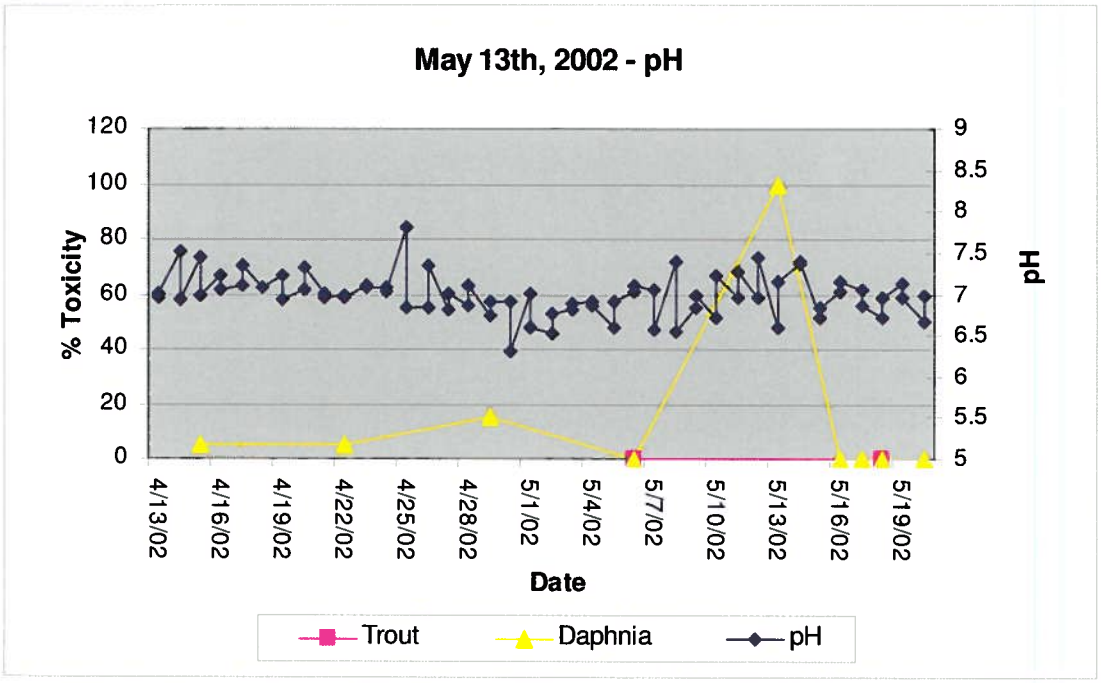
The daily measured variables behave relatively independent of each other and of toxicity variables over a five year period. The correlation between daphnia and trout is the highest value, and may be considered a moderate positive correlation at 0.580.

4.2.2 Analysis of Data Surrounding Toxicity Event

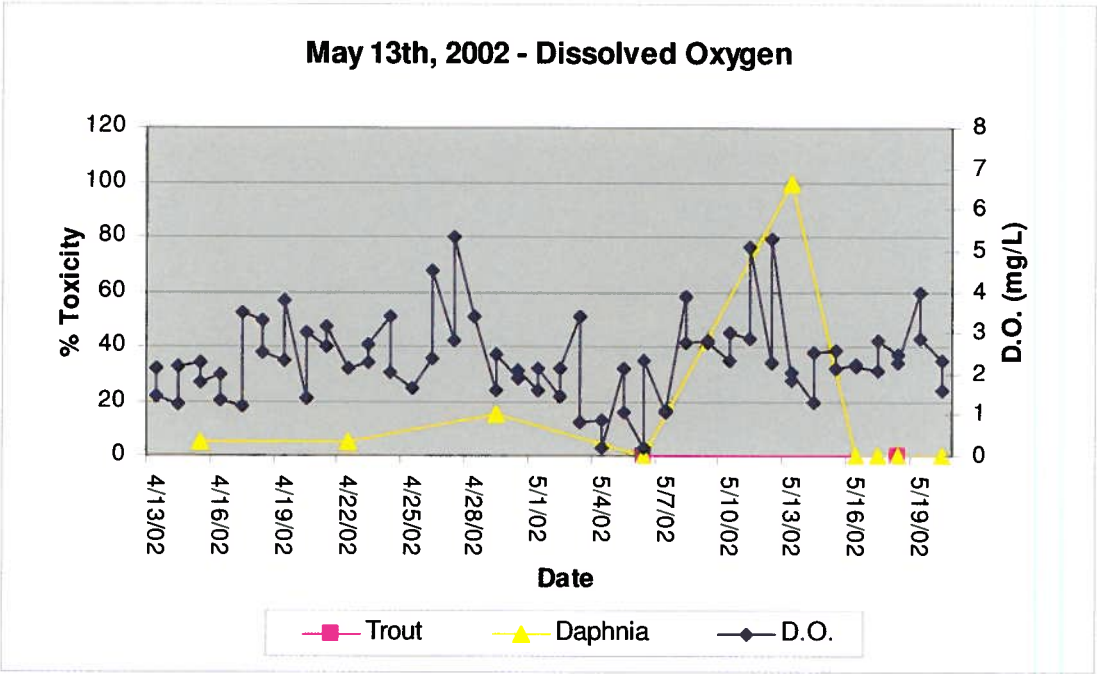
4.2.2.1 Daphnia Toxicity, May 13th, 2002

4.2.2.1.1 Graphical Representation – May 13th, 2002

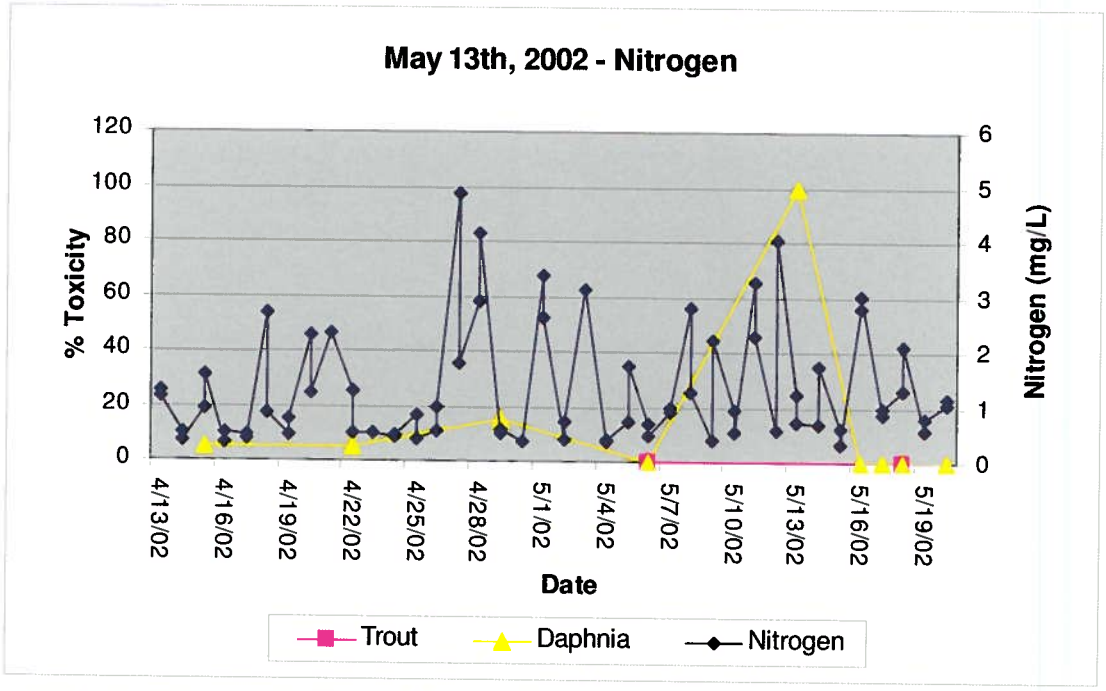
Each growth parameter was graphed against trout and daphnia toxicity (Appendix. D). A visual examination was conducted to identify correlations, trends, or values outside of the target ranges. Parameters displaying unusual characteristics are noted below.



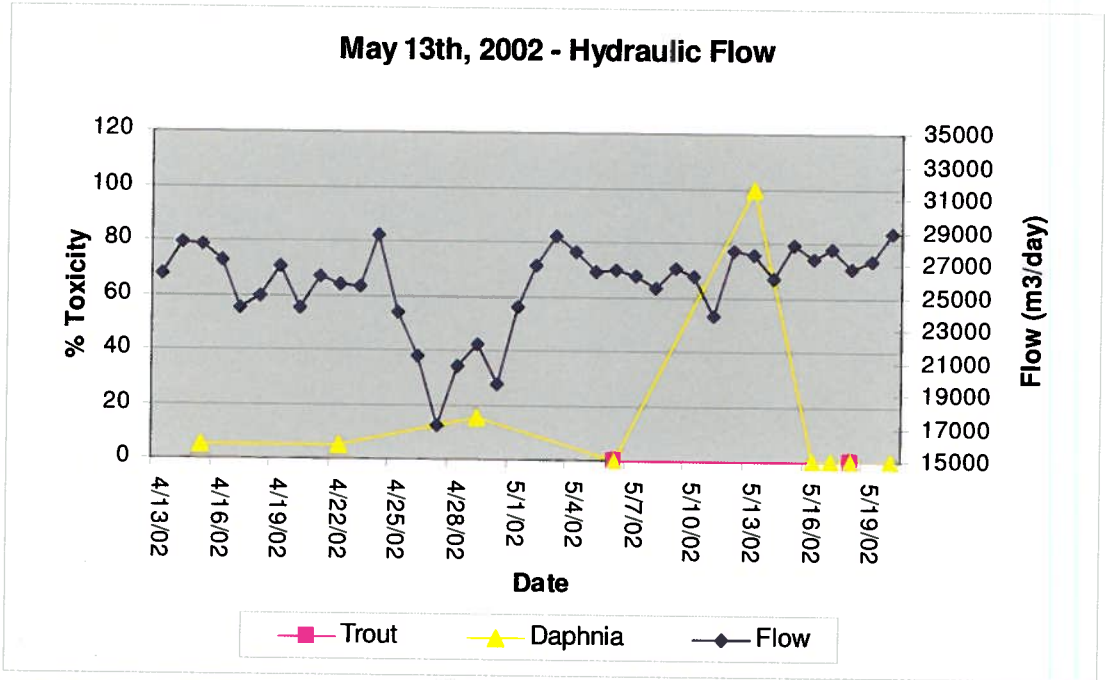
One of the pH values was slightly below the target range of 6.5 to 8.5. The pH of the aeration basin was 6.3 on April 30th.



Several dissolved oxygen concentrations were below the minimum target value of 1.0 mg/L during the period, with the lowest being 0.21 mg/L on May 6th.



Several nitrogen values exceeded the maximum target value of 1.0 mg/L, with the highest being 4.86 mg/L on April 27th.



The hydraulic flow was 17,073 m^3/day on April 27th, which is significantly lower than typical values

4.2.2.1.2 Multiple Regression Analysis –May 13th, 2002

A multiple regression analysis was conducted on the growth parameters and toxicity data surrounding each toxicity event to identify correlations between variables. Data was analyzed for a period of 4 weeks prior and one week after the toxicity event. Multiple regression coefficients were calculated using Pearson Product-Moment Correlation and reviewed to identify correlations between parameters. The regression coefficients are presented in Table 3.

Table 3: Correlation coefficients for May 13th, 2002, daphnia toxicity.

Pearson Product-Moment Correlation									
	Daphnia	**Trout**	**LN**	**Flow**	**F/M**	**P**	**D.O.**	**pH**	**Temp**
Daphnia	1.000								
Trout	-	-							
LN	-0.016	-	1.000						
Flow	0.061	-	-0.352	1.000					
F/M	-0.126	-	0.034	-0.009	1.000				
P	-0.213	-	0.541	-0.067	0.064	1.000			
D.O.	0.024	-	0.438	-0.279	-0.288	0.410	1.000		
pH	-0.533	-	-0.156	0.043	-0.145	0.190	0.017	1.000	
Temp	-0.399	-	-0.275	0.076	0.070	-0.183	-0.357	0.031	1.000

There are no correlation values for trout toxicity data, as there was only one value of zero during this period. There was a moderate negative correlation between daphnia and pH, and a moderate positive correlation between nitrogen, phosphorous, and dissolved oxygen.

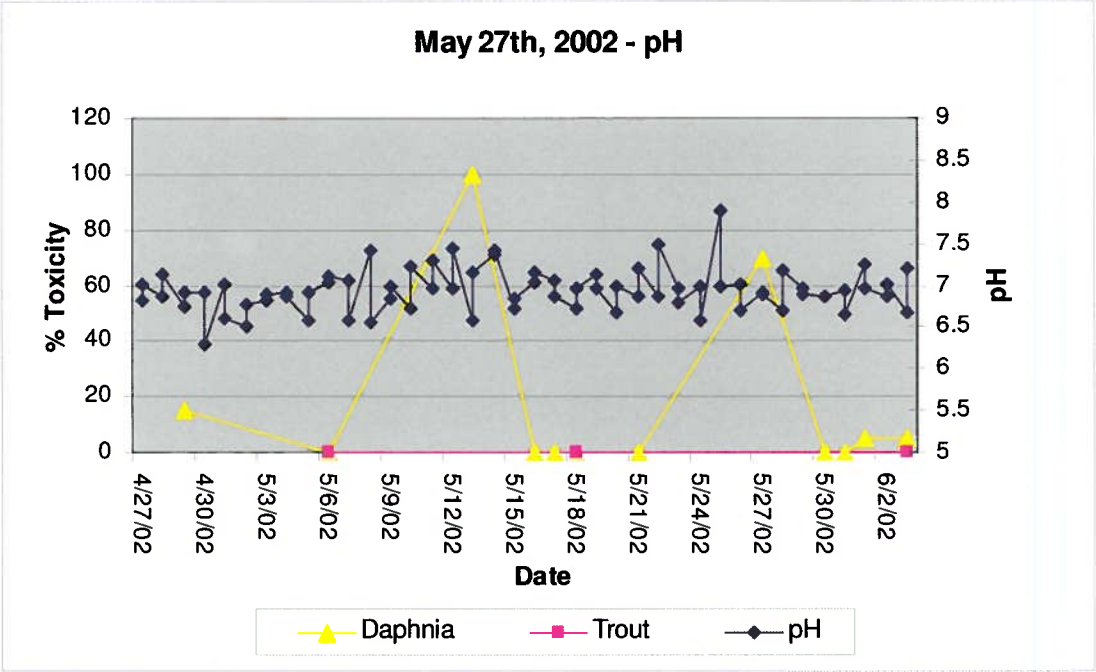
4.2.2.1.3 Records Review – May 13th, 2002

A review of mill records, log books, and databases was conducted to identify mill or wastewater treatment operating issues during the May 13th, 2002, daphnia toxicity episode. There was one glycol spill of 205 litres from the de-inking plant reported on April 15th, 2002. However, the spill was contained and it was unlikely that a significant amount of the chemical entered the wastewater treatment system. There were no mill shutdowns reported; however, low flows on April 27th, 2002, indicate an unplanned shutdown. There were two maintenance shutdown of the aeration equipment for approximately four hours each at the wastewater treatment facility on May 7th and May 9th, 2002.

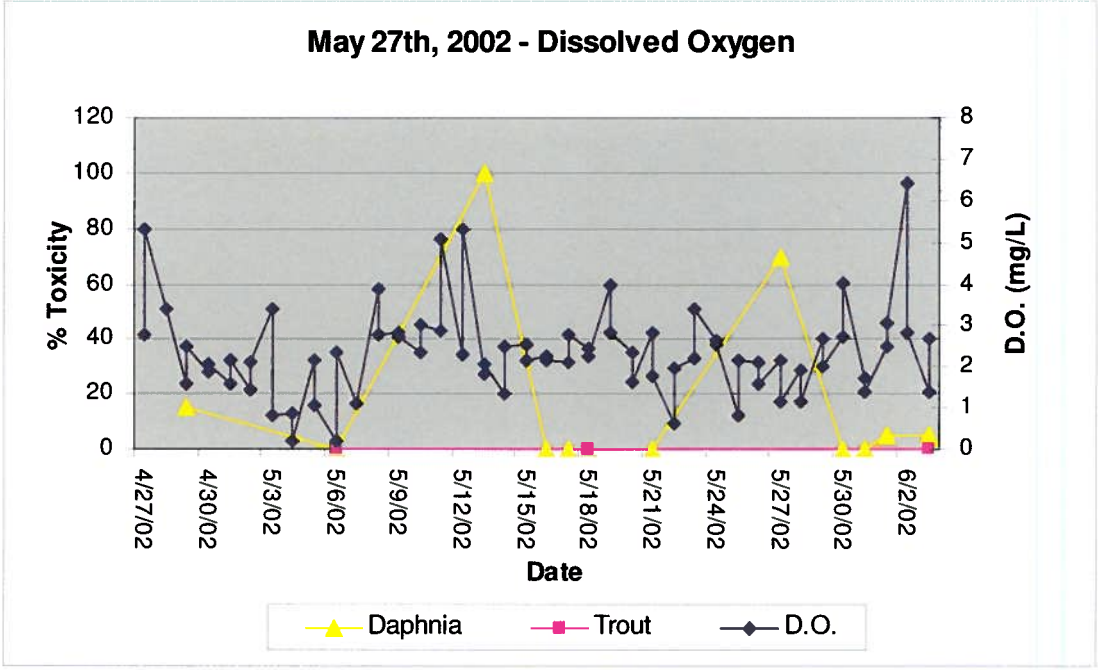
4.2.2.2 Daphnia Toxicity, May 27th, 2002

4.2.2.2.1 Graphical Representation – May 27th, 2002

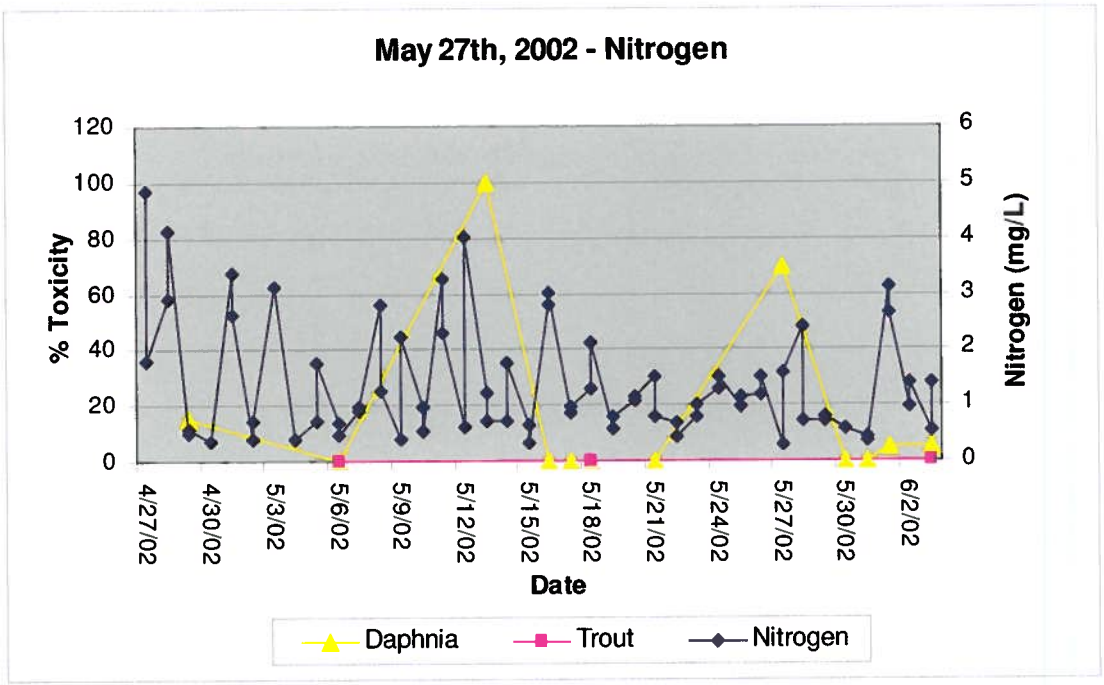
Each growth parameter was graphed against trout and daphnia toxicity (Appendix. D). A visual examination was conducted to identify correlations, trends, or values outside of the target ranges. Parameters displaying unusual characteristics are noted below.



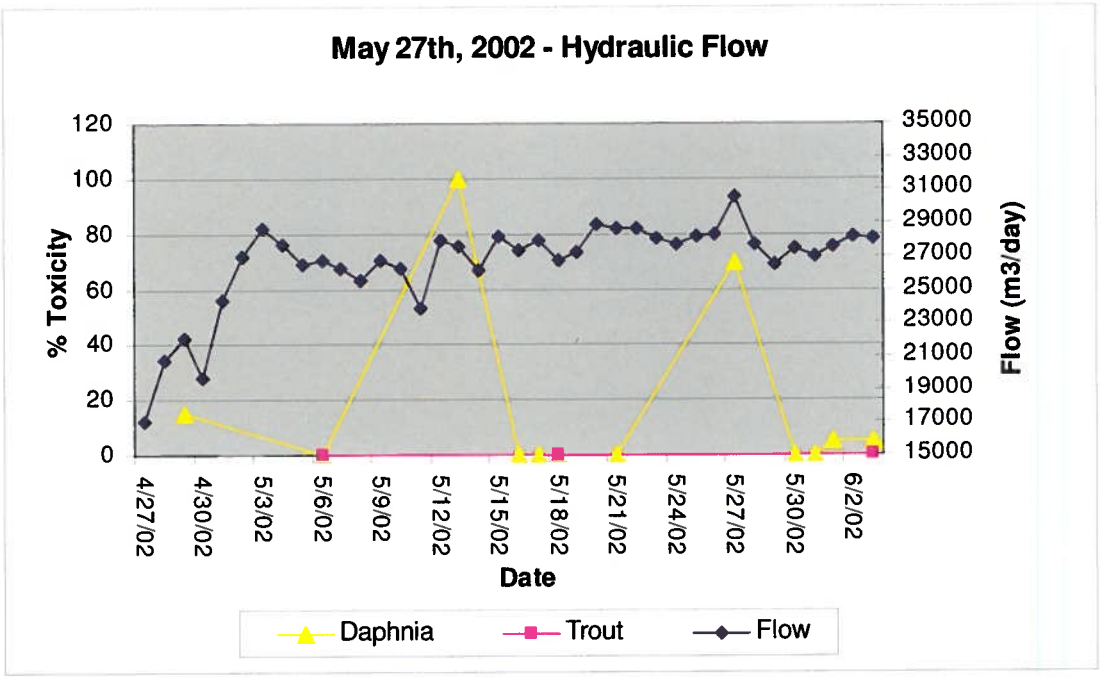
There was one value below the minimum target of 6.5. The pH value was 6.3 on April 30th.



Several values of dissolved oxygen were below the minimum target of 1.0 mg/L. Dissolved oxygen for May 4th and May 6th, was .20 mg/L and .21 mg/L, respectively.



Nitrogen values were below and above the target during this period, ranging from 0.3 on May 15th to 4.86 on April 27th.



The flow was 17,073 m^3/day on April 27th, which is lower than typical values. There was

a trend of increasing flows after April 27th, to a maximum of 30,581 m^3/day on May 27th.

4.2.2.2.2 Multiple Regression Analysis – May 27th, 2002

A multiple regression analysis was conducted on the growth parameters and toxicity data surrounding each toxicity event to identify correlations between variables. Data was analyzed for a period of 4 weeks prior and one week after the toxicity event. Multiple regression coefficients were calculated using Pearson Product-Moment Correlation and reviewed to identify correlations between parameters. The regression coefficients are presented in Table 4.

Table 4: Correlation coefficients for May 27th, 2002, daphnia toxicity.

Pearson Product-Moment Correlation									
	Daphnia	**Trout**	**LN**	**Flow**	**F/M**	**P**	**D.O.**	**pH**	**Temp**
Daphnia	1.000								
Trout	-	-							
LN	-0.104	-	1.000						
Flow	0.268	-	-0.419	1.000					
F/M	-0.143	-	-0.002	-0.238	1.000				
P	-0.247	-	0.424	-0.051	-0.107	1.000			
D.O.	0	-	0.341	-0.124	-0.078	0.391	1.000		
pH	-0.471	-	0.135	0.055	-0.213	0.335	-0.030	1.000	
Temp	-0.246	-	-0.216	0.222	-0.005	-0.054	-0.150	-0.085	1.000

There are no correlation values for trout toxicity data, as there was only one value of zero during this period. There was a moderate negative correlation between daphnia and pH, and a moderate positive correlation between nitrogen and phosphorous. In addition, there was a moderate negative correlation between flow and nitrogen.

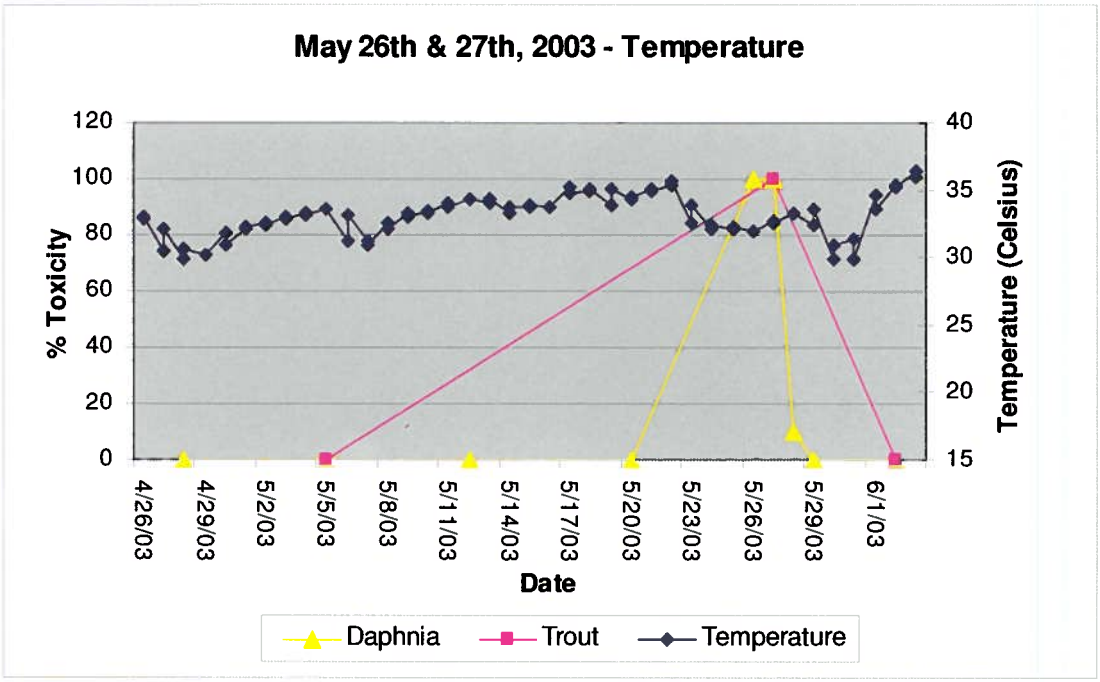
4.2.2.2.3 Records Review – May 27th, 2002

A review of mill records, log books, and databases was conducted to identify mill or wastewater treatment operating issues during the May 27th, 2002, daphnia toxicity episode. There were no spills reported during this period. Low flows on April 27th, 2002, indicate an unplanned maintenance shutdown. A de-inking plant shut-down was recorded on May 22nd, 2002. At the time of the toxicity floating sludge appeared on the secondary clarifier and oxygen uptake rates in the aeration basin decreased. In addition, the paper machine (PM) department drained a large volume of whitewater on May 25th. Whitewater is process water, which includes higher amounts of solids (BOD) and some process chemicals

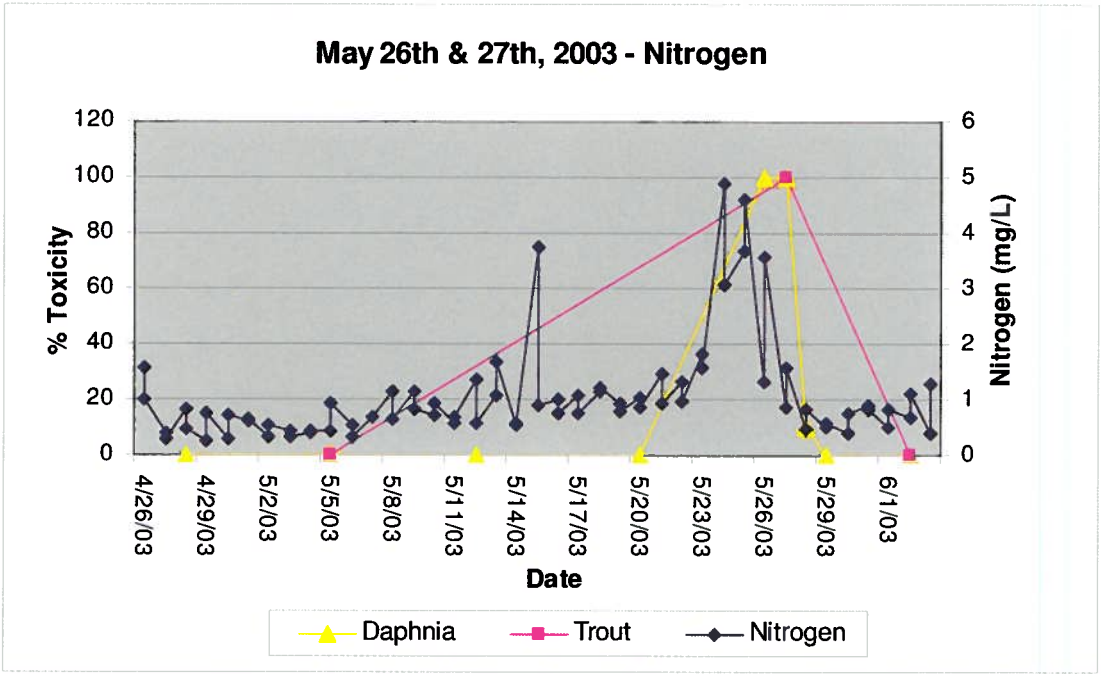
4.2.2.3 Daphnia and Trout Toxicity, May 26th & 27th, 2003

4.2.2.3.1 Graphical Representation- May 26th & 27th, 2003

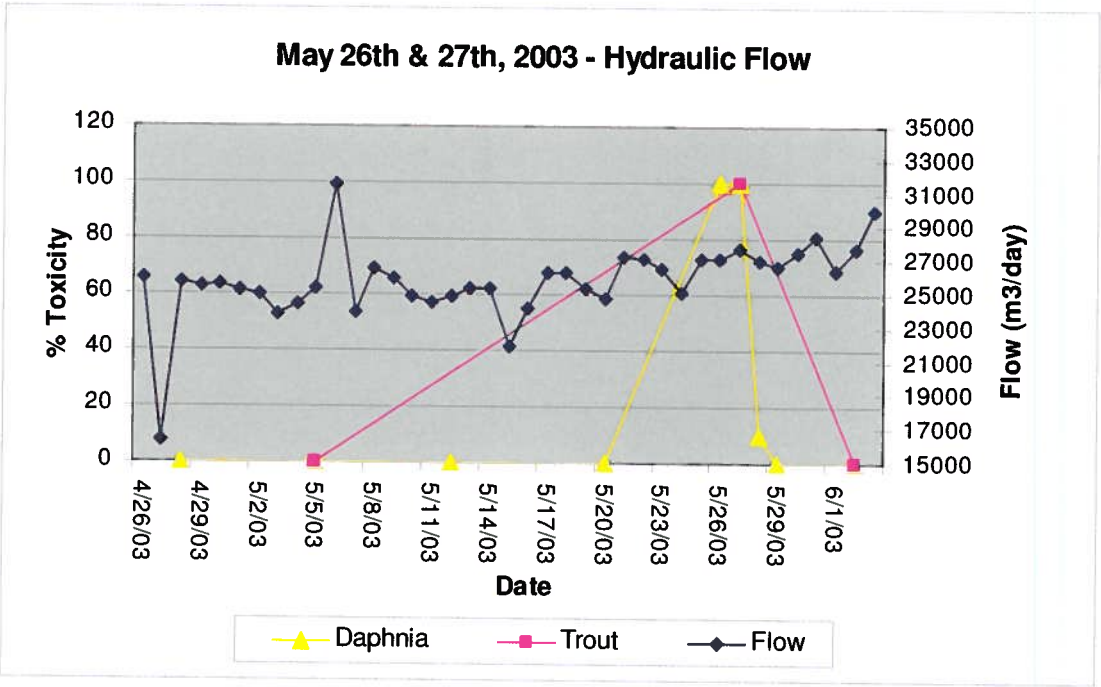
Each growth parameter was graphed against trout and daphnia toxicity (Appendix. D). A visual examination was conducted to identify correlations, trends, or values outside of the target ranges. Parameters displaying unusual characteristics are noted below.



There were several values for temperature above the maximum target of 35° C during this period.



There were nitrogen values below and above the target during this period, ranging from 0.252 mg/L on April 29th to 4.905 mg/L on May 24th.



Flows varied during this period, ranging from 16,289 m^3/day on April 27th to 31,603 m^3/day on May 6th. There is a trending of increasing flow coinciding with the toxicity episodes.

4.2.2.3.2 Multiple Regression Analysis – May 26th & 27th, 2003

A multiple regression analysis was conducted on the growth parameters and toxicity data surrounding each toxicity event to identify correlations between variables. Data was analyzed for a period of 4 weeks prior and one week after the toxicity event. Multiple regression coefficients were calculated using Pearson Product-Moment Correlation and reviewed to identify correlations between parameters. The regression coefficients are presented in Table 5.

Table 5: Correlation coefficients for May 26th and 27th , 2003 daphnia and trout toxicity.

Pearson Product-Moment Correlation									
	Daphnia	**Trout**	**LN**	**Flow**	**F/M**	**P**	**D.O.**	**pH**	**Temp**
Daphnia	1.000								
Trout	1.000	1.000-							
LN	0.333	0.771	1.000						
Flow	0.831	0.022	0.004	1.000					
F/M	0.194	0.384	0.432	0.456	1.000				
P	-0.004	-0.336	0.029	-0.025	0.072	1.000			
D.O.	0.674	0.986	0.523	-0.072	0.217	0.057	1.000		
pH	-0.486	0.173	0.008	-0.583	-0.316	0.201	-0.032	1.000	
Temp	-0.232	-0.686	0.085	0.215	0.512	-0.063	0.058	-0.152	1.000

There were several more significant correlations between the growth parameters and the toxicity data surrounding the May 26th and 27th, 2003, toxicity event. There are high positive correlations between flow and daphnia toxicity and between dissolved oxygen and trout toxicity. There are marked positive correlations between dissolved oxygen and daphnia toxicity and between nitrogen and trout toxicity. There is a marked negative correlation between temperature and trout toxicity. There are positive moderate correlations between nitrogen and F/M ration, dissolved oxygen and nitrogen, F/M ratio and flow, and F/M ratio and temperature. There are negative moderate correlations between pH and daphnia, and pH and flow.

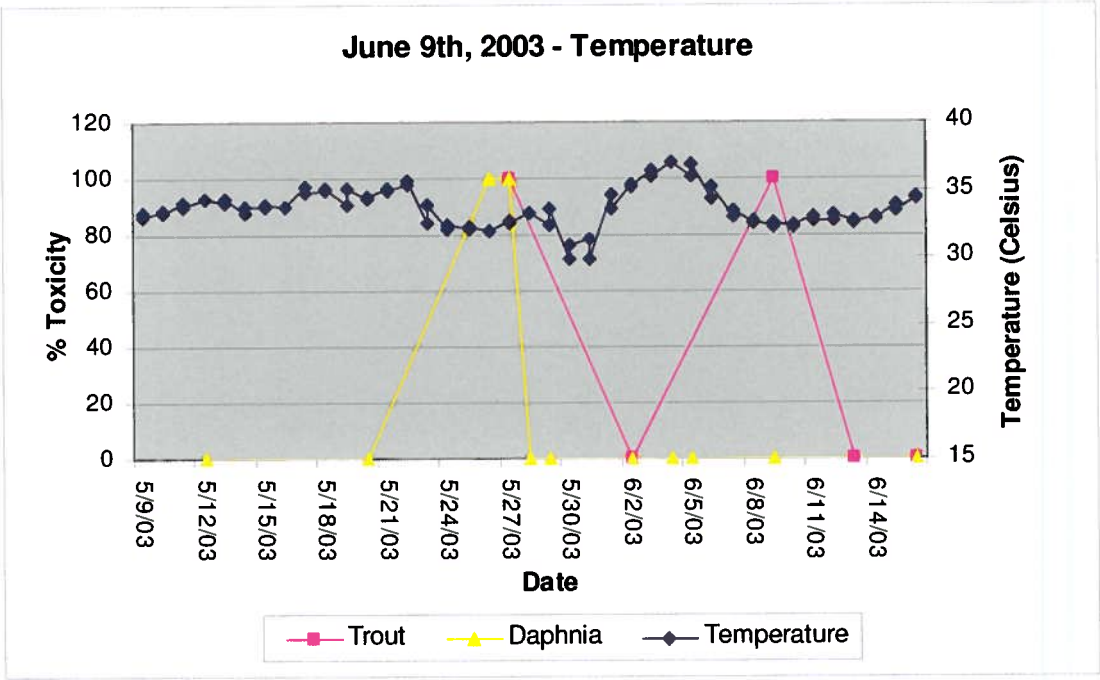
4.2.2.3.3 Records Review – May 26th and 27th, 2003

A review of mill records, log books, and databases was conducted to identify mill or wastewater treatment operating issues during the May 26th and 27th, 2003, toxicity episodes. There was a 50 litre spill of sodium hypochlorite in the wastewater treatment plant reported on May 10th, 2003. The spill was fully contained, causing no adverse effect on the plant. On May 23rd, the equalization (EQ) basin at the wastewater treatment plant was brought into service for the summer season. Typically, the EQ basin is treated with sodium hypochlorite and aerated for several days prior to being brought on-line. Due to unseasonably warm temperatures, the EQ basin was not treated as typical. In addition, operators noted excessive nitrogen in the system. To compensate, nitrogen dosing was dramatically reduced. However, upon further investigation, the cause of the issue was determined to be a faulty NO^3meter probe, not high nitrogen concentrations.

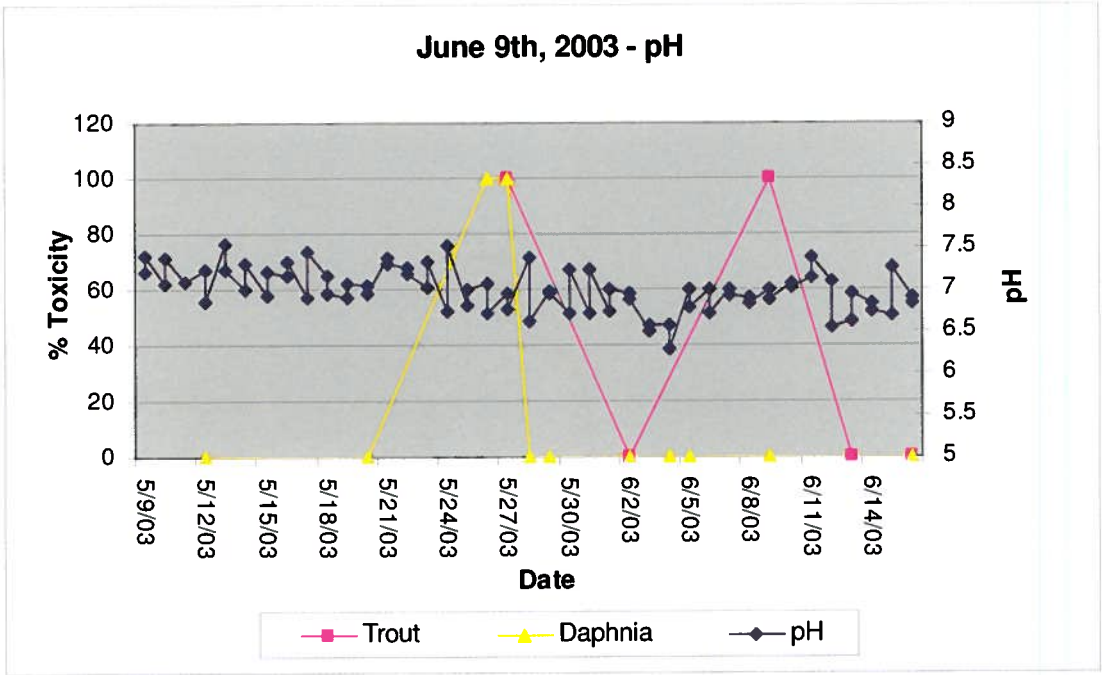
4.2.2.4 Daphnia Toxicity, June 9th, 2003

4.2.2.4.1 Graphical Representation- June 9th, 2003

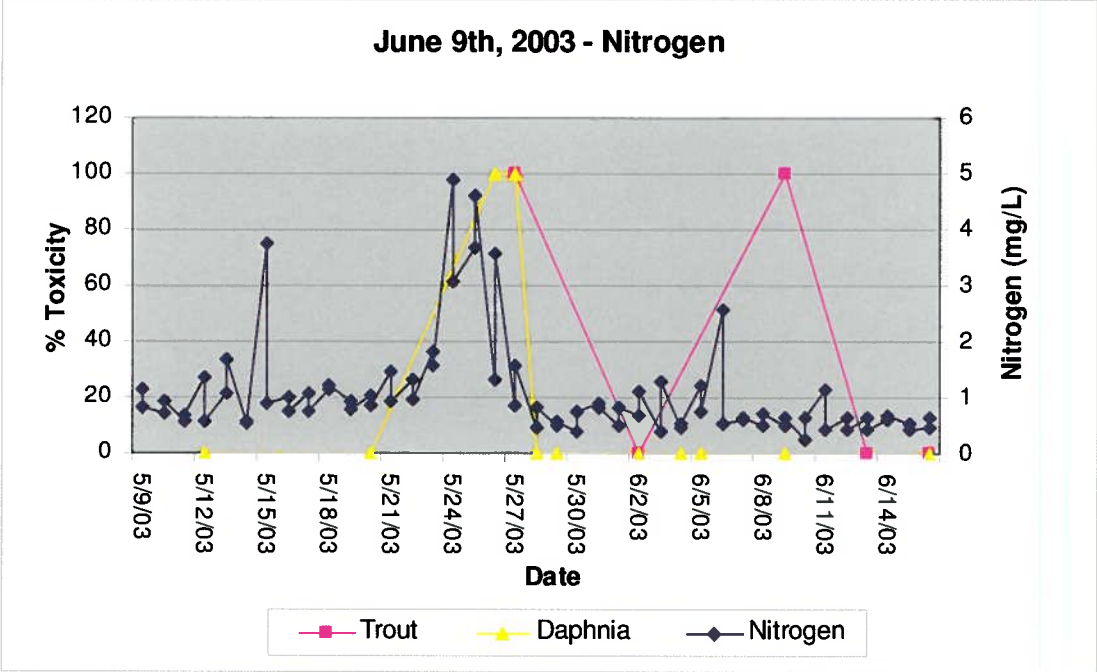
Each growth parameter was graphed against trout and daphnia toxicity (Appendix. D). A visual examination was conducted to identify correlations, trends, or values outside of the target ranges. Parameters displaying unusual characteristics are noted below.



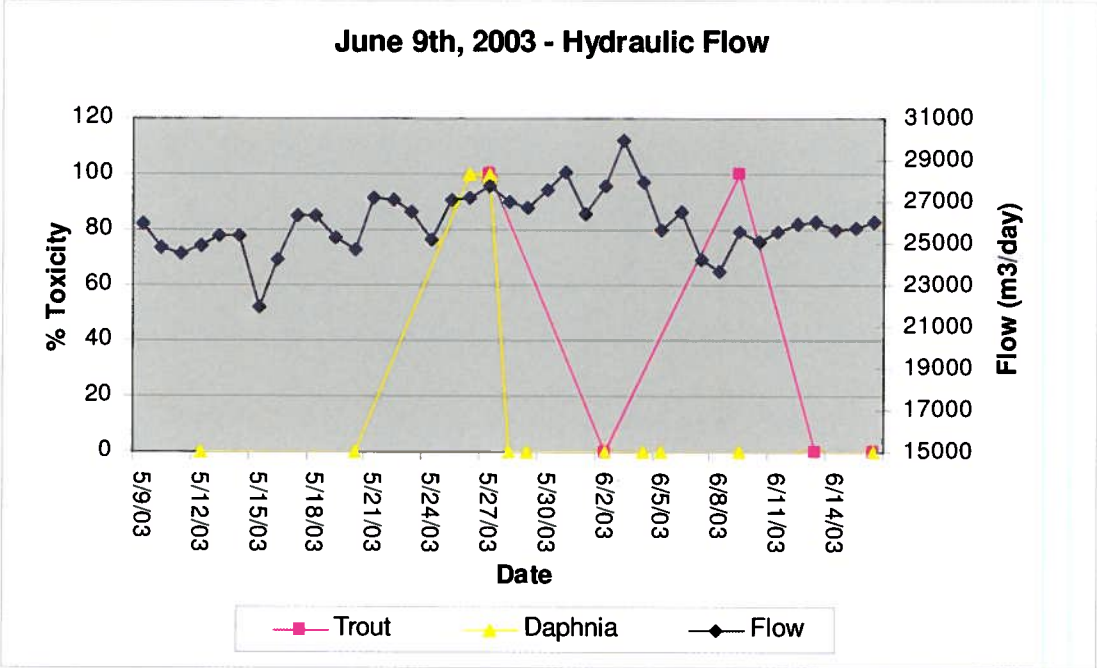
On several occasions the temperature of the aeration basin exceeded the maximum target value of 35° C, with the highest being 37° C on June 4th.



On June 4th, the pH of the aeration basin was below the target range at 6.28.



There were nitrogen values below and above the target prior to the toxicity episode, ranging from 0.386 mg/L on June 3rd to 4.905 mg/L on May 24th.



There was a trend of increasing flows prior to the toxicity event, to a maximum of 29,976 m^3/day on June 3rd.

4.2.2.4.2 Multiple Regression Analysis – June 9th, 2003

A multiple regression analysis was conducted on the growth parameters and toxicity data surrounding each toxicity event to identify correlations between variables. Data was analyzed for a period of 4 weeks prior and one week after the toxicity event. Multiple regression coefficients were calculated using Pearson Product-Moment Correlation and reviewed to identify correlations between parameters. The regression coefficients are presented in Table 6.

Table 6: Correlation coefficients for June 9th, 2003 daphnia toxicity.

Pearson Product-Moment Correlation									
	Daphnia	**Trout**	**LN**	**Flow**	**F/M**	**P**	**D.O.**	**pH**	**Temp**
Daphnia	1.000								
Trout	1.000	1.000							
LN	0.352	0.797	1.000						
Flow	0.794	-0.400	-0.175	1.000					
F/M	-0.105	0.888	0.188	-0.077	1.000				
P	-0.170	-0.098	0.026	-0.022	-0.095	1.000			
D.O.	0.631	0.871	0.434	-0.250	0.0536	-0.100	1.000		
pH	-0.070	0.662	0.290	-0.379	0.443	0.184	0.118	1.000	
Temp	-0.922	-0.894	-0.123	0.125	-0.135	-0.180	-0.176	-0.192	1.000

There were several more significant correlations between the growth parameters and the toxicity data surrounding the June 9th 2003, toxicity event. There are high positive correlations between flow and daphnia toxicity, F/M ratio and trout toxicity, and dissolved oxygen and trout toxicity. There are high negative correlations between temperature and daphnia toxicity, and temperature and trout toxicity. There are marked

positive correlations between dissolved oxygen and daphnia toxicity, flow and daphnia toxicity, nitrogen and trout toxicity, and pH and trout toxicity. There are positive moderate correlations between dissolved oxygen and nitrogen and F/M ratio and pH. There are negative moderate correlations between flow and trout toxicity.

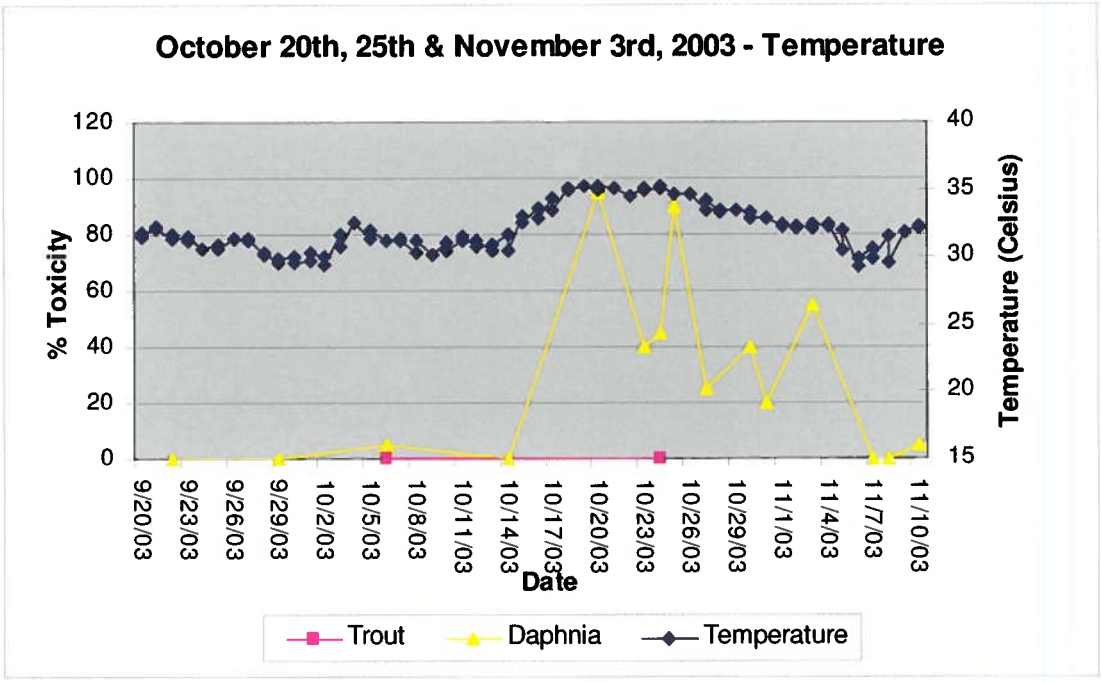
4.2.2.4.3 Records Review – June 9th, 2003

A review of mill records, log books, and databases was conducted to identify mill or wastewater treatment operating issues during the June 9th toxicity episode. There were no spills reported during this period. There was a paper machine shut-down reported in the mill on June 5th, 2003. During the first week of June, the EQ basin was taken off-line to re-treat it with hypochlorite.

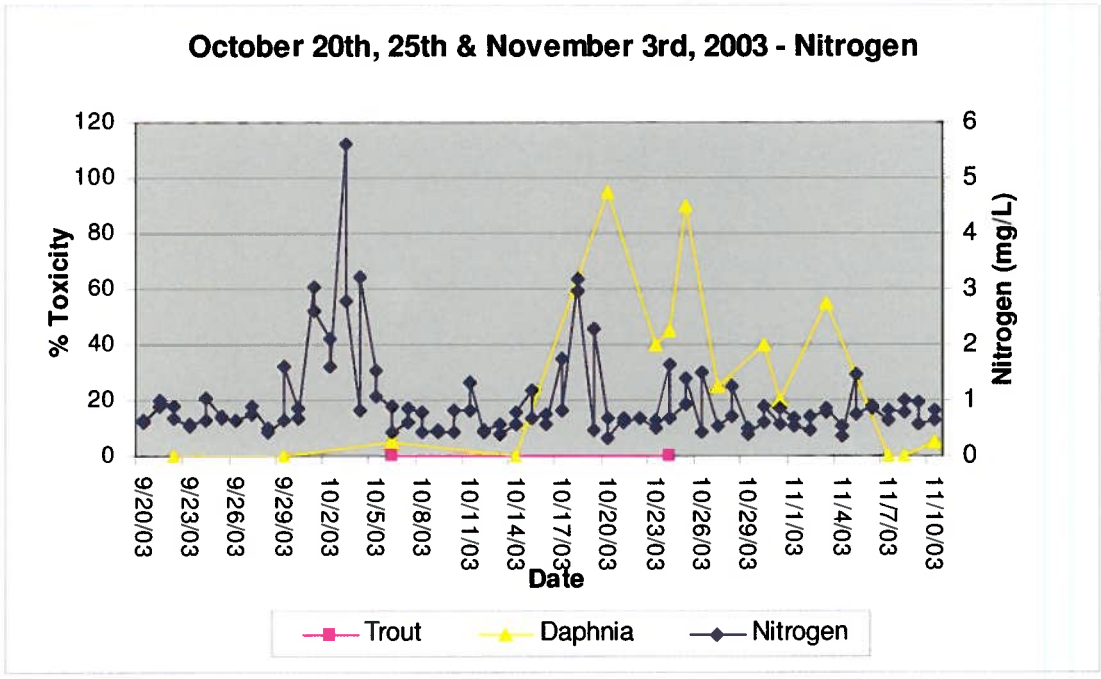
4.2.2.5 Daphnia Toxicity, October 20th, 25th, & November 3rd, 2003

4.2.2.5.1 Graphical Representation- October 20th, 25th, & November 3rd, 2003

Each growth parameter was graphed against trout and daphnia toxicity (Appendix. D). A visual examination was conducted to identify correlations, trends, or values outside of the target ranges. Parameters displaying unusual characteristics are noted below.



Temperature was slightly above the maximum target value on several occasions during the period. Peaks of higher temperature occurred concurrently with toxicity failures.



There were nitrogen values below and above the target prior to the toxicity episode, ranging from 0.335 mg/L on October 20th to 5.61 mg/L on October 3rd.

4.2.2.5.2 Multiple Regression Analysis – October 20th, 25th, & November 3rd, 2003

A multiple regression analysis was conducted on the growth parameters and toxicity data surrounding each toxicity event to identify correlations between variables. Data was analyzed for a period of 4 weeks prior and one week after the toxicity event. Multiple regression coefficients were calculated using Pearson Product-Moment Correlation and reviewed to identify correlations between parameters. The regression coefficients are presented in Table 7.

Table 7: Correlation coefficients for October 20th, 25th and November 3rd, 2003 daphnia toxicity.

Pearson Product-Moment Correlation									
	Daphnia	**Trout**	**LN**	**Flow**	**F/M**	**P**	**D.O.**	**pH**	**Temp**
Daphnia	1.000								
Trout	-	-							
LN	0.073	-	1.000						
Flow	-0.135	-	-0.110	1.000					
F/M	**0.506**	-	0.126	-0.294	1.000				
P	-0.110	-	0.234	-0.341	0.294	1.000			
D.O.	-0.279	-	-0.215	0.315	-0.368	-0.324	1.000		
pH	0.224	-	0.170	-0.136	0.277	0.165	0.063	1.000	
Temp	**0.778**	-	-0.019	-0.380	**0.692**	0.122	-0.324	0.296	1.000

There are no correlation values for trout toxicity data, as there was only one value of zero during this period. There were marked positive correlations between temperature and daphnia toxicity, and temperature and F/M ratio. There was a moderate positive correlation between F/M ratio and daphnia toxicity.

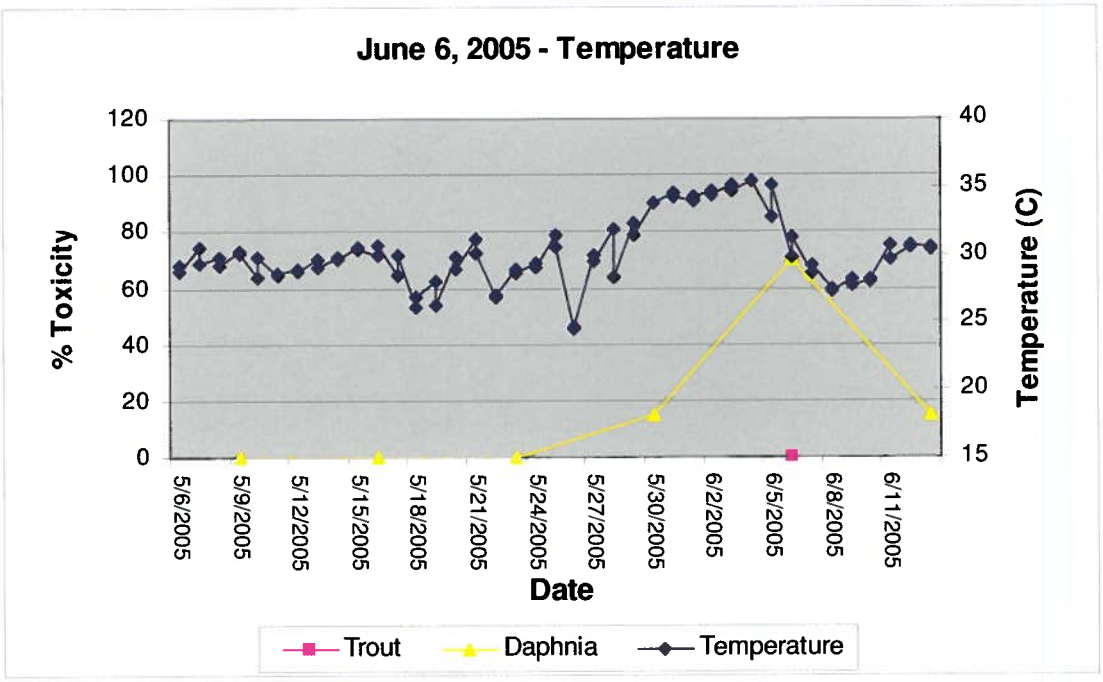
4.2.2.5.3 Records Review – October 20th, 25th, & November 3rd, 2003

A review of mill records, log books, and databases was conducted to identify mill or wastewater treatment operating issues during the May 26th and 27th toxicity episodes. There were no spills or mill shut-downs reporting during this period. The EQ basin was taken out of service and the selector was brought on-line on Oct. 14th. This was during a period where the selector was used as an intermediate step between the primary clarifier and the aeration basin to adjust the F/M ratio. Operators observed a decrease in filamentous bacteria in the aeration basin, resulting in sludge settling very rapidly.

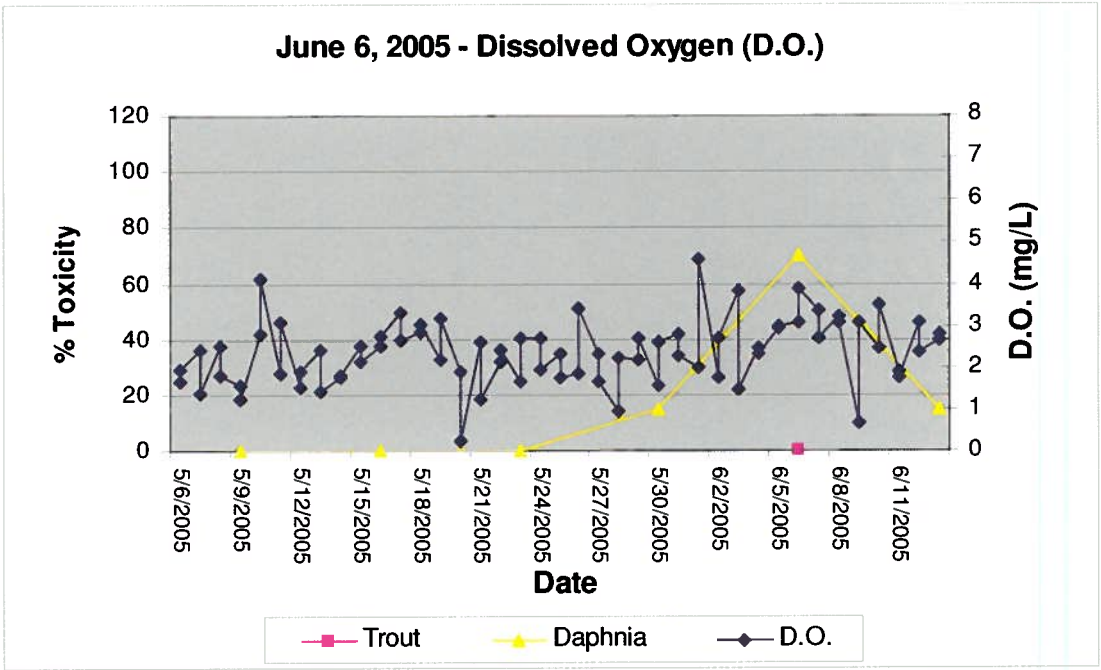
4.2.2.6 Daphnia Toxicity, June 6th, 2005

4.2.2.6.1 Graphical Representation- June 6th, 2005

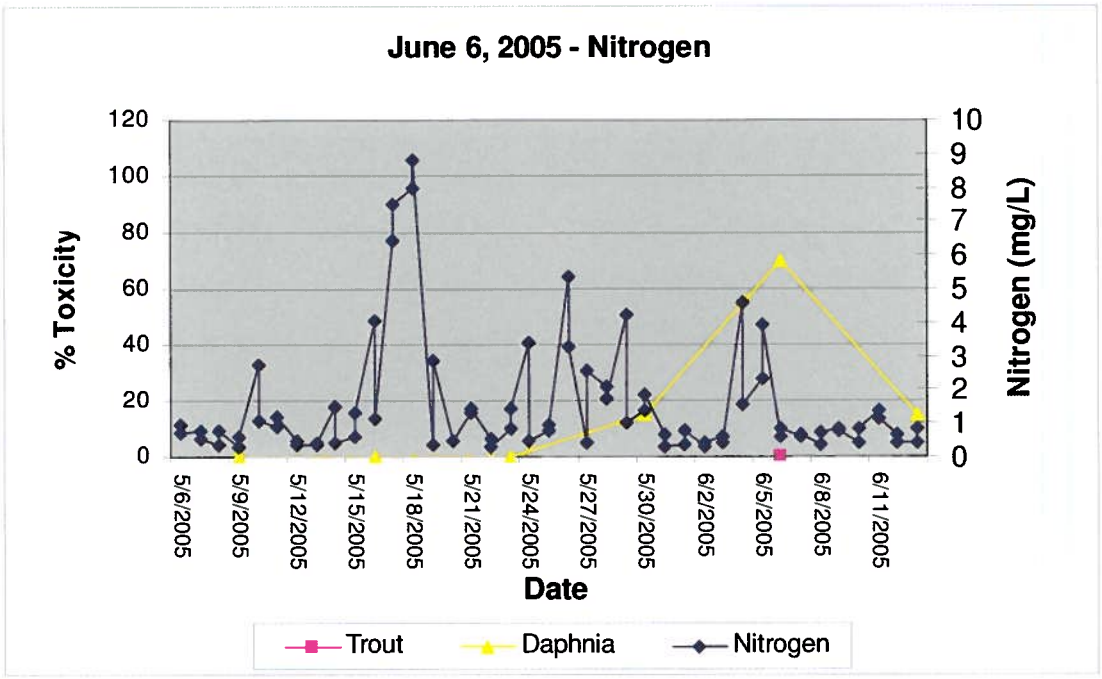
Each growth parameter was graphed against trout and daphnia toxicity (Appendix. D). A visual examination was conducted to identify correlations, trends, or values outside of the target ranges. Parameters displaying unusual characteristics are noted below.



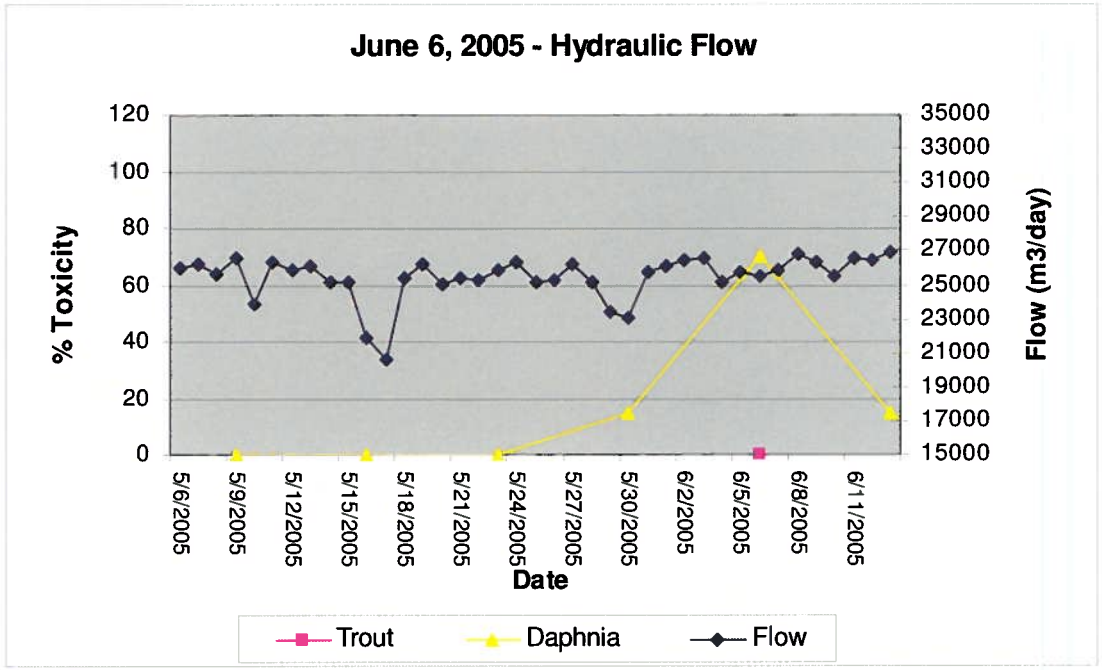
There were several values for temperature that were slightly over the maximum target value prior to the toxicity episode. Toxicity failures occurred directly after peaks in temperature.



There was one low value of dissolved oxygen of 0.23 mg/L May 20th.



There were nitrogen values below and above the target prior to the toxicity episode, ranging from 0.291 mg/L on May 9th to 8.815 mg/L on May 18th.



There were low flows of 20, 602 m^3/day on May 17th.

4.2.2.6.2 Multiple Regression Analysis – June 6th, 2005

A multiple regression analysis was conducted on the growth parameters and toxicity data surrounding each toxicity event to identify correlations between variables. Data was analyzed for a period of 4 weeks prior and one week after the toxicity event. Multiple regression coefficients were calculated using Pearson Product-Moment Correlation and reviewed to identify correlations between parameters. The regression coefficients are presented in Table 8.

Table 8: Correlation coefficients for June 6th, 2005 daphnia toxicity

Pearson Product-Moment Correlation									
	Daphnia	**Trout**	**LN**	**Flow**	**F/M**	**P**	**D.O.**	**pH**	**Temp**
Daphnia	1.000								
Trout	-	-							
LN	-0.237	-	1.000						
Flow	0.138	-	**-0.570**	1.000					
F/M	**-0.454**	-	0.006	-0.089	1.000				
P	-0.184	-	**0.448**	**-0.594**	0.397	1.000			
D.O.	**0.799**	-	0.201	-0.174	-0.201	-0.011	1.000		
pH	**0.411**	-	0.129	-0.050	-0.297	0.132	0.295	1.000	
Temp	0.141	-	-0.188	0.003	**-0.697**	-0.303	0.097	0.253	1.000

There are no correlation values for trout toxicity data, as there was only one value of zero during this period. There was a marked positive correlation between dissolved oxygen and daphnia. There were moderate positive correlations between pH and daphnia toxicity, and nitrogen and phosphorous. There were moderate negative correlations between F/M ratio and daphnia toxicity, nitrogen and flow, phosphorous and flow, and

temperature and F/M ratio.

4.2.2.6.3 Records Review – June 6th, 2005

A review of mill records, log books, and databases was conducted to identify mill or wastewater treatment operating issues during the June 5th toxicity episode. There were no spills or mill shut-downs reported during the period. Due to a series of unusual circumstances (unseasonably high temperatures, mechanical issues), there was a delay bringing the EQ basin into service for the summer season. The EQ basin was brought into service on June 4th, 2005.

5.0 DISCUSSION

5.1 Global Data – Full Data Set (2002 – 2006)

There were 8 Daphnia and 2 trout toxicity test failures between January 1, 2002 and December 31, 2006. The majority of failures occurred concurrently and can be attributed to two episodes of toxicity in the final effluent. Specifically, six of the toxicity test failures could be attributed to two episodes of effluent toxicity. The remaining four test failures were attributed to independent episodes of toxicity. Normal probability plots indicated all the variables were normally distributed, with the exception of nitrogen. Based on the multiple regression analysis, the daily measured variables behave relatively independent of each other and of toxicity variables over a five-year period.

5.2 Analysis of Data Surrounding Toxicity Events

Based on the results of the graphical representations, the multiple regression analyses, and the records review, the root and contributing causes of toxicity were identified for each toxicity episode over the five year period. Each result was reviewed to determine if relevant and significant to the cause of toxicity on each occasion. Only results related to the cause of toxicity were discussed. Insufficient data and faulty monitoring equipment resulted in irrelevant or insignificant results recorded during some toxicity events. For example, there was minimal trout data collected over a five week period on most occasions, and incorrect nitrogen readings were recorded due to a faulty residual probe during one toxicity event. In some cases, a correlation was noted between a parameter and the degree of toxicity; however, the parameter was well within the target

range. In addition, there was a lack of evidence or symptoms to support some correlations between parameters and toxicity results. For example, there were some cases of higher nitrogen values, however, there was no evidence of denitrification, such as floating sludge. As there was no notable symptoms, it is unlikely it was the cause of the toxicity event. All results potentially related to toxicity were discussed.

5.2.1 Daphnia Toxicity, May 13th, 2002

5.2.1.1 Root Cause

The aeration system shutdown on May 7th and May 9th would have resulted in rapid decreases in the dissolved oxygen levels. Oxygen levels would have decreased below target levels in under 30 minutes of the shutdown on both occasions. This is not reflected in the reported dissolved oxygen levels, as the testing was not conducted at this time. The start up of aeration basin rapidly corrected the problem. The shutdown of the aeration system was necessary, as key parts of the system needed to be repaired and working conditions in the basin would be too dangerous if the blowers were kept running.

5.2.1.2 Contributing Cause

For a period of five days beginning April 27th, one of the two paper machines in the mill was undergoing maintenance issues. This caused swings in the amount of BOD loading to the WWTP, resulting in difficulties with stabilizing nutrients, dissolved oxygen, and the food to mass ratio. In addition, draining of storage tanks in the paper

machines may have released septic material to the WWTP. This may have been the cause of the low pH (6.3) on April 30th. The lower pH inhibited the ability of the bacteria to metabolize the additional BOD loading. The moderate negative correlation between pH and daphnia toxicity supports this conclusion. There was a high nitrogen value of 4.86 mg/L on April 27th. Operators observed signs of denitrification at this time.

5.2.2 *Daphnia Toxicity, May 27th, 2002*

5.2.2.1 Root Cause

The large volume of whitewater drained from the paper machines on May 25th, caused swings in the amount of BOD loading to the WWTP, resulting in difficulties with stabilizing nutrients, dissolved oxygen, and the food to mass ratio. The biology could not consume the additional BOD, releasing a portion with the final effluent.

In addition, a second root cause of toxicity was identified. The DIP shutdown on May 22nd resulted in septic material entering the WWTP. There are no agitators in the DIP storage tanks, resulting in an accumulation of septic material in these storage tanks. This may have been the cause of the low pH (6.3) on April 30th. The lower pH inhibited the ability of the bacteria to metabolize the additional BOD loading. The moderate negative correlation between pH and daphnia toxicity supports this conclusion. In addition, floating sludge appeared on the secondary clarifier and oxygen uptake rates decreased in the aeration basin during this period. This would indicate that toxic material had entered the WWTP system, likely from the shutdown.

5.2.3 Daphnia and Trout Toxicity, May 26th and 27th, 2003

5.2.3.1 Root Cause

On May 23rd, the equalization (EQ) basin was brought into service for the summer season. Prior to 2004, the EQ basin was not drained and cleaned in the fall. Over the winter period the basin became anoxic, forming organic acids and other compounds that are potentially toxic to the bacteria. Prior to bringing the EQ basin on-line, stagnant effluent in the basin was treated with hypochlorite and aerated. This treatment typically required several days. However, unseasonably warm weather caused a rapid rise in effluent temperature. Consequently, it was necessary to bring the EQ basin into service without allowing for adequate treatment time. This resulted in a pulse of toxic effluent entering the aeration basin. During this period, operators observed an increase in filamentous bacteria, resulting in increased settling time. The negative moderate correlations between pH and daphnia toxicity, the decreasing trend of pH, and the operator's observations during this period, support this conclusion.

In addition, a secondary contributing cause of the toxicity was identified. After the EQ basin was brought back on-line, effluent samples from the aeration basin indicated an excessive amount of nitrogen in the system. This was reflected in the peak of nitrogen concentration of 4.905 mg/L on May 24th. To compensate, operators began to reduce the nitrogen dosing. Despite the reduction in nitrogen dosing, the tests, using a NO^3 ion probe, indicated that residual nitrogen levels were increasing. The operators

shut off the nitrogen supply and effluent samples were sent to an outside laboratory to cross check the NO^3 probe data. The results indicated a dramatic nitrogen deficiency in the effluent, contrary to what the NO^3 probe was reading, indicating a faulty probe. Nitrogen values during this period were disregarded as false readings.

5.2.3.2 Contributing Cause

Flows varied during this period, ranging from 16,289 m^3/day on April 27th to 31,603 m^3/day on May 6th. However, there was a trend of increasing flow from May 14th, which coincides with the toxicity events. The increasing flows would decrease retention time, not allowing for adequate treatment. This is reflected in the high positive correlation between flow and daphnia toxicity. The positive moderate correlation between F/M ratio and flow indicates an increase in BOD loading with the increasing flow. Considering the combination of decreased retention time and increased BOD loading, the bacteria may have been unable to metabolize the additional loading.

In addition, there were several values for temperature above the maximum target of 35° C during this period. The higher temperatures decreased the bacteria's ability to metabolize the BOD load. The positive moderate correlation between F/M ratio and temperature indicates higher temperature whitewater was entering the WWTP.

5.2.4 Trout Toxicity, June 9th, 2003

5.2.4.1 Root Cause

During the first week of June, the EQ basin was taken off-line to re-treat it with hypochlorite. However, the effluent temperature quickly rose to 37°C by June 4th, stressing the bacteria. When the EQ pond was put back on-line it was evident by visual inspection that the treatment plant was not operating well, bringing the pH down. A decreasing trend of pH was also observed during this period, with the lowest value being 6.28 on June 4th. The decreasing trend of pH supports the necessity of treating the EQ basin with hypochlorite and aeration.

5.2.4.2 Contributing Cause

There were nitrogen values below and above the target prior to the toxicity episode, ranging from 0.386 mg/L on June 3rd to 4.905 mg/L on May 24th. Denitrification was observed on May 30th, as a result of the high nitrogen values. Flows trended upwards during this period, and peaked at 29, 976 m^3/day on June 3rd. Higher flows decreased the retention time, resulting in decreased treatment time. This is reflected in the marked positive correlation between flow and daphnia toxicity. In addition, there was a paper machine shutdown reported in the mill on June 5th, 2003. Chemicals or septic material may have entered the WWTP, as a result of the shutdown.

5.2.5 Daphnia Toxicity, October 20th, 25th and November 3rd, 2003

5.2.5.1 Root Cause

The EQ basin was taken out of service on Oct. 14th, resulting in a rapid increase of temperature from 30 °C to 37°C. The higher temperatures decreased the bacteria's ability to metabolize the BOD load. The marked positive correlations between temperature and daphnia toxicity supports this conclusion.

5.2.5.2 Contributing Cause

During this period, the operators observed minimal filament growth. Filaments act as a backbone for the flocs to adhere to, as newly formed bacteria come into contact with the larger surface area of the filaments. The lack of filamentous bacteria, resulted in rapidly settling sludge and poor floc formation. The poor floc formation resulted in an increase in total suspended solids (TSS) in the final effluent. The levels of TSS were previously witnessed without experiencing toxicity; however, it may have been a contributing cause of the toxicity.

5.2.6 Daphnia Toxicity, June 6th, 2005

5.2.6.1 Root Cause

There was a rapid rise in temperature from 24°C on May26th, to 35°C on June 4th. The temperature of the aeration tank did not exceed the maximum target value; however,

the rapid increase in temperature decreased the bacteria's ability to metabolize the BOD load. Due to a series of unusual circumstances (unseasonably high temperatures, mechanical issues), there was a delay (June 4th) bringing the EQ basin into service for the summer season.

5.2.6.2 Contributing Cause

Low flows of 20, 602 m^3/day on May 17th indicated mechanical issues within the mill. This caused swings in the amount of BOD loading to the WWTP, causing difficulties with stabilizing nutrients, dissolved oxygen, and the food to mass ratio. There was a peak of nitrogen to 8.815 mg/L on May 18th and the corresponding decrease of DO to 0.23 mg/L May 20th. These values indicate conditions conducive to denitrification.

5.3 Summary

Previous toxicity events at the Pine Falls wastewater treatment facility can be attributed to various direct and indirect sources; specifically: low dissolved oxygen, high temperature, nitrogen deficiency, denitrification, high total suspended solids, dramatic swings in BOD loading, high hydraulic flows, chemical releases from the mill, and septic material entering the system during mill shutdowns and while bringing the EQ basin into service. Particularly, the root cause of five of the 10 toxicity events is related to bringing the EQ basin into service. The root cause in three of the ten cases was partially related to bringing the EQ basin into service and partially related to a nitrogen deficiency caused by failure of a NO^3 metering probe. The root causes of the remaining two cases were related

to releases of septic material or chemicals from the mill operation and low dissolved oxygen caused by an aeration basin shutdown. With the exception of the May 27th, 2002 toxicity event, contributing causes were significant in the toxicity test failures. Contributing causes included: denitrification, high total suspended solids, dramatic swings in BOD loading, high hydraulic flows, and chemical releases and septic material entering the system during mill shutdowns. See Table 9 for a summary of the sources of mill effluent toxicity at the Pine Falls wastewater treatment facility.

Table 9: Sources of Mill Effluent Toxicity			
Date	**Species Sensitivity**	**Source of Toxicity**	
		Root Cause	**Contributing Cause**
May 13, 2002	Daphnia	A maintenance shutdown of the aeration basin resulted in low dissolved oxygen levels.	Paper machine shutdown resulted in BOD swings, denitrification, and low pH.
May 27, 2002	Daphnia	A DIP shutdown may have resulted in septic material or chemicals entering the mill sewer. In addition, whitewater drained from the paper machines caused an increase in the BOD loading	
May 26, 2003	Daphnia	The EQ basin was brought into service too quickly, resulting in a pulse of septic effluent entering the system. In addition, a nitrogen deficiency occurred as a result of a failure in the NO^3 probe.	Increased flows, wastewater temperatures, and BOD loading from the mill.
May 27, 2003	Trout	Same source as the May 26th toxicity event.	
May 27, 2003	Daphnia	Same source as the May 26th toxicity event.	
June 9, 2003	Trout	A rapid rise in effluent temperature as the EQ basin was brought off line to be treated with hypochlorite.	Increased flows and BOD loading from the mill, and denitrification.
October 20, 2003	Daphnia	A rise in temperature as a result of bringing the EQ basin out of service.	A decrease in filaments prevented proper formation of flocs, causing more increased TSS in the final effluent.
October 25, 2003	Daphnia	Same source as the October 20th toxicity event.	
November 3, 2003	Daphnia	Same source as the October 20th toxicity event.	
June 6, 2005	Daphnia	An increase in effluent temperature due to a delay in bringing the EQ basin online.	Swings in BOD loading from the mill and denitrification.

The results of this study are relatively consistent with the findings of the 2002 Kovacs et al survey of 73 Canadian pulp and paper mills. Three of nine mills identified the causes of trout toxicity: malfunctions in the biotreatment system, a mill upset, and hydrogen sulphide. Similarly, a malfunction in an NO^3 probe was a contributing cause in one of the two cases of trout toxicity, and mill upsets were contributing causes in both of the trout toxicity failures at the Pine Falls facility. Three of 19 mills identified the causes of daphnia toxicity as polymers. One of these mills also identified contributing causes as inadequate biotreatment due to high effluent flows, low dissolved oxygen levels and contamination by a cleaning product. The remaining mills in the survey did not identify the causes of daphnia toxicity. Although non-concentration dependent daphnia toxicity has occurred at the Pine Falls facility as a result of polymer releases, toxicity test failures at 100% effluent concentrations has not occurred. Low dissolved oxygen, high flows and chemical contamination was identified as contributing causes of daphnia toxicity in five of the ten cases at the Pine Falls facility.

In contradiction to toxicity episodes at the Pine Falls facility, the primary cause of trout toxicity identified in Kovacs et al (July 2003), was poor biotreatment performance (i.e. ammonia, carbon dioxide, resin acids). In the Kovacs study, the most common cause of Daphnia toxicity was misapplication of polymers. Polymers have not been cited as a cause of toxicity test failures at the Pine Falls facility. In both this study and the Kovacs report, causes of toxicity were due to more than one compound in cases of both trout and daphnia toxicity.

Contradictions between previous studies and this study illustrate the point that causes of mill effluent toxicity are site specific. There were two causes of site specific toxicity at the Pine Falls facility that were not prevalent at other mills. High aeration basin temperature and septic material entering the system was the root or contributing cause in eight of 10 toxicity events at the Pine Falls facility.

6.0 CONCLUSIONS

The purpose of this study was to develop a method to assist in rapid identification of the sources of mill effluent toxicity at the Tembec Pine Falls wastewater treatment facility. A three phase methodology was developed: graphical representation of the primary growth parameters versus toxicity data to identify trends, multiple regression analyses to identify correlations between these variables, and a review of mill and wastewater treatment plant operating records. Examining the previous episodes of toxicity using this approach provided a basis for investigations of future toxicity events. In addition to the development of this methodology, the following considerations were noted throughout the study:

- The causes of toxicity are relatively specific to the site, as there are many variances between site, including, the design of the facility, the type of chemicals used, the type of furnish used in production, and the end product. For example, the primary cause of previous toxicity episodes at the Pine Falls facility was related to the operation of the EQ basin. This was not identified as a cause of toxicity in other mills.
- Rarely can a toxicity episode be attributed to one causal agent. The compounding effect of several contributing causes is significant in most cases.
- The causes of toxicity are often related to the operation of the mill, and are not within the control of the wastewater treatment plant operators. Causes of toxicity through mill operation include: release of chemicals or septic material to mill sewers, swings in BOD loading, high flows, and mechanical breakdown.

Communication between mill and WWTP operators is imperative for the WWTP operators to adjust growth pressures to address these issues and ensure adequate treatment of effluent.

- Rapid changes in growth pressures may cause toxicity, regardless if the growth pressure is within the target range. Rapid changes do not allow the biomass adequate time to adapt to variations, and may damage or destroy the inventory of bacteria.
- The likelihood of a toxicity event is largely dependent on the health of the biomass at the onset of a toxic event. If oxygen uptake rates are high, indicating a healthy biomass, the bacteria may be able to survive a toxic event.

Investigation of future toxicity events will include consideration of the points above, and be will be based on the three phase methodology. This methodology will be added to the Tembec Pine Falls standard operating procedures.

References

1. Franzblau, A. A Primer of Statistics for Non-Statisticians, Harcourt, Brace & World, 1958.

2. Jenkins David, Daigger Glen, Richard Michael, Manual on the Causes and Control of Activated Sludge Bulking and Foaming, Lewis Publishers, 1993.

3. Kerri Paul, Dendy Bill, Brady John, Crooks William, Operation of Wastewater Treatment Plants, 6th ed., Office of Water Programs, College of Engineering and Computer Science, 2004.

4. Klopping Paul, Richard H. Marshall Jr., Michael G. Richard, Activated Sludge Operations for Pulp and Paper Mills, Callan and Brooks Publishing Company, 1995.

5. Kovacs, Tibor Highlights of the 29th Annual Aquatic Toxicity Workshop, Paprican, December 2002b.

6. Kovacs, Tibor Highlights of the 31st Annual Aquatic Toxicity Workshop, Paprican, November 2004.

7. Kovacs Tibor, Gibbons Sharon, O'Connor Brian, Martel Pierre, Paice Mike, Naish Valerie, Voss Ron, Diagnosing Causes of Mill Effluent Toxicity, Paprican, September 2003b.

8. Kovacs Tibor, Gibbons Sharon, O'Connor Brian, Martel Pierre, Paice Mike, Naish Valerie, Voss Ron, A Summary of Case Studies Investing the Causes of Pulp and Paper Mill Effluent Regulatory Toxicity, Paprican, July 2003a.

9. Kovacs Tibor, Gibbons Sharon, Naish Valerie, Voss Ron Regulatory Toxicity Compliance in Relation to Water Usage: 2000 Survey of Canadian Mills, Paprican, December 2002a.

10. Luoma, Maire Cycle 3 Environmental Effects Monitoring for Pine Falls Operations, Winnipeg River, Manitoba, Stantec Consulting Ltd., March 2004.

11. Marshall Rick, Industrial Activated Sludge Operations, Marshall Environmental Training and Consulting Group, Inc., 1999.

12. Oram Brian, Nitrogen – Ammonia in Water, Wilkes University Center for Environmental Quality Environmental Engineering and Earth Science, 2004.

13. Sithole B.B., Milanova, E. A Survey of Additives Used in Canadian Pulp and Paper Mills, Paprican, June 1994.

APPENDIX A
DEFINITION OF TERMS

Definition of Terms

Activated Sludge: A treatment process that increases the speed of decomposition in wastewater. Activated sludge is added to wastewater and the mixture is aerated and agitated. The activated sludge is then allowed to settle through sedimentation and is disposed of or reused as required.

Biological Oxygen Demand (BOD): The rate which organisms use oxygen to consume organic material in wastewater. BOD measurements (mg/L) are used as a measure of the organic strength of waste in wastewater.

Chemical Oxygen Demand (COD): The amount of oxygen required to oxidize an organic compound in the presence of a strong oxidizing agent under acidic conditions (measured in mg/L).

Denitrification: An anoxic process that occurs when nitrate or nitrate ions are reduced to nitrogen gas. Nitrogen bubbles are formed as a result of this process. Bubbles attach to the flocs and float the floc to the surface of the clarifiers.

Dissolved Oxygen (DO): The atmospheric oxygen in wastewater (measured in mg/L).

Filaments: Bacteria which grow in a thread like form (measured in the number per floc).

Floc: Bacteria and other particles that gather to form a clump or cluster.

Food to Mass Ratio (F/M): A measure of the food (BOD load) in relation to the microbiology present in the aeration basin.

Mixed Liquor: The mixture of activated sludge, primary effluent and return activated sludge in the aeration basin.

Mixed Liquor Suspended Solids (MLSS): The suspended solids in the mixed liquor of the aeration basin (measured in mg/L),

Oxygen Reduction Potential (ORP): The electrical potential required for electron transfer from one compound to another.

Oxygen Uptake Rate (OUR): A measure of the oxygen required for the biomass to consume the BOD load.

Return Activated Sludge (RAS): Sludge collected on the floor of the secondary clarifier and returned to the aeration basin.

Sludge: Settled solids produced during wastewater treatment.

Total Suspended Solids (TSS): Solids that float or remain suspended in wastewater (measured in mg/L).

Volatile Organic Acids (VOA): Fatty acids produced during digestion.

Waste Activated Sludge (WAS): Sludge collected on the floor of the secondary clarifier, which is pumped to sludge dewatering.

(Definitions obtained from Kerri Paul, Dendy Bill, Brady John, Crooks William, Operation of Wastewater Treatment Plants, 6th ed., Office of Water Programs, College of Engineering and Computer Science, 2004.)

APPENDIX B
PHOTOS

Figure 1: Aerial view of Pine Falls paper mill site.

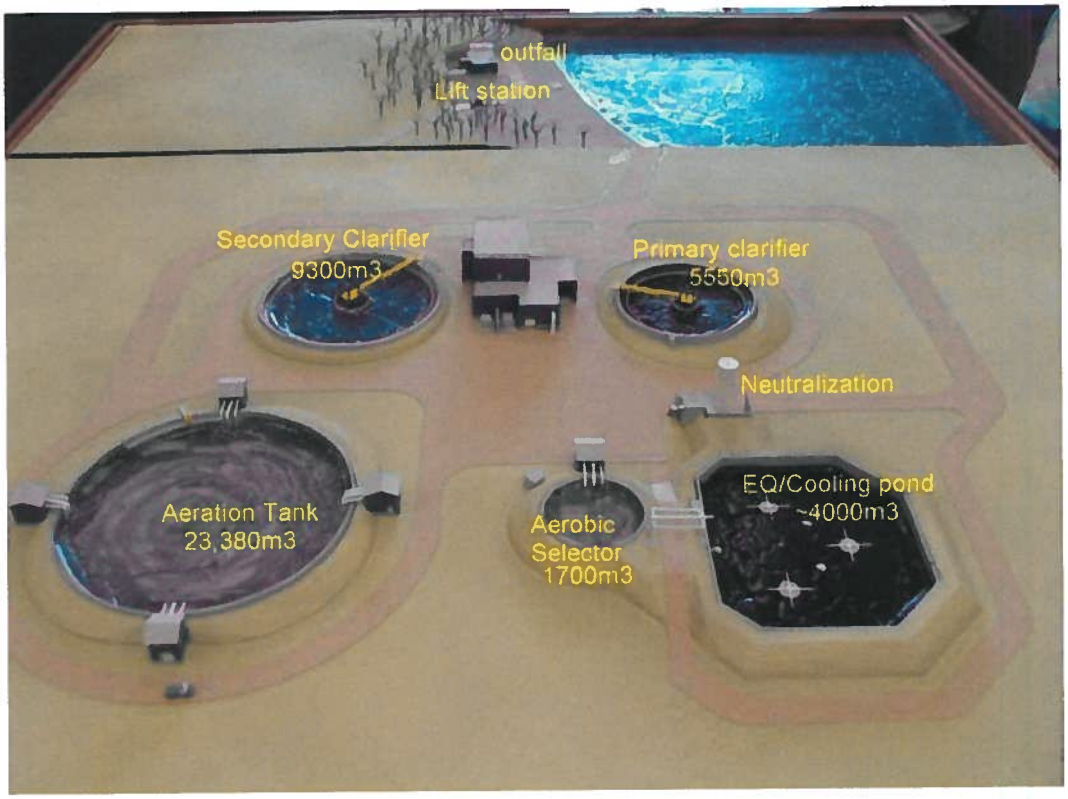


Figure 2: Design model of the Pine Falls wastewater treatment facility.

Figure 3: Primary clarifier at the Pine Falls wastewater treatment facility.

Figure 4: Aeration basin at the Pine Falls wastewater treatment facility.

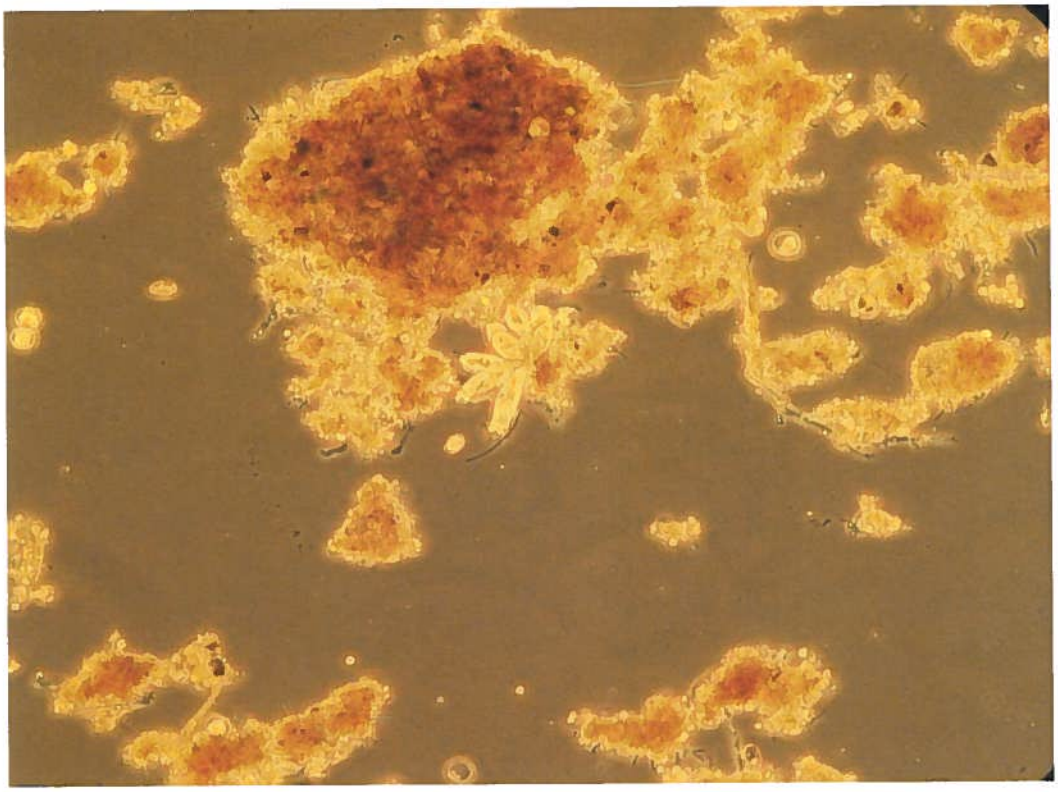


Figure #5: Microscopic view of the floc forming bacteria.

Figure #6: Secondary clarifier at the Pine Falls wastewater treatment facility.

APPENDIX C
Global Data (2002 – 2006)

Tembec Pine Falls Wastewater Treatment Plant Toxicity Data and Growth Pressures - December 2001 to December 2006									
Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
1-Dec-01	30.37552	7.33	2.93	1.97025	3.595	0.2397904	25890.97		
2-Dec-01	30.33234	7.47	2.07	1.3405	3.5	0.2397904	25738.51		
3-Dec-01	30.72608	7.03	1.94	2.25	3.695	0.21980056	24321.55		
4-Dec-01	30.34839	7.46	3.76	0.52	2.84	0.21980056	23562.23		
5-Dec-01	28.951835	7.29	4.105	0.74175	3.11	0.21980056	22374.87		
6-Dec-01	28.7354	7.145	2.75	1.14725	3.7175	0.21980056	23113.06		
7-Dec-01	28.121455	7.005	2.835	1.57375	4.33	0.21980056	22482.78		
8-Dec-01	27.779475	7.055	3.3	2.2775	3.66	0.21980056	25519.01		
9-Dec-01	28.70309	7.14	2.19	0.2815	3.235	0.19981072	24532.64		
10-Dec-01	29.44818	7.2	3.84	2.83	3.635	0.49319431	23658.65		
11-Dec-01	29.80736	7.19	2.27	2.43	3.925	0.49319431	23406.11		
12-Dec-01	28.96367	7.265	3.335	1.805	4.8525	0.49319431	22510.71		
13-Dec-01	28.599595	7.515	4.095	4.725	4.9725	0.49319431	26084.93		
14-Dec-01	28.777615	7.07	2.695	1.384	4.1875	0.49319431	21724.67		
15-Dec-01	27.55526	7.28	3.615	5.6675	4.02	0.49319431	25226.63		
16-Dec-01	29.42733	7.22	1.59	1.6075	3.485	0.78657789	25383.1		
17-Dec-01	30.72133	7.13	2.15	1.4305	3.425	0.51641572	24941.67		
18-Dec-01	29.99223	7.21	1.915	0.38925	4.1375	0.51641572	24901.59		
19-Dec-01	28.89744	6.985	1.865	0.6575	3.6475	0.51641572	27920.38		
20-Dec-01	29.315085	6.905	1.73	0.62	3.1275	0.51641572	26009.62		
21-Dec-01	29.658275	7.145	2.84	1.45	3.3975	0.51641572	25532.83		
22-Dec-01	29.872785	7.145	2.395	0.7985	4.06	0.51641572	24566.84		
23-Dec-01	28.88761	7.385	2.94	3.2205	3.8775	0.51641572	27232.66		
24-Dec-01	27.36518	7.2	3.41	0.34425	2.4575	0.51641572	27112.705		
25-Dec-01	23.94479	7.425	6.455	1.469	2.8	0.51641572	26191.6975		
26-Dec-01	22.84439	7.21	5.23	1.97	2.71	0.51641572	26992.75		
27-Dec-01	25.81901	6.79	0.3	0.4705	2.84	0.51641572	25270.69		
28-Dec-01	27.80257	6.78	1.35	1.0565	3.17	0.51641572	25169.62		
29-Dec-01	28.11029	7.11	1.535	2.677	3.975	0.51641572	25275.04		
30-Dec-01	28.83847	7.01	2.13	0.9505	5.015	0.51641572	24166.97		
31-Dec-01	28.95958	7.21	1.58	1.58	4.06	0.51641572	24907.47		
1-Jan-02	29.12684	6.98	1.32	2.445	3.795	0.51641572	24941.25		
2-Jan-02	28.873335	7.19	1.85	1.945	4.0325	0.51641572	24768.91		
3-Jan-02	28.84198	6.905	2.48	0.8695	3.238	0.51641572	25118.27		
4-Jan-02	29.372695	7.075	0.975	2.4625	3.265	0.51641572	24024.55		
5-Jan-02	29.566465	7.11	1.6	2.615	4.05	0.51641572	23712.84		
6-Jan-02	28.86736	6.99	2.14	2.715	3.925	0.24625355	23931.68		
7-Jan-02	29.58287	7.27	2.26	0.432	3.6475	0.22995925	24474.38	20	0
8-Jan-02	29.82782	7.41	0.98	0.465	3.335	0.22995925	25575.41		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
9-Jan-02	28.83207	7.28	2.64	1.4005	3.771	0.22995925	27072.68		
10-Jan-02	28.099415	7.25	2.735	0.5485	3.575	0.22995925	25855.96		
11-Jan-02	28.68332	7.025	1.475	0.8455	3.1855	0.22995925	25378.48		
12-Jan-02	28.870935	6.835	2.715	2.005	4.47	0.22995925	24411.95		
13-Jan-02	29.44574	6.94	2.87	2.47	4.19	0.21366494	23898.16		
14-Jan-02	30.01988	7.23	2.45	1.44	3.495	0.24825231	24935.16		0
15-Jan-02	30.37494	7.12	3.55	1.435	3.73	0.24825231	25247		
16-Jan-02	29.651605	7.425	2.21	2.54575	4.2625	0.24825231	26176.26		
17-Jan-02	28.29172	7.125	2.16	2.93875	3.9425	0.24825231	25538.78		
18-Jan-02	27.945905	7.355	2.07	0.52075	3.0325	0.24825231	25962.77		
19-Jan-02	28.157665	7.295	2.01	2.3375	3.3975	0.24825231	25355.48		
20-Jan-02	28.9848	6.73	1.13	1.325	4.26	0.28283967	24763.33		
21-Jan-02	29.10853	7.25	2.31	1.664	3.1	0.17714514	26152.33		5
22-Jan-02	29.01231	7.29	2.93	2.445	3.3825	0.17714514	26342		
23-Jan-02	27.90723	7.105	4.515	0.64	3.595	0.17714514	26493.25		
24-Jan-02	27.31645	7.34	2.565	2.3	3.3775	0.17714514	25982.93		
25-Jan-02	26.65138	7.415	3.055	2.935	4.655	0.17714514	24129.89		
26-Jan-02	26.637685	7.19	3.505	5.335	4.1825	0.17714514	27532.88		
27-Jan-02	27.36952	6.9	0.26	0.4425	3.003	0.0714506	29448.07		
28-Jan-02	26.83392	6.73	2.99	1.16175	3.2465	0.13853938	27554.61		0
29-Jan-02	27.97374	6.81	2.4	1.881	3.49	0.13853938	25996.92		
30-Jan-02	28.296365	7.15	1.87	1.915	3.095	0.13853938	26137.61		
31-Jan-02	28.799625	7.055	3.335	5.4875	4.0875	0.13853938	25002.24		
1-Feb-02	28.55485	6.96	3.78	1.80725	4.4725	0.13853938	25341.05		
2-Feb-02	28.80318	7.375	4.72	0.9295	3.285	0.13853938	25023.34		
3-Feb-02	29.14333	7.1	2.18	1.29	3.175	0.20562816	26032.69		
4-Feb-02	28.82	7.195	1.56	0.631	3.9605	0.16287997	26789.56	0	0
5-Feb-02	28.93482	6.98	2.76	4.04	4.355	0.16287997	25436.38		
6-Feb-02	28.422875	7.285	2.845	1.85	3.91	0.16287997	24060.6		
7-Feb-02	28.38313	7.4	2.575	1.225	3.45	0.16287997	24663.97		
8-Feb-02	28.57596	7.355	4.17	2.9425	4.4225	0.16287997	25251.11		
9-Feb-02	28.911755	7.27	3.1	2.07	4.5025	0.16287997	26781.97		
10-Feb-02	28.41566	7.23	1.91	0.3105	3.267	0.12013178	28759.79		
11-Feb-02	27.21592	7.08	3.58	2.97	4.29	0.08475994	28020.69		0
12-Feb-02	27.95843	6.875	2.43	1.4535	3.8975	0.08475994	26313.52		
13-Feb-02	27.423975	7.135	1.57	1.1825	3.45	0.08475994	31002.64		
14-Feb-02	26.654055	6.92	3.515	1.5325	3.9175	0.08475994	26892.55		
15-Feb-02	28.21467	7.105	2.555	2.015	4.0925	0.08475994	24992.2		
16-Feb-02	29.44816	6.82	2.76	2.2375	4.19	0.08475994	26068.65		
17-Feb-02	28.12139	7.18	3.83	4.57	5.181	0.0493881	20728.75		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
18-Feb-02	28.05472	7.09	2.14	3.755	3.595	0.11935174	26819.61		0
19-Feb-02	29.17521	7.07	2.44	0.835	3.17	0.11935174	26580.31		
20-Feb-02	29.093725	7.155	1.835	0.775	3.6	0.11935174	27858.23		
21-Feb-02	27.94049	7.01	2.18	6.8575	8.645	0.11935174	21669.71		
22-Feb-02	27.94519	7.045	2.285	4.46	4.27	0.11935174	24522.6		
23-Feb-02	28.80571	6.965	2.27	2.56	3.1275	0.11935174	25199.51		
24-Feb-02	29.30006	6.87	3.34	1.67	3.5	0.11935174	25042.68		
25-Feb-02	27.98555	7.03	4.71	0.5855	3.96	0.11935174	25519.59		0
26-Feb-02	26.75522	7.59	4.72	2.655	3.725	0.11935174	25253.82		
27-Feb-02	26.255765	7.14	3.385	3.0925	4.365	0.11935174	26662.39		
28-Feb-02	26.53315	7.18	3.32	1.08175	3.7775	0.11935174	25570.67		
1-Mar-02	26.757505	6.765	3.855	0.408	3.2	0.11935174	24651.1		
2-Mar-02	27.59514	7.03	2.875	0.955	3.595	0.11935174	24542.22		
3-Mar-02	28.00702	6.96	4.03	0.7825	3.6775	0.18931537	24468.61		
4-Mar-02	28.47835	7.03	3.99	0.61	3.76	0.28002402	25081.58	10	0
5-Mar-02	27.34636	7.33	2.28	0.84	4.095	0.28002402	25079.36		
6-Mar-02	25.933545	6.95	2.53	0.712	3.96	0.28002402	21649.63		
7-Mar-02	24.72684	7.1	3.225	2.133	4.27	0.28002402	24535.5		
8-Mar-02	25.35829	7.19	3.84	0.49175	3.4765	0.28002402	25441.98		
9-Mar-02	26.160045	7.075	2.34	0.4635	3.565	0.28002402	25555		
10-Mar-02	26.917675	7.01	2.265	1.404	4.2425	0.37073267	24137.07		
11-Mar-02	28.1711	7.24	2.15	0.965	3.76	0.39736122	25236.24		10
12-Mar-02	27.279	7.02	3.87	2.086	3.825	0.39736122	22695.19		
13-Mar-02	27.01137	7.04	2.935	4.3025	3.9	0.39736122	23208.85		
14-Mar-02	27.351115	6.82	2.795	5.335	4.2665	0.39736122	24872.09		
15-Mar-02	26.987745	7.255	3.7	6.945	4.775	0.39736122	23845.44		
16-Mar-02	27.66158	6.975	2.27	2.135	3.3165	0.39736122	23878.93		
17-Mar-02	28.59259	7.08	1.855	0.5145	3.0875	0.42398976	24198.36		
18-Mar-02	28.3048	6.94	1.1	0.56025	3.6625	0.29151734	24775.68		0
19-Mar-02	27.701525	7.145	0.71	0.61125	3.265	0.29151734	25316.02		
20-Mar-02	26.80242	7.105	1.05	1.864	3.745	0.29151734	24419.3		
21-Mar-02	27.15594	6.98	1.31	1.35275	3.8275	0.29151734	27410.1		
22-Mar-02	27.82726	7.025	1.665	2.7275	3.3355	0.29151734	25584.19		
23-Mar-02	27.901445	7.27	2.28	4.75	5.2175	0.29151734	26219.29		
24-Mar-02	28.60241	6.86	2.18	0.71	3.168	0.15904493	26447.48		
25-Mar-02	28.59144	6.79	0.47	1.9	2.87	0.21197728	29229.68		5
26-Mar-02	29.33374	6.87	1.35	3.19	3.995	0.21197728	28294.43		
27-Mar-02	29.22837	7.115	1.72	1.1125	4.45	0.21197728	27439.47		
28-Mar-02	29.863695	6.71	2.11	1.975	4.5025	0.21197728	28524.8		
29-Mar-02	29.53406	6.97	1.465	1.51125	3.89	0.21197728	26231.08		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
30-Mar-02	28.85535	6.965	1.905	1.646	4.0905	0.21197728	25902.67		
31-Mar-02	28.7761	7.06	1.73	3.815	4	0.26490963	25103.45		
1-Apr-02	28.75973	7.22	2.4	1.545	3.663	0.32391416	26160.5	0	10
2-Apr-02	28.28052	6.88	1.18	2.655	3.63	0.32391416	26557.76		
3-Apr-02	27.62897	7.14	3.145	1.69	3.4325	0.32391416	24291.29		
4-Apr-02	28.561365	7.23	3.43	4.525	3.815	0.32391416	26066.66		
5-Apr-02	28.120895	7.04	3.525	1.67625	3.4975	0.32391416	24560.74		
6-Apr-02	24.32879	7.51	2.08	2.14	3.365	0.32391416	23092.5		
7-Apr-02	24.34705	7.23	1.18	1.27	4.045	0.38291869	23461.14		
8-Apr-02	24.56095	7.13	1.53	0.501	4.39	0.34538145	25698.15		10
9-Apr-02	24.85692	7	1.8	2.82	3.003	0.34538145	26513.71		
10-Apr-02	23.672605	7.315	3.865	1.15	3.8425	0.34538145	24769.5		
11-Apr-02	24.5449	7.19	2.89	2.11	3.6075	0.34538145	26456.42		
12-Apr-02	25.75252	7.385	1.425	1.9075	2.93	0.34538145	27364.52		
13-Apr-02	26.677475	6.99	1.785	1.223	4.283	0.34538145	26272.46		
14-Apr-02	27.80233	7.51	1.27	0.51	3.46	0.3078442	28185.97		
15-Apr-02	26.32814	7.46	2.3	0.9375	4.06	0.29506076	28070.11		5
16-Apr-02	25.86957	7.24	1.97	0.3215	3.219	0.29506076	27102.2		
17-Apr-02	24.289695	7.23	2.35	0.43825	3.1325	0.29506076	24179.85		
18-Apr-02	22.568845	7.085	2.925	1.7775	4.23	0.29506076	24923.83		
19-Apr-02	23.69167	7.085	3.055	0.62	3.545	0.29506076	26794.49		
20-Apr-02	24.61004	7.19	2.215	1.77	3.8575	0.29506076	24198.01		
21-Apr-02	24.6767	7.02	2.69	1.52075	3.59525	0.28227732	26107.13		
22-Apr-02	29.05872	7	2.14	1.2715	3.333	0.2870408	25720.23		5
23-Apr-02	28.40875	7.12	2.28	0.525	3.53	0.2870408	25557.37		
24-Apr-02	26.883995	7.065	2.71	0.453	3.6375	0.2870408	28705.72		
25-Apr-02	26.5267	7.33	1.635	0.61575	3.16	0.2870408	24009.87		
26-Apr-02	26.036165	7.09	3.455	0.76825	3.895	0.2870408	21284.87		
27-Apr-02	25.228595	6.92	4.055	3.33	4.6025	0.2870408	17073.28		
28-Apr-02	25.63977	6.86	2.8175	2.91	3.265	0.29180428	20718.82		
29-Apr-02	25.36814	6.74	1.58	0.515	2.475	0.30829084	22058.94		15
30-Apr-02	24.391175	6.92	1.87	1.76	3.455	0.30829084	19656.91		
1-May-02	23.41421	6.81	1.87	3.005	4.435	0.30829084	24299.93		
2-May-02	23.461585	6.645	1.78	0.555	3.4	0.30829084	26920.79		
3-May-02	25.102545	6.855	2.12	3.138	3.765	0.30829084	28678.89		
4-May-02	27.355795	6.895	0.535	0.38575	2.97	0.30829084	27696.52		
5-May-02	28.66589	6.59	2.15	0.711	3.885	0.3247774	26523.52		
6-May-02	28.30149	7.03	0.21	0.675	3.265	0.31099269	26688.53	0	0
7-May-02	28.29118	7.06	1.09	0.905	3.995	0.31099269	26250.69		
8-May-02	27.766735	6.98	3.335	2.02975	3.895	0.31099269	25552.77		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
9-May-02	20.63693	6.92	2.78	1.31525	3.8965	0.31099269	26757.64		
10-May-02	22.219005	6.97	2.68	0.75475	2.85	0.31099269	26217.77		
11-May-02	23.57585	7.125	3.97	2.7925	4.3285	0.31099269	23804.54		
12-May-02	23.413375	7.205	3.79	2.315	4.2725	0.29720799	27882.48		
13-May-02	24.89478	6.59	1.83	1.225	3.32	0.28785828	27581.97		100
14-May-02	23.26068	7.38	1.33	0.705	4.255	0.28785828	26098.4		
15-May-02	23.655205	6.79	2.345	0.4875	3.86	0.28785828	28175.65		
16-May-02	23.844665	7.09	2.195	2.92	4.5225	0.28785828	27339.52		0
17-May-02	23.655855	6.965	2.45	0.9155	3.372	0.28785828	27926.7		
18-May-02	24.16469	6.84	2.36	1.70575	3.075	0.28785828	26728.34		
19-May-02	25.127905	7.05	3.42	0.69	3.94625	0.27850858	27265.65		
20-May-02	28.08018	6.67	2.34	1.065	3.465	0.27613354	28892		0
21-May-02	24.62559	6.86	2.84	1.521	3.47	0.27613354	28688.47		
22-May-02	24.87837	7.18	1.285	0.54	3.35	0.27613354	28670.5		
23-May-02	27.73714	6.88	2.8	0.90275	3.385	0.27613354	28065.69		
24-May-02	27.73714	6.79	2.59	1.395	3.734	0.27613354	27699.64		
25-May-02	27.73714	7.445	1.485	1.06	3.765	0.27613354	28153.75		
26-May-02	27.73714	7.01	2.11	1.183	4.745	0.27375849	28327.2		
27-May-02	27.73714	6.91	2.14	0.3	3.529	0.3010587	30580.89		70
28-May-02	30.59591	6.93	1.53	1.54925	3.25	0.3010587	27721		
29-May-02	28.964345	6.93	2.33	0.75725	3.77175	0.3010587	26483.31		
30-May-02	26.18171	6.865	3.395	0.56	4.06	0.3010587	27457.27		0
31-May-02	28.66309	6.8	1.56	0.3945	3.579	0.3010587	26981.22		5
1-Jun-02	28.12844	7.11	2.795	2.885	3.9075	0.3010587	27547.39		
2-Jun-02	27.73726	6.88	6.43	0.983	4.092	0.3010587	28127.03		
3-Jun-02	27.896375	6.94	2.04	0.96375	3.8575	0.3010587	28107.96	0	5
4-Jun-02	28.422975	7.015	1.045	0.401	3.2	0.3010587	28549.86		
5-Jun-02	28.383335	7.17	1.19	0.6775	3.795	0.3010587	25861.67		
6-Jun-02	28.634405	6.74	2.97	2.005	3.8825	0.3010587	28322.09		
7-Jun-02	28.96511	7.325	1.7	0.681	3.3825	0.3010587	27367.54		
8-Jun-02	29.079625	6.865	1.98	1.2815	3.745	0.3010587	26259.11		
9-Jun-02	28.4146	7.05	2.38	0.9205	4.155	0.32835891	26231.46		
10-Jun-02	22.84341	7.19	2.47	1.5915	3.055	0.34070536	28464.25		5
11-Jun-02	26.02608	7.02	1.535	1.6025	3.3	0.34070536	29016.51		
12-Jun-02	25.58619	6.975	0.98	2.905	3.824	0.34070536	27750.78		
13-Jun-02	24.77308	6.9	1.29	2.1325	3.7175	0.34070536	27503.54		
14-Jun-02	25.20949	7	1.34	0.90125	3.605	0.34070536	27964.47		
15-Jun-02	26.195725	6.975	0.505	2.9375	3.7025	0.34070536	27462.34		
16-Jun-02	26.73941	6.8	1.05	0.851	3.685	0.35305182	28269.73		
17-Jun-02	25.92115	6.95	0.42	0.885	3.66	0.32814989	28242.18		0

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
18-Jun-02	24.319965	7.04	0.795	0.847	3.53	0.32814989	30243.02		
19-Jun-02	23.35652	7.13	0.425	1.4085	3.5125	0.32814989	29804.2		
20-Jun-02	22.931325	6.955	1.16	2.7	4.475	0.32814989	29529.99		
21-Jun-02	23.921275	7.24	1.895	0.47625	3.8775	0.32814989	28500.95		
22-Jun-02	21.51238	6.96	1.08	1.465	3.563	0.32814989	27873.95		
23-Jun-02	25.45381	6.89	2.06	0.69	3.825	0.30324797	28447.53		
24-Jun-02	20.75258	7.03	2.91	0.8515	3.465	0.21352718	31786		10
25-Jun-02	32.24054	7.4	1.88	1.055	3.9	0.21352718	29398.58		
26-Jun-02	32.58843	6.85	1.53	1.49075	3.5875	0.21352718	30565.66		
27-Jun-02	32.82787	7.015	1.72	1.1755	3.7325	0.21352718	27719.39		
28-Jun-02	32.82787	7.33	2.215	2.23	4.1085	0.21352718	28651.75		
29-Jun-02	32.82787	6.97	0.98	3.3175	4.3075	0.21352718	28492.16		
30-Jun-02	32.82787	7.09	4.05	1.6785	3.535	0.1238064	29346.11		
1-Jul-02	32.93632	6.81	4.21	0.755	3.365	0.14155025	29189.65		
2-Jul-02	31.91802	7.33	4.68	0.365	3.365	0.14155025	29700.88	0	5
3-Jul-02	31.18401	6.995	3.32	1.473	3.38	0.14155025	30322		
4-Jul-02	30.47482	6.985	3.355	0.34575	3.725	0.14155025	30371.5		
5-Jul-02	30.84765	7.1	3.87	0.6125	3.4775	0.14155025	29076.98		
6-Jul-02	32.066275	7.19	2.63	1.205	3.844	0.14155025	28884.05		
7-Jul-02	32.70089	6.68	2.875	1.88	3.78	0.1592941	29030.41		
8-Jul-02	33.25823	6.945	3.12	0.5925	3.5975	0.16030467	30859.79		5
9-Jul-02	32.86552	6.73	2.82	0.387	3.234	0.16030467	31111.67		
10-Jul-02	33.688665	6.895	2.31	1.2175	3.3775	0.16030467	31169.44		
11-Jul-02	32.92338	7.205	1.855	2.7775	4.265	0.16030467	29927.81		
12-Jul-02	33.30904	6.9	1.57	1.40375	3.8575	0.16030467	30892.65		
13-Jul-02	34.131275	6.795	1.97	1.4525	3.7625	0.16030467	29790.88		
14-Jul-02	35.35379	7.06	1.71	1.1835	4.03	0.16131523	29057.54		
15-Jul-02	35.09758	7.03	1.75	1.75	4.09	0.17264894	31339.42		0
16-Jul-02	34.75475	7.11	1.19	1.553	3.26	0.17264894	32526.69		
17-Jul-02	34.07991	7.06	1.155	0.835	3.7275	0.17264894	31671.95		
18-Jul-02	33.86805	6.985	1.64	1.31	3.9775	0.17264894	31111.49		
19-Jul-02	34.426285	6.99	1.91	1.092	3.7625	0.17264894	32500.73		
20-Jul-02	34.76143	6.78	1.53	1.12825	3.911	0.17264894	33079.59		
21-Jul-02	33.33618	7.06	1.83	0.3395	3.42	0.17264894	35017.94		
22-Jul-02	32.04076	6.9	4.01	0.441	3.696	0.17264894	29908.46		30
23-Jul-02	32.62476	7.105	3.435	0.3305	4.142	0.17264894	27128.21		
24-Jul-02	32.975925	7.085	3.1	2.37	3.6525	0.17264894	27187.21		
25-Jul-02	33.6074	7.08	3.155	0.552	3.6775	0.17264894	27845.55		
26-Jul-02	34.229655	7	2.7	2.2875	4.2575	0.17264894	29088.71		
27-Jul-02	34.439695	6.915	3.365	1.9775	3.8435	0.17264894	30932.57		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
28-Jul-02	34.20692	6.97	3.21	1.186	4.095	0.18398264	30386.68		
29-Jul-02	33.43367	6.8	3.78	2.04	4.085	0.22843348	29616.91		20
30-Jul-02	33.71141	6.88	2.74	6.877	3.894	0.22843348	29398.96		
31-Jul-02	33.80598	7.075	1.98	0.8625	3.43	0.22843348	28275.96		
1-Aug-02	33.172125	7.19	2.89	2.23975	3.9725	0.22843348	28451.95		
2-Aug-02	33.206135	7.375	2.705	0.60925	4.1725	0.22843348	28034.3		
3-Aug-02	33.52093	7.275	5.68	2.2475	3.96	0.22843348	28232.19		
4-Aug-02	33.421405	7.065	2.305	1.9575	3.7775	0.27288431	27951.86		
5-Aug-02	33.70262	6.985	2.33	1.0425	3.9075	0.34323925	28084.77		
6-Aug-02	33.19966	7	2.585	2.13	3.7125	0.34323925	26911.54	0	35
7-Aug-02	33.94333	7.055	2.49	1.8745	3.6785	0.34323925	32239.58		
8-Aug-02	34.98676	6.985	2.91	0.6245	3.27	0.34323925	32706.9		
9-Aug-02	35.375595	7.035	2.075	2.9895	3.56	0.34323925	30400.11		
10-Aug-02	34.456355	6.715	2.3	2.46375	4.5055	0.34323925	29250.05		
11-Aug-02	34.1559	7.24	3.77	1.4915	4.59	0.4135942	31217.21		
12-Aug-02	32.76348	6.71	1.34	0.5895	3.38	0.34924467	31606.2		20
13-Aug-02	32.51202	6.99	2.24	0.855	3.465	0.34924467	28382.71		
14-Aug-02	32.28893	6.69	2.81	2.105	4.485	0.34924467	28408.71		
15-Aug-02	32.786745	7.115	2.32	1.72175	4.0915	0.34924467	29469.39		
16-Aug-02	32.87355	6.94	2.65	0.505	4.055	0.34924467	30786.31		
17-Aug-02	32.091725	6.63	2.14	1.7125	3.8765	0.34924467	31216.16		
18-Aug-02	32.43891	7.17	2.14	1.8225	3.9425	0.34924467	28817.17		
19-Aug-02	32.70999	6.83	2.03	1.9	4.225	0.34924467	31527.66		20
20-Aug-02	32.33783	6.95	3.06	0.3495	3.861	0.34924467	30253.42		
21-Aug-02	31.319105	7.175	2.47	1.17325	3.7525	0.34924467	29227.55		
22-Aug-02	31.084895	7.23	1.81	1.64	3.59	0.34924467	29183.91		
23-Aug-02	31.781155	7.16	1.505	1.374	3.6325	0.34924467	29415.28		
24-Aug-02	32.337065	6.835	2.455	1.108	3.5475	0.34924467	28704.86		
25-Aug-02	32.66398	6.67	2.61	1.985	3.835	0.28489513	28760.63		
26-Aug-02	32.58774	6.72	1.37	1.55	3.3	0.54459904	29918.38		20
27-Aug-02	32.78611	6.83	1.28	0.8575	3.4	0.54459904	30264.16		
28-Aug-02	33.05881	6.685	1.915	1.18925	3.3885	0.54459904	30165.62		
29-Aug-02	33.43311	6.72	2.28	1.31025	3.415	0.54459904	29712.98		
30-Aug-02	33.696445	6.885	1.865	1.2085	3.534	0.54459904	30020.29		
31-Aug-02	33.766975	6.87	2.005	1.07825	3.9965	0.54459904	28139.33		
1-Sep-02	33.43442	6.83	3.03	3.415	3.53	0.80430294	31810.65		
2-Sep-02	32.23995	6.64	3.19	0.452	3.66	0.44264204	31709.86	0	0
3-Sep-02	31.64399	7.12	2.56	1.9375	3.366	0.44264204	30289.14		
4-Sep-02	31.18525	7.045	2.19	1.2275	3.6975	0.44264204	28904.86		
5-Sep-02	32.263775	7	2.42	0.90575	4.1725	0.44264204	30433		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
6-Sep-02	33.45454	7.23	2.7	0.69775	3.36	0.44264204	27512.49		
7-Sep-02	33.61688	7.245	2.13	1.241	4.108	0.44264204	30781.34		
8-Sep-02	32.29151	6.85	2.98	0.7965	3.675	0.08098114	25097.42		
9-Sep-02	30.69943	6.95	4.65	3.285	5.05	0.10052503	23357		5
10-Sep-02	30.550695	6.9	4.115	1.97825	3.8575	0.10052503	29590.42		
11-Sep-02	30.189195	7.025	3.58	0.804	3.065	0.10052503	27343.65		
12-Sep-02	30.424805	7.15	4.79	0.4655	3.19	0.10052503	30939.06		
13-Sep-02	30.436415	6.8	3.14	0.4955	2.9605	0.10052503	30982.74		
14-Sep-02	31.119195	6.905	2.725	0.5175	3.0275	0.10052503	28845.07		
15-Sep-02	30.89642	7.66	2.84	1.178	3.597	0.12006893	29063.91		
16-Sep-02	32.13898	7.05	2.92	0.4495	3.165	0.15244953	30872.29		5
17-Sep-02	32.4085	7.24	3.4	0.5565	3.2	0.15244953	30789.07		
18-Sep-02	32.16659	6.92	3.11	1.175	4.34	0.15244953	30234.16		
19-Sep-02	31.180535	7.13	3.885	1.2425	3.88	0.15244953	29339.93		
20-Sep-02	29.72819	7.425	3.81	0.358	3.228	0.15244953	28879.82		
21-Sep-02	29.16827	7.035	1.805	1.67075	3.1075	0.15244953	28304.5		
22-Sep-02	30.57114	7.34	1.76	0.7195	4.205	0.18483013	28348.16		
23-Sep-02	33.08389	7.14	1.71	0.945	3.995	0.12896271	29186.22		**20**
24-Sep-02	33.40762	6.83	2.01	1.43	4.045	0.12896271	28435.49		
25-Sep-02	33.88096	7.235	1.89	1.0725	4.19	0.12896271	29356.95		
26-Sep-02	34.28209	7.165	2.075	1.20625	4.05	0.12896271	27857.73		
27-Sep-02	34.683725	7.255	2.445	1.523	3.97	0.12896271	25227.51		
28-Sep-02	33.915995	7.02	2.11	1.7425	3.6875	0.12896271	27415.03		
29-Sep-02	33.42776	6.91	3.13	0.492	3.384	0.12896271	27218.37		
30-Sep-02	33.35869	7.47	1.77	0.426	3.37	0.12896271	28080.9		0
1-Oct-02	32.23973	6.99	3.11	0.535	3.955	0.12896271	27447.74		
2-Oct-02	29.8026	6.98	3.33	0.515	3.6475	0.12896271	31514.38		
3-Oct-02	29.49624	7.2	5.455	0.87125	3.1025	0.12896271	30518.15		
4-Oct-02	31.532255	7.07	4.35	2.15	4.0575	0.12896271	29313.82		
5-Oct-02	30.975175	7.25	3.33	3.0625	4.275	0.12896271	27004.99		
6-Oct-02	30.34943	6.91	4.06	0.685	3.99	0.0730953	27480.09		
7-Oct-02	30.163105	6.88	3.385	0.79575	3.6	0.11906403	29010.84	0	5
8-Oct-02	29.48121	7	2.64	0.657	3.4	0.11906403	29674.69		
9-Oct-02	29.09605	7.15	3.03	0.73075	3.65	0.11906403	29319.61		
10-Oct-02	28.116495	6.865	5.745	5.87325	4.5725	0.11906403	28180.19		
11-Oct-02	28.743015	7.35	4.59	5.4975	4.3425	0.11906403	28325.52		
12-Oct-02	28.27154	7.165	6.005	2.3075	3.5725	0.11906403	29753.46		
13-Oct-02	29.1578	7.41	5.73	2.735	3.465	0.11906403	27991.37		
14-Oct-02	30.17795	6.79	3.31	0.53	3.53	0.11906403	30255.1		0
15-Oct-02	28.6	7.52	4.3	0.5	3.43	0.11906403	29700.8		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
16-Oct-02	27.63538	7.145	4.945	3.462	4.158	0.11906403	29700.8		
17-Oct-02	26.18174	7.505	4.41	2.2775	3.2325	0.11906403	29146.5		
18-Oct-02	27.715615	7.35	3.245	0.5875	2.8275	0.11906403	30010.44		
19-Oct-02	29.283355	6.855	3.365	1.0475	3.695	0.11906403	26347.22		
20-Oct-02	30.00255	6.79	4.75	2.09	4.185	0.16503277	27736.22		
21-Oct-02	29.7139	6.81	3.13	1.53	3.4	0.1779719	27987.19		0
22-Oct-02	29.9414	6.595	3.51	0.58	4.11	0.1779719	24822.03		
23-Oct-02	30.07383	6.91	2.3	1.545	4.29	0.1779719	26569.73		
24-Oct-02	30.51838	6.885	2.8	1.9025	4.195	0.1779719	30769.61		
25-Oct-02	30.89742	6.875	2.025	0.481	3.428	0.1779719	27660.27		
26-Oct-02	31.008365	6.94	2	1.71575	3.55	0.1779719	27142.94		
27-Oct-02	31.46404	6.65	2.74	1.557	4.29	0.19091103	26724.32		
28-Oct-02	31.22424	6.71	5.88	1.325	3.81	0.28018123	26049.45		0
29-Oct-02	31.1194	7.16	3.7	0.78	3.925	0.28018123	27512.33		
30-Oct-02	30.63544	7.41	3.095	0.4875	4.1625	0.28018123	26257.25		
31-Oct-02	29.49305	7.195	3.01	0.6095	3.27	0.28018123	28308.05		
1-Nov-02	29.71395	7	2.275	1.07725	3.405	0.28018123	26273.94		
2-Nov-02	30.230525	7.165	2.63	2.4425	3.8575	0.28018123	27384.85		
3-Nov-02	31.347545	6.885	3.9	0.47725	3.695	0.36945142	27282.52		
4-Nov-02	32.450135	7.05	3.935	0.95	3.7475	0.33994276	28273.98	0	45
5-Nov-02	32.152915	7.025	3.685	1.05675	3.3	0.33994276	27974.25		
6-Nov-02	31.953395	7.22	4.17	1.91	3.4	0.33994276	27396.48		
7-Nov-02	32.11444	6.85	2.93	0.64225	3.845	0.33994276	25976.36		
8-Nov-02	31.33096	7.12	2.74	0.979	3.4875	0.33994276	24843.3		
9-Nov-02	32.250765	7.07	2.02	0.86	3.775	0.33994276	25247.27		
10-Nov-02	32.426885	7.355	2.73	0.7275	3.632	0.3104341	24167.06		
11-Nov-02	33.926365	7.18	1.92	0.9125	3.73	0.37043985	28339.37		0
12-Nov-02	32.76121	6.93	1.61	1.55	4.255	0.37043985	27120.21		
13-Nov-02	32.1169	6.96	4.14	1.9005	4.92	0.37043985	27939.3		
14-Nov-02	32.10474	7.265	4.015	1.96	4.275	0.37043985	25180.99		
15-Nov-02	31.02306	7.045	3.135	0.51775	3.795	0.37043985	25811.06		
16-Nov-02	31.13152	6.815	4.81	1.255	3.7475	0.37043985	26347.83		
17-Nov-02	31.39658	7.12	0.73	1.215	3.565	0.37043985	25060.63		
18-Nov-02	27.86898	7.08	4.17	0.417	4.752	0.37043985	28594.97		
19-Nov-02	24.93568	7.18	4.14	0.6345	3.465	0.37043985	30995.32		5
20-Nov-02	26.950055	7.03	3.38	0.515	3.795	0.37043985	27412.63		
21-Nov-02	28.72811	6.965	3.76	0.52775	4.29	0.37043985	25626.46		
22-Nov-02	29.728675	6.895	3.25	0.8125	3.4325	0.37043985	28622.44		
23-Nov-02	29.970605	7.17	2.69	1.362	3.8105	0.37043985	26282.77		
24-Nov-02	30.25776	7.44	2.72	1.59	3.795	0.43044561	26053.54		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
25-Nov-02	30.445935	7.35	2.215	1.37225	4.0585	0.40717723	26005.31		
26-Nov-02	30.65035	7.205	2.225	0.50325	3.63	0.40717723	29498.26		0
27-Nov-02	32.053245	7.205	2.945	0.88325	2.95	0.40717723	31304.64		
28-Nov-02	32.10417	7.05	2.655	0.9625	3.81	0.40717723	27346.87		
29-Nov-02	31.417935	7.06	2.265	0.76425	3.745	0.40717723	25978.68		
30-Nov-02	30.6464	7.185	1.85	1.6225	3.95	0.40717723	25766.04		
1-Dec-02	29.37336	7.04	2.21	0.9375	3.663	0.38390885	25547.76		
2-Dec-02	28.45602	7.36	1.47	0.425	5.245	0.3958534	26916.95		
3-Dec-02	28.85604	6.73	1.77	0.305	3.417	0.3958534	25490.19	0	5
4-Dec-02	28.41929	7.17	2.1	1.3815	4	0.3958534	26550.96		
5-Dec-02	28.47785	7.095	4.485	0.7395	3.18	0.3958534	26546.72		
6-Dec-02	29.620685	7.29	4.265	1.31325	3.565	0.3958534	25380.35		
7-Dec-02	29.426815	7.005	4.855	2.955	4.39	0.3958534	22606.5		
8-Dec-02	29.21716	7.33	4.37	1.729	3.135	0.40779795	26190.69		
9-Dec-02	30.49472	7.2	5.58	0.9785	2.9	0.32693589	27896.54		0
10-Dec-02	29.94906	7.06	2.65	0.4615	3.76	0.32693589	25850.85		
11-Dec-02	29.94061	7.15	3.315	0.42375	3.315	0.32693589	25710.67		
12-Dec-02	30.946735	7.42	2.605	1.1775	3.307	0.32693589	25786.26		
13-Dec-02	31.568285	7.05	2.63	0.96675	3.33875	0.32693589	25716.16		
14-Dec-02	31.86726	7.04	2.115	1.58375	4.11625	0.32693589	26053.64		
15-Dec-02	31.605965	7.075	4.225	1.573	4.69	0.32693589	24970.52		
16-Dec-02	31.06997	6.89	3.32	1.265	2.77	0.32693589	25546.95		0
17-Dec-02	30.59979	6.95	2.41	1.695	3.795	0.32693589	25652.84		
18-Dec-02	30.23506	7.04	2.085	0.58	3.5575	0.32693589	23238.21		
19-Dec-02	28.8813	7.1	3.07	0.4015	3.085	0.32693589	24515.1		
20-Dec-02	28.78505	7.035	2.485	0.6885	3.1025	0.32693589	25683.95		
21-Dec-02	29.17282	6.93	3.055	1.0135	3.2175	0.32693589	25728.73		
22-Dec-02	28.31597	7.17	2.13	0.72	3.895	0.24607384	26079.36		
23-Dec-02	27.887295	7.005	1.85	0.53975	3.465	0.32653852	25835.13		0
24-Dec-02	27.89329	7.15	1.94	0.485	2.8175	0.32653852	25660.27		
25-Dec-02	28.62772	7.33	1.96	0.68	3.1	0.32653852	25329.56		
26-Dec-02	26.81543	7.18	2.16	0.485	3.47	0.32653852	30159		
27-Dec-02	27.101925	7.145	2.055	0.95475	3.26	0.32653852	25991.25		
28-Dec-02	28.63332	7.135	2.225	1.5385	4.0565	0.32653852	24869.84		
29-Dec-02	29.989835	7.255	4.38	3.73	4.715	0.32653852	25690.75		
30-Dec-02	29.08585	6.915	3.51	1.055	3.6875	0.32653852	26224.39		
31-Dec-02	28.570615	7.08	2.84	0.51225	3.3825	0.32653852	26395.74		10
1-Jan-03	29.26896	7.08	1.81	1.575	4.09	0.32653852	24698.25		
2-Jan-03	30.32964	7.14	3.98	1.44	3.275	0.32653852	25403.07		
3-Jan-03	30.72667	6.9	4.82	1.4175	3.612	0.32653852	24757.59		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
4-Jan-03	31.1825	7.22	2.495	1.7475	3.27	0.32653852	25409.2		
5-Jan-03	30.75304	7.27	1.88	0.4625	3.293	0.4070032	25003.55		
6-Jan-03	30.61905	7.1	2.77	0.8055	3.34	0.38076006	25401.49	0	15
7-Jan-03	30.72682	7.2	3.29	1.5935	4.41	0.38076006	24223.41		
8-Jan-03	30.12253	7.335	3.02	0.968	3.3825	0.38076006	22373.21		
9-Jan-03	27.58345	7.285	4.17	0.68	3.825	0.38076006	22738.61		
10-Jan-03	26.402015	6.98	6.115	0.431	3.4725	0.38076006	26712.12		0
11-Jan-03	27.602675	7.2	4.53	0.46525	2.7275	0.38076006	26259.68		
12-Jan-03	27.72156	7.12	1.86	0.454	2.6135	0.35451692	26353.84		
13-Jan-03	28.018935	6.9	1.25	1.1995	3.095	0.34426054	26108.26		
14-Jan-03	28.358075	7.42	1.44	1.75725	3.61325	0.34426054	25786.96		
15-Jan-03	29.190705	7.2	3.615	0.74525	3.695	0.34426054	27247.43		
16-Jan-03	29.560395	7.135	3.13	1.12375	3.4725	0.34426054	25095.31		
17-Jan-03	28.413255	7.135	1.565	0.84	3.3875	0.34426054	24640.32		
18-Jan-03	28.335015	7.19	1.74	0.5595	2.8875	0.34426054	25323.8		
19-Jan-03	28.395815	7.05	1.115	0.70575	2.9375	0.33400415	25025.93		
20-Jan-03	28.60567	7.18	2.03	1.3385	3.1775	0.24824146	25647.52		0
21-Jan-03	28.034975	7.305	1.46	0.6185	3.73	0.24824146	23846.42		
22-Jan-03	26.327255	7.005	3.57	0.739	3.19	0.24824146	23184.9		
23-Jan-03	24.227525	6.995	5.66	3.825	4.695	0.24824146	21219.18		
24-Jan-03	24.16125	7.02	3.965	1.561	3.22	0.24824146	22464.75		
25-Jan-03	23.433555	7.065	4.705	0.9875	3.125	0.24824146	18406.12		
26-Jan-03	22.92167	7.49	8.99	1.62275	3.945	0.16247876	19391.42		
27-Jan-03	24.30514	6.81	2.51	0.7125	2.56	0.19272482	23116.94		0
28-Jan-03	24.67121	7.25	1.085	0.499	2.3225	0.19272482	22211.12		
29-Jan-03	24.025915	7.175	4.325	2.497	2.845	0.19272482	19652.08		
30-Jan-03	25.696595	7.275	3.775	2.3525	4.0125	0.19272482	26509.68		
31-Jan-03	26.77756	7.055	3.08	0.926	3.53	0.19272482	26205.45		
1-Feb-03	28.177465	7.385	1.03	0.3235	3.52	0.19272482	28288.21		
2-Feb-03	29.9282	7.04	2.54	0.98	3.655	0.22297087	26497.9		
3-Feb-03	29.54092	7.19	2.6	0.4365	3.145	0.25938531	27646.9	10	0
4-Feb-03	29.15077	7.5	1.08	0.57	3.135	0.25938531	25724.35		
5-Feb-03	29.11484	7.075	1.705	0.889	3.9075	0.25938531	25418.32		
6-Feb-03	27.97157	6.94	1.125	0.60075	4.0625	0.25938531	24819.84		
7-Feb-03	27.98787	7.27	1.005	0.391	3.7075	0.25938531	26203.26		
8-Feb-03	28.41097	7.025	1.655	0.54525	3.57	0.25938531	25544.91		
9-Feb-03	28.40869	7.37	1.24	1.3445	3.75	0.29579975	25590.46		
10-Feb-03	28.16188	6.97	3.01	1.0085	3.29	0.30984413	27028.98		0
11-Feb-03	28.173725	7.51	1.975	0.7905	4.0375	0.30984413	25566.56		
12-Feb-03	28.038385	7.185	3.275	0.80825	3.931	0.30984413	25508.55		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
13-Feb-03	28.027265	7.37	1.78	0.3925	3.195	0.30984413	25522.13		
14-Feb-03	28.0638	7.22	2.04	0.58025	2.9575	0.30984413	25982.5		
15-Feb-03	28.581435	7.42	1.545	0.75175	3.0725	0.30984413	24767.41		
16-Feb-03	29.6018	6.74	0.79	1.63	3.82	0.32388851	24245.78		
17-Feb-03	30.17277	6.76	2.44	1.74	3.8	0.30268273	25960.94		0
18-Feb-03	30.17124	6.97	1.41	0.545	3.865	0.30268273	27445.48		
19-Feb-03	30.38851	7.05	2.105	0.6135	3.7925	0.30268273	26487.75		
20-Feb-03	29.67623	7.32	2.67	2.4555	4.96	0.30268273	24515.15		
21-Feb-03	29.05358	7.16	2.265	1.2435	3.8375	0.30268273	24935.09		
22-Feb-03	28.3502	7.18	2.995	1.48525	3.3225	0.30268273	22663.57		
23-Feb-03	28.59365	7.38	2.64	0.4	3.27	0.28147695	28134.04		
24-Feb-03	28.96196	7.14	3.41	1.755	4.025	0.30217377	26873.57		0
25-Feb-03	29.0209	7.41	2.47	0.708	4.285	0.30217377	26545.51		
26-Feb-03	28.7891	7.505	3.02	1.185	3.6325	0.30217377	25581.97		
27-Feb-03	29.5271	7.215	3.03	0.9315	3.6875	0.30217377	25620.44		
28-Feb-03	29.42052	7.295	1.69	1.78	3.6675	0.30217377	26635.25		
1-Mar-03	28.62299	7.21	1.615	0.5635	3.0225	0.30217377	27390.05		
2-Mar-03	29.046755	7	1.695	2.184	3.425	0.32287058	26500.23		
3-Mar-03	29.62037	7.05	2.88	1.542	3.68	0.34475626	26301.63	20	0
4-Mar-03	30.07806	6.94	2.84	0.4925	4.384	0.34475626	28299.47		
5-Mar-03	29.805435	7.22	1.005	1.586	3.95	0.34475626	26564.75		
6-Mar-03	29.528775	7.09	2.33	1.1	3.65	0.34475626	26350.18		
7-Mar-03	29.565	7.175	1.475	1.07575	3.2175	0.34475626	27406.12		
8-Mar-03	29.31616	7.015	1.64	1.5755	3.605	0.34475626	27214.34		
9-Mar-03	28.92929	7.31	2.94	0.34	3.305	0.36664194	27634.65		
10-Mar-03	29.53062	7.19	1.15	0.4635	2.485	0.32257478	28879.08		0
11-Mar-03	30.06712	7.285	2.87	0.64425	3.0295	0.32257478	26886.16		
12-Mar-03	30.018615	7.44	4.17	3.28375	4.0175	0.32257478	25730.05		
13-Mar-03	30.260975	7.12	3.27	1.564	3.445	0.32257478	27025.21		
14-Mar-03	31.445485	7.14	3.43	1.245	2.9325	0.32257478	29712.77		
15-Mar-03	32.26551	7.14	1.45	1.16375	3.7	0.32257478	26776.77		
16-Mar-03	31.51893	7.05	2.03	0.4395	3.055	0.27850763	28298.8		
17-Mar-03	30.92371	6.89	1.73	1.08	3.495	0.28335323	27331.54		0
18-Mar-03	31.76643	7.8	2.69	0.6705	2.675	0.28335323	28774.79		
19-Mar-03	31.15866	7.315	2.565	1.74125	3.37	0.28335323	27310.6		
20-Mar-03	30.73544	7.1	2.865	0.75875	3.335	0.28335323	29087.08		
21-Mar-03	31.181705	6.94	2.04	1.09275	3.4375	0.28335323	29012.54		
22-Mar-03	31.282225	7.135	1.28	0.985	3.5375	0.28335323	28304.31		
23-Mar-03	31.44143	7.07	1.43	0.451	3.825	0.28819883	25029.47		
24-Mar-03	31.12159	7.55	2.37	1.79	3.385	0.27354778	26942.29		25

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
25-Mar-03	31.3478	7.68	3.02	1.89	4.33	0.27354778	26568.99		
26-Mar-03	32.10594	7.245	1.45	0.755	4.3575	0.27354778	26060.51		
27-Mar-03	31.454595	7.275	1.6	1.37675	3.54	0.27354778	25786.14		
28-Mar-03	30.873885	7	1.36	0.479	3.2575	0.27354778	25549.13		
29-Mar-03	30.748575	7.305	1.955	0.59125	3.32	0.27354778	25495.85		
30-Mar-03	30.12164	7.17	1.44	0.39	2.855	0.25889673	26249.18		
31-Mar-03	30.77693	7.01	1.85	0.515	3.375	0.24931145	26535.68		10
1-Apr-03	29.8732	7.39	0.2	0.825	3.315	0.24931145	27289.72		
2-Apr-03	28.92759	7.17	2.395	0.416	3.115	0.24931145	25537.05		
3-Apr-03	27.9657	7.18	1.02	0.3815	3.0025	0.24931145	24990.29		
4-Apr-03	29.628625	7.9	1.665	0.41175	3.7165	0.24931145	27560.14		
5-Apr-03	30.37564	7.055	0.375	0.73675	3.5075	0.24931145	27675.65		
6-Apr-03	31.59465	6.99	1.16	0.498	4.08	0.23972616	27888.92		
7-Apr-03	32.33395	7.03	1.91	0.795	3.035	0.24149456	28644.45	0	0
8-Apr-03	32.13979	7.11	2.13	0.449	3.505	0.24149456	26488.55		
9-Apr-03	32.563745	7.19	1.385	0.7835	3.46	0.24149456	24857.59		
10-Apr-03	32.772925	7.255	2.97	0.63325	3.3675	0.24149456	26823.53		
11-Apr-03	33.02226	7.35	1.77	0.44525	3.64	0.24149456	25255.06		
12-Apr-03	32.73641	7.435	2.685	0.47075	3.8125	0.24149456	25370.86		
13-Apr-03	31.99048	7.1	1.73	0.5345	3.525	0.24326296	21689.38		
14-Apr-03	30.40631	7.17	5.15	3.313	3.875	0.262676	20625.52		0
15-Apr-03	29.58971	7.195	5.965	1.33975	3.4825	0.262676	23407.57		
16-Apr-03	29.8129	7.09	3.685	0.6495	3.3225	0.262676	24849.39		
17-Apr-03	31.021065	7.285	2.36	0.7945	3.31	0.262676	26043.32		
18-Apr-03	32.214615	6.92	2.47	0.49	3.3275	0.262676	27051.42		
19-Apr-03	33.18405	7.375	1.39	0.4105	3.04	0.262676	25810.58		
20-Apr-03	33.48299	7	2.42	0.4835	2.92	0.28208903	26289.55		
21-Apr-03	33.444215	7.255	3.27	0.47925	3.595	0.20899272	24785.54		0
22-Apr-03	33.557325	7.185	3.97	0.3517	3.2075	0.20899272	24117.2		
23-Apr-03	32.672805	7.02	2.955	0.965	2.63	0.20899272	24537.97		
24-Apr-03	32.177575	7.015	3.24	0.68325	3.22	0.20899272	25597.91		
25-Apr-03	32.17754	7.015	2.62	0.4455	3.4375	0.20899272	25727.44		
26-Apr-03	32.88673	7.105	1.325	1.28175	3.5025	0.20899272	25905.95		
27-Apr-03	30.45259	7.9	2.32	0.4055	3.555	0.13589641	16289.45		
28-Apr-03	29.85094	7.25	1.94	0.82	2.77	0.1801161	25772.95		0
29-Apr-03	30.18465	6.92	2.61	0.252	3.145	0.1801161	25478.09		
30-Apr-03	31.34728	7.05	3.475	0.503	3.725	0.1801161	25617.16		
1-May-03	32.20218	7.15	4.145	0.6175	3.365	0.1801161	25248.8		
2-May-03	32.48839	7.23	4.915	0.42125	3.81	0.1801161	24995.54		
3-May-03	32.92508	7.25	2.18	0.377	3.565	0.1801161	23773.04		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
4-May-03	33.31139	6.85	2.38	0.4045	3.239	0.22433578	24427.59		
5-May-03	33.567745	7.205	2.12	0.67275	3.682	0.24418808	25343.81	0	0
6-May-03	32.23876	7.075	1.76	0.43775	3.2225	0.24418808	31602.98		
7-May-03	31.26995	6.93	2.09	0.6765	3.48	0.24418808	23938.38		
8-May-03	32.51268	6.64	3.32	1.157	3.675	0.24418808	26536.67		
9-May-03	33.149145	7.305	2.85	0.975	3.3475	0.24418808	25992.36		
10-May-03	33.34629	7.22	3.295	0.80925	3.5875	0.24418808	24836.24		
11-May-03	33.915795	7.1	2.715	0.635	3.2125	0.24418808	24492.19		
12-May-03	34.33203	7.25	2.36	1.367	3.64	0.24418808	24882.6		0
13-May-03	34.00387	7.55	2.06	1.0875	3.82	0.24418808	25358.47		
14-May-03	33.51823	7.145	2.3	0.55525	3.5475	0.24418808	25358.95		
15-May-03	33.83894	7.065	4.655	2.3205	3.22	0.24418808	21953.97		
16-May-03	33.698145	7.25	4.26	0.8775	3.205	0.24418808	24210.44		
17-May-03	34.97586	7.185	3.33	0.91975	4.0225	0.24418808	26315.39		
18-May-03	35.033995	7.055	3.74	1.1725	3.24	0.26404038	26320		
19-May-03	34.481695	6.99	4.665	0.86525	3.035	0.25134165	25330.79		0
20-May-03	34.32943	7.04	4.21	1.05	3.02	0.25134165	24723.17		
21-May-03	34.978165	7.34	4.01	1.1845	3.9625	0.25134165	27211.58		
22-May-03	35.551705	7.225	3.955	1.1475	3.6025	0.25134165	27088.24		
23-May-03	33.206985	7.18	3.64	1.685	3.3525	0.25134165	26499.33		
24-May-03	32.23834	7.125	4.855	3.995	3.6575	0.25134165	25148.67		
25-May-03	32.06739	6.82	4.88	3.67	3.335	0.23864292	27100.29		
26-May-03	32.00344	7.08	4.8	1.305	3.52	0.24127173	27168.63		100
27-May-03	32.66609	6.96	4.17	0.855	2.92	0.24127173	27748.93	100	100
28-May-03	33.338085	6.995	2.355	0.6365	2.87	0.24127173	26979.14		10
29-May-03	33.04668	6.965	2.785	0.53	3.915	0.24127173	26698.79		
30-May-03	30.452785	6.98	2.32	0.57325	3.945	0.24127173	27554.57		
31-May-03	30.65253	6.98	3.36	0.86375	4.2225	0.24127173	28422.49		
1-Jun-03	34.66808	6.74	3.44	0.513	4.05	0.24390055	26443.56		
2-Jun-03	35.45449	6.96	1.62	0.68	3.475	0.22329012	27715.88		
3-Jun-03	36.4218	6.5	1.68	0.386	2.74	0.22329012	29976.19	0	
4-Jun-03	36.988485	6.425	3.145	0.5	3.1225	0.22329012	27938.1		
5-Jun-03	36.42356	6.89	3.085	0.98425	3.8	0.22329012	25627.32		
6-Jun-03	34.807725	6.855	2.875	1.55425	3.75	0.22329012	26510.85		
7-Jun-03	33.19584	6.97	3.33	0.627	3.8825	0.22329012	24268.4		
8-Jun-03	32.64998	6.87	3.2	0.6035	3.89	0.2026797	23707.66		
9-Jun-03	32.424095	6.94	3.285	0.55925	3.3725	0.24081792	25563.64	100	
10-Jun-03	32.27745	7.045	3.59	0.44575	3.0825	0.24081792	25103.14		
11-Jun-03	32.848975	7.255	3.685	0.7775	3.195	0.24081792	25547.64		
12-Jun-03	32.91302	6.815	3.47	0.538	3.14	0.24081792	25981.41		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
13-Jun-03	32.638415	6.79	2.82	0.5385	3.82	0.24081792	26094.27		
14-Jun-03	32.98665	6.785	2.345	0.638	3.4375	0.24081792	25699.27		
15-Jun-03	33.72272	6.975	6.405	0.4705	3.575	0.27895614	25757.37		
16-Jun-03	34.40746	6.9	2.59	0.477	3.7	0.23279599	26088.93	0	0
17-Jun-03	33.82896	7.15	4.02	1.075	3.21	0.23279599	27221.98		
18-Jun-03	33.44763	6.915	4.54	0.61825	3.475	0.23279599	25161.37		
19-Jun-03	33.143915	7.18	4.6	0.54125	3.155	0.23279599	28368.91		
20-Jun-03	32.945655	6.915	3.475	0.71425	3.255	0.23279599	26193.7		
21-Jun-03	33.374515	7.13	3.465	0.52625	3.1875	0.23279599	27060.03		
22-Jun-03	34.17862	7.27	2.44	0.273	3.23	0.23279599	27612.64		
23-Jun-03	34.381175	6.905	1.9755	0.66275	3.475	0.23279599	27550.68		0
24-Jun-03	33.47897	7.32	4.12	1.1555	3.43	0.23279599	29000.25		
25-Jun-03	32.82595	7.015	3.245	1.2575	3.3925	0.23279599	29148.86		
26-Jun-03	32.254005	7.1	3.295	1.074	3.2075	0.23279599	29579.13		
27-Jun-03	32.56387	7.11	3.06	0.9485	3.0525	0.23279599	27044.67		
28-Jun-03	33.384385	6.95	2.16	0.7455	3.715	0.23279599	23175.93		
29-Jun-03	34.15536	7.01	2.11	0.6225	4.925	0.23279599	25492.33		
30-Jun-03	34.873055	6.86	2.355	0.43975	4.1825	0.23279599	26182.56		0
1-Jul-03	35.44998	6.94	2.22	0.5065	3.375	0.23279599	26812.55		
2-Jul-03	35.29724	6.91	3.385	0.6075	4.0425	0.23279599	24384.81		
3-Jul-03	33.68271	6.77	4	0.58	4.01	0.23279599	26040.34		
4-Jul-03	32.93677	7.34	4.615	0.53025	4.1325	0.23279599	25266.26		
5-Jul-03	33.564285	7.13	3.745	0.57	3.5875	0.23279599	26080.97		
6-Jul-03	33.48563	7.26	3.58	0.502	4.055	0.23279599	26236.28		
7-Jul-03	32.526245	6.915	3.06	0.66175	3.9175	0.23279599	25523.06	0	0
8-Jul-03	32.41321	7.3	2.97	0.4045	3.895	0.23279599	25422.26		
9-Jul-03	32.528065	6.765	2.72	0.475	3.7375	0.23279599	27814.51		
10-Jul-03	33.38418	7.09	2.78	0.91	4.21	0.23279599	25278.93		
11-Jul-03	33.225005	7.12	3.495	0.8465	4.0875	0.23279599	24164.38		
12-Jul-03	33.255175	7.17	4.58	0.675	3.745	0.23279599	30471.27		
13-Jul-03	33.517795	7.19	5.435	0.5855	3.805	0.18663583	26065.3		
14-Jul-03	33.13492	7.08	3.14	1.3455	3.355	0.20697915	25588.91		0
15-Jul-03	33.03369	7.37	4.68	0.8175	3.535	0.20697915	25314.48		
16-Jul-03	33.20841	7.095	3.095	0.84	3.9925	0.20697915	24636.42		
17-Jul-03	33.627045	7.115	2.655	0.657	3.54	0.20697915	28508.27		
18-Jul-03	34.75201	6.93	3.455	0.85025	3.695	0.20697915	27054.9		
19-Jul-03	35.228345	6.94	3.785	0.86425	3.81	0.20697915	27424.41		
20-Jul-03	35.269145	6.97	5.06	0.6575	3.0325	0.20697915	24128.89		
21-Jul-03	35.234855	7.17	3.585	0.435	3.2675	0.20697915	26968.45		0
22-Jul-03	35.15139	6.95	2.16	0.8145	5.775	0.20697915	26198.9		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
23-Jul-03	35.64545	6.77	2.31	0.98625	4.015	0.20697915	24578.29		
24-Jul-03	35.36171	7.03	1.19	0.613	3.21	0.20697915	26390.22		
25-Jul-03	35.432425	7.26	1.775	0.994	3.6375	0.20697915	27887.18		
26-Jul-03	34.3156	7.065	3.545	3.25575	3.7425	0.20697915	27265.61		
27-Jul-03	33.98089	6.87	2.84	0.7105	3.69	0.22732247	26850.09		
28-Jul-03	34.21708	7.035	2.965	0.905	3.695	0.1988628	26323.24		0
29-Jul-03	33.58057	7.11	3.69	0.535	3.845	0.1988628	25994		
30-Jul-03	33.3342	6.835	3.665	0.55575	3.925	0.1988628	28061.38		
31-Jul-03	33.18497	6.98	4.34	0.509	4.425	0.1988628	28795.09		
1-Aug-03	33.831525	6.595	3.965	0.7555	4.53	0.1988628	24331.59		
2-Aug-03	34.430185	6.825	2.79	0.7305	4.3275	0.1988628	28928.74		
3-Aug-03	34.477795	6.89	3.135	0.54775	4.05	0.17040314	27933.11		
4-Aug-03	34.85611	7.06	3.35	1.036	3.23	0.16642173	28170.56	0	0
5-Aug-03	35.256875	6.955	3.35	0.905	3.69	0.16642173	28159.71		
6-Aug-03	35.339765	7.06	3.5	0.6775	3.335	0.16642173	28205.43		
7-Aug-03	35.73018	6.88	2.86	0.555	3.89	0.16642173	28714.87		
8-Aug-03	35.911445	7.055	3.47	0.6615	3.9625	0.16642173	28683.29		
9-Aug-03	36.104145	7.015	4.655	0.50825	4.5675	0.16642173	28605.63		
10-Aug-03	36.348	7.14	4.14	0.7725	4.2	0.16244032	28055.58		
11-Aug-03	35.97324	6.74	2.825	0.77075	4.425	0.14671411	27996.07		0
12-Aug-03	35.26174	6.62	4.03	1.3865	3.785	0.14671411	26595.28		
13-Aug-03	34.709005	6.93	3.885	0.8575	4.1475	0.14671411	25266.79		
14-Aug-03	34.5208	7.22	3.22	1.87	3.58	0.14671411	26173.32		
15-Aug-03	34.61836	7.195	2.08	0.84825	3.8475	0.14671411	26557.31		
16-Aug-03	34.59261	6.94	1.775	0.98025	3.84	0.14671411	26514.77		
17-Aug-03	35.18012	6.98	0.85	0.7255	4.125	0.1309879	26091.99		
18-Aug-03	35.003015	7.195	3.155	0.50325	4.3925	0.13027357	26378.21		0
19-Aug-03	35.55273	6.99	1.91	1.1915	4.235	0.13027357	28289.71		
20-Aug-03	34.59137	6.785	2.65	1.11	3.825	0.13027357	28615.17		
21-Aug-03	33.65469	7.19	3.15	0.675	4.275	0.13027357	29284.95		
22-Aug-03	34.06018	6.96	3.475	0.57725	4.195	0.13027357	26486.46		
23-Aug-03	34.25196	6.985	2.775	0.752	3.695	0.13027357	25683.01		
24-Aug-03	34.4927	6.905	2.68	0.74575	4.385	0.12955924	25741.76		
25-Aug-03	34.565915	6.885	2.46	0.718	3.9225	0.14076003	28614.8		0
26-Aug-03	33.7328	6.81	7.04	0.491	4.08	0.14076003	30470.84		
27-Aug-03	32.562245	6.805	4.065	1.262	3.9775	0.14076003	29334.78		
28-Aug-03	30.72812	6.88	2.52	0.9475	3.57	0.14076003	25734.16		
29-Aug-03	30.8354	7.19	2.24	1.225	3.5675	0.14076003	27038.98		
30-Aug-03	31.23175	6.925	3.07	0.857	4.25	0.14076003	25733.3		
31-Aug-03	31.30854	6.76	2.08	0.71225	4.29	0.14076003	25818.5		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
1-Sep-03	31.71363	6.08	4.09	0.745	3.85	0.14076003	26554.64	0	0
2-Sep-03	31.419125	7.115	3.49	0.6125	3.69	0.14076003	26298		
3-Sep-03	30.61303	6.86	2.975	0.73575	4.035	0.14076003	23211.02		
4-Sep-03	30.37835	6.64	2.42	0.84	4.43	0.14076003	24451.3		
5-Sep-03	30.33402	7.035	2.725	1.14175	3.82	0.14076003	26062.13		
6-Sep-03	31.44452	7.435	2.835	0.6675	4.4475	0.14076003	26329.34		
7-Sep-03	32.56411	7.33	2.98	0.518	4.325	0.15196081	26114.61		
8-Sep-03	32.77297	6.75	3.405	0.595	3.8325	0.1715428	27005.36		0
9-Sep-03	32.699485	7.065	3.58	0.521	3.685	0.1715428	26378.06		
10-Sep-03	32.910575	7.01	2.87	0.67	3.725	0.1715428	26142.95		
11-Sep-03	31.64306	7.51	2.14	0.53	3.975	0.1715428	26401.44		
12-Sep-03	31.64468	7.145	3.695	0.45325	4.0795	0.1715428	27315.75		
13-Sep-03	31.46733	6.65	3.675	0.5395	4.075	0.1715428	27947.42		
14-Sep-03	30.69783	6.72	4.25	0.6155	3.73	0.19112479	26598.2		
15-Sep-03	30.772575	7.16	3.705	0.83275	3.635	0.20663606	28347.48		0
16-Sep-03	30.47893	7.08	3.98	0.66	4.305	0.20663606	26525.22		
17-Sep-03	30.43805	6.91	3.3	0.54375	4.35	0.20663606	25447.66		
18-Sep-03	30.62154	6.78	3.84	0.4645	4.115	0.20663606	27088.54		
19-Sep-03	31.01024	6.585	2.58	0.4745	4.1975	0.20663606	26198.07		
20-Sep-03	31.66848	6.995	3.78	0.63575	4.55	0.20663606	26580.64		
21-Sep-03	32.140895	7.035	2.825	0.95	4.0175	0.22214733	27360.22		
22-Sep-03	31.57029	7.04	2.685	0.7775	4.095	0.2091963	27980.17		0
23-Sep-03	31.44199	6.92	4.09	0.554	3.975	0.2091963	26539.86		
24-Sep-03	30.55176	7.12	4.91	0.6375	3.99	0.2091963	28517.49		
25-Sep-03	30.97322	7.04	3.85	0.727	4	0.2091963	28292.86		
26-Sep-03	31.40626	6.84	2.645	0.6265	4.275	0.2091963	29247.44		
27-Sep-03	31.30831	6.99	2.16	0.83475	3.855	0.2091963	27715.23		
28-Sep-03	30.16647	6.58	2.96	0.515	3.965	0.19624527	26983.07		
29-Sep-03	29.68171	6.815	2.56	1.1175	4.4475	0.2072071	27073.91		0
30-Sep-03	29.99578	7.05	2.83	0.875	3.97	0.2072071	28386.95		
1-Oct-03	30.04212	7.175	2.84	2.8235	4.335	0.2072071	26161.3		
2-Oct-03	30.00548	6.78	1.62	2.112	4.08	0.2072071	26011.33		
3-Oct-03	31.18181	7.225	1.865	4.19975	4.415	0.2072071	26227.07		
4-Oct-03	32.53827	6.935	2.29	2.005	4.2225	0.2072071	27686.37		
5-Oct-03	31.34351	7.01	2.17	1.5365	4.3	0.21816894	27163.73		
6-Oct-03	31.198575	7.05	1.685	0.666	3.945	0.20313056	26902.86	0	5
7-Oct-03	31.36442	6.84	1.18	0.61	4.105	0.19561137	28260.88		
8-Oct-03	30.75875	6.98	2.11	0.61175	4.5425	0.19561137	25833		
9-Oct-03	30.249875	6.93	5.345	0.4585	4.3625	0.19561137	27411.85		
10-Oct-03	30.761145	7.09	2.865	0.616	4.235	0.19561137	25930.25		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
11-Oct-03	31.34855	6.905	2.21	1.06	4.35	0.19561137	25818.44		
12-Oct-03	31.03629	6.865	1.8	0.445	4.255	0.18809218	25315.02		
13-Oct-03	30.699805	7.2	3.465	0.493	4.3175	0.23315435	25855.53		0
14-Oct-03	31.032095	6.95	3.255	0.67525	4.2675	0.23315435	27011.92		
15-Oct-03	32.751955	6.84	1.975	0.9325	4.3625	0.23315435	26253.05		
16-Oct-03	33.22835	6.905	2.045	0.6675	4.3775	0.23315435	24635.73		
17-Oct-03	33.908875	7.105	1.715	1.2905	3.9175	0.23315435	25576.92		
18-Oct-03	35.00284	7.1	2.15	3.07725	4.6475	0.23315435	25223.97		
19-Oct-03	35.221805	6.99	2.24	1.37175	4.5575	0.27821651	25896.94		
20-Oct-03	35.060645	7.16	0.96	0.5	4.1975	0.24475372	26924.52		95
21-Oct-03	35.09944	6.965	1.405	0.647	4.015	0.24475372	26511.02		
22-Oct-03	34.50985	6.875	1.145	0.68025	4.1275	0.24475372	25613.43		
23-Oct-03	35.007645	7.065	1.315	0.58375	4.7375	0.24475372	26905.88		40
24-Oct-03	35.15783	7.315	2.115	1.1725	4.325	0.24475372	26051.71		37.5
25-Oct-03	34.610895	7.12	3.585	1.15925	4.225	0.24475372	27181.04		90
26-Oct-03	34.62162	7.22	1.61	0.4345	4.38	0.21129092	25107.05		
27-Oct-03	33.848275	7.045	3.2	0.5275	4.1225	0.21000014	23908.27		
28-Oct-03	33.38327	6.955	4.17	0.975	4.1175	0.20870936	25670.84		
29-Oct-03	33.39515	7.25	5.04	0.447	3.685	0.20870936	27105.96		
30-Oct-03	33.30737	6.73	3.72	0.5975	3.505	0.20870936	27436.46		
31-Oct-03	32.874065	7.01	3.855	0.7145	4.2225	0.20870936	26610.07		
1-Nov-03	32.35032	7.065	2.14	0.5925	4.64	0.20870936	25923.83		
2-Nov-03	32.13945	6.73	2.44	0.4695	4.07	0.2061278	26597.77		
3-Nov-03	32.253355	6.845	1.925	0.81	4.11	0.18788956	26855.5	0	55
4-Nov-03	32.31315	7.23	3.91	0.458	3.87	0.18788956	26994.62		
5-Nov-03	31.195245	6.96	3.31	1.095	4.025	0.18788956	25879.27		
6-Nov-03	29.545495	6.965	3.345	0.8755	4.38	0.18788956	26905.92		
7-Nov-03	30.298235	6.95	3.63	0.7265	4.155	0.18788956	27999.23		
8-Nov-03	30.550205	6.98	3.745	0.90225	3.8025	0.18788956	30670.45		
9-Nov-03	31.842	6.82	4.17	0.965	3.945	0.16965131	27984.06		
10-Nov-03	32.115105	7.03	2.75	0.73775	4.605	0.20696222	28315.54		5
11-Nov-03	31.71818	7.3	3.87	0.9075	4.57	0.20696222	27405.58		
12-Nov-03	31.43426	7.185	2.1	0.745	4.4275	0.20696222	28284.81		
13-Nov-03	31.89351	7.23	2.47	0.64025	4.0925	0.20696222	30119.39		
14-Nov-03	31.5556	6.855	3.495	0.5495	3.63	0.20696222	28924.02		
15-Nov-03	31.060415	6.89	3.2	0.55675	3.81	0.20696222	28380.65		
16-Nov-03	30.84675	6.795	2.405	0.5075	4.165	0.24427313	28314.78		
17-Nov-03	30.88259	6.75	1.545	0.58	4.3325	0.23000946	28399.62		0
18-Nov-03	30.07473	7.29	2.04	0.4135	3.985	0.23000946	28120.68		
19-Nov-03	29.75408	7.255	2.21	1.161	4.3175	0.23000946	28717.61		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
20-Nov-03	28.91745	7.32	7.59	1.678	4.555	0.23000946	26710.66		
21-Nov-03	28.9929	7.295	3.07	1.94825	4.7875	0.23000946	28409.23		
22-Nov-03	29.460935	7.315	3.23	0.538	4.0725	0.23000946	28191.47		
23-Nov-03	29.12886	7.165	3.27	0.664	4.565	0.21574579	28310.91		
24-Nov-03	29.09634	7.305	4.035	0.642	4.58	0.21023555	28048.85		0
25-Nov-03	31.343115	7.33	2.88	0.78	4.2225	0.21023555	29350.05		
26-Nov-03	31.082375	7.465	2.38	0.48325	3.5225	0.21023555	29852.34		
27-Nov-03	28.88588	7.37	0.87	0.395	3.485	0.21023555	27604.11		
28-Nov-03	29.125895	6.995	1.925	0.49775	3.4325	0.21023555	27377.55		
29-Nov-03	29.641695	7.19	1.665	0.55225	4.1875	0.21023555	27360.29		
30-Nov-03	29.52631	7.19	1.545	0.5175	4.08	0.2047253	27136.78		
1-Dec-03	28.908375	7.14	1.25	0.7025	4.32	0.21250857	26441.37	0	25
2-Dec-03	30.28655	7.39	3.115	0.7325	4.4175	0.21250857	29017.18		
3-Dec-03	29.979475	7.465	3.855	0.8475	4.515	0.21250857	24843.43		
4-Dec-03	28.25023	7.3	4.08	0.5645	4.225	0.21250857	28236.07		
5-Dec-03	29.3284	7.34	3.77	0.61625	3.73	0.21250857	27977.74		
6-Dec-03	31.12312	7.05	2.675	0.44925	4.1075	0.21250857	28069.73		
7-Dec-03	33.2342	7.42	1.35	0.618	5.07	0.22029184	28834.04		
8-Dec-03	33.289995	7.375	3.05	0.52	4.0475	0.20956361	28385.83		0
9-Dec-03	30.77466	7.39	5.01	0.4285	4.16	0.20956361	27199.26		
10-Dec-03	29.68758	7.145	3.265	0.65725	4.135	0.20956361	26819.23		
11-Dec-03	27.8	7.1	2.55	0.77	4.235	0.20956361	27186.73		
12-Dec-03	27.659745	6.97	2.64	0.811	4.01375	0.20956361	25724.29		
13-Dec-03	28.50263	7.205	4.095	0.852	3.7925	0.20956361	25063.73		
14-Dec-03	27.92911	6.8	4.44	0.525	4.56	0.19883539	25603.82		
15-Dec-03	28.61686	7.295	1.87	0.715	4.35	0.21627768	25683.55		0
16-Dec-03	28.11083	7.15	3.07	0.63	4.105	0.21627768	25477.42		
17-Dec-03	28.302805	7.3	4.565	0.86925	4.2225	0.21627768	24331.63		
18-Dec-03	28.22624	7.2	1.77	0.945	3.625	0.21627768	26613.96		
19-Dec-03	28.35002	7.29	2.41	0.845	3.9475	0.21627768	26469.34		
20-Dec-03	28.988705	7.27	2.085	0.66925	4.555	0.21627768	26796.67		
21-Dec-03	29.85521	7.08	1.82	0.625	4.285	0.23371996	26377.73		
22-Dec-03	29.77602	7.15	2.69	0.674	3.995	0.1989817	25843.93		0
23-Dec-03	30.15929	7.055	2.915	0.653	4.1225	0.1989817	25730.65		
24-Dec-03	30.25281	7.2	2.905	0.50325	4.1775	0.1989817	26877.96		
25-Dec-03	29.968725	7.195	1.66	0.659	4.01	0.1989817	26640.27		
26-Dec-03	30.15172	7.27	3.27	0.59	3.995	0.1989817	26490.52		
27-Dec-03	30.24841	7.29	2.41	0.7025	4.265	0.1989817	26225.92		
28-Dec-03	29.72911	7.34	5.01	1.073	4.235	0.16424344	24988.45		
29-Dec-03	29.32243	7.095	4.095	1.05075	4.19	0.14769082	25953.61		0

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
30-Dec-03	29.40225	7.18	3.85	0.58	4.47	0.14769082	25708.33		
31-Dec-03	29.14582	7.23	2.185	0.597	3.765	0.14769082	27453.9		
1-Jan-04	29.090015	7.13	3.005	0.56725	4.25	0.14769082	26474.6		
2-Jan-04	29.273845	7.15	2.39	0.83525	3.9375	0.14769082	26287.73		
3-Jan-04	29.628045	7.22	3.005	0.7725	4.14	0.14769082	26706.55		
4-Jan-04	28.72706	7.15	3.09	0.75	4.17	0.13113819	26950.45		
5-Jan-04	28.022575	7.24	2.6	0.5535	4.3925	0.16317037	26400.77	0	0
6-Jan-04	28.44639	7.35	3.28	0.385	4.325	0.16317037	26977.15		
7-Jan-04	28.213775	7.34	1.91	0.587	4.2175	0.16317037	26641.72		
8-Jan-04	27.684025	7.21	3.09	0.576	4.01875	0.16317037	26725.61		
9-Jan-04	28.00628	7.135	2.195	0.66575	4.32	0.16317037	27766.09		
10-Jan-04	28.673125	7.25	1.915	1.0025	4.3	0.16317037	27028.93		
11-Jan-04	28.80625	6.92	4.1	1.3105	3.82	0.19520254	27444.43		
12-Jan-04	28.57946	6.925	4.225	1.1525	4.085	0.19168278	27027.76		0
13-Jan-04	28.53529	7.09	2.93	0.659	4.315	0.19168278	27712.24		
14-Jan-04	28.654525	7.09	2.4	0.796	4.53	0.19168278	28367.34		
15-Jan-04	29.07174	7.03	2.01	0.81	4.35	0.19168278	27722.75		
16-Jan-04	29.01723	7.12	2.64	0.85575	3.83	0.19168278	26954.22		
17-Jan-04	28.32771	6.94	1.19	0.74875	3.8575	0.19168278	26295.15		
18-Jan-04	28.55321	6.85	0.83	0.75	4.01	0.18816301	29633.13		
19-Jan-04	28.597595	7.24	3.73	1.011	4.2175	0.19877465	27400.96		5
20-Jan-04	28.0947	7.15	4.05	0.695	4.63	0.19877465	26813.07		
21-Jan-04	27.24453	7.24	2.48	0.607	4.39	0.19877465	26346.69		
22-Jan-04	27.55131	7.135	3.815	0.6465	3.97	0.19877465	27526.93		
23-Jan-04	27.926645	7.245	2.87	0.4965	3.9925	0.19877465	25666.61		
24-Jan-04	27.405305	7.135	2.205	0.93825	4.66	0.19877465	25693.61		
25-Jan-04	27.45868	6.97	2.14	1.231	4.025	0.20938628	26977.71		
26-Jan-04	27.896325	7.065	1.93	0.778	3.8025	0.19596129	26712.49		0
27-Jan-04	27.53318	7.15	2.96	0.762	3.88	0.19596129	25508.92		
28-Jan-04	26.06747	7.39	4.115	0.9225	4.3475	0.19596129	22396.35		
29-Jan-04	24.71087	7.36	4.15	0.5885	3.7	0.19596129	26440.96		
30-Jan-04	25.162055	7.195	3.155	0.898	4.1175	0.19596129	26290.46		
31-Jan-04	25.439635	7.185	2.67	0.7985	4.235	0.19596129	27160.92		
1-Feb-04	26.9646	6.99	1.88	1.0345	4.515	0.18253631	26946.32		
2-Feb-04	27.11399	7.16	1.77	0.7605	4.105	0.17186626	26824.73	0	0
3-Feb-04	27.70402	6.95	2.71	0.7725	4.45	0.17186626	27260.77		
4-Feb-04	28.28714	7.01	2.125	0.84	3.955	0.17186626	27426.91		
5-Feb-04	28.047225	7.22	2.905	0.74975	3.4425	0.17186626	27828.29		
6-Feb-04	27.1198	7.13	2.035	0.6375	3.9325	0.17186626	27265.62		
7-Feb-04	27.078275	7.1	2.43	1.55075	4.8575	0.17186626	25750.29		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
8-Feb-04	28.35672	7.15	2.275	0.59	5.255	0.16119621	27295.09		
9-Feb-04	28.18698	7.115	2.12	0.6625	3.98	0.14734252	27728.01		15
10-Feb-04	28.476205	7.18	1.815	0.63675	3.8525	0.14734252	26888.01		
11-Feb-04	28.093675	7.145	2.575	0.816	3.8275	0.14734252	24940.07		
12-Feb-04	27.83579	7.31	5.48	0.78	4.395	0.14734252	24625.9		
13-Feb-04	29.618995	7.105	3.98	0.635	4.52	0.14734252	25991.21		
14-Feb-04	30.36908	7.21	2.46	0.541	4.24725	0.14734252	26104.91		
15-Feb-04	31.42282	7.34	1.62	0.57425	4.354875	0.13348884	25706.47		
16-Feb-04	31.282665	7.015	1.56	0.6075	4.4625	0.14974212	26759.61		0
17-Feb-04	29.97921	6.93	1.94	0.77	4.315	0.14974212	27077.22		
18-Feb-04	29.77263	6.89	1.705	0.675	4.0325	0.14974212	26612.96		
19-Feb-04	28.810665	6.925	3.48	0.7035	4.3275	0.14974212	27842.76		
20-Feb-04	27.990525	7.08	2.955	1.28825	4.1175	0.14974212	27753.58		
21-Feb-04	28.05663	6.915	3.075	1.67325	4.075	0.14974212	26861.64		
22-Feb-04	28.77198	7.275	4.32	0.727	4.0725	0.1659954	26572.78		
23-Feb-04	29.048145	7.05	3.95	0.6955	3.9025	0.15916445	27270.46		0
24-Feb-04	30.7429	7.03	6.6	0.557	4.89	0.15916445	26938.9		
25-Feb-04	28.504085	7.055	2.365	0.644	4.805	0.15916445	24393.47		
26-Feb-04	28.99209	7	3.95	0.7245	4.59	0.15916445	26130.91		
27-Feb-04	29.392495	6.965	2.355	0.68975	3.7925	0.15916445	26243.09		
28-Feb-04	29.72841	6.95	2.655	0.715	3.825	0.15916445	25801.86		
29-Feb-04	30.62103	7.05	2.13	0.735	4.02	0.15233351	25716.54		
1-Mar-04	30.57156	7.265	3.105	0.52	4.2725	0.18130983	25940.34	0	0
2-Mar-04	29.78305	7.12	3.8	0.5655	4.145	0.18130983	24170.77		
3-Mar-04	28.617295	6.66	2.175	0.7175	4.2	0.18130983	23488.18		
4-Mar-04	28.40785	6.89	3.42	0.623	4.06	0.18130983	25983.22		
5-Mar-04	28.79986	7.035	2.365	0.694	4.0925	0.18130983	25775.83		
6-Mar-04	29.14311	7.1	3.19	0.75	4.155	0.18130983	25309.09		
7-Mar-04	29.75479	7.31	4.62	1.239	3.84	0.21028614	25320.77		
8-Mar-04	29.938995	7.065	5.45	0.846	4.7725	0.18365439	24713.52		0
9-Mar-04	28.67763	7.19	3.82	0.6015	4.13	0.18365439	25922.09		
10-Mar-04	27.91594	7.025	3.595	1.44575	3.825	0.18365439	26476.76		
11-Mar-04	27.24608	6.935	3.055	0.66725	4.505	0.18365439	24423.3		
12-Mar-04	27.672385	6.955	3.005	0.72175	4.2825	0.18365439	24443.03		
13-Mar-04	28.629675	7.105	2.63	0.45825	3.88	0.18365439	24308.07		
14-Mar-04	29.57102	6.93	3.63	0.513	4.21	0.15702265	24398.49		
15-Mar-04	29.479615	6.985	3.34	0.725	4.4	0.15050726	24466.59		0
16-Mar-04	29.555135	7.14	5.235	0.704	4.705	0.15050726	25692.04		
17-Mar-04	29.740985	7.095	2.985	0.60075	4.61	0.15050726	26307.84		
18-Mar-04	29.75081	7.13	3.49	1.42	4.215	0.15050726	25740.05		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
19-Mar-04	29.409795	7.095	2.75	0.549	4.73	0.15050726	26873.59		
20-Mar-04	28.982225	7.01	4.235	0.6165	4.4425	0.15050726	25540.2		
21-Mar-04	29.02896	7.18	3.14	0.675	4.475	0.14399188	23825.5		
22-Mar-04	29.404075	7.07	2.38	0.72	4.525	0.15341672	24544.4		0
23-Mar-04	29.64954	7.05	2.84	0.631	3.815	0.15341672	25517.42		
24-Mar-04	29.85549	7.325	2.865	0.80725	3.97	0.15341672	27195.55		
25-Mar-04	29.33289	6.9	2.69	0.719	4.535	0.15341672	26373.38		
26-Mar-04	29.00373	7.025	2.295	0.587	4.7075	0.15341672	26727.41		
27-Mar-04	28.861585	6.955	3.07	0.5475	3.9	0.15341672	28504.62		
28-Mar-04	28.64208	6.93	2.08	0.7565	4.22	0.16284157	26727.29		
29-Mar-04	28.460815	7.1	2.705	1.1185	4.855	0.14523257	26677.78		0
30-Mar-04	28.52763	6.96	5.94	0.67	4.685	0.14523257	24131.99		
31-Mar-04	28.422875	7.115	3	0.775	3.93	0.14523257	26406.98		
1-Apr-04	28.450825	7.08	2.91	0.7045	4.02	0.14523257	26998.11		
2-Apr-04	28.460825	6.925	4.825	0.927	4.4225	0.14523257	26374.34		
3-Apr-04	28.598295	6.865	4.15	0.89825	4.64	0.14523257	24340.07		
4-Apr-04	29.187235	7.035	2.2	0.56125	4.34	0.12762357	23334.615		
5-Apr-04	28.75997	6.985	2.93	0.6145	4.1	0.17893238	22329.16	0	0
6-Apr-04	28.91079	6.99	1.6	0.634	4.185	0.17893238	25942.12		
7-Apr-04	28.73685	7.135	2.11	0.9475	4.195	0.17893238	26503.09		
8-Apr-04	28.40716	7.13	1.92	0.628	3.96	0.17893238	25862.78		
9-Apr-04	28.488115	7.23	2.135	0.705	4.48	0.17893238	25662.39		
10-Apr-04	29.00378	7.03	2.14	0.6025	4.54	0.17893238	25439.62		
11-Apr-04	29.44741	7.17	1.36	0.56	4.615	0.23024119	25681.79		
12-Apr-04	29.47278	7.06	1.24	0.85	4.415	0.25422249	25611.24		0
13-Apr-04	29.512505	6.93	2.61	0.71425	4.435	0.25422249	24706.77		
14-Apr-04	29.502245	7.25	2.965	0.79675	4.26	0.25422249	23201.02		
15-Apr-04	29.548095	7.095	3.02	0.6875	4.0925	0.25422249	26029.95		
16-Apr-04	29.619815	7.055	2.095	0.72775	3.85	0.25422249	26627.73		
17-Apr-04	29.47662	7.36	3.18	0.7055	5.115	0.25422249	22340.94		
18-Apr-04	29.57673	7.09	3.05	0.4535	4.09	0.27820379	25898.49		
19-Apr-04	29.742795	7.22	3.515	0.71175	3.84	0.2147389	22286.31		0
20-Apr-04	29.53565	6.9	1.35	1.1	3.725	0.2147389	28371.6		
21-Apr-04	28.625955	7.06	2.47	0.478	4.01	0.2147389	26625.04		
22-Apr-04	29.06244	7.12	2.81	0.302	4.48	0.2147389	27062.35		
23-Apr-04	30.10065	6.965	2.235	0.46725	4.505	0.2147389	29645.86		
24-Apr-04	30.223505	7.15	2.39	0.6075	4.525	0.2147389	32814.75		
25-Apr-04	29.55658	6.8	4.08	0.525	4.14	0.15127402	25709.07		
26-Apr-04	29.18206	7.07	3.71	0.43325	4.08	0.16350956	26716.96		0
27-Apr-04	29.67361	7.06	3.26	0.355	4.505	0.16350956	26111.09		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
28-Apr-04	29.13266	6.91	2.935	0.4485	4.25	0.16350956	26125.6		
29-Apr-04	29.63609	6.82	4.54	1.7325	3.665	0.16350956	27061.32		
30-Apr-04	30.115845	7.185	2.465	1.06325	4.1325	0.16350956	26569.93		
1-May-04	30.886605	6.96	2.07	0.55375	4.495	0.16350956	26936.6		
2-May-04	31.16682	6.91	3.15	0.692	4.275	0.17574511	27170.46		
3-May-04	29.9885	7.225	2.27	1.5225	4.4925	0.15594529	27226.14	0	0
4-May-04	29.9551	6.76	2.99	0.5145	4.495	0.15594529	26864.34		
5-May-04	29.59686	6.93	2.255	0.48275	4.425	0.15594529	25710.99		
6-May-04	29.17557	7.02	1.81	2.169	3.99	0.15594529	25906.53		
7-May-04	30.07749	7.2	2.445	1.51825	4.28	0.15594529	30302.46		
8-May-04	31.579585	6.98	1.16	0.499	4.195	0.15594529	29796.26		
9-May-04	32.21756	6.95	2.23	1.6935	4.6	0.13614547	26956.15		
10-May-04	31.95476	6.97	1.765	1.135	3.555	0.12230432	28147.04		0
11-May-04	29.72686	6.9	2.96	2.236	3.7475	0.11538375	25887.92		
12-May-04	28.50649	6.895	4.08	2.236	3.94	0.11538375	25161.41		
13-May-04	28.321025	7.04	4.31	0.72575	4.5725	0.11538375	23289.64		
14-May-04	29.40015	7.26	2.265	0.61075	3.785	0.11538375	26662.55		
15-May-04	30.12685	7.125	1.19	0.638	3.5875	0.11538375	26508.95		
16-May-04	31.78089	7.18	1.85	0.475	3.9375	0.10846317	26914.58		
17-May-04	32.786255	7.085	3.385	5.235	4.4525	0.14325649	25109.08		0
18-May-04	33.209435	7.055	1.99	6.6975	6.0325	0.14325649	21478.89		
19-May-04	31.8696	7.01	1.025	1.71825	4.3725	0.14325649	26167.59		
20-May-04	31.394575	6.875	2.245	0.4875	4.455	0.14325649	26230.73		
21-May-04	31.5297	6.96	2.095	0.5835	4.5925	0.14325649	27096.12		
22-May-04	31.64508	6.875	1.29	0.4995	3.8475	0.14325649	26135.74		
23-May-04	31.72907	7.02	1.12	0.354	3.9425	0.1780498	26511.5		
24-May-04	31.531355	7.17	1.28	0.413	4.64	0.17283959	25103.71		0
25-May-04	31.54656	6.91	2.23	0.659	4.53	0.17283959	27307.73		
26-May-04	31.457605	7.045	2.005	0.5175	4.8725	0.17283959	25844.06		
27-May-04	31.27465	6.78	1.8	2.3	4.595	0.17283959	24866.82		
28-May-04	31.904385	7.2	2.545	0.77975	3.64	0.17283959	25236.51		
29-May-04	32.88707	7.13	1.59	1.56875	4.265	0.17283959	28048.66		
30-May-04	32.128045	7.16	1.255	0.85875	4.585	0.16762939	27569.37		
31-May-04	31.518585	7.09	2.095	0.45775	4.87	0.16586822	25949.12		0
1-Jun-04	32.226145	7.25	3.45	4.12525	4.765	0.16586822	25151.21		
2-Jun-04	33.348935	7.145	2.84	3.7835	4.8	0.16586822	26342.1		
3-Jun-04	32.12881	7.245	1.935	2.225	4.085	0.16586822	27751.42		
4-Jun-04	31.84264	7.075	2.27	0.6025	3.6125	0.16586822	27239.36		
5-Jun-04	31.54427	7.17	2.625	1.60625	4.2325	0.16586822	26870.38		
6-Jun-04	29.93285	7.08	2.37	0.345	4.69	0.16410705	26099.53		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
7-Jun-04	29.789805	7.155	2.215	0.64325	4.5975	0.15217043	27347.01	0	0
8-Jun-04	28.32202	7.08	3.42	1.552	4.37	0.14620211	26064.88		
9-Jun-04	29.196905	7.19	2.475	0.55575	4.135	0.1402338	25736.92		
10-Jun-04	29.67363	7.04	3.09	0.355	4.685	0.1402338	24173.72		
11-Jun-04	29.349965	7.05	2.915	0.83	4.1975	0.1402338	26646.73		
12-Jun-04	30.345215	7.3	2.59	0.51	4.0375	0.1402338	25984.27		
13-Jun-04	30.71985	7.17	3.69	0.52825	4.485	0.16111587	25638.56		
14-Jun-04	30.962285	7.165	1.98	0.77675	4.3725	0.14058646	26193.25		0
15-Jun-04	30.214695	7.23	2.3	0.571	5.04	0.14058646	25732.88		
16-Jun-04	30.625665	7.12	1.735	0.9795	4.025	0.14058646	25273.24		
17-Jun-04	29.4016	7.33	3.02	2.395	4.705	0.14058646	24813.66		
18-Jun-04	29.835645	7.01	3.14	1.685	4.91	0.14058646	26833.16		
19-Jun-04	29.77596	7.03	2.5	0.5415	4.1	0.14058646	25431.48		
20-Jun-04	30.95237	6.99	1.56	0.875	3.54	0.12005704	25840.21		
21-Jun-04	30.63744	7.185	3.855	0.95475	3.6575	0.13725178	27030.07		0
22-Jun-04	29.20641	7.2	2.57	2.65	3.625	0.13725178	26119.39		
23-Jun-04	29.07417	6.95	1.995	0.413	3.7825	0.13725178	26423.2		
24-Jun-04	29.882115	6.91	3.27	0.42825	3.4275	0.13725178	26676.59		
25-Jun-04	30.712715	6.93	1.465	0.84625	3.3	0.13725178	25816.86		
26-Jun-04	31.818245	7.01	3.56	1.63	3.885	0.13725178	25585.66		
27-Jun-04	32.06593	7.155	2.39	1.84625	3.6775	0.15444651	25661.26		
28-Jun-04	31.81606	7	2.4	0.46675	3.65	0.16325784	26739.2		0
29-Jun-04	31.22008	6.905	2.655	0.46125	3.755	0.16325784	23646.25		
30-Jun-04	30.180345	7.12	4.285	0.463	4.095	0.16325784	25629.21		
1-Jul-04	30.16586	7.185	3.765	0.589	3.41	0.16325784	26780.61		
2-Jul-04	30.67161	6.97	2.125	2.085	3.785	0.16325784	26308		
3-Jul-04	30.873995	7.095	2.55	2.16825	4.6975	0.16325784	25868.18		
4-Jul-04	29.460775	7.005	3.03	0.53675	3.8125	0.17206917	26371.82		0
5-Jul-04	29.11713	7.175	2.845	0.50375	3.51	0.17336675	26536.5		
6-Jul-04	29.77423	7.095	2.67	0.542	3.2975	0.17336675	25015.74		
7-Jul-04	30.23805	7.365	1.84	1.6525	3.4325	0.17336675	26031.68		
8-Jul-04	30.33592	7.265	2.74	0.50925	4.31	0.17336675	26934.74		
9-Jul-04	30.391955	6.995	2.875	0.4385	4.1325	0.17336675	28207.3		
10-Jul-04	31.469855	7.02	1.43	0.557	3.44	0.17336675	28315.33		
11-Jul-04	31.76814	7.07	1.89	2.15	3.46	0.17466433	29429.38		
12-Jul-04	31.80121	7.17	1.795	0.59875	3.5175	0.14689037	30558.9		0
13-Jul-04	31.91576	7.38	3.24	2.315	3.79	0.14689037	27521.82		
14-Jul-04	32.52609	6.98	3.455	3.125	5.505	0.14689037	26620.93		
15-Jul-04	32.56398	7.115	4.98	1.04925	4.155	0.14689037	28472.18		
16-Jul-04	32.476465	7.04	3.67	0.6195	4.1625	0.14689037	27770.46		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
17-Jul-04	32.41431	7.075	2.755	0.551	3.785	0.14689037	25615.57		
18-Jul-04	33.31066	7.1	2.67	0.463	3.71	0.11911641	25481.27		
19-Jul-04	33.620995	7.22	2.515	0.7145	3.9375	0.1241986	26144.15		0
20-Jul-04	33.67735	6.96	3.36	0.345	3.565	0.1241986	29913.9		
21-Jul-04	32.501695	6.81	3.72	1.02225	4.0675	0.1241986	24680.99		
22-Jul-04	30.812125	6.9	3.085	1.94	3.4325	0.1241986	25261.33		
23-Jul-04	30.17471	6.91	4.775	0.37	3.29	0.1241986	25571.03		
24-Jul-04	30.451355	6.915	2.255	0.40525	3.58	0.1241986	25360.82		
25-Jul-04	31.119775	6.835	2.1	0.89325	4.27	0.12928078	25242.18		
26-Jul-04	31.63142	6.94	1.68	0.42575	3.895	0.15211902	27091.68		0
27-Jul-04	31.99217	6.94	2.06	0.48	3.03	0.16353813	25720.66		
28-Jul-04	32.240525	6.82	1.19	0.52525	3.325	0.16353813	26197.94		
29-Jul-04	31.555635	7.18	2.165	0.47525	4.09	0.16353813	25641.71		
30-Jul-04	30.605695	7.05	1.995	0.499	4.2625	0.16353813	25896.21		
31-Jul-04	31.06134	7.11	1.385	2.145	3.99	0.16353813	26501.37		
1-Aug-04	31.8672	7.135	3.105	1.58075	4.7275	0.17495725	25444.3		
2-Aug-04	31.65872	7.17	1.635	2.6175	4.6975	0.17579438	24556.17	0	0
3-Aug-04	31.04361	7.08	2.12	1.166	4.2	0.17579438	25494.32		
4-Aug-04	30.373645	7.165	1.95	0.8665	3.4975	0.17579438	23735.77		
5-Aug-04	29.927805	7.25	3.38	1.8715	3.895	0.17579438	24376.22		
6-Aug-04	31.43082	7.275	3.805	1.04725	4.2875	0.17579438	27844.16		
7-Aug-04	32.351745	7.205	2.865	0.73475	3.6275	0.17579438	27911.51		
8-Aug-04	32.83583	7.22	2.49	0.322	3.07	0.17663152	28022.59		
9-Aug-04	31.0833	7	2.98	0.477	3.045	0.16738054	28456.85		0
10-Aug-04	30.32184	6.86	2.84	0.815	2.84	0.16738054	27427.24		
11-Aug-04	30.22826	6.625	1.935	0.5565	3.39	0.16738054	26490.21		
12-Aug-04	30.10108	6.85	2.76	0.218	3.13	0.16738054	26816.42		
13-Aug-04	30.064495	6.97	2.35	0.5405	3.0975	0.16738054	25828.53		
14-Aug-04	29.9367	6.885	1.48	0.505	3.1725	0.16738054	24993.1		
15-Aug-04	29.64821	7.23	2.73	0.77375	3.1125	0.15812956	25443.99		
16-Aug-04	29.862885	7.06	3.185	1.02975	3.3825	0.1217366	25574.3		0
17-Aug-04	29.90115	7.205	2.36	0.35225	3.945	0.1217366	25710.67		
18-Aug-04	28.244835	7.06	3.37	0.533	4.1	0.1217366	24854.16		
19-Aug-04	28.55457	7.1	2.62	0.321	3.365	0.1217366	25117.58		
20-Aug-04	29.27797	6.915	2.5	0.48675	3.3125	0.1217366	25017.28		
21-Aug-04	30.31564	7.06	2.425	0.4875	3.545	0.1217366	25253.53		
22-Aug-04	29.89695	6.82	1.94	0.5545	3.245	0.08534364	24765.9		
23-Aug-04	29.75549	7.365	1.43	1.19725	3.07	0.07625448	25880.22		0
24-Aug-04	28.52884	7.335	3.465	1.71975	3.6425	0.07625448	22918.69		
25-Aug-04	29.92258	7	1.41	0.95225	3.3725	0.07625448	27690.26		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
26-Aug-04	29.64797	7.295	3.21	0.455	3.4025	0.07625448	27967.53		
27-Aug-04	29.83088	7.185	2.58	0.3425	3.8025	0.07625448	26120.52		
28-Aug-04	30.17805	7.3	2.385	0.55	3.1575	0.07625448	25553.89		
29-Aug-04	30.39394	7.21	2.36	0.498	2.77	0.06716531	26377.72		
30-Aug-04	30.435125	7.08	2.285	0.5925	3.2275	0.09396892	26592.08		0
31-Aug-04	30.72753	6.99	2.46	1.22	3.42	0.10737073	25452.59		
1-Sep-04	30.747415	7.11	2.425	0.592	3.645	0.10737073	24605.74		
2-Sep-04	31.37009	7.16	1.88	0.575	3.51	0.10737073	25992.37		
3-Sep-04	30.820895	7.19	3.025	0.3435	3.68	0.10737073	26042.36		
4-Sep-04	29.615315	6.91	2.94	0.495	3.625	0.10737073	22314.62		
5-Sep-04	30.328555	6.85	3.79	0.29225	3.5925	0.12077253	25073.75		
6-Sep-04	29.41293	6.78	3.61	0.3075	2.88	0.13710388	25439.46	0	0
7-Sep-04	29.380075	7.02	3.07	0.7695	3.1	0.13710388	24027.71		
8-Sep-04	29.62788	7.12	2.825	0.91875	3.1825	0.13710388	25988.67		
9-Sep-04	32.64088	7.3	2.03	0.83	3.665	0.13710388	26391.7		
10-Sep-04	33.8434	7.16	2.01	1.06425	3.3325	0.13710388	26015.87		
11-Sep-04	34.157385	7.1	1.575	0.278	3.6975	0.13710388	24990.56		
12-Sep-04	34.49561	7.08	2.74	0.2905	3.05	0.15343522	25330.84		
13-Sep-04	34.226545	7.055	2.085	1.09775	3.21	0.14343588	25724.33		0
14-Sep-04	34.09374	7.075	2.43	2.045	3.61	0.14343588	25732.33		
15-Sep-04	35.13014	7.025	1.665	0.8425	3.47	0.14343588	24663.48		
16-Sep-04	35.1506	7.03	1.04	1.93	3.455	0.14343588	24377.32		
17-Sep-04	35.409645	7.11	1.105	2.23175	4.0875	0.14343588	24372.13		
18-Sep-04	36.10431	7.14	1.81	1.49525	3.9825	0.14343588	25136.32		
19-Sep-04	36.46987	7.38	1.25	1.53	3.175	0.13343654	25180.81		
20-Sep-04	36.15531	7.015	2.34	3.892	3.39	0.1397718	26197.02		0
21-Sep-04	35.14481	7.2	3.03	0.2655	3.515	0.1397718	25781.43		
22-Sep-04	34.70152	7.165	3.85	0.26125	3.2825	0.1397718	26496.2		
23-Sep-04	34.546365	7.08	2.355	1.53	3.13	0.1397718	26450.98		
24-Sep-04	32.785535	7.11	1.81	0.4445	3.115	0.1397718	29486.78		
25-Sep-04	34.58547	7.17	2.145	0.36125	3.7225	0.1397718	26773.5		
26-Sep-04	32.83595	7.15	2.66	0.4685	3.415	0.14610705	25127.09		
27-Sep-04	34.26713	7.275	1.49	1.24075	3.2525	0.15318544	25358.73		0
28-Sep-04	31.105525	7.22	2.31	0.9685	3.285	0.15318544	24410.31		
29-Sep-04	34.004435	7.17	2.73	1.6795	4.1425	0.15318544	24923.45		
30-Sep-04	32.80399	6.87	2.75	0.578	4.3925	0.15318544	25760.57		
1-Oct-04	31.018445	7.04	2.34	0.502	3.5525	0.15318544	25043.37		
2-Oct-04	31.93347	6.865	2.03	1.43575	3.385	0.15318544	25298.39		
3-Oct-04	29.67434	6.5	1.36	1.365	3.835	0.16026383	25454.68		
4-Oct-04	28.37126	7.03	1.775	0.37025	3.135	0.13265434	26944.92	0	0

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
5-Oct-04	29.34999	7.03	2.5	0.3655	3.04	0.13265434	26049.46		
6-Oct-04	33.158875	7.015	2.125	0.7185	3.3675	0.13265434	25432.7		
7-Oct-04	33.10959	6.9	2.1	0.345	3.89	0.13265434	26858.94		
8-Oct-04	32.774585	7.14	1.615	0.49525	3.6775	0.13265434	26719.97		
9-Oct-04	25.42436	7.05	3.07	0.5	3.4875	0.13265434	25877.86		
10-Oct-04	28.83072	7.3	2.735	0.48	3.3675	0.10504485	25469.8		
11-Oct-04	31.2691	7.03	2.91	0.3045	2.585	0.10398447	26158		0
12-Oct-04	33.02466	6.93	3.39	1.59975	2.6575	0.10398447	26708.32		
13-Oct-04	24.6053	7	3.985	0.59325	3.125	0.10398447	27486.52		
14-Oct-04	33.28007	7.16	1.56	0.605	3.54	0.10398447	27983.94		
15-Oct-04	31.75304	6.925	1.089	0.4345	3.675	0.10398447	27365.32		
16-Oct-04	31.17928	6.875	1.87	0.872	3.6175	0.10398447	27391.6		
17-Oct-04	28.96042	6.83	3.51	3.085	3.99	0.10292408	24865.77		
18-Oct-04	26.406725	7.105	2.54	1.6775	3.8325	0.11115026	15245.99		0
19-Oct-04	25.0311525	7.105	3.94	1.93625	3.715	0.11115026	19923.775		
20-Oct-04	23.65558	7.105	5.34	2.195	3.5975	0.11115026	19923.775		
21-Oct-04	28.43715	6.66	3.33	0.558	2.36	0.11115026	24601.56		
22-Oct-04	32.054625	6.625	1.33	0.30875	3.1625	0.11115026	25161.86		
23-Oct-04	31.691405	6.625	1.09	0.407	3.26	0.11115026	27074.32		
24-Oct-04	31.74426	6.62	1.65	0.261	3.275	0.11937644	27076.53		
25-Oct-04	30.140335	6.85	1.73	0.685	3.195	0.11965224	25562.18		0
26-Oct-04	30.92214	6.84	0.33	0.445	3.295	0.11965224	26588.43		
27-Oct-04	23.628915	6.765	1.525	0.5105	3.235	0.11965224	25191.85		
28-Oct-04	32.16661	6.77	1.36	0.4825	2.885	0.11965224	26856.49		
29-Oct-04	30.7963	6.62	0.855	0.91875	3.03	0.11965224	24666.8		
30-Oct-04	29.827405	6.98	2.715	0.98075	3.5875	0.11965224	25666.75		
31-Oct-04	30.18664	6.89	2.09	0.512	4.0425	0.11992804	25644.34		
1-Nov-04	30.064675	6.845	3.335	1.155	3.485	0.11627741	25609.53	0	0
2-Nov-04	29.49452	6.7	2.91	0.86775	3.18	0.11627741	24550.03		
3-Nov-04	28.68111	6.99	3.63	1.9125	3.4125	0.11627741	21809.28		
4-Nov-04	28.88501	7.07	5.42	2.78	3.77	0.11627741	24806.57		
5-Nov-04	29.81689	6.65	2.585	0.50225	3.5625	0.11627741	25966.75		
6-Nov-04	29.65106	6.725	2.225	0.2725	2.7125	0.11627741	23435.33		
7-Nov-04	28.78325	6.82	2.66	0.4195	2.605	0.11262679	23969.59		
8-Nov-04	28.89328	7.09	2.95	1.866	3.6375	0.12520319	24081.74		0
9-Nov-04	29.33525	6.65	2.66	3.565	4.17	0.12520319	23886.27		
10-Nov-04	28.75921	6.99	2.32	0.42475	3.56	0.12520319	23788.43		
11-Nov-04	28.61773	6.89	2.55	2.91	3.305	0.12520319	24714.14		
12-Nov-04	28.97026	6.68	1.425	0.84175	3.1475	0.12520319	25684		
13-Nov-04	29.703425	6.805	2.545	0.476	2.985	0.12520319	24845.2		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
14-Nov-04	30.16838	7.01	2.58	1.59	3.48	0.13777959	24606.81		
15-Nov-04	30.474955	6.965	2.83	0.508	3.4675	0.13775756	24815.04		0
16-Nov-04	30.90018	6.95	3.015	1.705	3.2025	0.13775756	23819.5		
17-Nov-04	30.43791	7.065	4.53	6.25	3.87	0.13775756	24669.41		
18-Nov-04	30.42362	6.9	1.42	1.041	3.215	0.13775756	25869.7		
19-Nov-04	30.622225	6.935	3.06	0.7025	3.095	0.13775756	25963.04		
20-Nov-04	30.05152	6.895	3.425	1.235	3.2875	0.13775756	22762.46		
21-Nov-04	29.00312	7.12	1.71	0.4	3.755	0.13775756	24637.65		
22-Nov-04	29.34311	6.89	1.88	0.41875	3.15	0.13775756	26078.87		0
23-Nov-04	29.1812	6.93	2.13	0.285	2.47	0.13775756	25138.65		
24-Nov-04	29.164575	7.01	2.855	2.1575	2.9725	0.13775756	25403.01		
25-Nov-04	28.78236	6.89	2.38	0.274	3.31	0.13775756	25341.82		
26-Nov-04	28.83523	6.87	1.135	0.84925	3.485	0.13775756	26141.83		
27-Nov-04	28.49217	7.01	2.515	1.7225	3.4325	0.13775756	23770.14		
28-Nov-04	28.30829	6.845	2.16	0.65725	3.57	0.13773552	24851.18		
29-Nov-04	28.1587	7.235	2.17	0.72325	2.6075	0.15005148	25796.64		0
30-Nov-04	28.11266	6.84	0.8	0.55	3.455	0.15005148	26508.06		
1-Dec-04	27.068	7.045	3.035	0.82425	3.6925	0.15005148	20453.46		
2-Dec-04	24.694975	7.08	4.915	7.8025	4.2275	0.15005148	21778.93		
3-Dec-04	24.19222	6.96	7.07	7.48	5.11	0.15005148	25222.47		
4-Dec-04	25.69765	6.845	1.29	0.3885	3.6275	0.15005148	25043		
5-Dec-04	27.0207	6.815	1.675	0.56	2.41	0.16236743	25261.02		
6-Dec-04	27.71309	6.85	0.84	0.838	2.855	0.15615882	25204.34	0	0
7-Dec-04	27.590625	6.85	1.935	0.6975	4.0275	0.15615882	25095.78		
8-Dec-04	28.29612	6.925	3.125	0.3355	4.4475	0.15615882	24728.52		
9-Dec-04	29.11172	7.05	1.47	1.73	2.915	0.15615882	25033.41		
10-Dec-04	28.693025	6.99	2.71	0.3545	2.8125	0.15615882	24711.17		
11-Dec-04	27.893115	6.805	2.705	1.53	2.8375	0.15615882	24338.3		
12-Dec-04	27.70234	6.95	2.63	0.713	4.155	0.14995022	24307.13		
13-Dec-04	27.57981	7.055	2.985	0.5175	3.5225	0.13968883	25391.2		0
14-Dec-04	27.77007	7.45	2.68	0.557	3.085	0.13968883	24896.04		
15-Dec-04	27.791815	7.24	3	2.5425	4.075	0.13968883	22400.56		
16-Dec-04	27.374495	6.815	2.79	1.59	3.85	0.13968883	24881.17		
17-Dec-04	27.003535	6.87	0.71	0.6985	3.015	0.13968883	25275.26		
18-Dec-04	26.189105	6.86	2.815	0.352	2.7575	0.13968883	25300.08		
19-Dec-04	26.31955	6.74	2.19	0.45	3.49	0.12942745	26012.08		
20-Dec-04	26.595805	7.015	2.885	0.7975	3.7825	0.14821765	25543.56		0
21-Dec-04	25.952365	7.02	2.79	0.6925	3.6775	0.14821765	25785.52		
22-Dec-04	25.95784	6.67	3.51	0.2975	2.855	0.14821765	24748.76		
23-Dec-04	26.09604	6.79	2.645	0.74475	3.1775	0.14821765	24667.08		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
24-Dec-04	26.00582	6.945	2.635	1.455	3.7275	0.14821765	25121.74		
25-Dec-04	26.7817	6.88	2.655	0.36825	3.875	0.14821765	25537.4		
26-Dec-04	27.35389	6.88	2.655	0.5555	3.1925	0.16700784	25240.73		
27-Dec-04	27.7697	6.71	4.08	0.35525	3.21	0.15387431	25216.32		0
28-Dec-04	27.46697	6.59	2.49	2.089	3.445	0.15387431	22770.8		
29-Dec-04	26.98106	6.91	2.38	3.485	4.545	0.15387431	24010.71		
30-Dec-04	26.880745	6.735	3.235	0.21375	3.5775	0.15387431	25727.87		
31-Dec-04	27.09403	6.415	2.585	0.3665	2.865	0.15387431	25031.62		
1-Jan-05	27.297545	6.56	5.05	1.269	3.1275	0.15387431	26060.4		
2-Jan-05	27.163105	6.75	2.81	0.243	3.9325	0.15387431	25697.39		
3-Jan-05	26.82994	6.99	3.01	0.3615	3.61	0.15387431	24442.02	0	0
4-Jan-05	26.79957	6.52	3.13	0.323	3.475	0.15387431	24611.73		
5-Jan-05	26.986155	6.66	1.165	0.33	3.345	0.14074078	29524.29		
6-Jan-05	27.026555	6.805	0.98	1.32125	2.7525	0.1393626	26405.15		
7-Jan-05	28.321565	6.81	1.515	0.543	3.655	0.1393626	26370.83		
8-Jan-05	28.66056	6.825	2.98	1.53	4.145	0.1393626	25589.77		
9-Jan-05	28.55469	6.61	2.58	1.4	3.525	0.13798442	24280.06		
10-Jan-05	28.17666	6.92	3	0.37125	3.0975	0.15144063	24279.18		0
11-Jan-05	28.21082	6.93	1.7	0.5005	3.055	0.15144063	25472.04		
12-Jan-05	27.940155	6.695	0.81	0.53325	2.9775	0.15144063	23040.86		
13-Jan-05	27.3705	6.77	3.15	0.8555	2.85	0.15144063	25386.78		
14-Jan-05	27.42288	6.71	0.98	0.735	3.485	0.15144063	24543.8		
15-Jan-05	27.26516	6.66	3.175	2.8025	4.3125	0.15144063	26677.55		
16-Jan-05	26.19043	6.7	2.24	0.45	3.59	0.16489685	25448.4		
17-Jan-05	26.612955	6.815	2.37	0.54275	2.8625	0.15696054	24256.32		0
18-Jan-05	26.59754	6.63	3.23	2.665	3.57	0.15696054	23730.87		
19-Jan-05	27.62815	7.26	2.02	0.791	3.4225	0.15696054	25757.22		
20-Jan-05	28.03934	6.46	0.68	0.560625	3.13	0.15696054	25347.22		
21-Jan-05	27.91658	6.995	2.5	0.33025	2.8375	0.15696054	25206.46		
22-Jan-05	28.044055	6.94	1.98	0.5	3.0125	0.15696054	25832.37		
23-Jan-05	28.326615	6.795	2.3	1.9375	3.865	0.14902423	24784.57		
24-Jan-05	28.446225	6.79	1.8	0.615	4.465	0.1461733	25722.27		0
25-Jan-05	27.69663	6.93	2.12	0.35	3.59	0.1461733	24715.56		
26-Jan-05	27.566625	7.025	3.48	0.22525	2.58	0.1461733	25194.94		
27-Jan-05	28.00554	6.78	5.66	0.2625	1.935	0.1461733	26004.82		
28-Jan-05	28.23927	7.035	2.665	1.99	2.865	0.1461733	25876.97		
29-Jan-05	28.993055	6.915	2.04	0.481	3.975	0.1461733	25186.4		
30-Jan-05	29.43272	6.715	2.475	0.82	3.935	0.14332238	24770.77		
31-Jan-05	29.938215	7.16	2.4	0.485	3.08	0.13529577	27025.74		0
1-Feb-05	29.1240875	7.14	2.38	1.449	3.0375	0.13529577	25016.5		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
2-Feb-05	29.1240875	6.885	2.56	0.37375	4.315	0.13529577	21937.23		
3-Feb-05	29.1240875	6.5	0.48	0.353	3.815	0.13529577	25107.59		
4-Feb-05	29.1240875	6.875	2.185	0.37175	3.235	0.13529577	24753.06		
5-Feb-05	29.1240875	6.705	2.505	0.3365	2.8025	0.13529577	23888.62		
6-Feb-05	29.1240875	6.69	2.47	0.8015	3.78	0.12726917	24636.3		
7-Feb-05	29.1240875	6.685	0.775	0.365	3.5525	0.16560544	24938.74	0	0
8-Feb-05	29.1240875	6.83	2.76	2.2425	3.585	0.16560544	24030.75		
9-Feb-05	29.1240875	6.85	1.49	0.6435	3.245	0.16560544	25485.73		
10-Feb-05	29.1240875	6.86	0.34	1.01	3.07	0.16560544	25475.13		
11-Feb-05	29.1240875	6.76	1.245	1.7575	3.2025	0.16560544	24830.09		
12-Feb-05	29.1240875	6.91	1.895	1.6625	4.055	0.16560544	24346.48		
13-Feb-05	29.1240875	7.33	1.9	2.4	3.825	0.20394172	24106.99		
14-Feb-05	28.30996	6.985	2.675	0.44475	3.5825	0.18767995	25115.5		0
15-Feb-05	28.55629	6.87	1.15	0.39	3.17	0.18767995	24409.3		
16-Feb-05	28.785415	7	1.825	0.58575	3.1775	0.18767995	24371.19		
17-Feb-05	28.88708	7.35	1.5	1.74	4.08	0.18767995	23844.24		
18-Feb-05	29.42792	6.76	1.485	0.52225	3.65	0.18767995	24773.69		
19-Feb-05	29.605215	6.735	0.775	0.56275	3.5525	0.18767995	24358.14		
20-Feb-05	29.90026	6.81	3.4	2.8485	3.985	0.17141817	23995.16		
21-Feb-05	30.57143	6.825	2	1.316	3.6225	0.10101098	25563.75		0
22-Feb-05	29.18079	6.7	2.29	0.61	3.595	0.10101098	24385.21		
23-Feb-05	28.563635	6.99	2.185	0.345	3.3575	0.10101098	25282.96		
24-Feb-05	28.566115	6.775	2.28	0.3285	2.8375	0.10101098	26389.55		
25-Feb-05	29.09174	6.74	2.74	0.3015	3.3675	0.10101098	26893.14		
26-Feb-05	29.535615	6.625	2.7	0.5265	3.78	0.10101098	26421.72		
27-Feb-05	29.78362	6.53	1.91	1.245	3.46	0.03060379	29395.81		
28-Feb-05	29.26965	6.78	2.1	0.868	3.255	0.04878403	28957.7		0
1-Mar-05	28.91109	6.62	2.96	0.211	3.725	0.04878403	26253.93		
2-Mar-05	28.523385	6.785	3.11	0.416	3.6625	0.04878403	25587.27		
3-Mar-05	28.75619	6.81	1.89	0.36	2.865	0.04878403	26257.39		
4-Mar-05	28.949	6.825	2.09	0.422	2.9425	0.04878403	25225.77		
5-Mar-05	29.271895	6.845	1.89	0.5025	3.2825	0.04878403	24703.81		
6-Mar-05	28.52917	6.77	1.94	0.405	4.035	0.06696426	24988.29		
7-Mar-05	27.565	6.625	2.365	0.27	3.785	0.14862378	25354.48	0	0
8-Mar-05	27.12653	6.54	2.14	0.423	3.155	0.14862378	25999.7		
9-Mar-05	27.05274	6.81	2.8	1.41	3.12	0.14862378	24133.48		
10-Mar-05	26.08926	6.57	1.78	0.3665	3.26	0.14862378	22957.63		
11-Mar-05	27.41444	6.755	2.15	0.535	3.18	0.14862378	25281.25		
12-Mar-05	28.39621	6.665	2.115	0.2975	3.27	0.14862378	24176.21		
13-Mar-05	29.08385	6.89	2.11	0.695	3.165	0.14862378	24066.03		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
14-Mar-05	28.648885	6.92	2.15	2.155	3.4825	0.14862378	25805.66		0
15-Mar-05	28.38689	6.93	3.94	3.225	4.39	0.14862378	23649.89		
16-Mar-05	28.1462	6.725	2.835	2.8735	4.0275	0.14862378	25962.17		
17-Mar-05	29.48145	6.74	3.17	1.325	2.91	0.14862378	25857.12		
18-Mar-05	30.53461	6.635	3	0.34575	2.965	0.14862378	25758.04		
19-Mar-05	31.344195	6.935	2.63	0.9025	3.545	0.14862378	24698.87		
20-Mar-05	30.96771	6.77	2.42	0.609	3.385	0.23028331	25915.52		
21-Mar-05	30.92246	6.8	1.785	0.51625	3.46	0.20099678	25688.06		0
22-Mar-05	30.0485	6.67	1.14	0.5575	2.875	0.20099678	27196.13		
23-Mar-05	28.7813	6.61	2.11	1.881	2.955	0.20099678	25471.43		
24-Mar-05	28.11219	6.96	1.27	0.75775	3.64	0.20099678	27786.26		
25-Mar-05	27.906605	6.585	1.355	0.721	3.7225	0.20099678	26129.81		
26-Mar-05	28.71853	6.73	1.82	0.572	3.48	0.20099678	26752.13		
27-Mar-05	30.114975	6.87	1.965	0.365	3.225	0.20099678	25914.01		
28-Mar-05	30.535945	6.69	1.655	0.3475	3.2275	0.20099678	26983.96		0
29-Mar-05	29.578195	6.66	2.32	0.63125	2.97	0.20099678	26815.1		
30-Mar-05	28.575095	6.71	3.275	1.851	3.235	0.20099678	24623.46		
31-Mar-05	28.24273	6.46	3.78	4.22	4.235	0.20099678	25036.99		
1-Apr-05	28.036755	6.645	1.655	0.7335	3.4625	0.20099678	26114.92		
2-Apr-05	28.008565	6.78	1.85	0.66725	2.7875	0.20099678	25290.55		
3-Apr-05	29.03491	6.46	1.92	2.63	2.655	0.17171026	26668.32		
4-Apr-05	28.96118	6.9	1.815	1.21	3.7175	0.16971785	27339.66	0	0
5-Apr-05	29.95046	6.94	1.21	1.0435	3.095	0.16971785	27381.94		
6-Apr-05	29.79607	7.13	2.245	1.68975	4.135	0.16971785	22825.45		
7-Apr-05	28.83377	7.56	1.68	0.405	3.37	0.16971785	25649.07		
8-Apr-05	28.20424	7.375	2.38	0.82375	2.6825	0.16971785	23769.29		
9-Apr-05	28.05468	7.28	1.525	0.4685	3.08	0.16971785	23816.65		
10-Apr-05	26.71798	7.18	2.68	1.995	3.065	0.16772543	25533		
11-Apr-05	24.36731	7.16	2.305	0.573	3.3625	0.18193769	26351.96		0
12-Apr-05	22.63409	7.15	3.47	1.415	2.855	0.18193769	24958.36		
13-Apr-05	26.91783	7.315	3.92	2.2925	3.1125	0.18193769	22972.48		
14-Apr-05	26.67977	7.55	2.11	2.015	3.785	0.18193769	23212.04		
15-Apr-05	27.45018	7.225	2.705	0.29775	2.895	0.18193769	26121.11		
16-Apr-05	27.818745	6.67	2.23	0.5825	2.6975	0.18193769	26349.91		
17-Apr-05	28.7086	7.12	3.72	0.9315	3.165	0.19614995	26375.8		
18-Apr-05	29.28452	7.115	3.035	1.54075	3.6625	0.17464935	26103.82		
19-Apr-05	29.33376	7.02	2.73	0.6395	3.42	0.17464935	25991.45		0
20-Apr-05	29.74932	7.06	2.35	0.87	3.34	0.17464935	25741.27		
21-Apr-05	29.23012	7.22	3.13	0.605	3.235	0.17464935	25958.46		
22-Apr-05	29.7537	7.495	3.01	0.47075	3.3775	0.17464935	25819.14		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
23-Apr-05	30.689215	7.205	2.985	1.373	3.2675	0.17464935	25413.25		
24-Apr-05	31.34632	6.93	2.82	1.095	3.805	0.15314875	26317.54		
25-Apr-05	31.096565	7.305	3.52	2.56375	3.6125	0.13185555	26198.82		0
26-Apr-05	29.55444	7.11	3.64	0.86	3.35	0.13185555	26380.8		
27-Apr-05	29.09016	7.185	2.69	0.5785	3.2675	0.13185555	27033.57		
28-Apr-05	29.18104	7.08	2.9	1.18	3	0.13185555	26211.91		
29-Apr-05	29.612635	7.075	3.265	0.84	3.295	0.13185555	25645.71		
30-Apr-05	29.790645	7.3	1.825	1.00075	3.7275	0.13185555	24726.17		
1-May-05	28.98658	7.21	2.56	1.235	3.435	0.11056235	24387.75		
2-May-05	29.308105	7.12	2.04	0.54425	3.08	0.13935832	25123.02	0	0
3-May-05	28.73106	7.19	1.7	1.375	2.86	0.13935832	26030.43		
4-May-05	27.95465	7.21	2.385	1.79	3.01	0.13935832	27015.46		
5-May-05	28.38865	6.96	2.65	0.53	3.265	0.13935832	27331.62		
6-May-05	28.957765	7.145	1.795	0.84	3.39	0.13935832	25954.68		
7-May-05	29.998985	7.585	1.9	0.6525	3.28	0.13935832	26256.13		
8-May-05	29.77407	6.91	2.52	0.33	3.615	0.1681543	25650.58		
9-May-05	30.151765	7.025	1.395	0.4405	3.2775	0.14474635	26634.8		0
10-May-05	28.36521	7.2	2.77	2.71	3.515	0.14474635	23859.54		
11-May-05	28.52	7.16	2.45	1.041	2.9125	0.14474635	26354.14		
12-May-05	28.88659	7.25	1.53	0.4745	3.03	0.14474635	25844.22		
13-May-05	29.39489	7.095	1.91	0.37075	3.275	0.14474635	26168.64		
14-May-05	29.67108	7.31	1.76	0.965	2.98	0.14474635	25192.55		
15-May-05	30.47156	7.52	2.49	0.575	3.515	0.1213384	25157.93		
16-May-05	30.294015	7.33	2.61	2.5925	4.1225	0.14527014	21932.78		0
17-May-05	28.46319	7.25	3.3	6.415	3.86	0.14527014	20602.14		
18-May-05	26.503075	7.17	2.935	8.4075	3.63	0.14527014	25436.14		
19-May-05	27.99012	7.07	2.18	0.372	2.535	0.14527014	26171.79		
20-May-05	29.38241	6.97	1.06	0.4675	2.58	0.14527014	25042.22		
21-May-05	30.648025	7.005	1.92	1.37575	2.7	0.14527014	25441.02		
22-May-05	26.95207	7.055	2.27	0.4375	3.455	0.16920189	25295.73		
23-May-05	28.96401	7.02	1.67	0.856	2.55	0.1405913	25861.99		0
24-May-05	29.33019	7.34	2.7	3.365	2.7	0.1405913	26289.02		
25-May-05	30.983815	7.15	2.045	0.8575	3.2575	0.1405913	25211.78		
26-May-05	24.49511	7.12	1.86	5.38	3.685	0.1405913	25329.24		
27-May-05	29.68506	7.16	1.99	1.48675	2.97	0.1405913	26219.09		
28-May-05	30.089215	7.245	1.58	1.8975	2.835	0.1405913	25175.8		
29-May-05	32.26004	7	2.19	4.245	3.24	0.11198071	23397.55		
30-May-05	33.80596	7.11	2.07	1.62	3.49	0.10733991	23068.73		***15***
31-May-05	34.379765	7.315	2.535	0.4875	2.6575	0.10733991	25749.09		
1-Jun-05	34.10488	7.21	3.295	0.5745	2.6675	0.10733991	26140.35		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
2-Jun-05	34.74487	7.15	1.76	0.315	2.52	0.10733991	26419.53		
3-Jun-05	34.888285	7.275	2.66	0.50975	2.4125	0.10733991	26540.55		
4-Jun-05	35.392235	7.335	2.37	3.075	2.64	0.10733991	25215.66		
5-Jun-05	32.81409	7.37	2.94	2.33	3.06	0.10269912	25741.72		
6-Jun-05	30.53287	7.255	3.465	0.7215	3	0.12402404	25531.23	***0***	***70***
7-Jun-05	28.911185	7.09	3.03	0.63	2.2125	0.12402404	25879.6		
8-Jun-05	27.31849	7.11	3.16	0.51225	2.2675	0.12402404	26766.01		
9-Jun-05	28.10532	7.02	0.67	0.837	3.12	0.12402404	26359.05		
10-Jun-05	28.12025	7.24	2.975	0.63	3.0475	0.12402404	25489.57		
11-Jun-05	30.113215	7.315	1.81	1.2355	3.275	0.12402404	26574.86		
12-Jun-05	30.59597	7.27	3.06	0.6415	3.115	0.14534897	26514.51		
13-Jun-05	30.43568	7.12	2.7	0.603	2.4325	0.12195633	26919.9		15
14-Jun-05	29.62821	6.93	3.67	0.5545	3.39	0.12195633	26365.95		
15-Jun-05	29.211345	7.205	3.16	1.37525	2.9025	0.12195633	24349.52		
16-Jun-05	29.5463	7.08	2.33	1.4205	2.845	0.12195633	25005.32		
17-Jun-05	30.408685	7.1	3.925	1.645	3.165	0.12195633	24856.56		
18-Jun-05	31.174	7.135	3.505	1.82	2.8875	0.12195633	25142.69		
19-Jun-05	31.71418	6.96	2.98	0.4205	2.65	0.0985637	23875.43		
20-Jun-05	31.25616	7.115	3.59	1.318	2.8	0.12178599	25285.52		0
21-Jun-05	31.08251	7.105	2.39	0.45075	2.855	0.12178599	25689.82		
22-Jun-05	31.49511	7.11	1.77	0.6675	2.72	0.12178599	26115.88		
23-Jun-05	32.53098	7.075	2.055	0.69	3.1675	0.12178599	26673.47		
24-Jun-05	31.5446	7.065	2.115	0.661	2.6825	0.12178599	26045.26		
25-Jun-05	31.618725	7.05	3.335	0.48475	2.8625	0.12178599	25862.33		
26-Jun-05	33.35659	7.17	1.64	0.498	2.515	0.14500829	26338.62		
27-Jun-05	31.9413	7.075	1.635	0.4565	2.715	0.13435713	28150.16		0
28-Jun-05	31.81801	6.97	1.6	0.975	3.52	0.13435713	26014.45		
29-Jun-05	30.9962	7.125	3.3	0.47225	2.8825	0.13435713	28422.98		
30-Jun-05	28.917975	7.04	2.905	0.7375	2.585	0.13435713	26996.78		
1-Jul-05	29.99117	7.185	1.58	0.4575	2.4825	0.13435713	26377.9		
2-Jul-05	30.026065	7.175	2.615	0.67775	2.755	0.13435713	26241.42		
3-Jul-05	29.69917	7.07	3.13	0.875	3.44	0.12370598	24917.81		
4-Jul-05	29.12321	7.06	3.555	1.14025	3.43	0.11901723	25432.4	0	50
5-Jul-05	29.67513	7.04	2.08	1.1095	2.75	0.11901723	25072.7		
6-Jul-05	29.032995	6.97	1.905	0.514	2.58	0.11901723	27345.78		
7-Jul-05	32.98619	6.88	1.41	0.3765	2.12	0.11901723	29912.05		
8-Jul-05	33.582365	7.165	3.72	0.54275	2.4925	0.11901723	28446.69		
9-Jul-05	34.75042	7	2.045	0.9075	2.795	0.11901723	29128.54		
10-Jul-05	34.89508	6.95	2.49	1.198	3	0.11432847	27911.09		
11-Jul-05	34.58723	7.05	2.275	0.66575	2.775	0.20532649	27603.8		0

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
12-Jul-05	34.57697	6.83	2.08	0.49	2.895	0.20532649	26334.17		
13-Jul-05	34.704525	6.835	2.09	0.55075	2.8425	0.20532649	25659.28		
14-Jul-05	33.90672	7.17	2.6	0.425	2.6	0.2963245	26489.63		
15-Jul-05	33.97045	6.875	2.715	3.4	3.0575	0.21613279	26717.61		
16-Jul-05	34.43116	6.995	1.97	2.6525	3.42	0.21613279	27212.71		
17-Jul-05	34.017345	7.045	1.89	0.5525	2.845	0.13594108	28767.71		
18-Jul-05	31.667365	6.905	1.935	0.6015	2.6025	0.12264491	28136.66		0
19-Jul-05	31.29234	6.83	1.96	0.325	2.87	0.12264491	28531.37		
20-Jul-05	29.2615	7.01	3.11	1.36	2.895	0.12264491	28232.3		
21-Jul-05	31.09411	7.41	2.31	1.204	2.81	0.12264491	27942.62		
22-Jul-05	31.866025	7.13	2.955	0.512	2.9	0.12264491	27212.93		
23-Jul-05	32.600935	7.265	3.24	1.315	2.925	0.12264491	26854.08		
24-Jul-05	31.59119	7.23	3.09	0.549	3.095	0.10934874	27985.35		
25-Jul-05	29.715205	7.135	2.285	0.56725	2.5825	0.10491285	27753.32		0
26-Jul-05	29.3039	7.41	2.68	0.885	2.615	0.10491285	26747.29		
27-Jul-05	28.408005	7.02	3.145	0.3315	2.9175	0.10491285	28148.7		
28-Jul-05	27.26299	6.85	2.59	0.4225	2.635	0.10491285	27854.06		
29-Jul-05	28.79686	6.915	2.71	0.54975	2.9525	0.10491285	27335.1		
30-Jul-05	30.350635	6.92	3.12	1.80125	3.265	0.10491285	26748.38		
31-Jul-05	30.995715	7.35	2.815	0.9655	3.4625	0.10047695	26684.18		
1-Aug-05	32.68845	7.05	2.395	0.5625	3.1325	0.10121856	28041.3	0	0
2-Aug-05	33.90252	7.19	0.66	1.045	2.365	0.10121856	25976.07		
3-Aug-05	32.850895	7.305	3.525	0.806	2.6475	0.10121856	27430.79		
4-Aug-05	28.11362	7.16	3.47	1.04075	2.915	0.10121856	26998.18		
5-Aug-05	29.440315	7.105	2.815	0.57525	2.9475	0.10121856	26600.93		
6-Aug-05	31.493945	7.145	2.28	0.71475	3.1025	0.10121856	25927.99		
7-Aug-05	32.8849	6.97	4.13	0.3755	3.005	0.10196017	26990.53		
8-Aug-05	33.22768	7.02	3.975	0.492	2.72	0.10917248	25864.14		0
9-Aug-05	28.83698	7.04	1.4	0.585	2.77	0.10917248	25373.36		
10-Aug-05	29.315675	7.13	1.335	0.6925	3.2475	0.10917248	26853.98		
11-Aug-05	30.42266	7.08	2.51	1.0675	3.245	0.10917248	27230.86		
12-Aug-05	29.787415	7.19	2.83	0.6025	3.575	0.10917248	26282.75		
13-Aug-05	28.124895	7.25	4	1.24025	3.2925	0.10917248	26226.07		
14-Aug-05	30.002145	7.18	2.155	0.95825	3.1675	0.11638479	26112.39		
15-Aug-05	30.399795	7.11	1.975	0.51725	3.315	0.11048201	27411.88		0
16-Aug-05	30.69809	7.22	2.215	0.64125	3.1725	0.11048201	25987.84		
17-Aug-05	31.107465	7.31	1.976	0.59375	3.1575	0.11048201	24937.25		
18-Aug-05	30.84434	7.07	1.55	0.95	3	0.11048201	28248.76		
19-Aug-05	30.94613	7.32	5.25	0.6005	3.01	0.11048201	26607.51		
20-Aug-05	25.29556	7.61	2.74	0.488	2.56	0.11048201	26902.4		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
21-Aug-05	29.7061	7.05	2.94	0.542	2.64	0.10457922	27620.47		
22-Aug-05	30.59546	7.125	2.79	0.5175	2.8225	0.11539661	27300.89		0
23-Aug-05	28.856	6.94	3.12	0.937	2.445	0.11539661	26795.83		
24-Aug-05	29.88936	7.25	3.01	0.525	2.4975	0.11539661	28052.39		
25-Aug-05	30.47485	7.06	2.18	0.8955	2.8	0.11539661	28694.9		
26-Aug-05	29.469165	7.165	1.685	0.46925	2.5425	0.11539661	29033.68		
27-Aug-05	29.68341	7.185	3.005	0.67875	2.7425	0.11539661	27413.9		
28-Aug-05	25.821865	6.98	3.735	1.359	2.645	0.12621399	29115.38		
29-Aug-05	27.7201	6.905	1.785	1.18	3.455	0.12612101	27579.19		0
30-Aug-05	28.75085	7.16	1.93	0.7	3.48	0.12612101	27316.8		
31-Aug-05	29.26056	7.055	1.565	0.424	2.6125	0.12612101	28532.81		
1-Sep-05	28.70869	6.99	3.175	0.46975	2.4775	0.12612101	29938.37		
2-Sep-05	28.709315	6.92	3.19	0.78675	2.6175	0.12612101	27703.92		
3-Sep-05	29.615735	7.3	2.83	0.5455	2.8875	0.12612101	26466.21		
4-Sep-05	28.469615	6.945	2.59	1.46975	2.69	0.12602804	28857.34		
5-Sep-05	32.11615	7.31	3.22	1.295	2.615	0.12992043	28419.38	0	0
6-Sep-05	30	7.31	2.42	0.51	2.96	0.12992043	28280.43		
7-Sep-05	30.267465	7.1	2.28	0.88775	2.725	0.12992043	26686.71		
8-Sep-05	28.90941	6.77	3.42	0.5185	2.72	0.12992043	28635.25		
9-Sep-05	20.895285	7	1.94	0.81925	2.61	0.12992043	28554.04		
10-Sep-05	32.862395	7.09	2.21	0.62	2.79	0.12992043	27466.77		
11-Sep-05	32.30268	6.975	1.96	1.325	2.7575	0.13381281	26664.13		
12-Sep-05	26.490855	7.15	2.91	1.705	2.9	0.14945784	27292.38		0
13-Sep-05	25.43808	7.12	2.79	0.545	2.71	0.14945784	25229.28		
14-Sep-05	23.43576	6.99	3.8	0.66125	2.765	0.14945784	25963.61		
15-Sep-05	25.58738	6.84	1.7	0.512	2.925	0.14945784	27449.87		
16-Sep-05	25.847835	6.985	4.01	0.55675	2.73	0.14945784	27915.23		
17-Sep-05	26.76514	7.25	2.97	0.84	2.94	0.14945784	27391.6		
18-Sep-05	28.52635	6.91	1.83	1.075	2.94	0.16510286	27213.74		
19-Sep-05	23.452145	7.14	1.87	0.5	2.915	0.15493121	27699.32		0
20-Sep-05	26.6179	7.14	3.685	0.50575	2.5475	0.15493121	26584.37		
21-Sep-05	29.67733	7.05	2.54	0.473	2.7075	0.15493121	27932.17		
22-Sep-05	28.56032	6.88	2.76	0.453	3.14	0.15493121	28121.8		
23-Sep-05	29.097635	7.075	2.87	0.528	3.24	0.15493121	26941.77		
24-Sep-05	29.50389	7.235	1.925	0.54175	3.1	0.15493121	26228.8		
25-Sep-05	30.20218	7.05	2.08	0.827	2.675	0.14475956	26455.34		
26-Sep-05	30.548025	7.19	2.985	0.5475	2.86	0.14331029	27137.34		0
27-Sep-05	30.500745	7.235	3.87	0.714	3.345	0.14331029	26812.8		
28-Sep-05	28.570435	7.175	3.61	0.61875	3.105	0.14331029	24897.63		
29-Sep-05	28.75869	7.35	2	0.560625	2.53875	0.14331029	26771.85		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
30-Sep-05	21.88725	6.875	1.755	0.5025	1.9725	0.14331029	27150.96		
1-Oct-05	31.39257	7.095	1.615	0.59825	2.7025	0.14331029	26251		
2-Oct-05	30.76988	7.07	3.63	0.4605	2.965	0.14186102	28085.2		
3-Oct-05	30.151205	7.05	2.42	0.68575	2.3875	0.13193199	28349.03	0	0
4-Oct-05	28.80834	7.21	2.92	0.9275	2.07	0.13193199	26369.38		
5-Oct-05	28.82507	7.445	2.565	2.4025	3.075	0.13193199	26485.23		
6-Oct-05	30.96781	6.99	3.87	3.49	3.595	0.13193199	25724.55		
7-Oct-05	32.015	6.88	2.245	2.0085	2.965	0.13193199	31173.44		
8-Oct-05	32.84998	7.05	2.6	0.53225	2.37	0.13193199	30633.79		
9-Oct-05	33.29946	6.99	2.27	0.782	2.295	0.12200297	30742.85		
10-Oct-05	33.38451	6.91	3.02	0.4105	2.935	0.11071558	27680.41		0
11-Oct-05	33.5832	6.95	3.26	0.63825	2.865	0.11071558	28618.37		
12-Oct-05	32.774415	6.95	2.125	0.6	2.345	0.11071558	28131.23		
13-Oct-05	30.69803	7.115	2.6	1.42825	2.5375	0.11071558	27406.31		
14-Oct-05	30.826105	7.045	3.54	1.154	2.955	0.11071558	27196.35		
15-Oct-05	31.532535	7.215	1.835	0.88975	2.785	0.11071558	27215.82		
16-Oct-05	31.74213	7.25	1.53	0.473	3.03	0.09942819	26013.73		
17-Oct-05	31.33057	7.15	2.08	1.5095	2.97	0.12320014	27211.3		0
18-Oct-05	29.72858	7.06	3.73	2.17	3.37	0.12320014	24279.21		
19-Oct-05	30.100855	7.005	3.82	2.5225	2.59	0.12320014	26887.71		
20-Oct-05	30.657165	7.03	2.89	0.685	1.945	0.12320014	29477.03		
21-Oct-05	31.161015	7.245	3.01	0.59	2.9	0.12320014	30181.01		
22-Oct-05	32.238015	6.95	2.785	0.5725	3.0075	0.12320014	29383.88		
23-Oct-05	31.79641	7.07	3.34	0.445	2.71	0.14697208	27313.11		
24-Oct-05	30.766505	6.9	2.55	0.484	2.3075	0.13865254	28167.08		0
25-Oct-05	31.67554	7.18	3.84	0.525	2.24	0.13865254	26660.15		
26-Oct-05	31.830905	7.175	2.28	0.81025	2.515	0.13865254	28332.38		
27-Oct-05	31.6668	7.23	1.08	1.24	3.135	0.13865254	27727.46		
28-Oct-05	31.67957	6.96	3.2	1.145	3.4675	0.13865254	26863.99		
29-Oct-05	31.680115	7.005	3.315	1.03475	2.9875	0.13865254	27313.96		
30-Oct-05	30.92147	6.73	3.15	1.0215	2.585	0.130333	26461.96		
31-Oct-05	31.470005	7.07	2.71	0.99875	2.735	0.11724357	28348.8		0
1-Nov-05	33.52797	7.43	2.1	0.829	2.755	0.11724357	27378.09		
2-Nov-05	31.7646	7.32	3.355	0.873	2.995	0.11724357	26793.01		
3-Nov-05	32.04235	6.91	3.54	1.0435	2.41	0.11724357	27647.17		
4-Nov-05	31.805045	7.11	3.475	0.9005	2.7325	0.11724357	27909.17		
5-Nov-05	31.729265	6.89	2.455	1	2.815	0.11724357	25251.83		
6-Nov-05	31.94303	7.06	3.59	1.105	3.02	0.10415414	25192.61		
7-Nov-05	30.101715	6.87	1.895	1.10825	2.5725	0.14493231	27958.98	0	0
8-Nov-05	31.32131	7.17	2.41	1.145	2.395	0.14493231	26814.25		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
9-Nov-05	26.57007	7.09	2.37	1.125	2.64	0.14493231	26850.52		
10-Nov-05	20.06659	7.08	3.105	1.3715	2.655	0.14493231	27997.26		
11-Nov-05	26.923115	6.835	2.705	1.51525	2.135	0.14493231	27576.72		
12-Nov-05	27.28762	6.74	3.63	2.1875	2.2475	0.14493231	24981.47		
13-Nov-05	30.59371	6.75	3.88	2.53	2.68	0.18571048	25623.39		
14-Nov-05	29.84765	6.98	2.065	1.6875	2.6375	0.1692195	27007.37		0
15-Nov-05	28.06159	6.99	4.17	3.735	2.795	0.1692195	25885.45		
16-Nov-05	27.820695	6.785	3.215	1.605	3.01	0.1692195	24800.09		
17-Nov-05	27.3629	6.95	2.55	1.365	2.715	0.1692195	26866.53		
18-Nov-05	27.83171	6.68	2.43	1.7455	2.5075	0.1692195	26121.77		
19-Nov-05	28.12838	6.635	3.095	1.6525	2.5325	0.1692195	25363.98		
20-Nov-05	27.95654	6.83	1.53	4.61	2.325	0.15272851	26759.33		
21-Nov-05	27.823875	6.65	2.65	1.5575	2.98	0.16273356	25955.63		0
22-Nov-05	27.94065	6.71	5	1.225	3.145	0.16273356	25648.94		
23-Nov-05	25.733835	6.755	3.6	1.6325	2.615	0.16273356	26529.96		
24-Nov-05	25.84223	6.95	5.26	1.325	3.475	0.16273356	25078.35		
25-Nov-05	25.721345	6.525	2.71	1.7075	2.7625	0.16273356	26498.18		
26-Nov-05	25.709425	6.585	1.59	2.23	2.2375	0.16273356	25391.26		
27-Nov-05	25.97541	6.7	2.95	2.775	2.905	0.17273862	26968.15		
28-Nov-05	25.580575	6.915	3.315	2.605	3.2425	0.1454664	27174.94		0
29-Nov-05	25.7825	6.85	4.85	2.29	2.94	0.1454664	26625.21		
30-Nov-05	26.28751	6.71	2.66	2.065	2.69	0.1454664	26534.92		
1-Dec-05	26.77577	6.795	1.5	2.2625	2.2025	0.1454664	27328.32		
2-Dec-05	25.74457	6.9	1.05	2.64	3.53	0.1454664	25810.76		
3-Dec-05	25.144045	6.81	3.4	2.31	2.795	0.1454664	25889.76		
4-Dec-05	25.7202	7.06	3.34	2.5775	2.84	0.1454664	26305.32		
5-Dec-05	25.605105	6.755	4.63	2.015	2.53	0.1454664	26525.53	0	0
6-Dec-05	26.485375	6.795	2.31	3.585	2.37	0.1454664	25910.4		
7-Dec-05	26.16037	6.91	3.26	2.4675	3.04	0.1454664	24806.04		
8-Dec-05	27.57778	6.86	3.5	0.9	3.315	0.1454664	27189.01		
9-Dec-05	27.577775	6.735	3.82	1.66525	2.5975	0.1454664	24634.51		
10-Dec-05	27.31057	6.89	3.865	0.886	2.935	0.1454664	23157.28		
11-Dec-05	27.00831	6.755	3.92	0.5475	2.61	0.11819419	26993.4		
12-Dec-05	26.7001	6.78	1.185	0.8435	1.9625	0.13102398	26854.55		0
13-Dec-05	27.68889	7	3.41	6.59	4.245	0.13102398	26871.36		
14-Dec-05	27.69617	6.86	1.78	0.918	2.7075	0.13102398	27088.75		
15-Dec-05	28.30069	6.815	3.58	0.7375	2.875	0.13102398	27436.19		
16-Dec-05	27.91708	6.88	3.215	2.845	2.8825	0.13102398	27002.46		
17-Dec-05	27.86747	6.66	1.05	1.4395	2.3775	0.13102398	27298.01		
18-Dec-05	27.455415	6.86	2.315	4.293	2.69	0.14385377	27651.63		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
19-Dec-05	28.331115	6.745	2.715	2.35975	2.8475	0.14725234	25944.26		0
20-Dec-05	29.33049	6.85	2.14	0.94	3.125	0.14725234	27163.05		
21-Dec-05	28.57451	6.66	1.315	2.061	2.2575	0.14725234	27815.11		
22-Dec-05	28.40321	6.48	1.78	1.342	2.35	0.14725234	27605.8		
23-Dec-05	28.82187	6.66	1.65	0.9875	2.945	0.14725234	27222.74		
24-Dec-05	29.46608	6.94	2.25	0.8955	3.25	0.14725234	27989.91		
25-Dec-05	30.286875	6.68	2.175	0.8725	2.33	0.14725234	26483.36		
26-Dec-05	31.88482	7.09	2.28	2.55	2.575	0.14725234	27288.19		0
27-Dec-05	31.82662	6.84	3.39	1.46	3.765	0.14725234	26123.08		
28-Dec-05	31.01574	6.815	1.145	1.06175	3.51	0.14725234	26614.34		
29-Dec-05	30.433705	6.875	3.06	0.853	2.935	0.14725234	27394.68		
30-Dec-05	30.9205	6.74	2.57	1.28	2.3275	0.14725234	26811.8		
31-Dec-05	31.247225	6.835	2.92	2.96	2.7725	0.14725234	27155.85		
1-Jan-06	30.677105	6.875	3.505	2.33	3.1725	0.15065092	26391.48		
2-Jan-06	30.98333	6.91	2.28	0.95175	2.775	0.16410792	27900.61	0	0
3-Jan-06	31.991965	6.655	4.14	0.9275	2.1725	0.16410792	27258.53		
4-Jan-06	31.85109	6.975	2.77	2.3075	2.6325	0.16410792	26423.22		
5-Jan-06	30.866925	6.8	3.925	1.783	3.165	0.16410792	26182.92		
6-Jan-06	31.11032	6.57	1.65	0.9665	2.85	0.16410792	24971.89		
7-Jan-06	31.669205	6.955	2.985	1.45	2.4	0.16410792	27116.37		
8-Jan-06	27.28015	6.93	2.27	2.545	3.155	0.17756491	26762.14		
9-Jan-06	30.257775	6.89	2.37	2.0025	2.78	0.17368449	27041.44		0
10-Jan-06	31.2049	7.23	3.66	1.6085	2.315	0.17368449	26074.98		
11-Jan-06	29.469385	6.71	2.215	2.7525	3.5175	0.17368449	25499.16		
12-Jan-06	27.88004	6.73	1.45	1.7325	3.3425	0.17368449	27195.41		
13-Jan-06	27.5996	6.9	1.825	0.78625	2.7	0.17368449	26991.71		
14-Jan-06	27.95742	6.94	2.955	0.578	2.055	0.17368449	26578.66		
15-Jan-06	30.22867	6.61	1.48	1.2325	2	0.16980407	26996.13		
16-Jan-06	28.884045	6.775	3.52	2.855	2.19	0.16409415	27628.21		0
17-Jan-06	26.797985	6.705	3.275	3.02	2.925	0.16409415	26951.81		
18-Jan-06	25.088265	6.9	2.05	0.54	2.82	0.16409415	27427		
19-Jan-06	26.79468	6.78	2.03	0.58	2.575	0.16409415	27794.73		
20-Jan-06	25.74107	6.7	0.86	2.8975	3.005	0.16409415	26428.9		
21-Jan-06	23.889805	6.78	2.56	3.6175	3.2075	0.16409415	26844.5		
22-Jan-06	26.07904	6.54	1.4	2.02	3.3	0.15838422	26206.01		
23-Jan-06	29.21408	6.83	2.72	1.7225	3.3375	0.16879674	26267.28		0
24-Jan-06	25.54331	6.71	2.01	1.293	2.895	0.16879674	26509.01		
25-Jan-06	29.137365	6.805	2.025	2.9475	2.51	0.16879674	27341.81		
26-Jan-06	32.3564	6.72	2.28	1.0265	2.4775	0.16879674	27120.64		
27-Jan-06	28.342355	6.685	2.96	0.8525	2.645	0.16879674	27191.16		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
28-Jan-06	29.38737	6.76	2.625	3.1875	2.925	0.16879674	26949.04		
29-Jan-06	28.961425	6.675	3.21	3.9525	3.19	0.17920925	27234.43		
30-Jan-06	28.67041	6.98	3.54	1.845	3.2975	0.15855169	26342.52		0
31-Jan-06	30.02628	6.89	3.56	0.4945	2.345	0.15855169	25900.51		
1-Feb-06	28.77359	6.925	4.795	3.53	2.805	0.15855169	25100.42		
2-Feb-06	28.188915	6.695	2.98	1.405	2.5225	0.15855169	25465.23		
3-Feb-06	26.90381	6.64	1.745	0.425	2.36	0.15855169	26183.92		
4-Feb-06	28.120785	6.63	3.99	0.914	2.415	0.15855169	26223.29		
5-Feb-06	28.34632	6.86	3.16	3.98	3.02	0.13789412	26951.99		
6-Feb-06	28.71208	6.765	2.38	2.615	3.045	0.14751816	26963.88	0	0
7-Feb-06	28.80666	6.63	3.3	1.4165	2.58	0.14751816	26787.3		
8-Feb-06	28.383365	6.765	1.57	0.5325	2.6525	0.14751816	26712.54		
9-Feb-06	28.0315	6.64	1.1	0.582	2.62	0.14751816	27980.73		
10-Feb-06	29.116195	6.93	2.355	3.3625	2.6475	0.14751816	26765.68		
11-Feb-06	26.11542	6.88	2.64	1.7735	3.5975	0.14751816	27603.68		
12-Feb-06	26.94283	6.85	2.18	1.685	3.035	0.15714219	27129.57		
13-Feb-06	27.03675	6.765	2.49	1.51425	2.7375	0.18157999	27674.53		0
14-Feb-06	20.26136	6.47	0.96	3.925	3.3	0.18157999	27127.39		
15-Feb-06	27.393245	7.035	2.625	1.88825	3.3	0.18157999	26762.17		
16-Feb-06	26.87934	6.38	3.61	2.88	2.8	0.18157999	26081.09		
17-Feb-06	26.91307	6.785	3.295	3.2275	3.1325	0.18157999	26148.87		
18-Feb-06	27.511635	6.965	2.69	0.524	3.0775	0.18157999	26632.25		
19-Feb-06	29.36885	6.7	3.57	0.5035	2.5	0.20601778	28247.82		
20-Feb-06	29.198205	6.83	1.81	5.3175	2.58	0.19641943	26984.49		0
21-Feb-06	28.61221	6.95	3.03	1.605	2.57	0.19641943	26576.69		
22-Feb-06	28.720675	6.745	2.49	0.851	2.7125	0.19641943	27019.58		
23-Feb-06	28.41114	6.9	2.3	2.8	2.805	0.19641943	25647.05		
24-Feb-06	28.04076	6.75	3.01	0.97525	2.7025	0.19641943	25290.87		
25-Feb-06	27.65582	6.965	3.825	3.63	3.39	0.19641943	25970.79		
26-Feb-06	27.562565	6.835	4.485	2.55	3.165	0.18682108	24839.3		
27-Feb-06	25.11869	6.665	2.85	1.22	2.385	0.16821533	26555.87		10
28-Feb-06	26.878675	6.745	4.51	0.57775	2.05	0.16821533	22866.45		
1-Mar-06	27.794715	6.74	4.35	2.94	3.1825	0.16821533	24807.29		
2-Mar-06	27.71667	6.36	2.53	1.015	2.77	0.16821533	24888.65		
3-Mar-06	28.365505	6.79	2.56	0.605	2.4	0.16821533	26060.5		
4-Mar-06	28.630065	6.885	3.905	1.3575	2.3025	0.16821533	24871.69		
5-Mar-06	28.928355	6.745	3.96	6.63	3.625	0.14960959	24893.19		
6-Mar-06	30.155255	6.73	2.375	1.0175	3.0675	0.17751623	23046.88	***0***	***20***
7-Mar-06	31.350405	6.81	4.225	1.1445	2.785	0.17751623	25871.79		
8-Mar-06	32.14144	6.51	3.395	0.353	2.325	0.17751623	28668.63		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
9-Mar-06	30.88875	6.47	2.78	0.3435	2.145	0.17751623	26673.82		
10-Mar-06	31.78892	6.56	2.295	1.735	2.2275	0.17751623	26775.12		
11-Mar-06	28.40453	6.69	3.28	6.3425	3.43	0.17751623	26131.54		
12-Mar-06	26.3055725	6.35	3	0.515	2.4	0.20542287	27601.82		
13-Mar-06	24.206615	6.805	3.005	1.04	2.1325	0.25185264	27750.94		0
14-Mar-06	29.03683	6.78	3.565	4.425	2.9175	0.25185264	26170.46		
15-Mar-06	29.01897	6.63	2.84	0.32	2.965	0.25185264	27210.5		
16-Mar-06	28.34765	6.91	2.91	0.251	1.945	0.25185264	26922.02		
17-Mar-06	29.02889	6.58	2.56	1.0275	1.8475	0.25185264	26875.89		
18-Mar-06	29.92178	6.805	2.79	1.27325	3.0025	0.25185264	26870.73		
19-Mar-06	29.88607	6.7	3.36	3.725	3.82	0.29828242	27131.57		
20-Mar-06	29.66582	6.845	2.69	1.14575	2.9	0.26005551	27232.36		0
21-Mar-06	28.74184	6.86	3.7	2.65	2.31	0.26005551	26815.27		
22-Mar-06	28.70348	6.915	2.455	2.1475	2.655	0.26005551	27443.66		
23-Mar-06	27.72196	6.72	3.42	1.618	2.7	0.26005551	26911.84		
24-Mar-06	29.356285	6.695	3.55	2.595	3.265	0.26005551	26301.8		
25-Mar-06	30.10499	6.94	2.86	2.3625	3.1	0.26005551	26517.71		
26-Mar-06	30.11756	6.72	2.55	2.3	2.64	0.22182859	26093.57		
27-Mar-06	31.49724	6.8	2.34	2.22	2.77	0.2029693	26983.96		0
28-Mar-06	26.85288	6.79	2.79	1.84	2.8	0.2029693	25965.49		
29-Mar-06	27.600925	6.92	3.59	0.65	2.605	0.2029693	25044.92		
30-Mar-06	28.34897	6.82	2.6	0.814625	2.305	0.2029693	28616.03		
31-Mar-06	28.128725	6.65	3.18	0.97925	2.005	0.2029693	26752.04		
1-Apr-06	29.153895	6.68	3.2	4.53	2.805	0.2029693	25291.98		
2-Apr-06	28.30267	6.83	2.49	0.53	2.755	0.18411	27405.57		
3-Apr-06	26.81055	6.675	3.12	0.52825	2.25	0.14680621	26712.26	0	0
4-Apr-06	30.51969	6.54	3.56	3.155	3.295	0.14680621	26538.83		
5-Apr-06	31.78429	6.885	2.93	1.377	3.1325	0.14680621	26946.03		
6-Apr-06	27.06453	6.61	1.51	0.9595	2.67	0.14680621	27590.55		
7-Apr-06	27.044025	6.93	2.575	2.4825	2.835	0.14680621	27139.98		
8-Apr-06	27.02352	6.625	2.12	1.2165	3.2	0.14680621	27956.34		
9-Apr-06	27.4934475	6.99	2.42	1.025	2.605	0.10950243	27064.62		
10-Apr-06	27.963375	6.815	2.805	2.7075	2.5725	0.07779208	27475.16		0
11-Apr-06	28.5569825	6.72	2.06	1.525	2.97	0.07779208	27386.42		
12-Apr-06	29.15059	6.7	2.38	2.75	2.9	0.07779208	26234.2		
13-Apr-06	28.86354	6.695	1.675	0.67475	3.015	0.07779208	26370.26		
14-Apr-06	28.85957	6.71	3.28	1.805	2.77	0.07779208	25665.76		
15-Apr-06	30.312005	6.73	1.96	0.575	2.3725	0.07779208	26100.51		
16-Apr-06	31.06336	6.82	4.49	9.45	3.3	0.04608173	24363.52		
17-Apr-06	31.234005	6.39	1.925	6.1325	4.0925	0.15787895	26239.99		0

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
18-Apr-06	31.8372	6.52	2.56	1.525	2.605	0.15787895	26426.16		
19-Apr-06	31.86233	6.635	2.24	3.74	2.4275	0.15787895	26354.16		
20-Apr-06	31.18109	6.61	2.24	1.84	3.095	0.15787895	26123.62		
21-Apr-06	32.043555	6.725	2.25	2.4175	3.315	0.15787895	26302.21		
22-Apr-06	32.124245	6.825	2.22	1.76925	3.035	0.15787895	26186.37		
23-Apr-06	31.76577	6.69	2.6	1.445	2.31	0.26967618	27199.82		
24-Apr-06	31.49327	6.445	2.7	1.1825	2.49	0.21304856	27039.25		0
25-Apr-06	26.86214	6.56	1.67	2.39	2.64	0.21304856	26946.57		
26-Apr-06	31.181085	6.565	2.425	2.355	3.135	0.21304856	26697.37		
27-Apr-06	25.42955	6.57	2.3	0.8605	2.605	0.21304856	26858.7		
28-Apr-06	32.148715	6.86	3.35	2.3225	2.49	0.21304856	26791.05		
29-Apr-06	32.17782	6.78	2.905	2.26	2.8375	0.21304856	27570.03		
30-Apr-06	32.40865	6.67	3.18	1.1195	2.725	0.15642095	26551.45		
1-May-06	32.85906	6.77	1.99	2.0975	3.0375	0.15338456	27197.6	0	0
2-May-06	32.63749	6.53	2.37	0.929	2.4	0.15338456	26830.57		
3-May-06	32.329945	6.905	2.4	0.302	2.5575	0.15338456	27290.77		
4-May-06	31.72476	6.59	2.44	1.275	2.605	0.15338456	27299.35		
5-May-06	32.42651	6.665	2.41	2.0375	2.845	0.15338456	26569.28		
6-May-06	33.007215	6.785	2.79	2.8025	2.9025	0.15338456	25985.59		
7-May-06	32.03959	6.69	2.5	1.93	2.4	0.15034817	28733.76		
8-May-06	31.75188	6.72	3.41	1.475	2.785	0.20316103	26069.39		0
9-May-06	30.62022	6.94	2.8	0.805	2.64	0.20316103	26047.73		
10-May-06	29.44293	6.72	3.5	1.055	2.46	0.20316103	25916.29		
11-May-06	28.081105	6.705	3.1	0.592	2.6075	0.20316103	24146.64		
12-May-06	28.81989	6.555	2.455	0.99225	2.935	0.20316103	25494.99		
13-May-06	29.54809	6.61	2.47	1.14	2.5725	0.20316103	24728.21		
14-May-06	29.01831	6.76	2.85	2.71	2.965	0.25597389	24631.19		
15-May-06	30.00776	6.695	1.97	2.11725	2.8975	0.22381607	26207.45		0
16-May-06	30.20751	7.87	2.95	0.995	3.035	0.22381607	24224.6		
17-May-06	29.52759	6.89	2.455	1.105	2.7775	0.22381607	25933.85		
18-May-06	29.333135	6.655	2.005	0.4525	2.47	0.22381607	24798.6		
19-May-06	28.57385	6.725	3.735	6.4675	3.6925	0.22381607	21106.88		
20-May-06	26.689515	6.66	4.73	10.185	4.0875	0.22381607	23328.13		
21-May-06	28.247115	6.525	2.81	5.045	2.84	0.19165825	26079.07		
22-May-06	32.0343	6.64	2.73	0.34	2.44	0.16356935	26713.23		0
23-May-06	31.2049	6.51	1.83	1.35	2.7	0.16356935	25166.84		
24-May-06	31.96816	6.56	2.88	1.46425	2.5725	0.16356935	26072.3		
25-May-06	30.51175	6.64	2.05	1.45575	2.505	0.16356935	26993.12		
26-May-06	29.4416	6.42	1.6	0.50375	2.29	0.16356935	26542.51		
27-May-06	31.50782	6.68	1.905	3.1275	2.8675	0.16356935	25326.47		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
28-May-06	29.8067	6.73	1.95	2.825	3.035	0.13548044	25366.88		
29-May-06	29.145295	6.815	2.095	2.09	2.9025	0.12316195	25890.79		0
30-May-06	22.1318	6.65	3.46	0.9755	2.44	0.12316195	24771.11		
31-May-06	29.625475	6.865	3.575	2.9975	2.62	0.12316195	26430.7		
1-Jun-06	30.011735	6.815	2.88	1.535	2.9375	0.12316195	26223.83		
2-Jun-06	31.64539	6.885	2.635	2.27	2.87	0.12316195	24893.05		
3-Jun-06	31.314695	6.575	2.485	2.1075	2.9425	0.12316195	24997.28		
4-Jun-06	29.93237	6.69	2.92	5.45	3.17	0.11084347	23274.32		
5-Jun-06	32.39807	6.58	4.935	5.6525	4.1675	0.11881771	25466.13	0	0
6-Jun-06	36.15747	6.58	2.11	3.7	3.235	0.11881771	24279.76		
7-Jun-06	39.303095	6.83	3.01	2.06	2.645	0.11881771	26400.38		
8-Jun-06	29.68368	6.57	2.62	1.0885	2.4	0.11881771	25473.07		
9-Jun-06	30.122185	6.71	2.67	1.745	2.8875	0.11881771	24959.11		
10-Jun-06	31.716825	6.865	1.61	2.52	3.2375	0.11881771	24504.92		
11-Jun-06	31.784285	6.725	1.995	2.485	3.315	0.12679195	24164.06		
12-Jun-06	31.545525	6.635	3.18	1.01925	3.0525	0.14007541	25030.1		0
13-Jun-06	32.68512	6.8	1.99	4.695	2.475	0.14007541	24857.23		
14-Jun-06	32.345155	6.71	2.61	3.04	3.1	0.14007541	23512.7		
15-Jun-06	33.048225	6.875	1.49	2.7725	2.8875	0.14007541	25572.26		
16-Jun-06	34.82541	6.885	2.87	2.4525	2.5375	0.14007541	24726.16		
17-Jun-06	36.009975	6.875	2.32	1.9475	2.9825	0.14007541	24111.82		
18-Jun-06	38.54976	6.765	2.54	2.7575	2.8675	0.15335888	24963.92		
19-Jun-06	31.9503	6.765	2.955	1.28	2.4025	0.14454315	24273.57		0
20-Jun-06	32.31539	6.71	2.645	1.62025	2.3575	0.14454315	23877.92		
21-Jun-06	32.161285	6.795	3.45	0.5565	3.3	0.14454315	23442.55		
22-Jun-06	30.67313	6.48	3.76	2.555	3.63	0.14454315	24545.93		
23-Jun-06	31.67251	6.895	2.455	1.7625	2.885	0.14454315	25583.81		
24-Jun-06	32.71025	6.64	1.68	2.7925	1.7475	0.14454315	25243.61		
25-Jun-06	33.17852	6.715	2.94	3.56	2.77	0.13572741	25159.79		
26-Jun-06	33.189105	6.835	3.32	3.0025	3.63	0.13475687	25969.39		0
27-Jun-06	32.47942	6.58	2.93	1.56325	3.3625	0.13475687	24056.76		
28-Jun-06	33.22217	6.905	2.69	2.48	2.7175	0.13475687	25260.94		
29-Jun-06	33.40935	6.745	3.235	3.0575	3.295	0.13475687	24524.88		
30-Jun-06	33.701685	6.855	1.555	1.45225	2.96	0.13475687	28056.1		
1-Jul-06	33.81545	6.585	3.57	2.41475	2.39	0.13475687	24191.36		
2-Jul-06	33.5542	6.7	2.735	2.705	2.6475	0.13378633	24734.26		
3-Jul-06	33.152065	6.74	2.225	1.6055	2.7375	0.20363327	25682.43	0	0
4-Jul-06	32.45495	6.755	3.525	3.2725	3.19	0.20363327	24348.83		
5-Jul-06	32.396745	6.505	3.215	2.115	3.1675	0.20363327	26870.77		
6-Jul-06	33.429855	6.58	2.255	0.59825	2.8175	0.20363327	27818.61		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
7-Jul-06	34.511905	6.615	2.41	1.79125	2.6225	0.20363327	26644.41		
8-Jul-06	33.92458	6.775	3.485	4.8175	3.05	0.20363327	24034.21		
9-Jul-06	32.402035	6.595	4.095	3.403	3.715	0.2734802	23898.49		
10-Jul-06	32.372935	6.595	2.1	1.0125	3.0325	0.2020557	24286.23		0
11-Jul-06	33.286995	6.85	2.055	0.911	2.76	0.2020557	24236.25		
12-Jul-06	34.910065	6.89	2.44	2.6325	2.36	0.2020557	24799.93		
13-Jul-06	30.862955	6.645	3.58	2.7075	2.2225	0.2020557	26639.66		
14-Jul-06	34.431215	6.68	2.8	0.787	2.97	0.2020557	24417.45		
15-Jul-06	34.054215	6.66	3.79	2.12	3.045	0.2020557	23605.43		
16-Jul-06	34.201705	6.645	2.595	0.69025	2.4425	0.13063119	25114.99		
17-Jul-06	33.78106	6.765	3.015	2.655	2.555	0.13642412	25741.44		0
18-Jul-06	34.05488	6.58	1.87	1.7075	2.3875	0.13642412	25145.28		
19-Jul-06	34.09853	6.895	3.14	2.185	2.925	0.13642412	25301.55		
20-Jul-06	33.548905	6.675	3.27	0.99875	2.7425	0.13642412	25693.58		
21-Jul-06	33.91466	6.705	1.84	0.48825	2.5725	0.13642412	25718.78		
22-Jul-06	34.059505	6.79	1.79	2.25	2.295	0.13642412	24066.86		
23-Jul-06	37.995505	6.67	2.28	3.315	2.8675	0.14221704	24225.25		
24-Jul-06	32.778375	6.795	1.075	0.54375	2.86	0.20561351	24642.44		0
25-Jul-06	42.09156	6.65	2.23	4.51	3.23	0.20561351	24047.95		
26-Jul-06	34.765885	6.855	1.455	5.7025	3.5725	0.20561351	25313.57		
27-Jul-06	35.002005	6.82	2.15	3.9375	3.265	0.20561351	23971.85		
28-Jul-06	33.68714	6.865	1.89	3.4325	3.5825	0.20561351	25253.44		
29-Jul-06	33.062775	6.905	2.73	0.75575	3.2725	0.20561351	24212.36		
30-Jul-06	35.19447	6.89	1.92	0.31	3.805	0.26900997	25535.18		
31-Jul-06	34.52579	6.8	2.125	2.055	2.66	0.17503416	24930.62		0
1-Aug-06	33.2182	6.56	2.06	0.3555	2.62	0.17503416	24857.73		
2-Aug-06	33.761215	6.705	2.17	1.42175	2.7025	0.17503416	21216.41		
3-Aug-06	28.5712	6.53	1.93	4.43	3.475	0.17503416	23686.71		
4-Aug-06	30.630805	6.78	2.24	1.045	3.2575	0.17503416	25133.63		
5-Aug-06	32.751255	6.945	1.64	1.3145	2.93	0.17503416	25565.2		
6-Aug-06	38.09273	6.72	5.045	3.555	3.1225	0.08105835	24015.03		
7-Aug-06	39.20124	6.77	3.82	4.215	3.505	0.1879433	23961.53	0	0
8-Aug-06	41.18809	6.89	1.23	1.537	3.355	0.1879433	24801.23		
9-Aug-06	41.837585	6.62	1.295	1.5465	2.8075	0.1879433	25124.79		
10-Aug-06	43.18155	6.96	3.05	4.02	3.565	0.1879433	24053.32		
11-Aug-06	33.776425	6.83	2.855	2.7575	3.5475	0.1879433	24241.45		
12-Aug-06	33.632245	6.85	2.895	2.5525	3.5975	0.1879433	25083.77		
13-Aug-06	32.88618	6.92	3.27	1.545	3.145	0.29482826	24999.63		
14-Aug-06	32.97018	6.975	3.06	2.22925	2.8	0.19221972	26337.89		0
15-Aug-06	34.238745	6.91	2.425	4.07	3.1875	0.19221972	23609.32		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
16-Aug-06	36.820195	6.87	3.51	3.3075	3.255	0.19221972	24969.89		
17-Aug-06	23.12126	6.57	2.09	0.26	3.11	0.19221972	24741.86		
18-Aug-06	32.525055	6.76	3.145	1.94	2.52	0.19221972	23959.41		
19-Aug-06	32.387485	6.665	2.79	2.0025	2.665	0.19221972	24194.84		
20-Aug-06	32.8293	6.98	2.32	3.19	3.18	0.08961118	22585.74		
21-Aug-06	32.23073	6.715	3.205	2.003	3.19	0.10667155	24200.79		0
22-Aug-06	31.801485	6.56	3.185	2.6925	3.2175	0.10667155	25238.5		
23-Aug-06	31.812065	6.665	1.85	0.9755	3.07	0.10667155	28237.38		
24-Aug-06	31.84381	6.98	2.25	0.6275	2.715	0.10667155	26609.66		
25-Aug-06	31.92318	6.82	2.255	1.1405	2.6025	0.10667155	26214.18		
26-Aug-06	33.062115	6.755	2.475	1.8375	2.735	0.10667155	25715.29		
27-Aug-06	33.09386	6.6	2.32	0.808	3.02	0.12373192	25543.27		
28-Aug-06	31.35901	6.84	3.275	0.83125	2.7	0.11578061	26813.52		0
29-Aug-06	31.128835	6.95	3.02	1.01475	2.51	0.11578061	27310.74		
30-Aug-06	30.828565	6.55	3.765	1.384	3.175	0.11578061	25274.12		
31-Aug-06	30.14401	6.57	2.7	2.005	3.59	0.11578061	23187.88		
1-Sep-06	29.16249	6.66	3.345	2.63	3.83	0.11578061	23398.22		
2-Sep-06	29.94559	6.745	1.29	1.615	3.3325	0.11578061	24748.63		
3-Sep-06	30.792845	6.735	4.08	0.80575	2.81	0.10782931	24314.51		
4-Sep-06	30.53027	6.71	2.73	2.41	2.76	0.12240794	25676.31	0	0
5-Sep-06	32.53828	6.8	2.78	1.875	2.825	0.12240794	25807.64		
6-Sep-06	32.859065	6.83	2.74	2.8075	2.9575	0.12240794	25690.73		
7-Sep-06	31.87159	6.8	3.265	1.845	2.9825	0.12240794	25628.37		
8-Sep-06	30.049435	6.82	4.2	2.4275	2.72	0.12240794	25041.76		
9-Sep-06	30.85568	6.785	2.645	0.482	2.4325	0.12240794	26049.3		
10-Sep-06	32.90205	6.67	2.86	2.85	2.6	0.13698657	25896.49		
11-Sep-06	33.08262	6.945	3.245	3.33	2.92	0.16056792	25119.7		0
12-Sep-06	31.17183	6.705	4.115	2.915	3.3675	0.16056792	23903.9		
13-Sep-06	30.943645	6.725	2.08	1.425	3.455	0.16056792	26615.27		
14-Sep-06	34.75662	6.87	2.28	0.735	2.83	0.16056792	28624.2		
15-Sep-06	33.43845	6.69	2.595	1.3965	2.6825	0.16056792	27100.61		
16-Sep-06	33.72881	6.61	2.865	2.3175	2.4325	0.16056792	26467.79		
17-Sep-06	31.6864	6.69	3.36	1.565	2.355	0.18414927	27426.02		
18-Sep-06	30.521675	6.65	2.09	0.42875	2.445	0.17917778	27092.73		0
19-Sep-06	29.17043	6.7	4.55	1.4235	2.78	0.17917778	22220.26		
20-Sep-06	29.610265	6.745	1.79	0.3755	2.5875	0.17917778	24066.5		
21-Sep-06	31.46152	6.53	2.78	1.4	2.53	0.17917778	26322.55		
22-Sep-06	31.31469	6.685	1.6	0.905	2.6775	0.17917778	26688.93		
23-Sep-06	30.400635	6.815	3.71	1.38	3.1975	0.17917778	24582.64		
24-Sep-06	30.79086	6.98	1.82	2.31	3.34	0.17420629	25306.09		

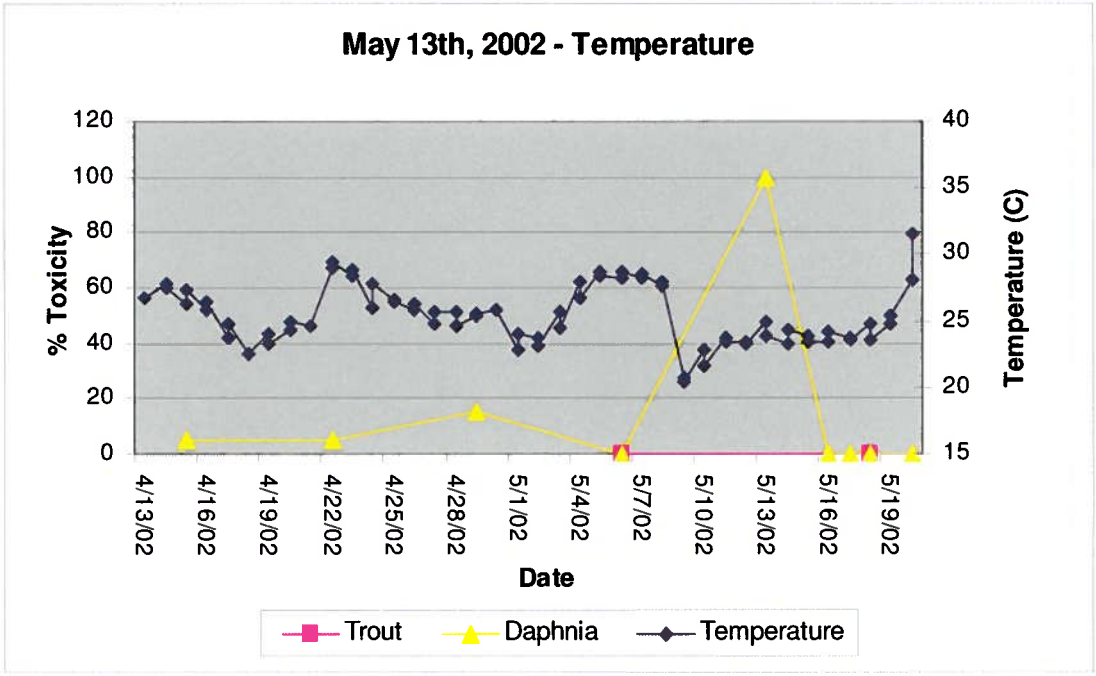
Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
25-Sep-06	30.68107	6.89	1.485	0.7885	2.45	0.12120327	25939.65		0
26-Sep-06	29.40986	7.17	3.28	1.291	2.305	0.12120327	24945.51		
27-Sep-06	29.16977	6.83	3.09	0.696	2.1625	0.12120327	26130.32		
28-Sep-06	29.79612	6.5	2.02	0.886	2.24	0.12120327	26087.95		
29-Sep-06	30.78557	6.685	2.065	1.66	2.5575	0.12120327	26624.88		
30-Sep-06	31.92649	6.69	3.515	2.94	3.2	0.12120327	25384.82		
1-Oct-06	32.55151	6.58	3.59	3.975	3.78	0.06820025	22812.63		
2-Oct-06	32.7043	6.555	4.04	8.89	4.5375	0.10242334	21360.79	0	0
3-Oct-06	32.87692	6.74	2.78	3.825	3.66	0.10242334	25369.46		
4-Oct-06	33.760555	6.59	1.615	1.14275	3.1875	0.10242334	25772.47		
5-Oct-06	34.28967	6.82	4.05	1.455	2.33	0.10242334	26309.82		
6-Oct-06	33.930535	6.855	3.01	1.666	2.3925	0.10242334	27368		
7-Oct-06	34.90544	6.79	3.305	2.1525	2.8	0.10242334	26588.67		
8-Oct-06	34.616405	6.765	2.655	1.575	3.095	0.13664643	25959.98		
9-Oct-06	32.48537	6.71	3.12	4.76	2.88	0.14024516	23337.58		0
10-Oct-06	32.28695	6.75	2.26	2.205	3.185	0.14024516	23003.77		
11-Oct-06	32.02107	6.735	1.3	1.1875	2.8325	0.14024516	24486.14		
12-Oct-06	31.22606	6.84	1.77	0.4	2.635	0.14024516	24805.66		
13-Oct-06	30.759775	6.865	2.9	2.36	2.545	0.14024516	24842.27		
14-Oct-06	31.26046	6.545	2.05	1.3525	2.525	0.14024516	24275.31		
15-Oct-06	32.81475	6.78	3.13	2.465	2.58	0.14384388	24442.47		
16-Oct-06	32.4232	6.94	2.97	1.09125	3.1475	0.16671125	25511.78		0
17-Oct-06	29.84903	6.8	4.82	7.69	3.375	0.16671125	26327.755		
18-Oct-06	28.0229	6.81	4.175	15.5	5.2625	0.16671125	26327.755		
19-Oct-06	28.41379	6.76	3.93	6.17	3.02	0.16671125	27143.73		
20-Oct-06	29.134715	6.53	2.295	0.8535	1.9725	0.16671125	25564.63		
21-Oct-06	29.26435	6.525	2.37	0.88275	1.87	0.16671125	24346.08		
22-Oct-06	27.98785	6.45	0.94	1.915	2.24	0.18957862	26091.63		
23-Oct-06	33.147435	6.56	1.36	2.5325	3	0.15654144	26063.01		0
24-Oct-06	31.72212	6.84	5.15	2.53	3.335	0.15654144	24138.95		
25-Oct-06	22.53658	6.86	4.135	1.2385	2.6775	0.15654144	24025.63		
26-Oct-06	26.5863375	6.67	4.53	2.15	2.1535	0.15654144	26305.93		
27-Oct-06	30.636095	6.925	3.345	1.5105	2.98	0.15654144	25083.9		
28-Oct-06	30.46016	6.72	2.55	0.7475	2.94	0.15654144	26269.78		
29-Oct-06	30.630145	6.63	2.605	3.0825	2.5525	0.12350426	24497.7		
30-Oct-06	30.00446	6.555	2.4	1.73775	2.8	0.12215342	25940.33		0
31-Oct-06	29.24186	6.675	3.135	2.5675	3.4825	0.12215342	23100.54		
1-Nov-06	28.756395	6.7	5.855	1.845	3.205	0.12215342	22141.43		
2-Nov-06	29.07122	6.31	3.22	1.109125	2.7375	0.12215342	25310.04		
3-Nov-06	30.41122	6.67	1.57	0.37325	2.27	0.12215342	28812.07		

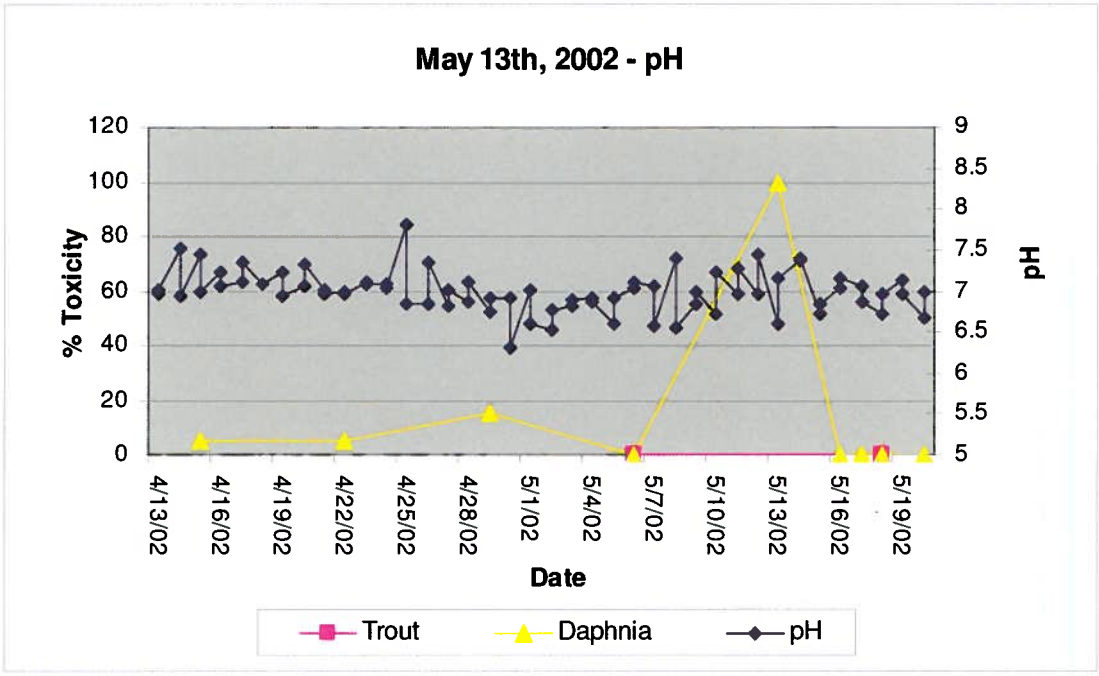
Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
4-Nov-06	32.786315	6.685	1.925	2.89	2.155	0.12215342	25820.27		
5-Nov-06	30.76573	6.77	4.66	8.955	3.605	0.12080258	23568.53		
6-Nov-06	30.697605	6.615	3.795	3.81	3.2825	0.10286194	23936.23	0	0
7-Nov-06	27.13001	6.715	1.89	0.7045	2.455	0.10286194	24552.43		
8-Nov-06	28.845025	6.95	2.02	2.2975	2.3625	0.10286194	25663.22		
9-Nov-06	29.83712	6.97	2.465	1.64275	2.4275	0.10286194	25093.66		
10-Nov-06	29.53883	6.795	2.65	0.97	2.7725	0.10286194	25515.09		
11-Nov-06	30.239915	6.915	1.225	1.2825	3.0575	0.10286194	25121.23		
12-Nov-06	33.05352	6.83	2.89	2.655	2.755	0.08492131	24314.01		
13-Nov-06	30.16121	6.71	1.3	2.775	3.045	0.14881503	23592.11		0
14-Nov-06	31.38612	6.68	3.25	2.895	2.87	0.14881503	19793.98		
15-Nov-06	28.214705	6.725	2.555	2.95	3.22	0.14881503	21518.62		
16-Nov-06	29.65722	6.74	2.33	0.564	3.265	0.14881503	23299.09		
17-Nov-06	29.56992	6.78	2.605	1.12325	2.2	0.14881503	23871.23		
18-Nov-06	30.07986	6.805	3.75	1.6175	2.36	0.14881503	23367.78		
19-Nov-06	30.00115	6.6	1.39	0.825	2.48	0.21270874	23415.76		
20-Nov-06	33.436465	6.815	2.945	1.885	2.4575	0.17185816	24101.01		0
21-Nov-06	34.54696	6.67	2.94	1.8735	2.9475	0.17185816	22633.65		
22-Nov-06	29.65259	6.625	4.34	7.08	3.2825	0.17185816	22930.81		
23-Nov-06	28.62411	6.66	2.34	1.4055	2.6	0.17185816	23079.41		
24-Nov-06	28.746475	6.735	3.44	0.846	2.4	0.17185816	24185.95		
25-Nov-06	28.293415	6.82	1.605	1.775	2.445	0.17185816	23033.8		
26-Nov-06	28.56194	6.71	3.22	1.765	2.96	0.13100757	23905.65		
27-Nov-06	27.90186	6.92	2.415	1.9975	3.085	0.14091155	21219.98		0
28-Nov-06	26.23844	6.91	2.265	5.685	3.1775	0.14091155	26400.79		
29-Nov-06	26.152455	6.695	3.09	0.9575	1.94	0.14091155	25928.01		
30-Nov-06	24.14907	6.97	2.4	0.4295	1.935	0.14091155	24661.67		
1-Dec-06	26.333685	6.73	1.405	1.10175	2.07	0.14091155	25018.82		
2-Dec-06	26.63991	6.77	3.79	2.44	2.75	0.14091155	24667.56		
3-Dec-06	24.47845	7	1.795	1.025	3.2525	0.15081553	24409.02		
4-Dec-06	26.91241	6.645	2.2	1.746	3.01	0.15879516	23978.68	0	0
5-Dec-06	26.14915	6.775	3.005	3.6875	3.5625	0.15879516	23311.54		
6-Dec-06	23.082235	6.69	2.275	6.505	3.85	0.15879516	23639.44		
7-Dec-06	25.759585	7.045	2.305	1.14725	2.475	0.15879516	24908.95		
8-Dec-06	28.5626	6.7	4.02	0.3705	2.26	0.15879516	25864.93		
9-Dec-06	27.42301	6.725	2.82	0.92425	2.2375	0.15879516	25158.58		
10-Dec-06	30.37021	6.6	3.48	3.44	3.115	0.16677478	25530.44		
11-Dec-06	29.66648	6.89	2.92	1.34	2.905	0.17304118	25117.33		0
12-Dec-06	29.99123	6.66	2.755	0.68625	2.6375	0.17304118	23387.86		
13-Dec-06	28.335085	6.75	2.485	1.57	2.4775	0.17304118	24864.88		

Date	Temp°C	pH	DO (mg/L)	N (mg/L)	P (mg/L)	F/M	Flow (m^3/day)	Trout	Daphnia
14-Dec-06	30.37418	6.9	1.83	3.915	3.465	0.17304118	24246.67		
15-Dec-06	27.449465	6.67	3.425	1.7585	2.84	0.17304118	25097.79		
16-Dec-06	29.243185	6.715	2.05	0.9115	1.8525	0.17304118	24458.38		
17-Dec-06	27.63334	6.71	2.42	5.26	2.58	0.17930757	24569.54		
18-Dec-06	28.033485	6.665	1.515	2.69	3.225	0.16419071	24653.59		0
19-Dec-06	26.97326	6.91	4.4	5.375	3.645	0.16419071	22109.43		
20-Dec-06	27.022865	6.86	3.955	1.23075	3.095	0.16419071	24392.3		
21-Dec-06	27.11347	6.95	2.79	3.725	2.14	0.16419071	24692.29		
22-Dec-06	30.45024	6.755	2.845	4.325	2.8575	0.16419071	23539.87		
23-Dec-06	29.36422	6.575	1.935	3.9525	3.5875	0.16419071	24977.68		
24-Dec-06	27.591665	6.805	3.09	2.5325	2.18	0.14907385	24964.01		
25-Dec-06	27.53214	6.855	3.085	4.085	1.91	0.14907385	23727.53		0
26-Dec-06	27.236495	6.885	3.165	4.905	2.8725	0.14907385	25276.52		
27-Dec-06	27.90319	6.795	2.06	0.7	2.375	0.14907385	25175.96		
28-Dec-06	28.567895	6.92	3.15	3.555	2.6125	0.14907385	24988.85		
29-Dec-06	27.178295	6.84	2.66	2.23525	3.3725	0.14907385	25152.18		
30-Dec-06	28.48125	6.825	3.345	1.297	2.6	0.14907385	25034.55		
31-Dec-06	26.04333	6.52	2.25	0.5195	2.65	0.14907385	25893.78		

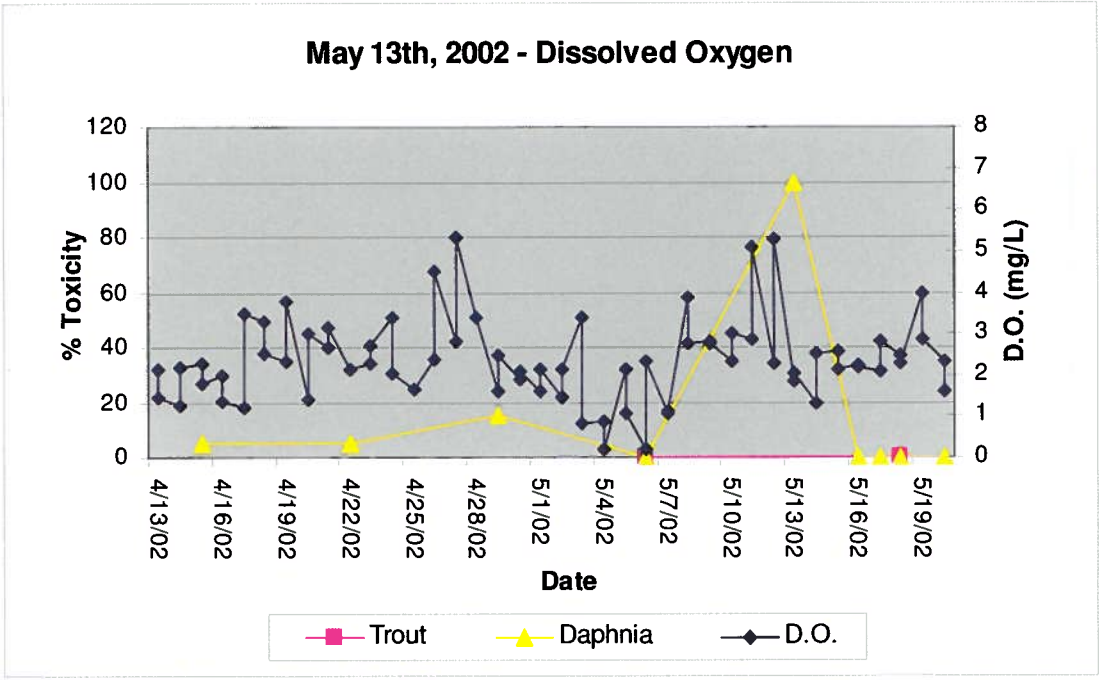
APPENDIX D
Graphs by Toxicity Episodes

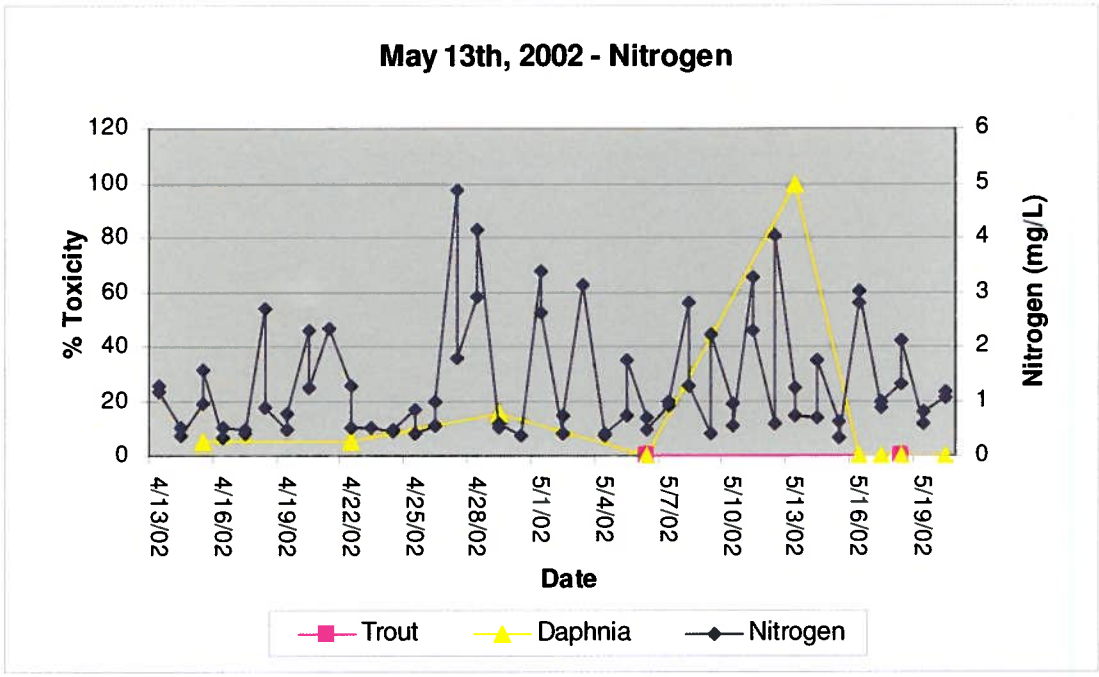
Daphnia Toxicity Episode: May 13, 2002



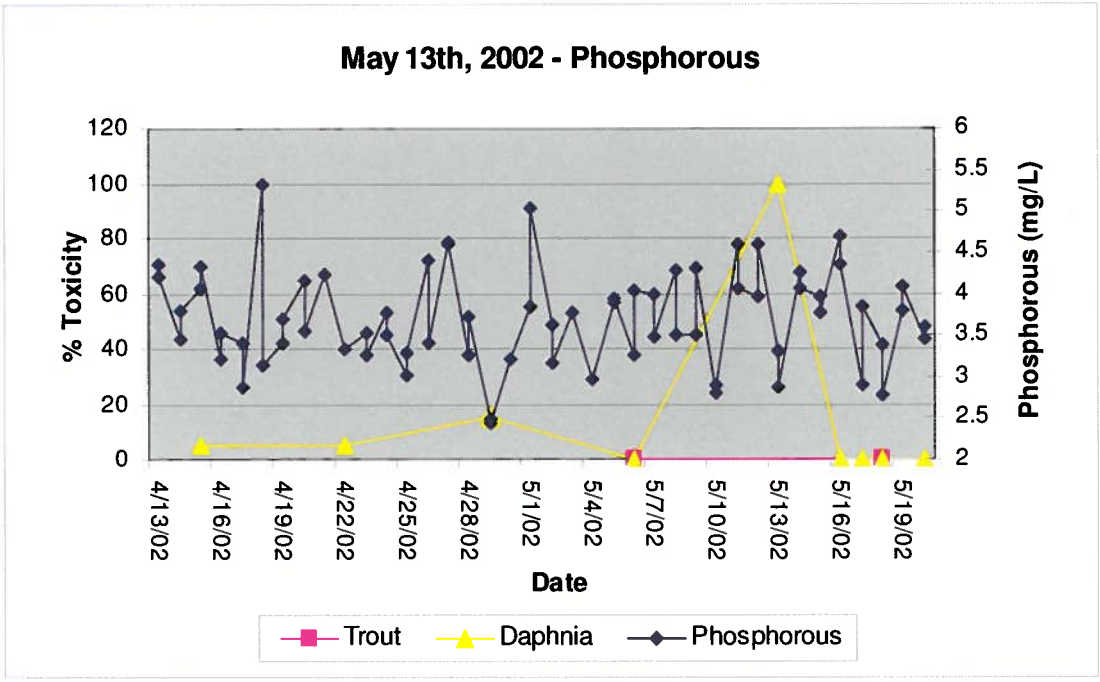


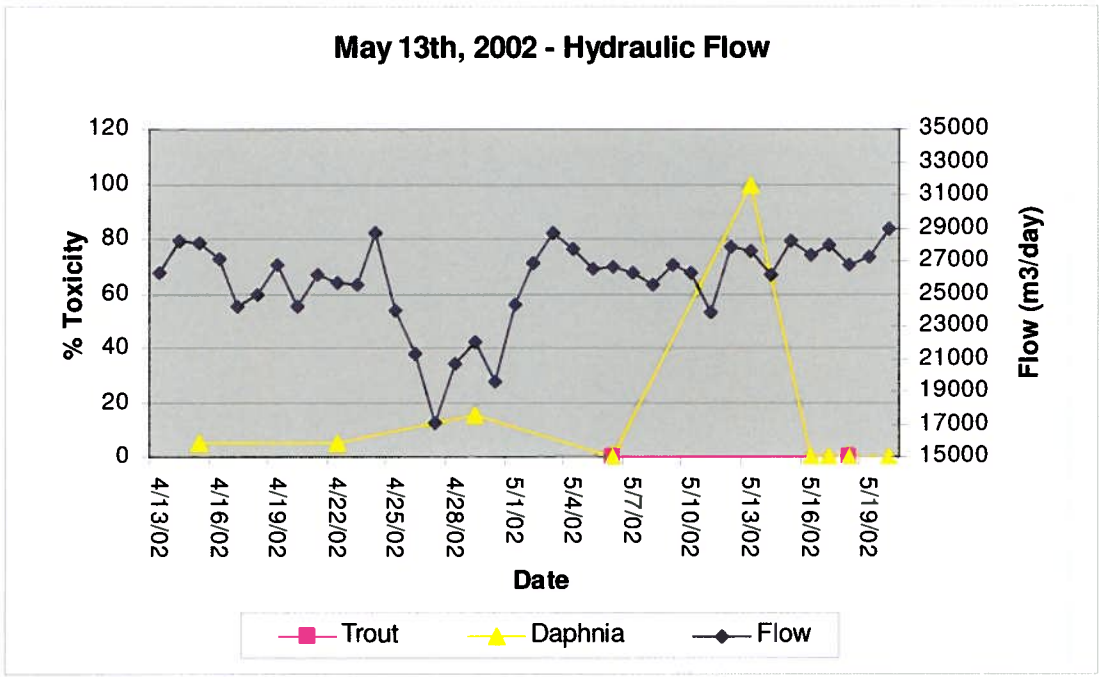
Daphnia Toxicity Episode: May 13, 2002



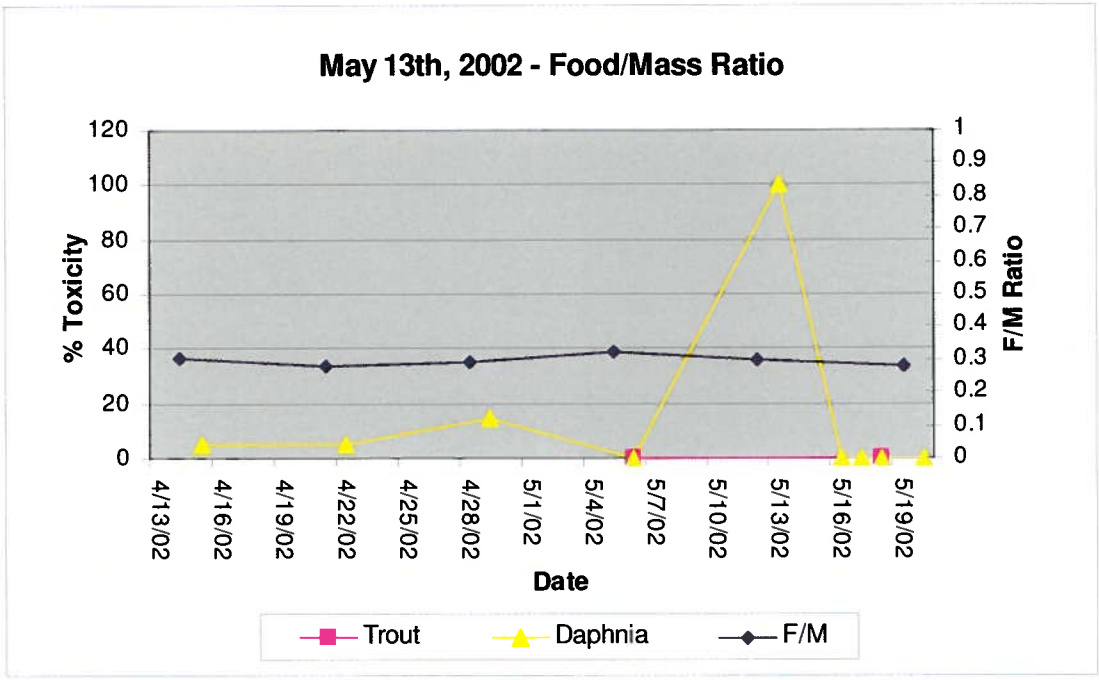


Daphnia Toxicity Episode: May 13, 2002

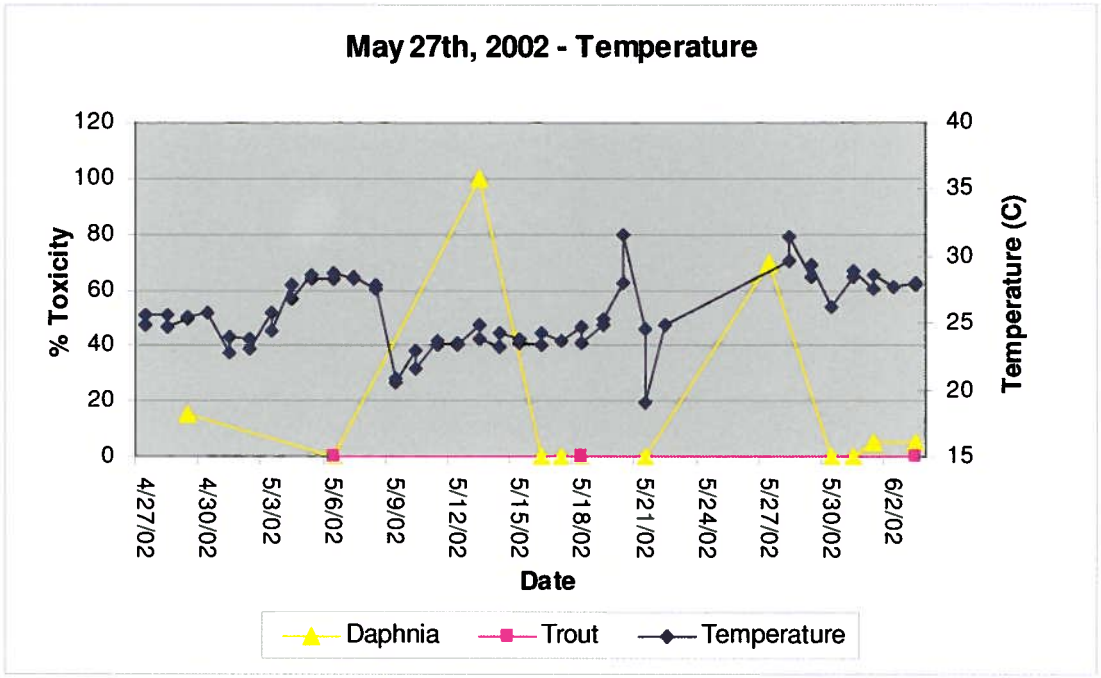


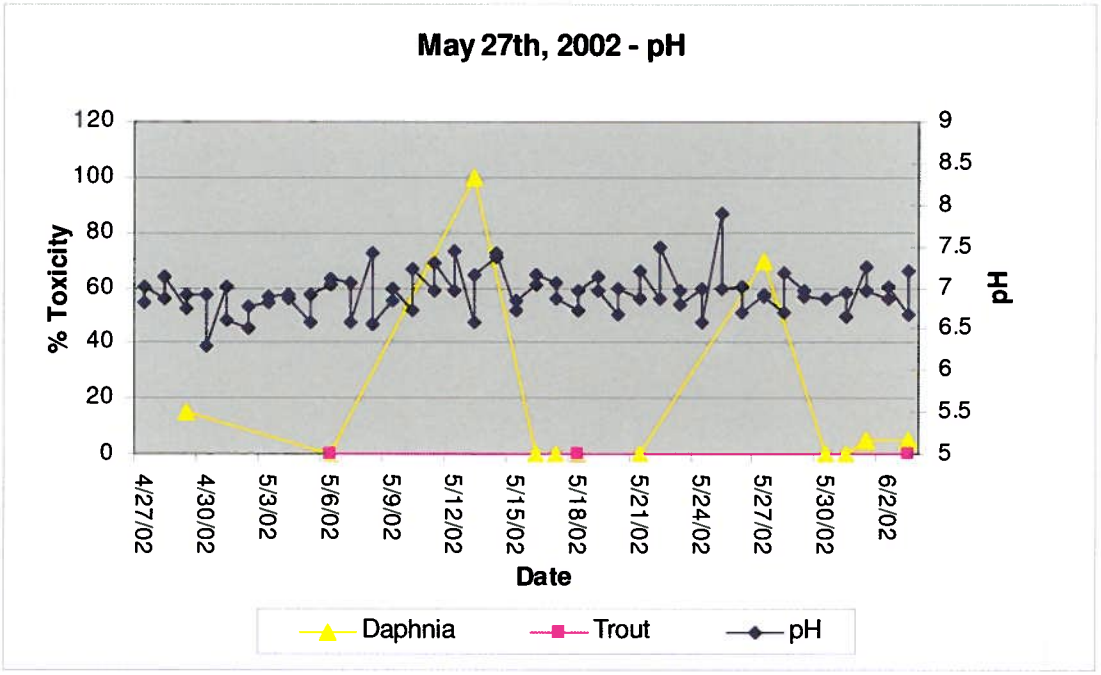


Daphnia Toxicity Episode: May 13, 2002

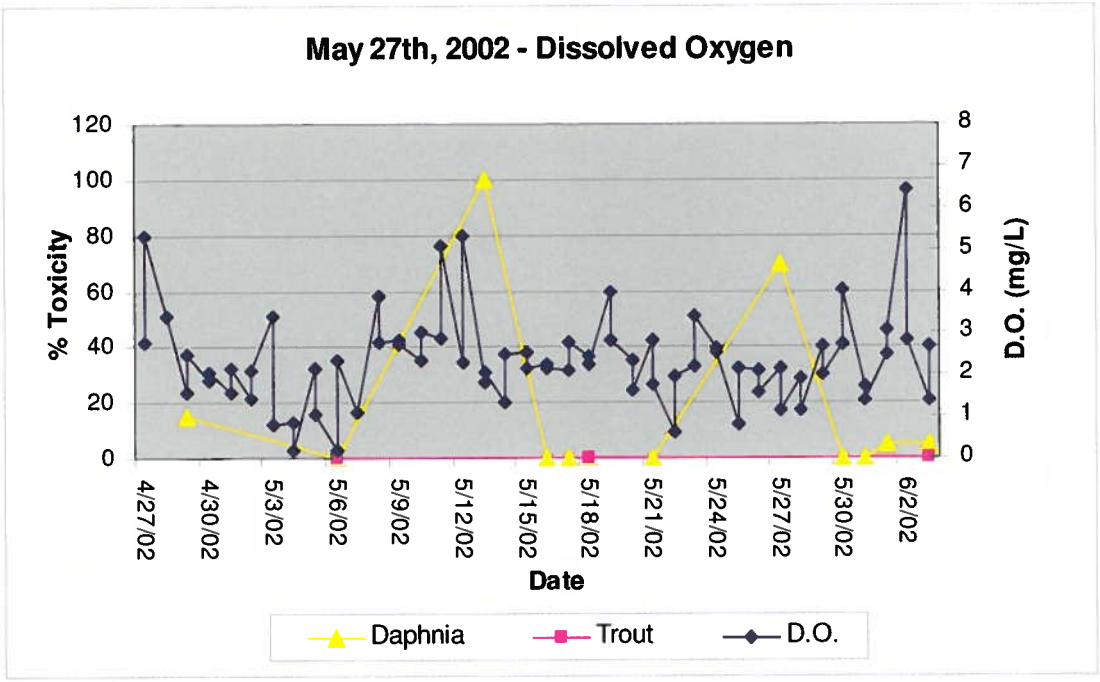


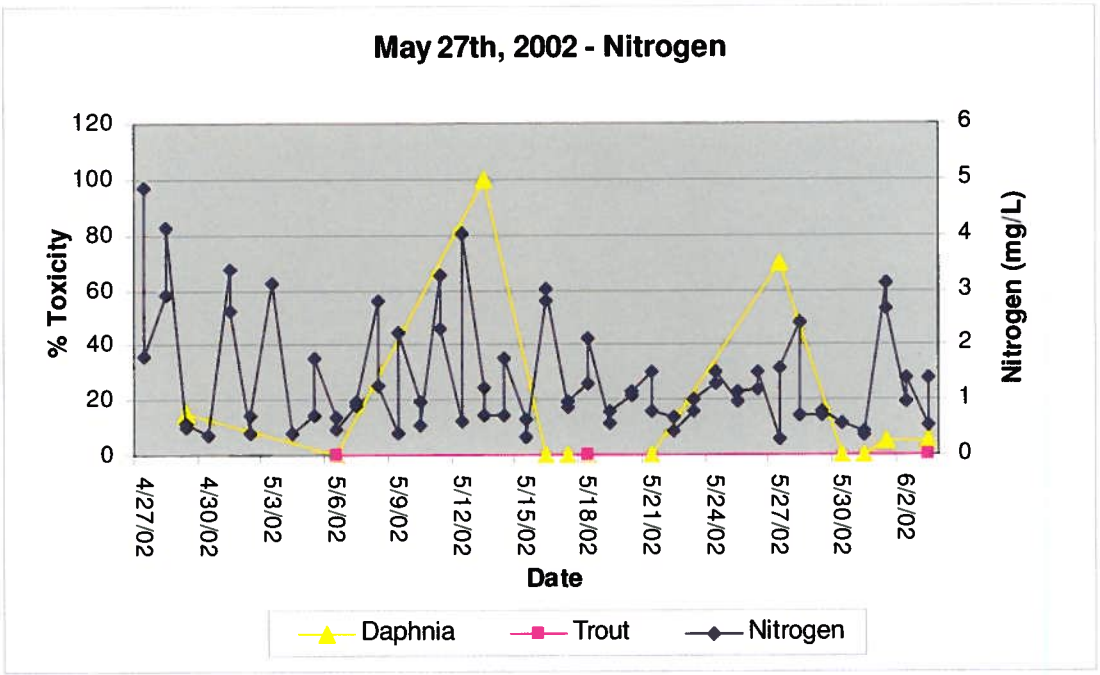
Daphnia Toxicity Episode - May 27, 2002



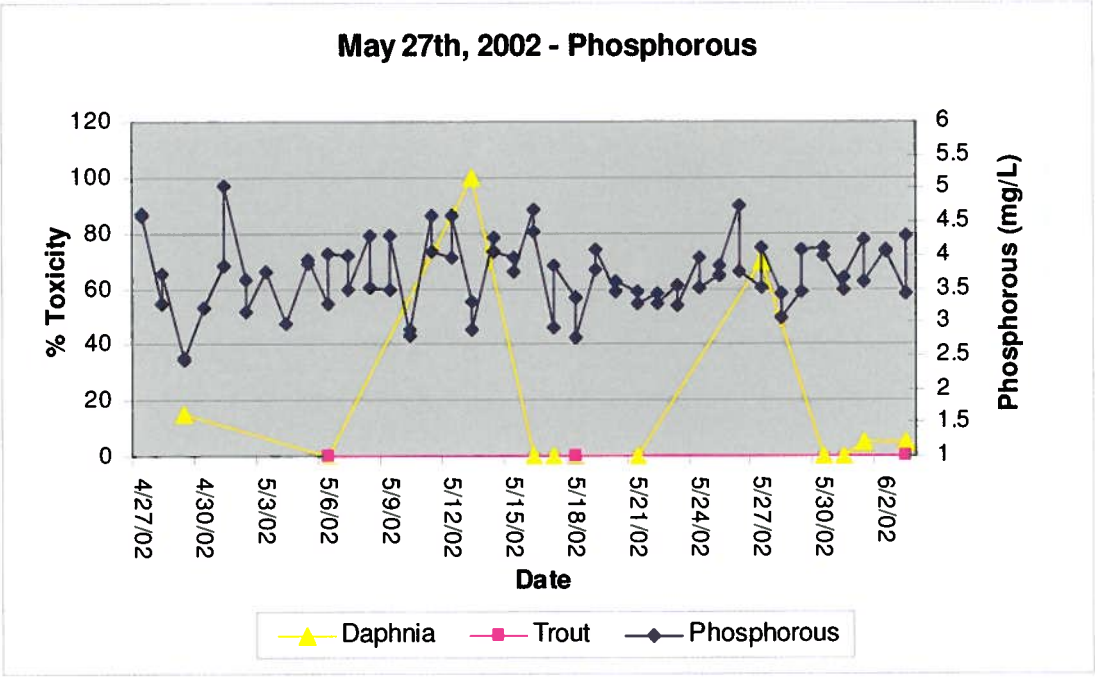


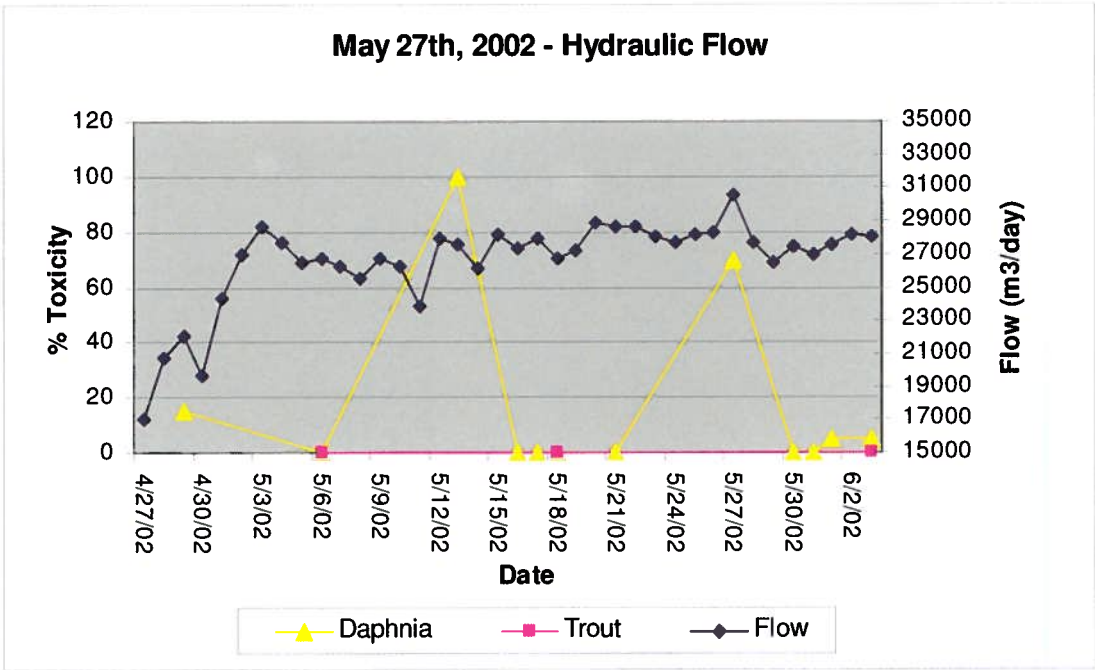
Daphnia Toxicity Episode - May 27, 2002



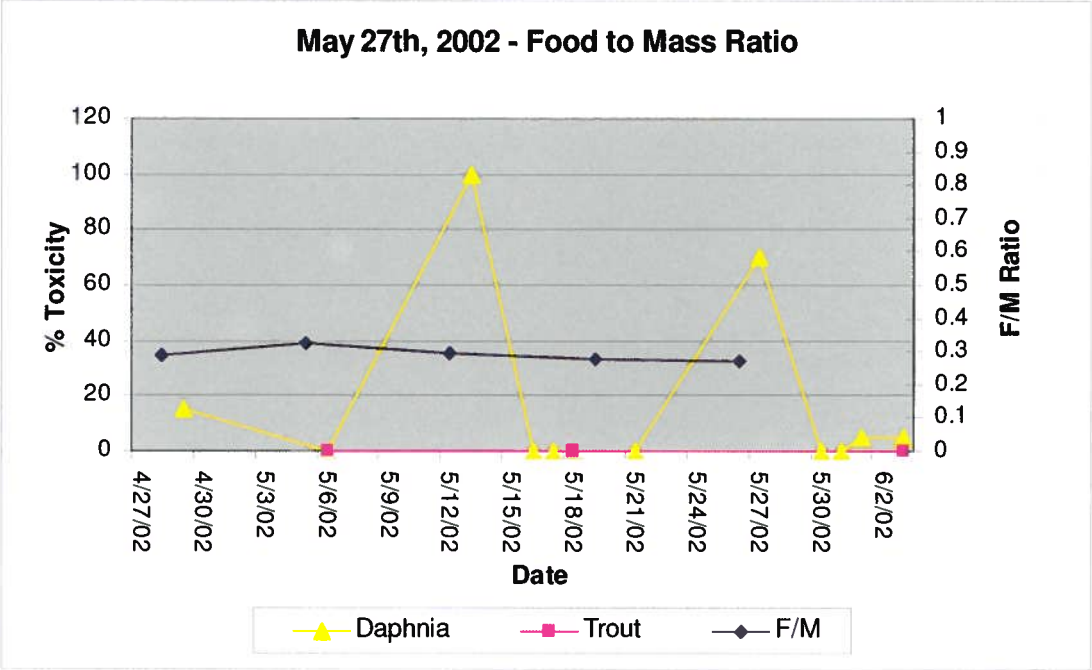


Daphnia Toxicity Episode - May 27, 2002

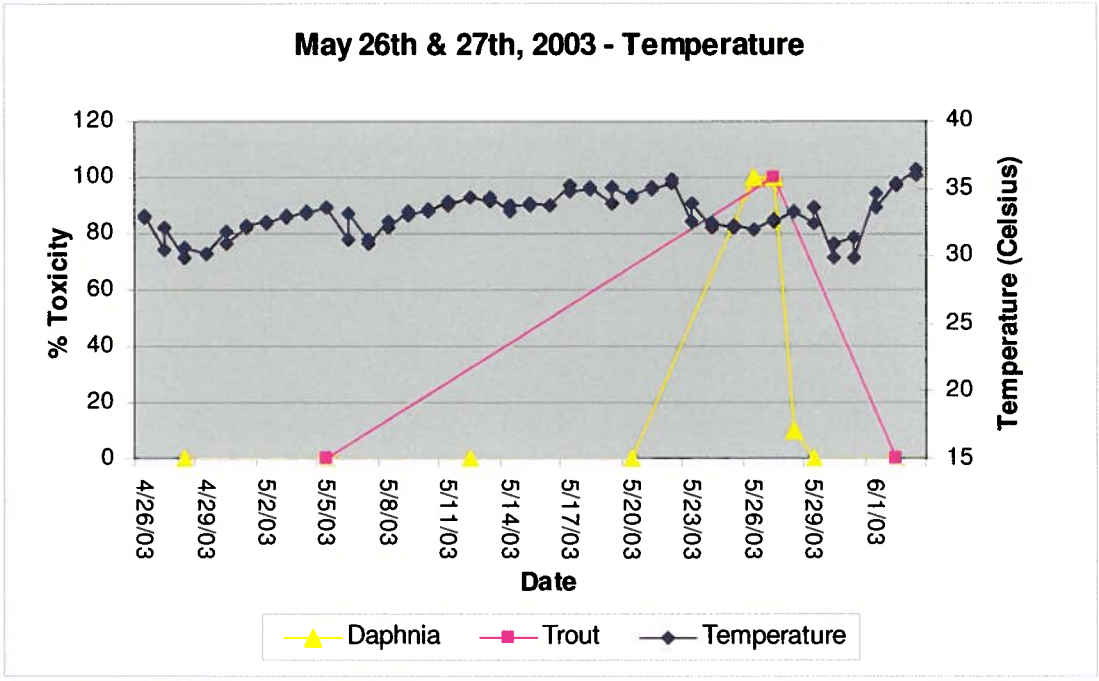


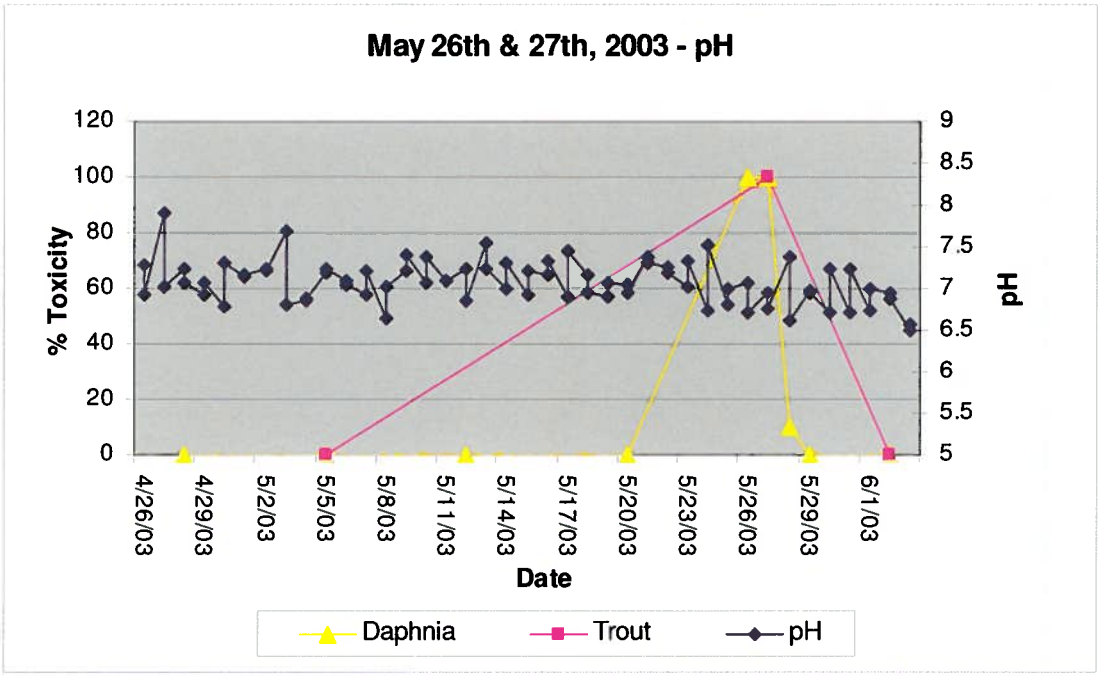


Daphnia Toxicity Episode - May 27, 2002

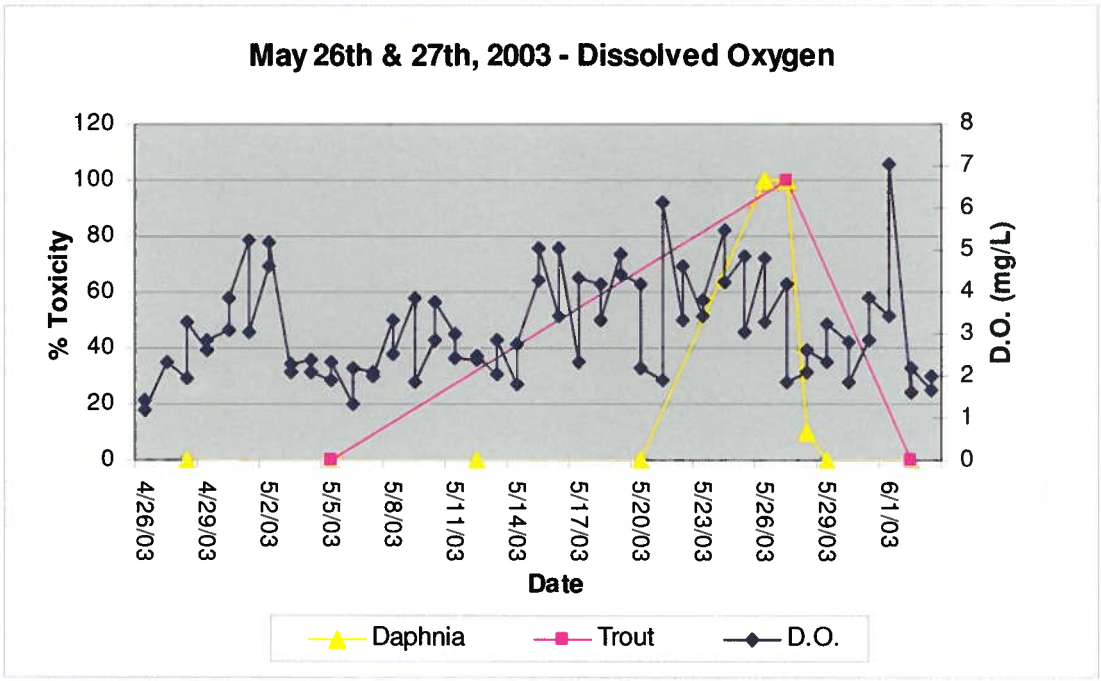


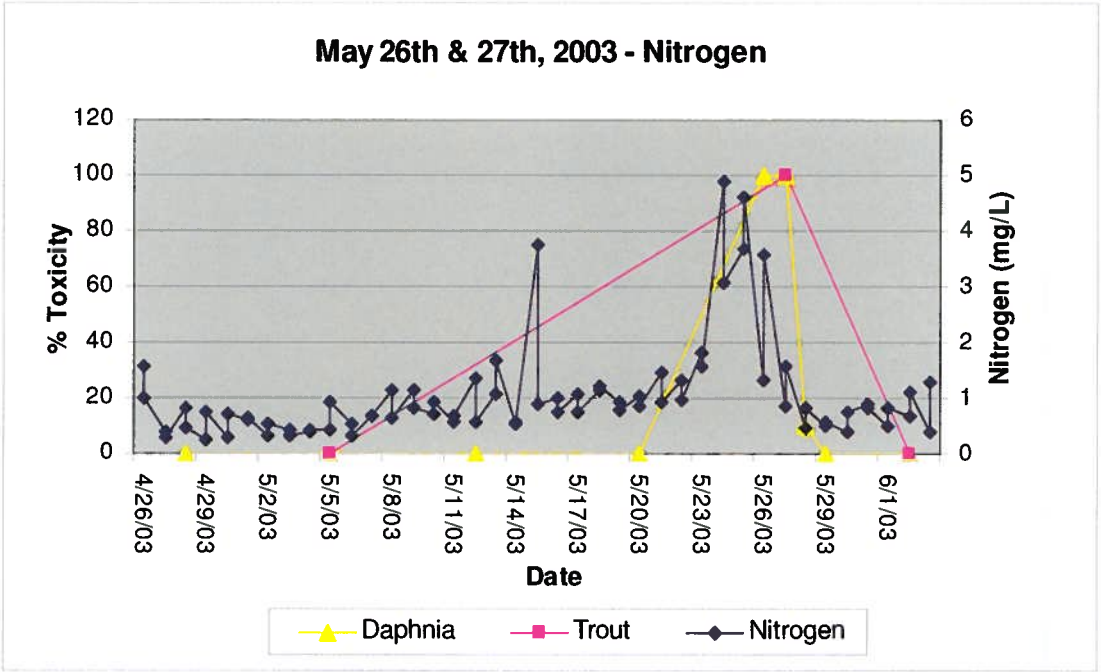
Daphnia and Trout Toxicity Episode – May 26 & 27, 2003



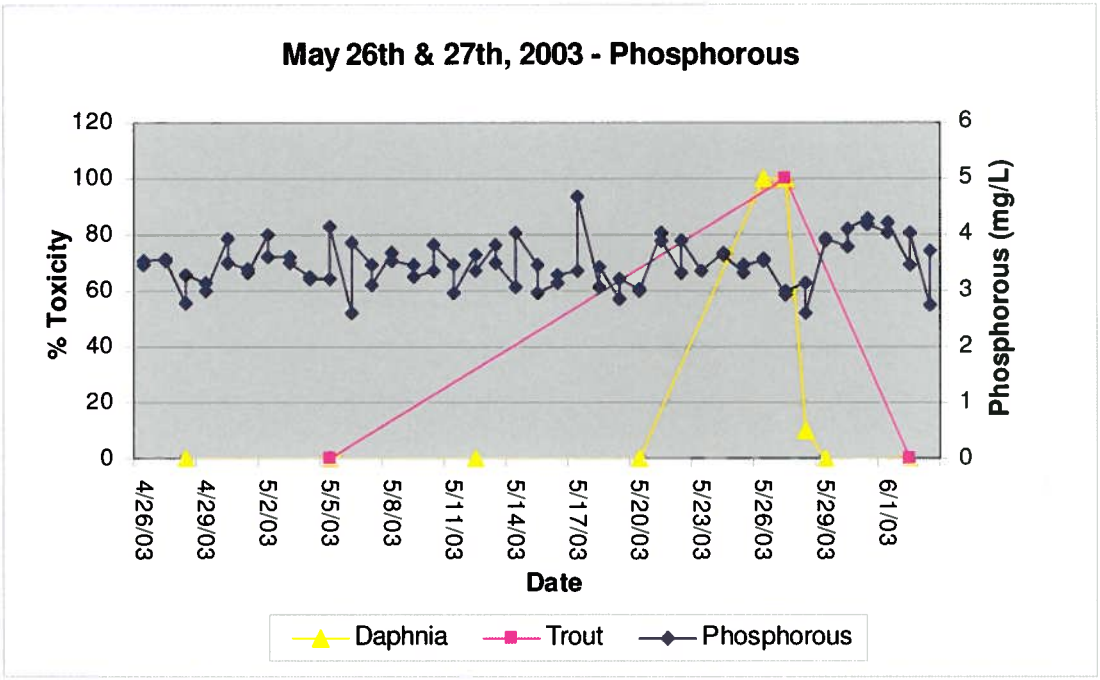


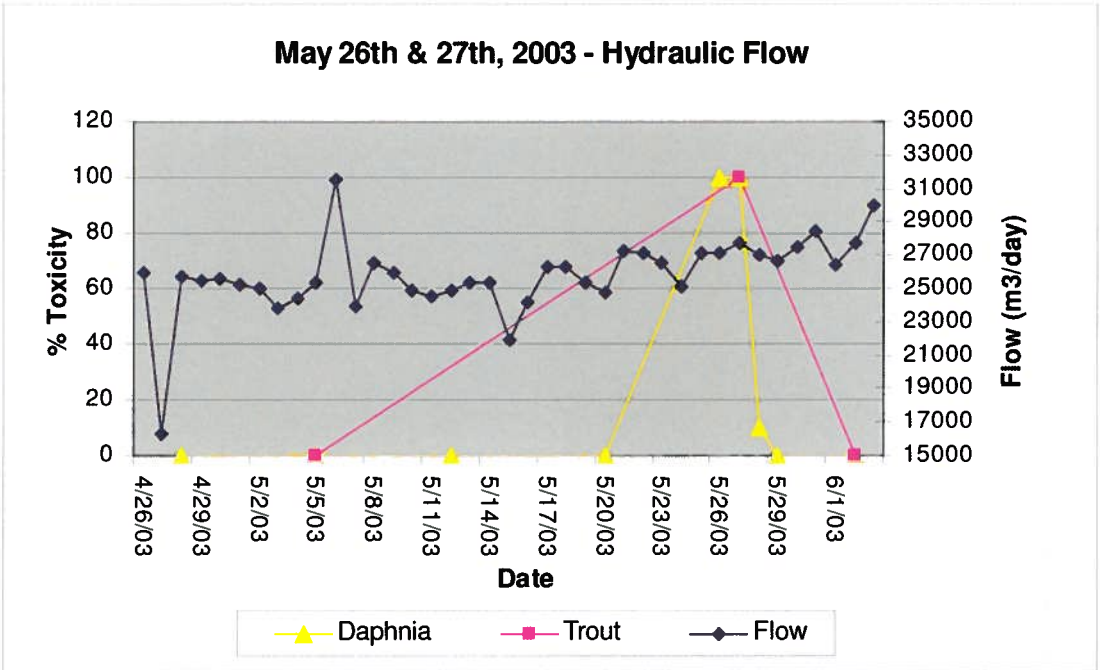
Daphnia and Trout Toxicity Episode – May 26 & 27, 2003



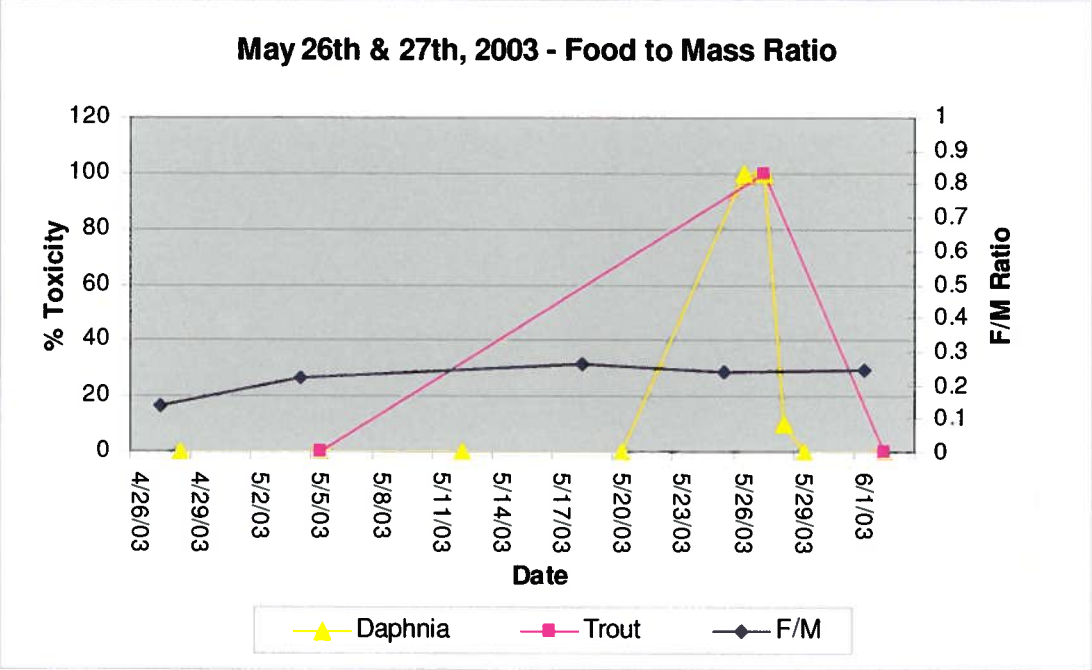


Daphnia and Trout Toxicity Episode – May 26 & 27, 2003

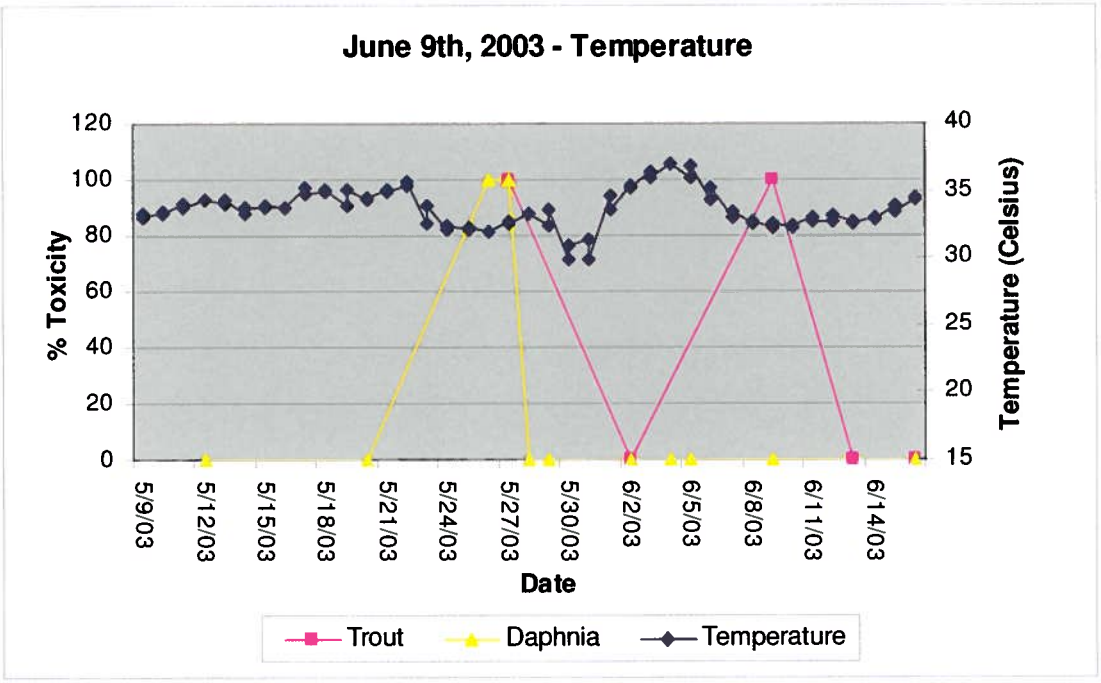


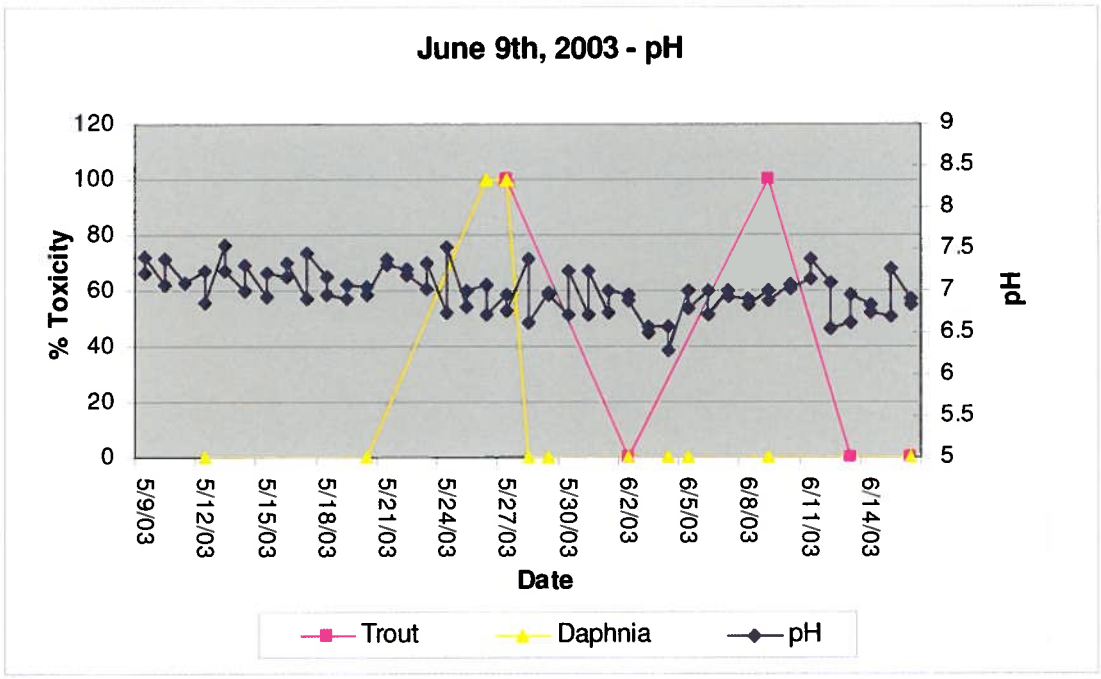


Daphnia and Trout Toxicity Episode – May 26 & 27, 2003

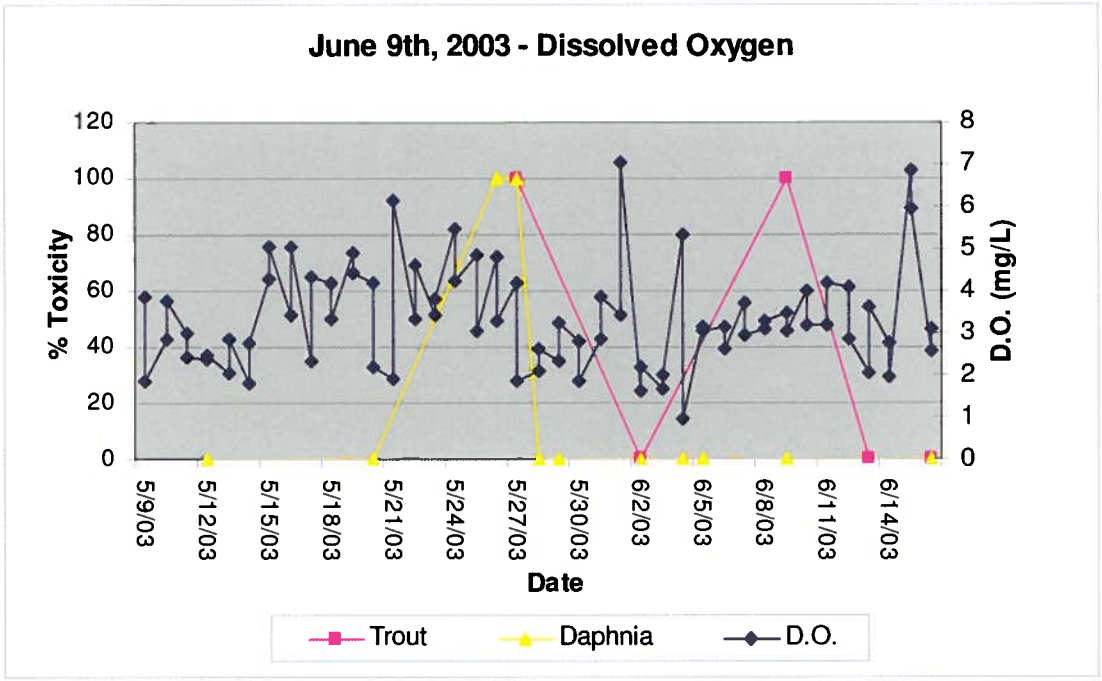


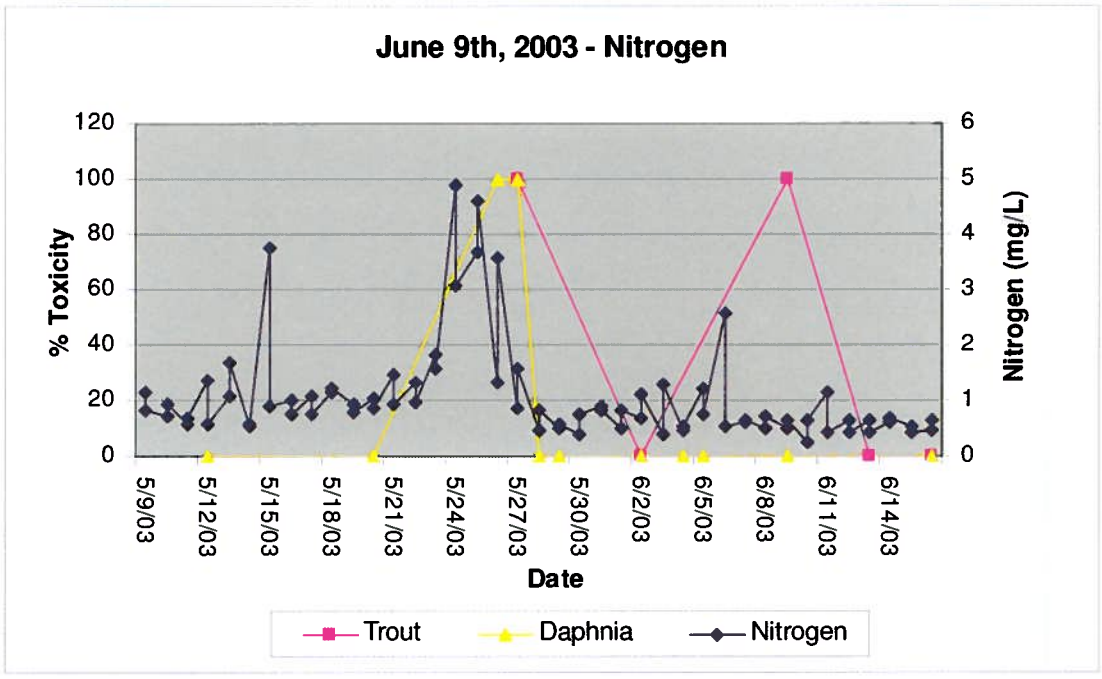
Trout Toxicity Episode – June 9, 2003



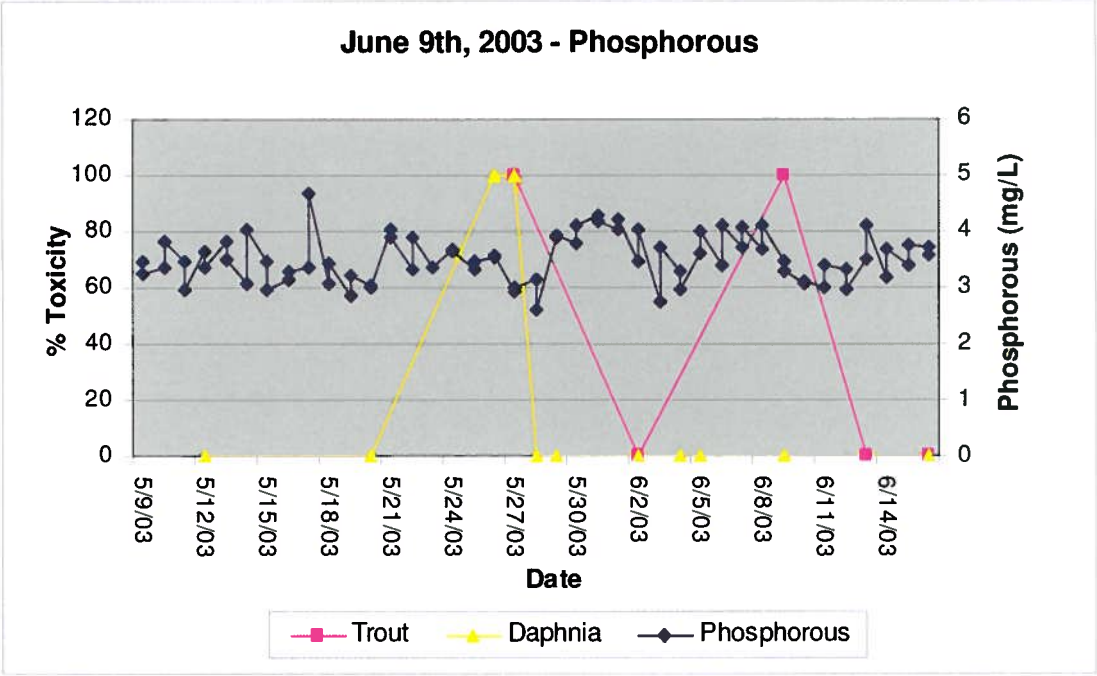


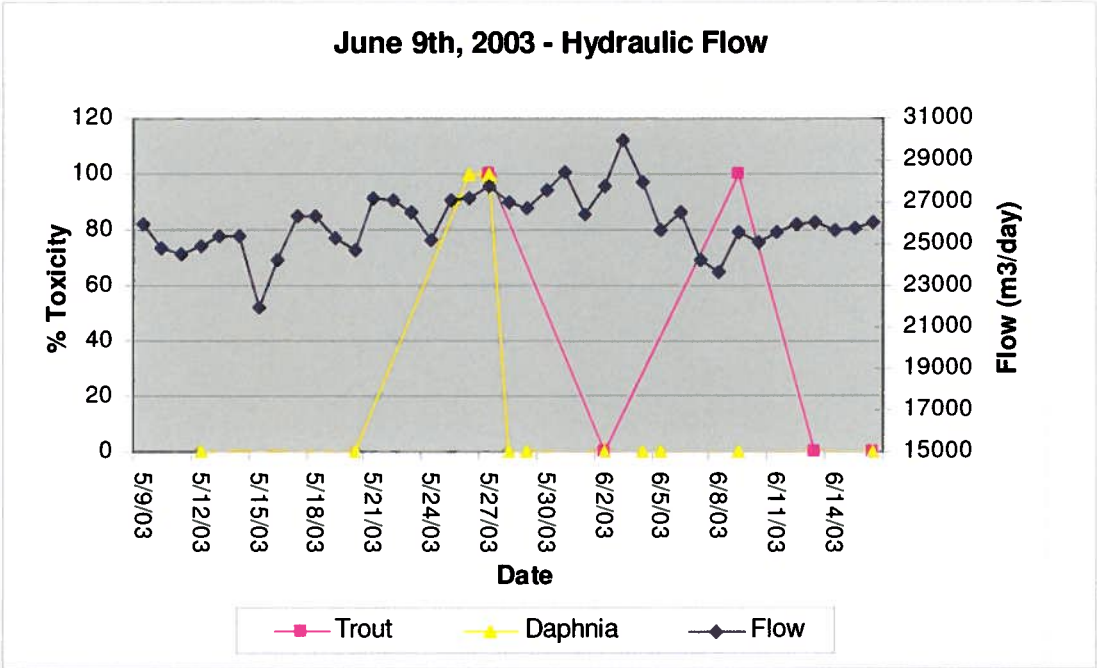
Trout Toxicity Episode – June 9, 2003



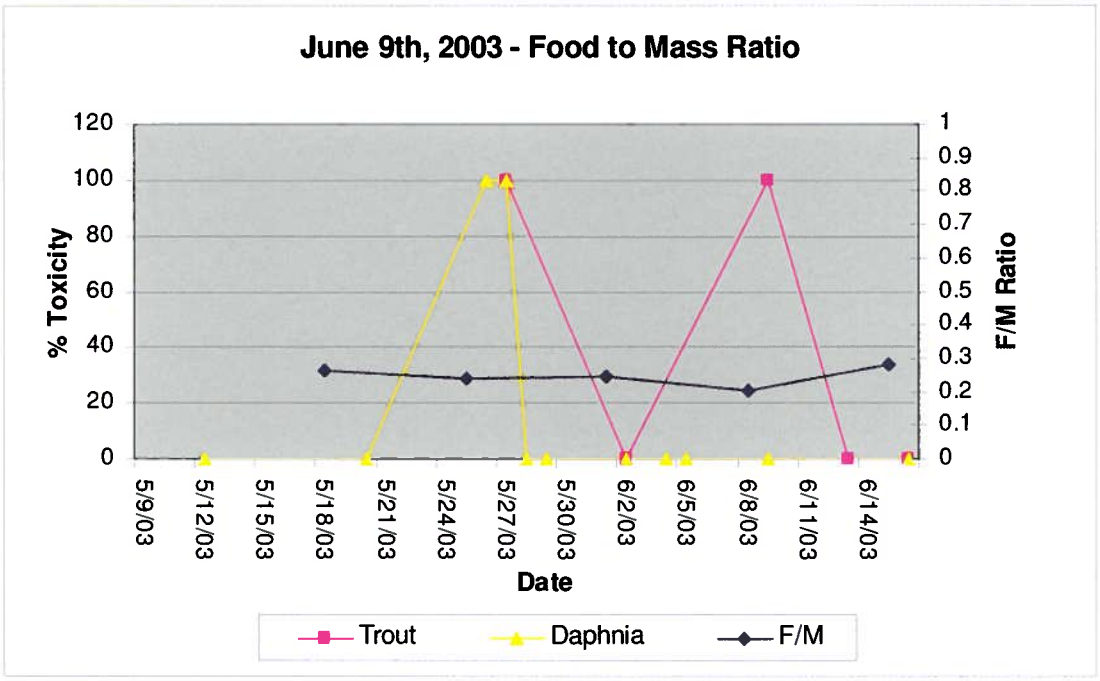


Trout Toxicity Episode – June 9, 2003

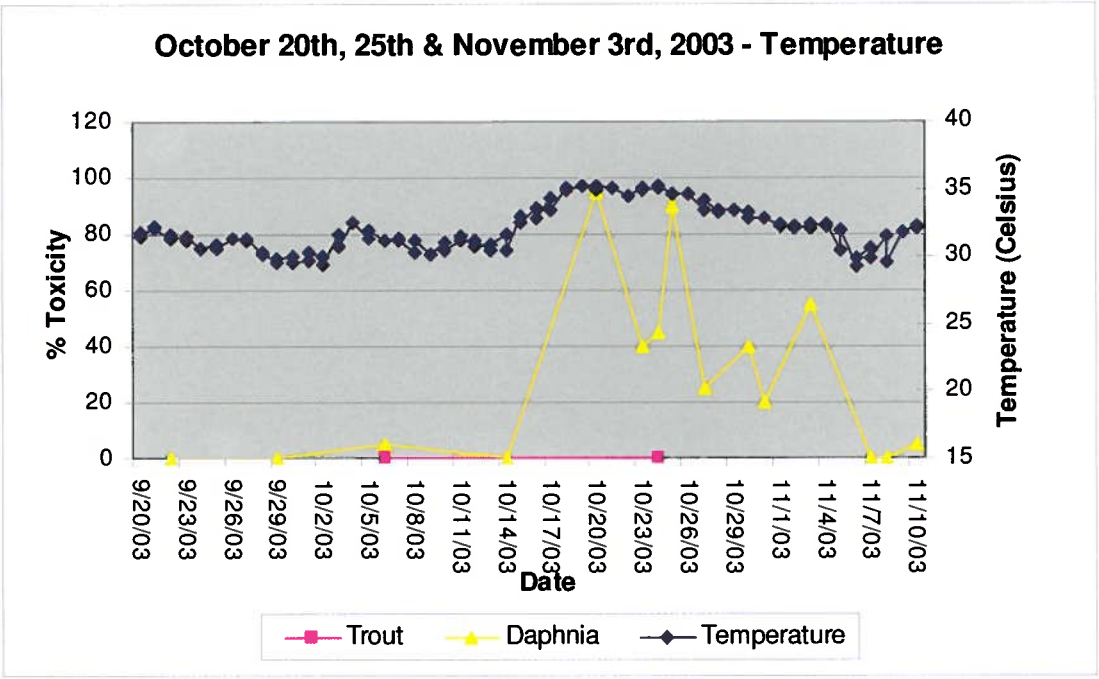


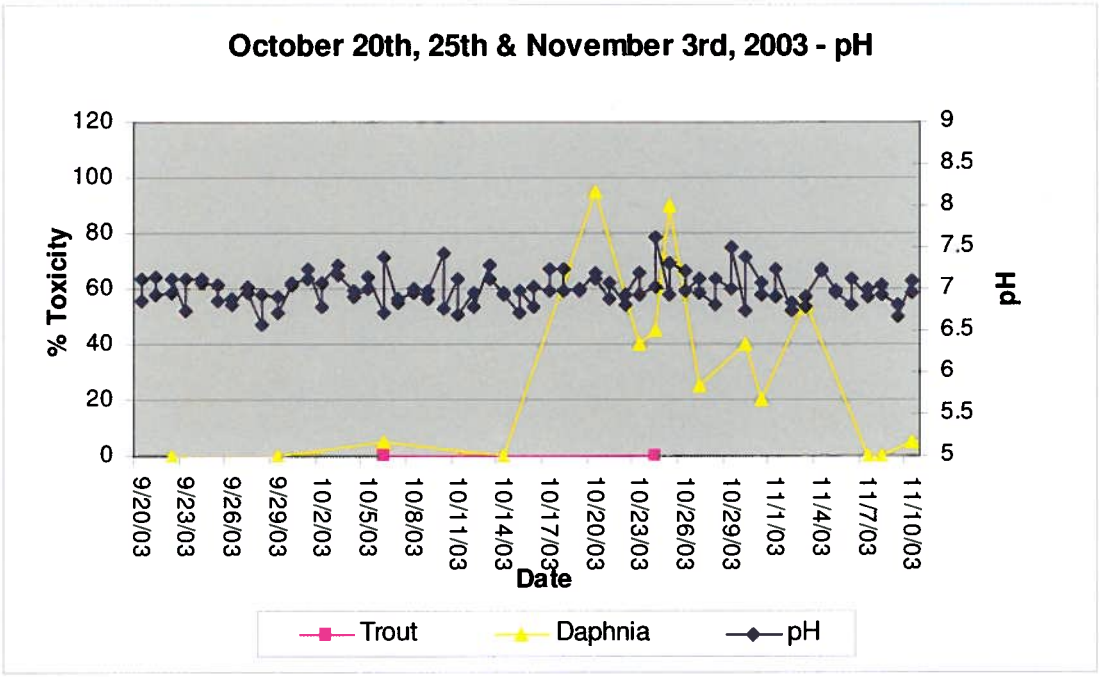


Trout Toxicity Episode – June 9, 2003

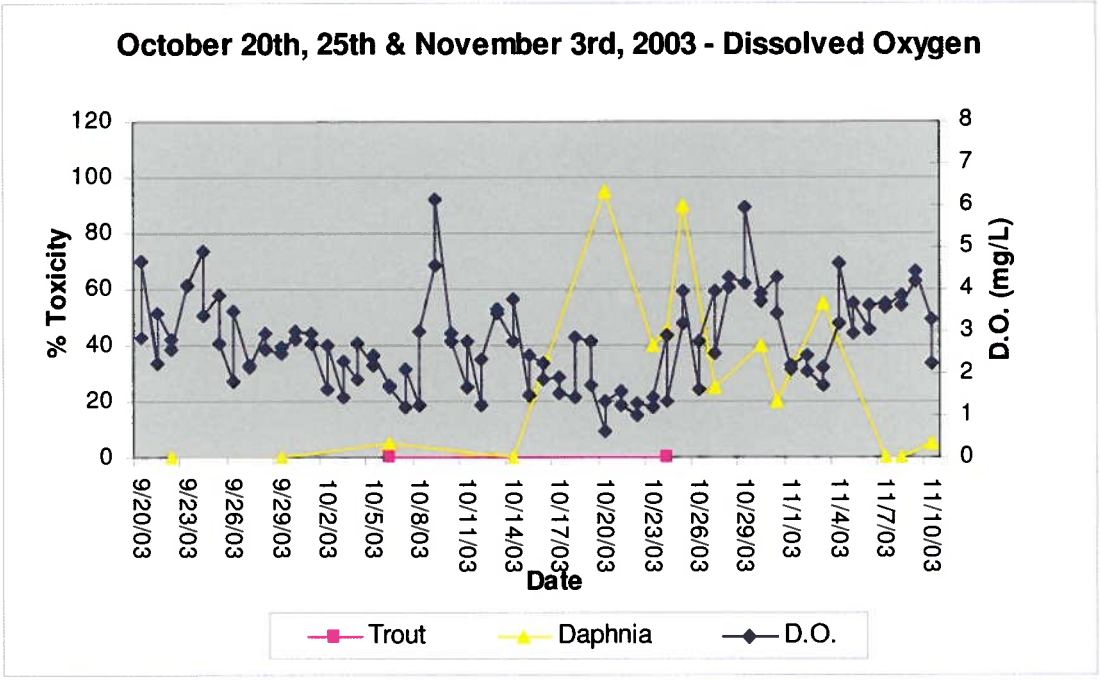


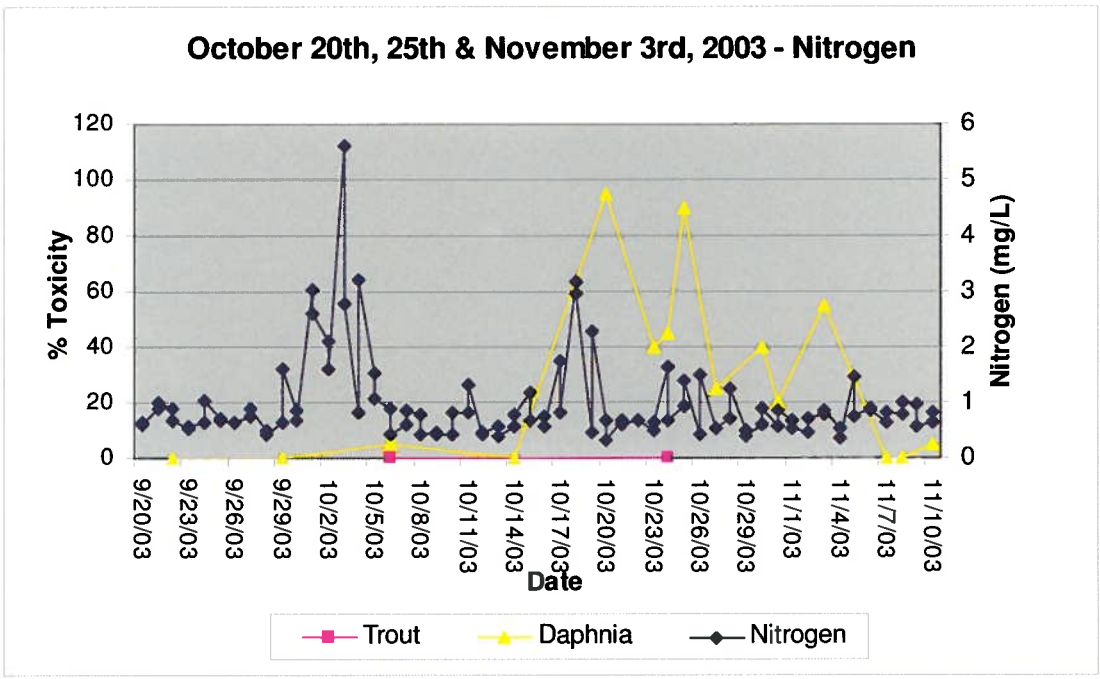
Daphnia Toxicity Events – October 20, October 25, & November 3, 2003



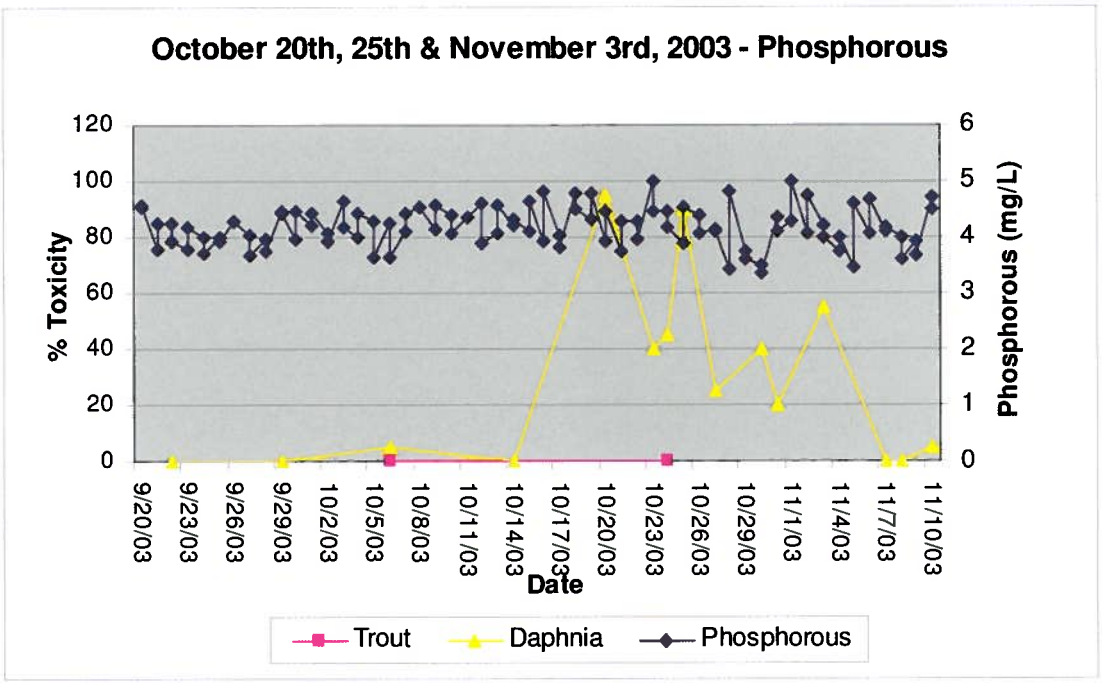


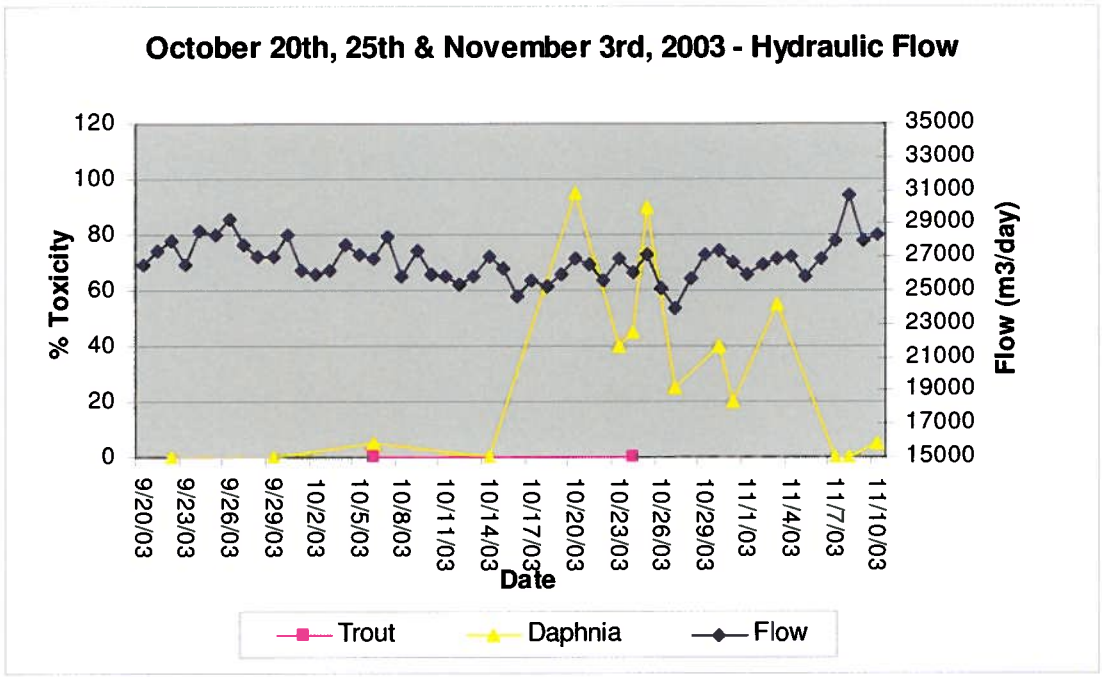
Daphnia Toxicity Events – October 20, October 25, & November 3, 2003



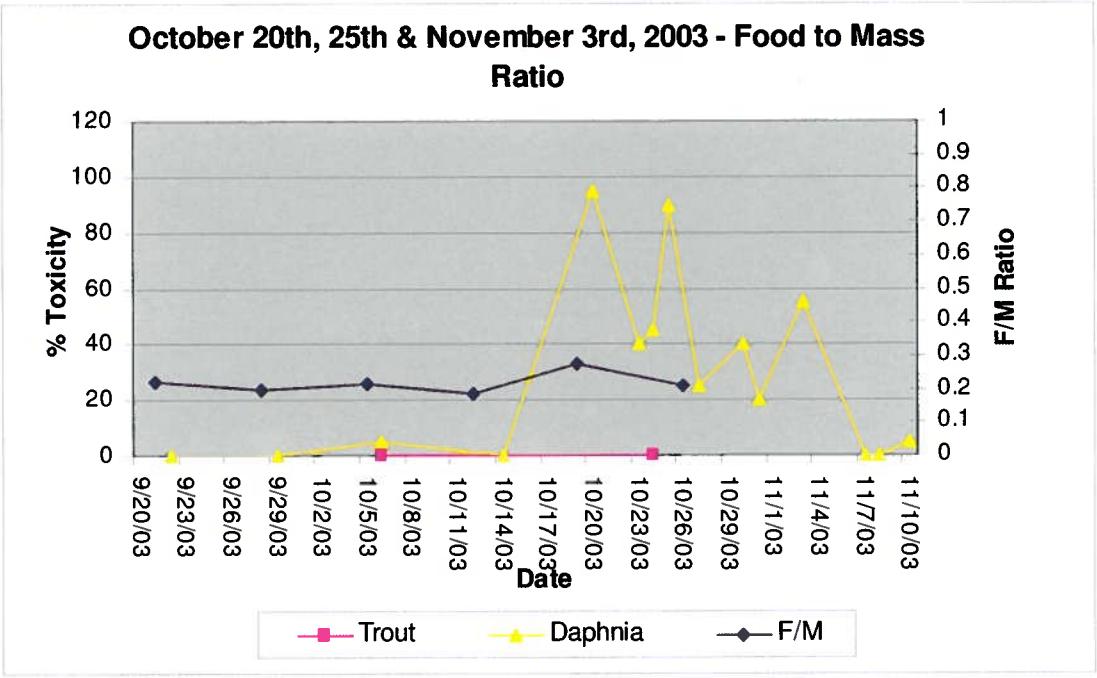


Daphnia Toxicity Events – October 20, October 25, & November 3, 2003

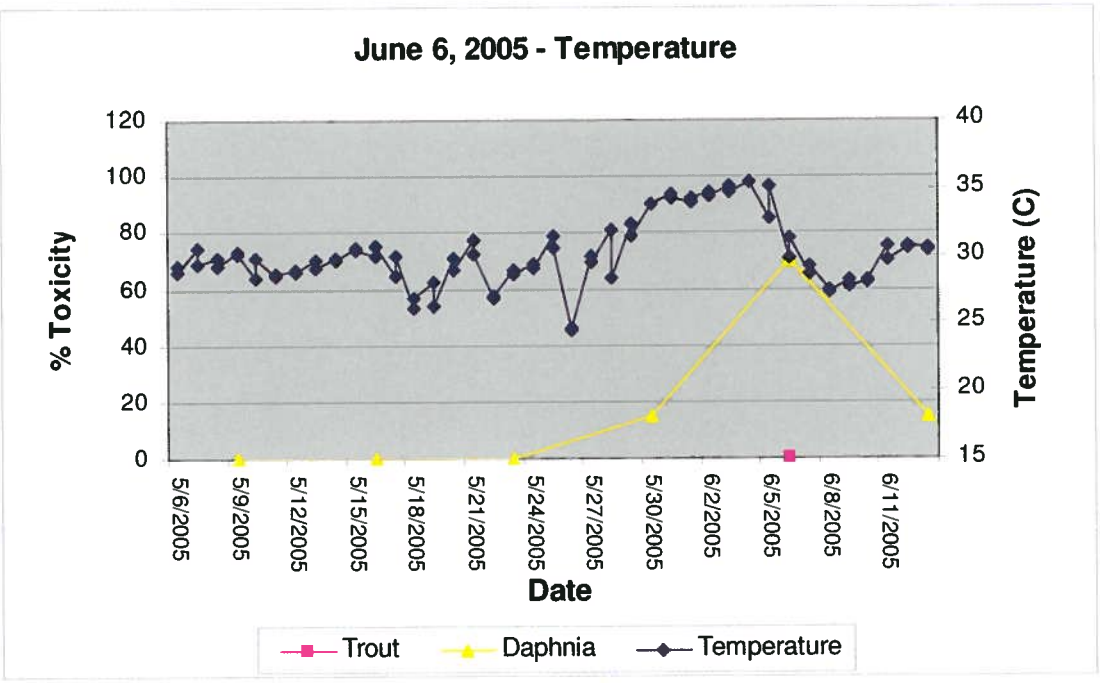


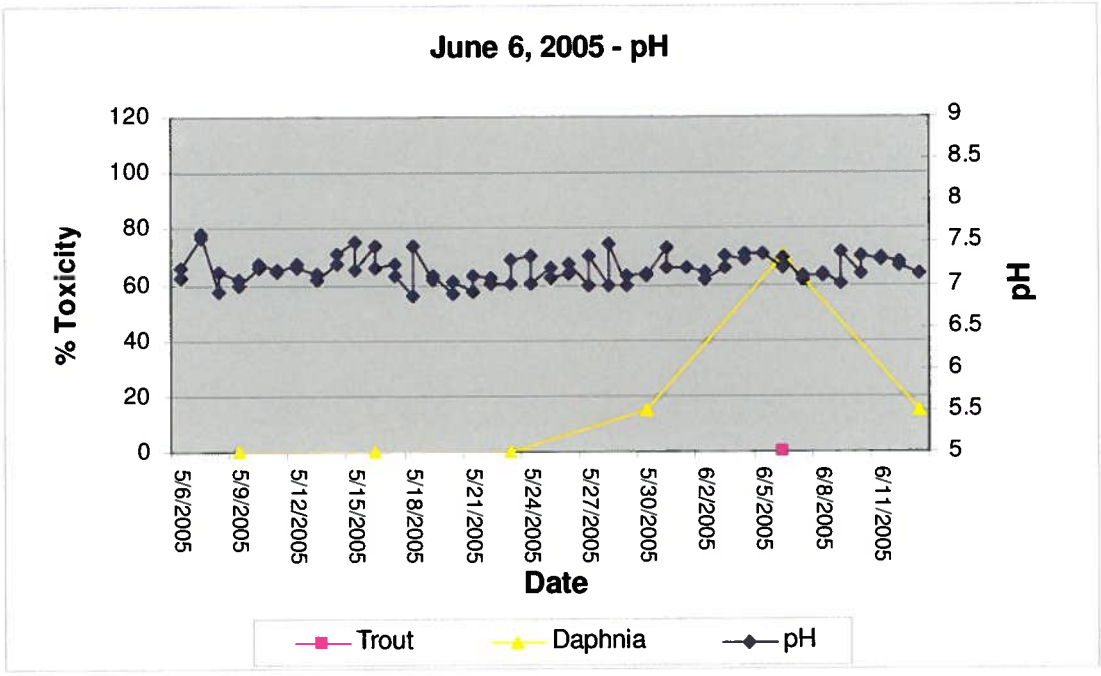


Daphnia Toxicity Events – October 20, October 25, & November 3, 2003



Daphnia Toxicity Episode - June 6, 2005





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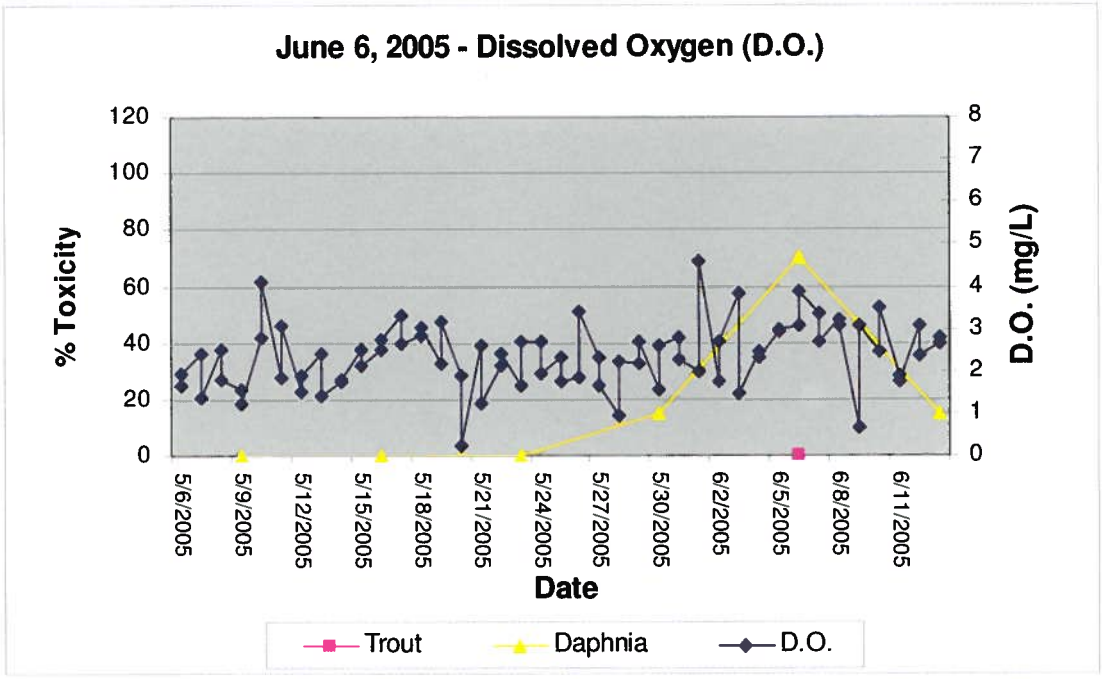

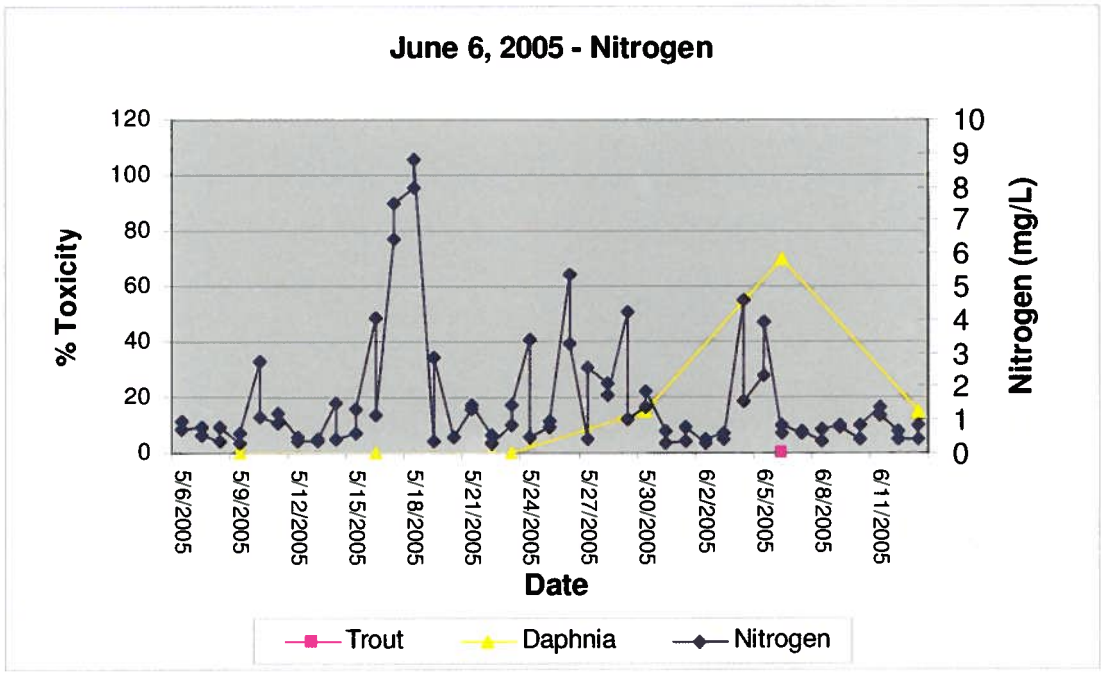

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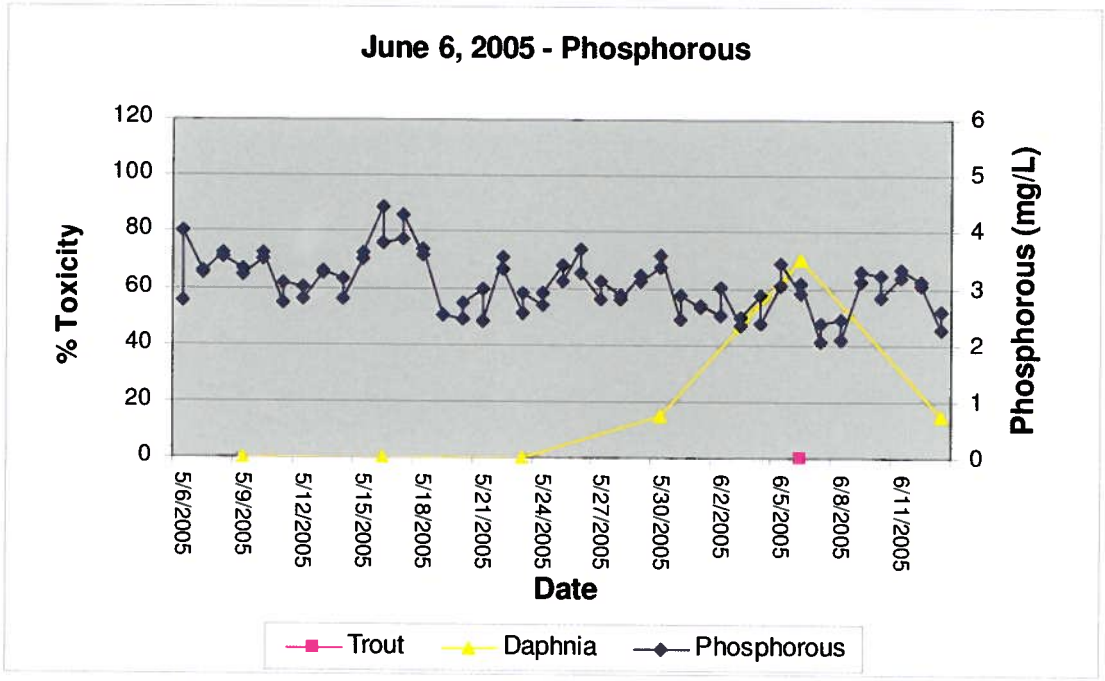

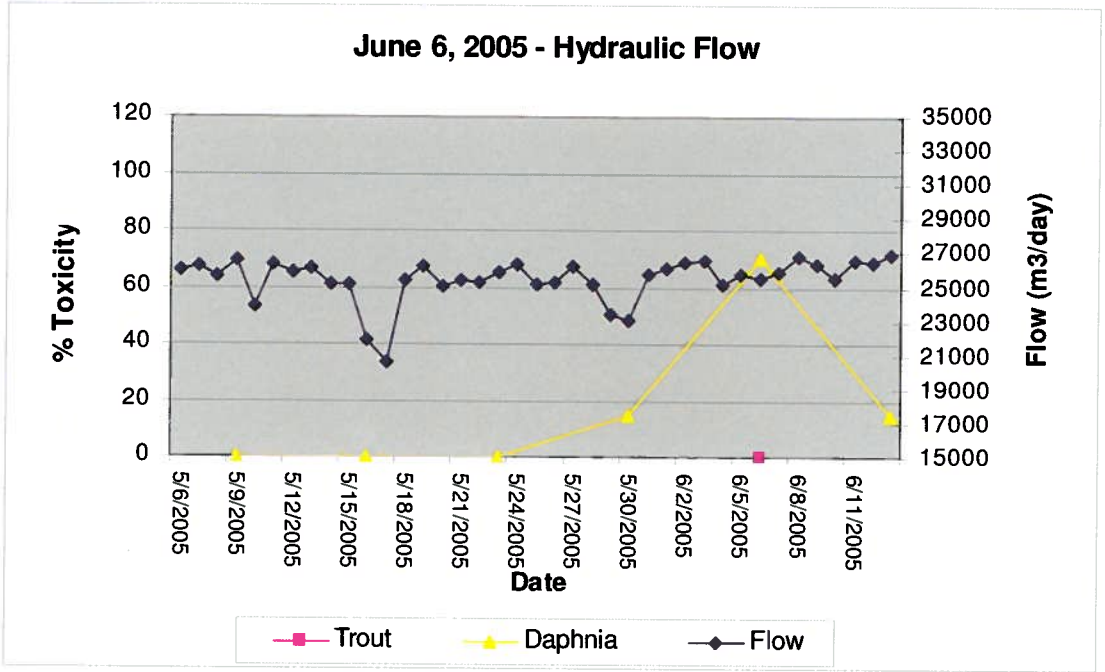

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