

**A Reconnaissance of Subsurface Tile Drain Ground  
Water in the Cow Creek Watershed**  
*Latah & Nez Perce County, Idaho*

---

Prepared by  
Eric Crook



Idaho Department of Environmental Quality  
Lewiston Regional Office April 2003  
Ground Water Quality Technical Report No. 22

---

## Table of Contents

Table of Contents .....	ii
List of Figures, Tables, and Illustrations .....	iii
Acknowledgements .....	iv
Abstract .....	1
Introduction .....	3
Purpose and Objectives .....	3
Literature Review and Data Sources .....	5
Study Area .....	6
Climate .....	6
Ecoregion .....	6
Soils .....	8
Geology .....	8
Hydrology and Hydrogeology .....	9
Land Use .....	9
Water Use .....	10
Materials and Methods .....	11
Material .....	11
Methods .....	11
Site Selection .....	11
Sampling .....	11
Quality Assurance/ Quality Control .....	13
Data Analysis .....	13
Results and Discussion .....	14
Flow Rate .....	14
Nitrate-N Concentration .....	14
Nitrite .....	16
Ammonia .....	18
pH .....	18
Electrical Conductivity .....	18
Conclusions .....	20
Recommendations .....	22
Literature Cited .....	23
<b>Appendices</b>	
Appendix A Sample Letters and Forms .....	24
Appendix B Raw Cow Creek Data .....	28
Appendix C Statistical Analysis .....	36

## List of Figures, Tables, and Illustrations

Figure 1. Location of Cow Creek Watershed.....	4
Figure 2. Cow Creek Watershed .....	7
Table 1. Precipitation and flow rate .....	14
Table 2. The relationship between residue management and NO <sub>3</sub> -N concentration.....	16
Table 3. Fertilizer application rates and NO <sub>3</sub> <sup>-</sup> N concentration.....	17
Table 4. Decreased flow rate tended to increase NO <sub>3</sub> <sup>-</sup> N concentration .....	17
Table 5. Mean pH by site .....	18
Table 6. Residue management affects on Electrical Conductivity.....	19
Table 7. Overall means for nitrate-nitrogen & total nitrate contributions from sampled subsurface tile drains to cow creek .....	20
Illustration 1. Representation of the fields with standing stubble .....	15
Illustration 2. Representation of the fields that had no standing stubble .....	15

## **Acknowledgements**

A special thanks to all the landowners that showed interest in the groundwater quality and who allowed me access to their land for this study.

## ABSTRACT

During the winter of 2002-03, the Idaho Department of Environmental Quality (DEQ), Lewiston Regional Office sampled 27 tile drain outlets and 4 sites on the Cow Creek main stem in the Cow Creek Watershed. In order to collect more information concerning the shallow groundwater in the area, tile drain samples were tested for nitrate, nitrite, ammonia, pH, electrical conductivity, and temperature. This information will be used to help identify the ground water sources of nitrate and further characterize groundwater quality in the watershed.

The objectives of the study were to:

- 1) Sample tile drain outlets in the Cow Creek watershed during late winter/early spring runoff and analyze the water for characterization of the Cow Creek Watershed.*
- 2) Describe groundwater nitrate contributions to Cow Creek.*
- 3) Determine groundwater quality in the Cow Creek Watershed.*
- 4) Provide general information to determine additional monitoring needs.*

The Cow Creek watershed is approximately 51.1 square miles in size located primarily in southwestern Latah County and the northwest section of Nez Perce County. The City of Moscow is 10 miles north of the watershed, and the City of Lewiston is 15 miles to the south of the watershed, respectively. The headwaters of Cow Creek are on the south slopes of Paradise Ridge, on the south side of Moscow. From Paradise Ridge the stream flows south towards the City of Genesee. After Genesee, the stream flows to the west, entering Union Flat Creek in the state of Washington (Strausz, 2001).

The 27 tile drains that were sampled in the Cow Creek watershed showed varied results. Almost all nitrate levels were above natural background levels of 2 mg/L, with a range of 8.8 mg/L to 12.5 mg/L and an overall mean of 10.6 mg/L. Overall, this study shows higher concentrations of nitrate than the Strausz 2001 study. There was a direct correlation between land use practices, nitrate concentration, and electrical conductivity levels in the tile drain discharge. Fields with standing stubble tended to have lower levels of nitrate and total dissolved solids than fields with no stubble. Overall nitrate loading increased with increased flow rates, but the nitrate concentrations were lower than expected. The lower nitrate concentrations in the groundwater could be attributed to the absence of a significant melting snowpack that would serve to flush the nitrate through the drain tiles. Nitrite, ammonia, pH, electrical conductivity, and temperature were at levels commensurate with or below Palouse regional groundwater levels (Crockett, 1995).

The following recommendations are based on the results of this study:

- Continue monitoring drain tile discharge to determine annual shallow groundwater nitrate level trends.
- Determine if the elevated levels of nitrate continue over the course of an entire growing season/year.
- Obtain accurate and extensive data of fertilizer application rates and timing to correlate fertilizer application to seasonal shallow groundwater nitrate levels.
- Determine fertilizer application rates and timing that would be optimal for both water quality and crop production.

- Study further the impacts of land-use practices such as tillage and residue management on subsurface tile drain water quality and flow rates.
- Promote tillage and residue management practices that leave standing stubble during winter periods.

## **INTRODUCTION**

The Cow Creek watershed is located in southern Latah County and northern Nez Perce county in northern Idaho (Figure 1). The 51.1 square mile watershed originates on the southern slopes of Paradise Ridge, south of Moscow, Idaho. From Paradise Ridge the stream flows south, through the hilly Palouse region and into the City of Genesee, Idaho. The Palouse region in eastern Washington State and northern Idaho is an area of rich loess farmland. From Genesee the stream flows in a westerly direction until it joins with Union Flat Creek one mile from the Idaho-Washington border. Genesee, a city of about 1000 people, is the only incorporated city in the Cow Creek watershed. Dry land agriculture is the dominant land use in the watershed. Wheat and peas grow well in the fertile loess soils of the Cow Creek valley and surrounding hills (Strausz, 2001).

Most of the people who live in the watershed rely on groundwater for their drinking water source. The City of Genesee has several municipal wells that have shown high nitrate levels in the past. The United States Environmental Protection Agency (EPA) has created a drinking water standard of 10.0 mg/l of nitrate (West, 2001). Municipal records for the city wells in Genesee and data from the Idaho Statewide Ambient Groundwater Monitoring Network (AMN) found that Cow Creek groundwater exceeded the EPA maximum contaminant level (MCL) of 10 mg/l. The data for the AMN was taken from nine domestic wells that surround the Genesee area and from the municipal wells of Genesee. Of these nine wells, seven are still actively monitored. While this data gave a general idea of the quality of Cow Creek groundwater, more data was needed to better understand the groundwater nitrate concentrations in the watershed.

In the summer of 2001, the Idaho Department of Environmental Quality (DEQ), Lewiston Regional Office, sampled 38 wells and springs in the Cow Creek Watershed. The samples from the wells and springs were tested for nitrite plus nitrate in order to collect more information on the groundwater in the area (nitrite plus nitrate will be referred to as nitrate for convenience in the rest of this report). This information was used to determine if the nitrate in the watershed is from inorganic sources such as fertilizers or organic sources like septic systems. The data gathered from this study will be used to support the 2001 study. Together, these studies can be used to increase the understanding of groundwater in the Cow Creek watershed and facilitate land use planning that will help improve groundwater quality.

## **PURPOSE AND OBJECTIVES**

The purpose of this study was to assess the extent of nitrate groundwater concentrations in the Cow Creek watershed and further characterize the water quality and conditions. The objectives are listed below:

- 1) Sample subsurface tile drain discharge in the Cow Creek area and test for nitrate.
- 2) Describe nitrate groundwater concentrations from fields, used for dryland agriculture.
- 3) Provide information to determine additional monitoring needs.
- 4) Provide information to landowners that will be useful in determining land-use practices.

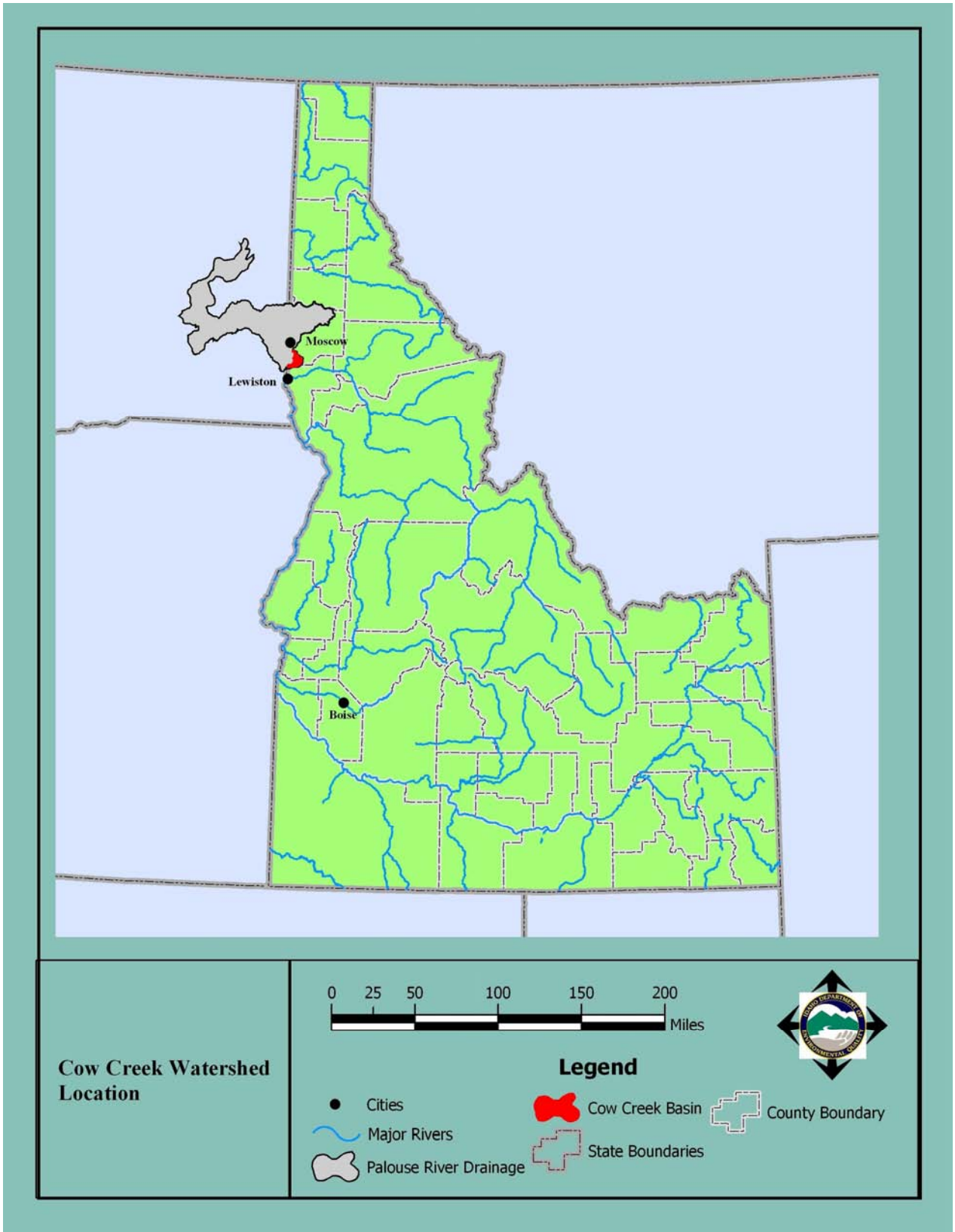


Figure 1. Location of Cow Creek Watershed



## LITERATURE REVIEW AND DATA SOURCES

There is a limited amount of groundwater quality data available for the Cow Creek watershed. Some groundwater studies were found that describe the geological and hydrogeological characteristics and provide groundwater quality data of the watershed (see Strausz, 2001).

*Nitrates in Groundwater: A Continuing Issue for Idaho Citizens* by the Idaho Department of Environmental Quality (DEQ, 2001) proved to be a valuable source of information on the effects of nitrates. It also provided background on groundwater in the state of Idaho and describes areas that have nitrate groundwater contamination.

*Ground Water Quality Technical Report No.18: A Reconnaissance of Groundwater Nitrate/Nitrite in the Cow Creek Watershed, Latah and Nez Perce County, Idaho. Vol I of II.* Idaho Department of Environmental Quality, Lewiston Regional Office (Strausz, David, 2001). This was used as the format for the study.

*Hydrogeological Assessment of the Potential for Future Ground-Water Development in Genesee, Idaho* (Lawrence, 1995) describes ground water development of the Genesee area. This thesis explores options for the development of aquifers for the City of Genesee. Ground water contamination by nitrates in 1993 led to the closure of one well, which left the city exploring their options for obtaining other water supplies. The report provided much needed background groundwater information for the Genesee and Cow Creek areas. His report describes geological and hydrogeological conditions along with historical information for Genesee city wells.

*Idaho Statewide Ground Water Quality Monitoring Program – Summary of Results, 1991 through 1993. Idaho Department of Water Resources Water Information Bulletin No. 50 Part 2.* Crockett, Janet. 1995. Contains useful statistics of Idaho ground water quality.

*The United States Department of Agriculture (USDA) soil survey for Latah County, Idaho* (Barker, 1981) was used for a description of the soils, topography, and climate of the Cow Creek watershed. This information was used for this report's Study Area description.

## STUDY AREA \*

The Cow Creek watershed is located mostly in southwestern Latah County, Idaho, extending into the northwest part of Nez Perce County, Idaho, and is approximately 51.1 square miles in size (Figure 2). Cow Creek's headwaters are on the south slopes of Paradise Ridge, located south of Moscow, Idaho. From Paradise Ridge, the stream flows south towards the city of Genesee, Idaho. The stream flows west after leaving Genesee, entering Union Flat Creek in the state of Washington.

### Climate

The climate of the Cow Creek watershed is typical for the Palouse region, of southeast Washington and north Idaho. Temperatures range from average daily highs of 85 degrees Fahrenheit in the summer to 35 degrees in the winter. Average daily minimum temperatures are around 50 degrees in the summer, and averages reaching as low as 23 degrees in the winter. Precipitation for the area ranges from 20 to 27 inches per year. Most precipitation occurs in the months of November, December, and January. The months of July and August receive the least precipitation, which is usually less than one inch per month (Barker 1981).

### Ecoregion

The Cow Creek watershed is located within the highly variable Columbia Basin ecoregion. This ecoregion is surrounded by high mountain ranges, namely the Northern Rocky Mountains, the Wallowa Mountains, the Blue Mountains, and the Cascade Mountains. The Columbia Basin ecoregion is very large covering around 34,000 square miles and is characterized by deep, dry channels that are cut into the Columbia River Basalt group (Omernik and Gallant, 1986).

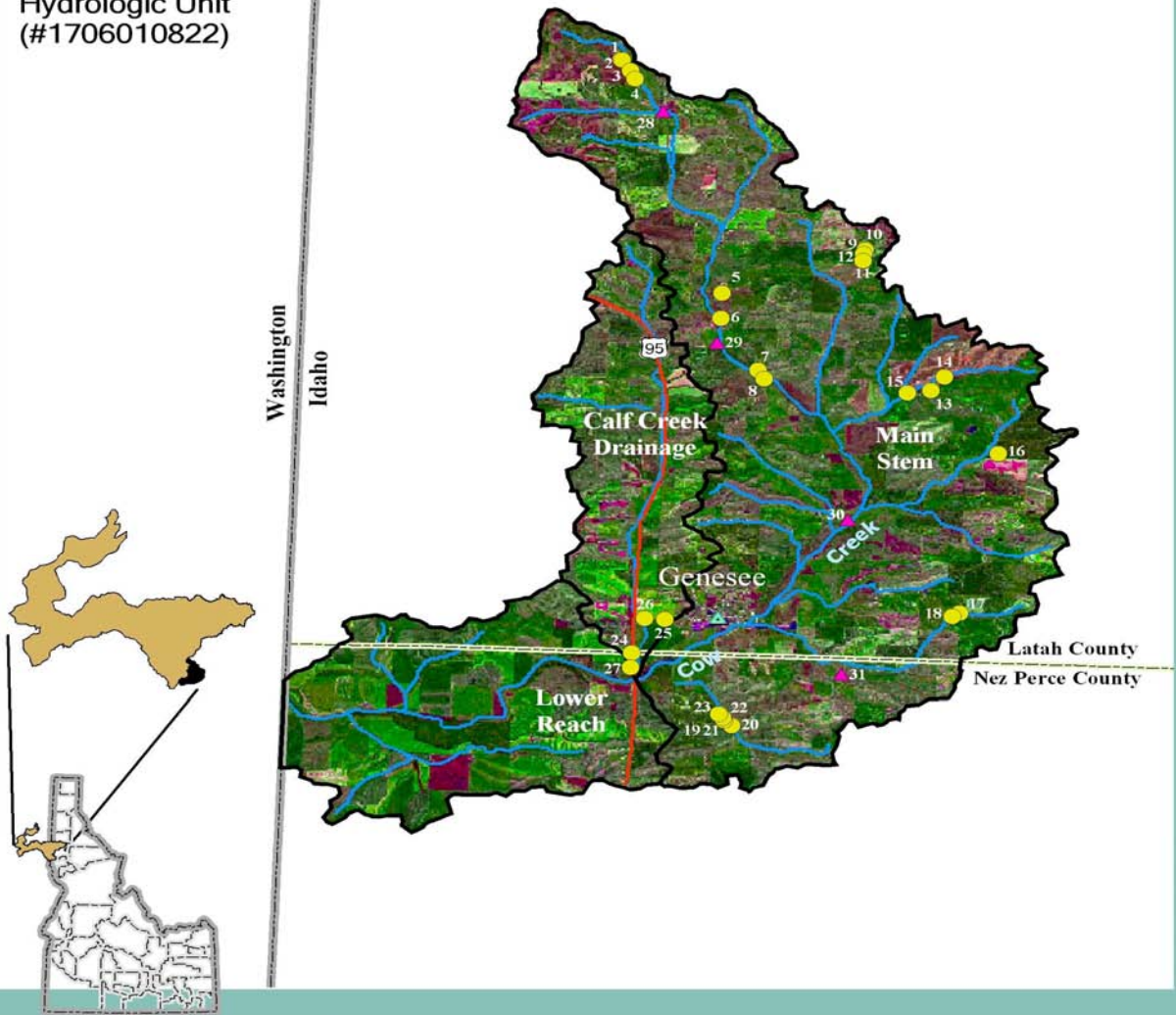
Most of the Cow Creek watershed is drained by intermittent and ephemeral streams. Some streams such as Cow Creek flow all year due to discharge from aquifers (Omernik and Gallant, 1986).

Natural vegetation consists primarily of grass and sagebrush with forests at higher elevations. Small trees and brush grow around springs where water is more plentiful. The Cow Creek area supports non-irrigated agriculture, especially wheat grasses and peas. Crop production is successful due to the large amount of rainfall the area receives in combination with the capacity of the loess soil to retain moisture. The Cow Creek watershed lies on the eastern portion of the Columbia Basin ecoregion and receives more rainfall than most of the ecoregion (Omernik and Gallant, 1986).

---

\* Taken from *A Reconnaissance of Ground Water Nitrite/Nitrate in the Cow Creek Watershed, Vol. I*, p.6-9. Prepared by David Strausz. Idaho Department of Environmental Quality, Lewiston Regional Office. August, 2001.

Upper Cow Creek Hydrologic Unit (#1706010822)



**Cow Creek Tile Drain Sample Points**



**Legend**

- △ Cities
- ▲ Surface Water Site
- Tile Drain Site
- Streams
- Highway 95
- Cow Creek Basin
- State Boundary
- County Boundary

Figure 2. Cow Creek Watershed.

## **Soils**

Three major soil groups exist in the Cow Creek watershed. The primary soil group is the Palouse-Naff soil group. The other two soil groups, the Latahco-Lovel and Palouse Silt Loam groups, occur less frequently. Soil variation in the Cow Creek area is primarily due to the changing landforms. The uplands and lowlands in the area are a result of the stream winding through the Palouse region. The lowlands in the valley of Cow Creek constitute the floodplain. The soils in the floodplain are primarily Latahco-Lovel with small quantities of Palouse Silt Loam soils. These soils, especially the Latahco-Lovel soils, occur in flat areas. The uplands surrounding the stream, comprising most of the watershed, primarily have soils in the Palouse-Naff soil group (Barker 1981). The characteristics of the watershed soil groups are discussed below:

**Palouse-Naff soil group:** These are very deep, well drained soils that exist on gently sloping to moderately sloping landscapes. These soils are generally formed from a loess base (Barker 1981).

**Latahco-Lovel soils:** These are very deep and somewhat poorly drained soils that are formed from alluvium. Permeability is moderately slow. Available water capacity is high. This soil is usually subject to brief periods of flooding in the winter and spring seasons (Barker 1981).

**Palouse Silt Loam soil:** A very deep soil that is well drained and usually lies on the south slopes of uplands. Soil is formed from loess. Permeability is moderate and the soil has a high available water capacity. Runoff is usually rapid, thus increasing the hazard of soil erosion (Barker 1981).

## **Geology**

The Cow Creek area lies on the eastern edge of the Columbia River plateau. The Columbia River plateau is made up of basalt flows over older granite and metamorphic rock bases. These basalt flows, called the Columbia River Basalt Group (CRBG), consist of multiple layers of basalt flows with sedimentary interbeds. The CRBG forms the basic geology around Cow Creek. It ends east of the Cow Creek watershed as the Rocky Mountain region is approached (Lawrence 1995).

The underlying metamorphic rock or basement rock is mostly granite from the Belt Supergroup, which is pre-Cambrian meta-sedimentary rock, and the Idaho Batholith consisting of Mesozoic intrusive rocks (Lawrence 1995).

The four major layers of the CRBG are Miocene basalt flows. These are the Imnaha, Grande Ronde, Wanapum, and Saddle Mountain formations starting with the Imnaha as the deepest. An individual flow can be 300 feet deep (Lawrence 1995).

## **Hydrology and Hydrogeology**

The major aquifers underlying the Cow Creek area are located in the deep loess soil layer and in the basalt layers that make up the CRBG. The alluvial aquifer consists of loess soil formations and constitutes an important drinking water supplying the area. The loess deposits are composed primarily of silty clays, which do not have extremely high water yielding capacity. Despite this, the water holding capacity of loess can be quite high, especially when penetrated by roots and animal burrows (Pierce, 1998).

The direction of groundwater flow in the alluvial aquifer is from areas of high to low elevations. Some ground water in this aquifer discharges to small tributaries and local drainages, but Cow Creek serves as the main discharge area for ground water in the alluvial aquifer.

Deeper wells in the area penetrate the basalt flows that underlie the loess. The basalt flows hold water in the sedimentary interbeds and in fractured areas within the individual flow units. Fractures formed during cooling of lava and also from stresses to the formations. These fractures then became open or sediment filled spaces where water can collect (Driscoll, 1986). The Wanapum aquifer, found in the Wanapum basalt, is found at depths up to 300 feet under the Palouse soil. The Wanapum aquifer provides adequate drinking water supplies for households but cannot support large systems as required by cities such as Moscow and Pullman.

The Grand Ronde aquifer, found in the Grand Ronde basalt, is the other major aquifer beneath the Wanapum basalt. The Grand Ronde aquifer is found at depths ranging from 300 to 600 feet below the surface of the Palouse. Well yields from this aquifer range from 900 to 2500 gallons per minute (gpm) (Lawrence, 1995).

The direction of groundwater movement in the Wanapum Aquifer, described by Lawrence (1995) is predominately from north to south. Ground water flow information is not available for the Grande Ronde aquifer, but the general flow direction is probably from north to south.

## **Land Use**

The Cow Creek watershed is mostly rural area. Figure 2 shows major drainage and land use features in the watershed. Land use is dominated by agriculture. Crops such as wheat, barley, and legumes, including peas, lentils, and chickpeas are most common. Some land is used as pasture for grazing animals, but not in large numbers. The city of Genesee, which lies to the west of Cow Creek, is the only incorporated city in the watershed. Genesee was once an active town with many businesses that supported local farmers. The town has since become a bedroom community for nearby larger cities on the Palouse and has a population of approximately 1000 residents. The City of Genesee treats its municipal wastewater with a lagoon located southwest of town, just north of Cow Creek. Most rural residents treat their wastewater with septic systems and drain fields.

## **Water Use**

Within the Cow Creek watershed, most wells are for domestic use. No large-scale irrigation is practiced in the watershed. The City of Genesee has the only municipal drinking water system in the area and is fairly small, using less than one million gallons of water per day.

## Materials and Methods

### Materials

This study's primary purpose was to collect information concerning the nitrate content, nitrite content, ammonia, pH, and temperature of the groundwater issuing from subsurface drain tiles. The materials used for sampling were Hach<sup>®</sup> Test Kits. Each used test kit and its contents are listed below.

Nitrate/Nitrite kit. Contains pre-measured reagents for both nitrate and nitrite, nitrate color disc, nitrite color disc, color comparator box, 2 test tubes for viewing samples plus stoppers, and a dropper.

Mid range ammonia test kit. Contains Nessler reagent, ammonia color disc, color comparator box, 2 test tubes for viewing samples plus stoppers, a dropper, and two 100 ml containers of deionized (demineralized) water.

Wide range pH test kit. Contains wide range 4 pH indicator solution with dropper, pH 4-10 color disc, color comparator box, and 2 test tubes for viewing samples plus stoppers.

One water quality instrument (Model 33 S-C-T meter) from Yellow Springs Instrument Co., Inc to measure the electrical conductivity of the sample water. Also used was a thermometer with a range of -20 to 110° C, a 250 ml measuring cup, five 1 liter cubitainers to contain contaminated samples, and two 500 ml wash bottles.

### Methods

**Site selection:** Potential groundwater sample sites were selected throughout the entire watershed during a pre-study reconnaissance. This was to establish an accurate representation of overall watershed groundwater conditions. Random final site selection was dependent on landowners' permission to access their private property. The Cow Creek Watershed Advisory Group (WAG) was addressed on January 21, 2003 in a successful attempt to gain the WAG's support. The next day a mailer containing an explanation of the study and a permission request form (see Appendix A, pg. 24) was sent to Cow Creek watershed landowners. When permission to access 15 sample sites was granted, initial samples were taken to begin collecting baseline data. Eventually, a total of 27 drain tile sites and four surface water sites were sampled (Figure 2).

**Sampling:** Samples for all locations were collected five times over two-day sampling periods during February and March of 2003. Samples at each site were taken in the following manner.

1. Flow rate: Flow rate was measured by holding a 250-ml cup directly below the drain tile opening. A stopwatch was used to determine the time it took for the cup to fill. The time was then multiplied by four to determine the number of seconds required for 1 liter of flow. When the seconds required for one liter of flow was known, the liters of flow per minute was then calculated.

2. Nitrite nitrogen ( $\text{NO}_2^- \text{N}$ ): Because it takes 10 minutes for the nitrite reagent to react with the nitrite in the water, this sample was analyzed first. Two 5-ml samples were taken from the flow measuring cup and put in two test tubes. The nitrite reagent was added to one and titrated for 60 seconds. The other test tube contained a “blank” sample for comparison. Both test tubes were placed in the comparator box for 10 minutes. After 10 minutes, the comparator box containing the nitrite color wheel was then held to the sky to allow light to filter through the color wheel and the  $\text{NO}_2^- \text{N}$  content was then read and recorded. The contaminated sample containing the nitrite reagent was discarded in the 1-liter cubitainer for safe disposal later.
3. Ammonia nitrogen ( $\text{NH}_3\text{N}$ ): While the nitrite reagent reaction was occurring, other tests were conducted. Two more 5-ml samples were collected in test tubes. Three drops of liquid Nessler reagent was added to one and briefly swirled to mix. A waiting period of one to three minutes was required for the reaction to occur. The comparator box containing the ammonia color wheel was then held to the sky to allow light to filter through the color wheel and the ammonia-N content was read and recorded. The contaminated sample containing the Nessler reagent was discarded in the 1-liter cubitainer for safe disposal later.
4. Temperature: The temperature was taken during the waiting period for the Nessler reagent to react by putting the thermometer into the flow measuring cup for 60 seconds. The temperature was then read and recorded.
5. PH: The pH was measured by taking two 5 ml samples from the flow measuring cup and adding six drops of wide range 4 pH indicator solution and briefly swirling to mix the sample and the reagent. The comparator box containing the pH color wheel was then held to the sky to allow light to filter through the color wheel and the pH was read and recorded. The contaminated sample containing the pH indicator solution was discarded in the 1-liter cubitainer for safe disposal later.
6. Nitrate nitrogen ( $\text{NO}_3^- \text{N}$ ): Two 5-ml samples were collected in separate test tubes. The nitrate reagent was added to one of the test tubes and titrated for 60 seconds. The test tubes were then placed in the comparator box containing the nitrate color wheel and left undisturbed for another 60 seconds. The comparator box was then held to the sky to allow light to filter through the color wheel and the  $\text{NO}_3^- \text{N}$  content was then read and recorded. The contaminated sample containing the nitrate reagent was discarded in the 1-liter cubitainer for safe disposal later.
7. Conductivity: Electrical Conductivity (EC) was measured by placing the probe from the YSI Model 33 water quality instrument into the sample measuring cup and reading the output. The EC was measured in microhms/cm ( $\mu\text{mho/cm}$ ). An hmo is defined as a reciprocal ohm (Yaron, 1981).



**Quality Assurance/Quality Control:** To eliminate potential sample contamination from residue of previous samples, each test tube was rinsed with deionized water from the wash bottles. The rinsing process consisted of vigorously agitating each test tube with 10 ml deionized water at least twice. The rinse water was discarded in the 1-liter cubitainer for safe disposal later. This process always occurred immediately after the samples were analyzed, recorded, and discarded at each sample site. Upon return to the lab, all the field test kit contents were thoroughly washed and then dried with a soft cloth. Also, every 10<sup>th</sup> sample was replicated to ensure field testing accuracy.

**Data Analysis:** After the raw data was collected (Appendix B, pg 28), initial statistical data analysis was done using Microsoft Excel<sup>®</sup>. Initial data analysis consisted of basic descriptive statistics grouped by sample period and by individual sites (Appendix C, pg. 36). Conductivity (EC) means were converted to Total Dissolved Solids (TDS) using the following equation from Yaron, 1981:

$$\text{TDS (mg/L)} \approx 0.64 \text{ EC } (\mu\text{mhos/cm}^3)$$

During the course data collection and analysis, differences in NO<sub>3</sub>-N concentration were noticed in connection with land management practices. Further data concerning residue management and fertilizer application was obtained from some of the participating landowners. Analysis of Variance (ANOVA) of selected factors was done using SAS software (Appendix C, pg. 81-85). When the ANOVA F value showed the means to be significantly different, Tukey's Studentized Range Test was conducted to display the different grouping.

## Results and Discussion

Because of varying weather conditions and degrees of landowner participation, the sample data is not abundant. For example, some tile drains had inconsistent flow, and other sample site data was not available due to site inaccessibility or lack of needed equipment. Despite the scant information, enough data was collected to reveal possible trends and make some reasonable inferences. The discussion below will only address the overall findings in the watershed. Results found during individual sample periods or at individual sites can be found in Appendix C.

### Flow rate

The flow rate averaged 16.3 L/min (0.010cfs) when the means of the entire study were pooled for analysis. The overall average increased to 22.25 L/min (0.013cfs) during the 4<sup>th</sup> sample period due to a precipitation event the previous week (Table 1). Drain tile flow was often inconsistent or nonexistent, depending on area precipitation (UI, 2003).

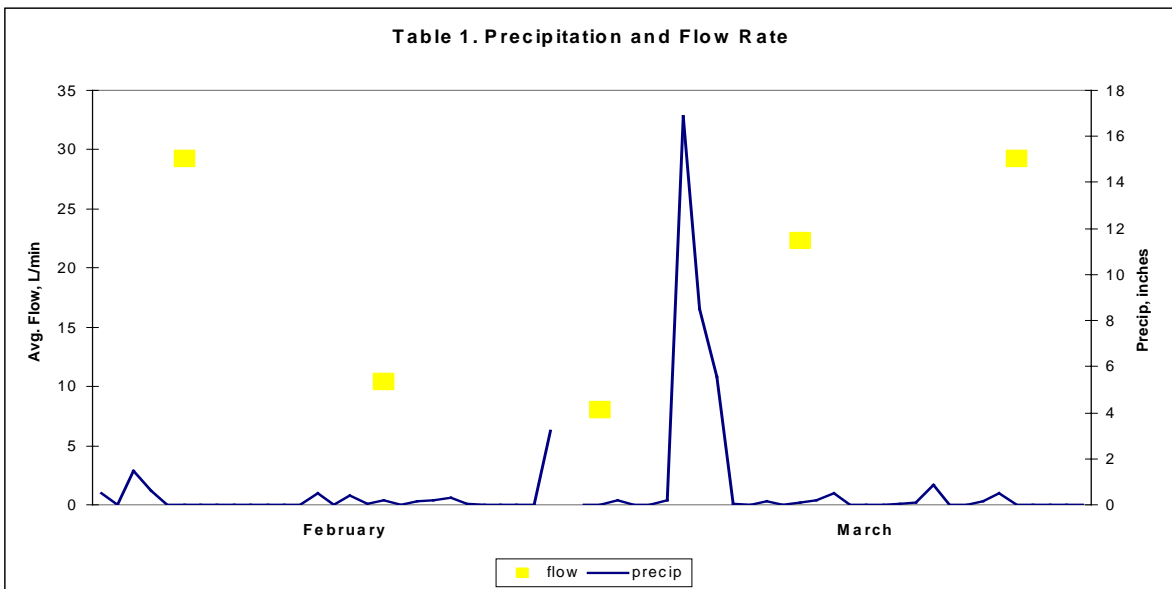


Table 1. Precipitation and flow rate.

### Nitrate Nitrogen Concentration.

Determining the groundwater contribution of nitrate nitrogen (hereafter referred to as  $\text{NO}_3^- \text{N}$ ) to Cow Creek surface water was the impetus of this study. The overall average  $\text{NO}_3^- \text{N}$  concentration of the drain tile outlets was  $\sim 10.6$  mg/l (Appendix C, pg. 38). This is slightly over the Idaho Quality Ground Water Rule of 10 mg/l for groundwater. The tiles drains sampled contributed an average of 0.24 kg  $\text{NO}_3^- \text{N}$  per day, and 1.1 kg of total  $\text{NO}_3^-$  per day (Appendix C, pg. 38). It was observed that fields with standing stubble, represented by Illustration 1, had lower levels of  $\text{NO}_3^- \text{N}$  than fields without stubble, represented by



Illustration 1. Representation of the fields with standing stubble.



Illustration 2. Representation of the fields that had no standing stubble.

Illustration 2: ANOVA produced a significant F value, so Tukey's separation of means test at the 95% confidence level ( $\alpha = .05$ ) was conducted. The Tukey's grouping showed that the standing stubble fields mean was 8.7 mg/l  $\text{NO}_3^-$ N and no-stubble fields mean was 13.3 mg/l  $\text{NO}_3^-$ N (Appendix C, 81) Table 2 shows the relationship between residue management and  $\text{NO}_3^-$ N concentration. Further investigation into other possible factors affecting  $\text{NO}_3^-$ N concentration did not yield conclusive results. From the data available, statistical analysis showed no statistical difference between fertilizer application rates means (Table 3 and Appendix C, pg. 83). However, it must be noted that fertilizer application time and application rate had a small and variable data set. Further study is needed for a more accurate conclusion. Increased flow rates tended to decrease  $\text{NO}_3^-$ N concentration (Table 4), probably due to the dilution the extra water provided. Although increased flow would increase overall flow rate and  $\text{NO}_3^-$ N discharge from drain tiles, it did not have a significant effect on groundwater  $\text{NO}_3^-$ N concentration. Tile length did not have a significant effect on  $\text{NO}_3^-$ N concentration either (Appendix C, 78, 79, 85).

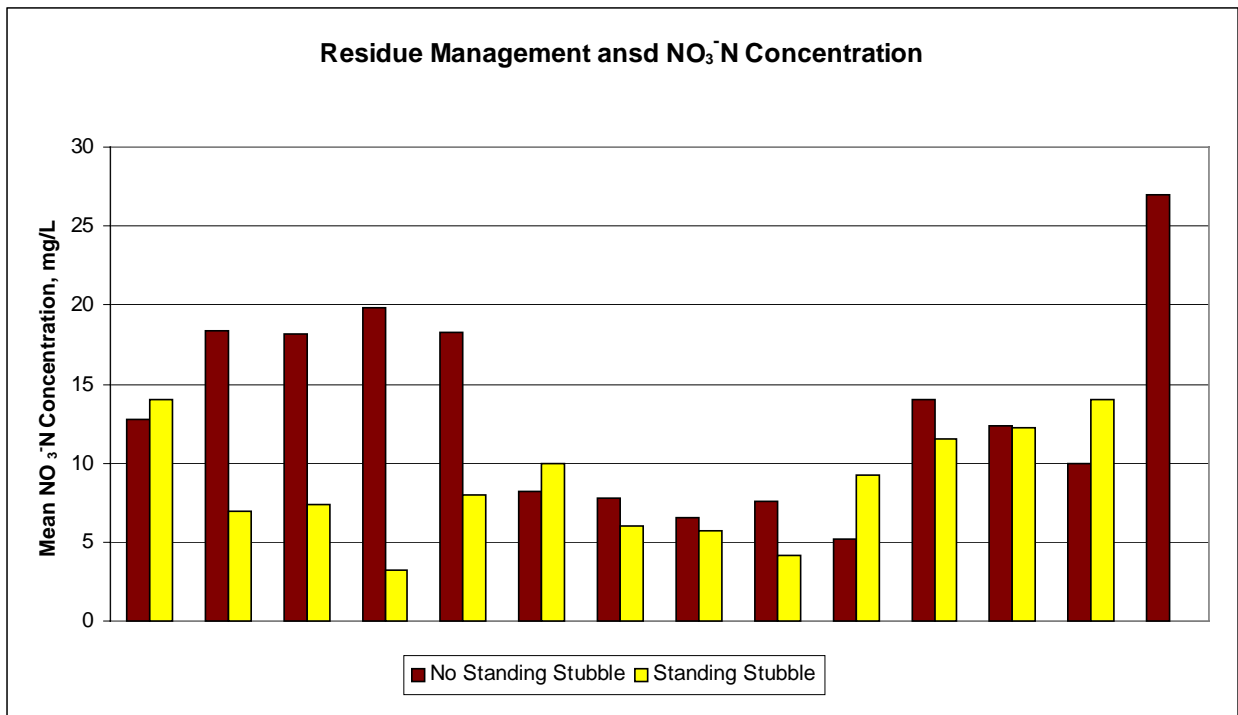


Table 2. The relationship between residue management and  $\text{NO}_3^-$ N concentration. Note the lower mean  $\text{NO}_3^-$ N concentration in fields with standing stubble.

### Nitrite.

During the sampling periods, Nitrite ( $\text{NO}_2^-$ ) appeared inconsistently at different sample periods and sample sites. When it was detected, it was at trace levels only. Because of the lack of  $\text{NO}_2^-$  in the groundwater, the little data that was obtained was not analyzed. See Appendix B for field data.

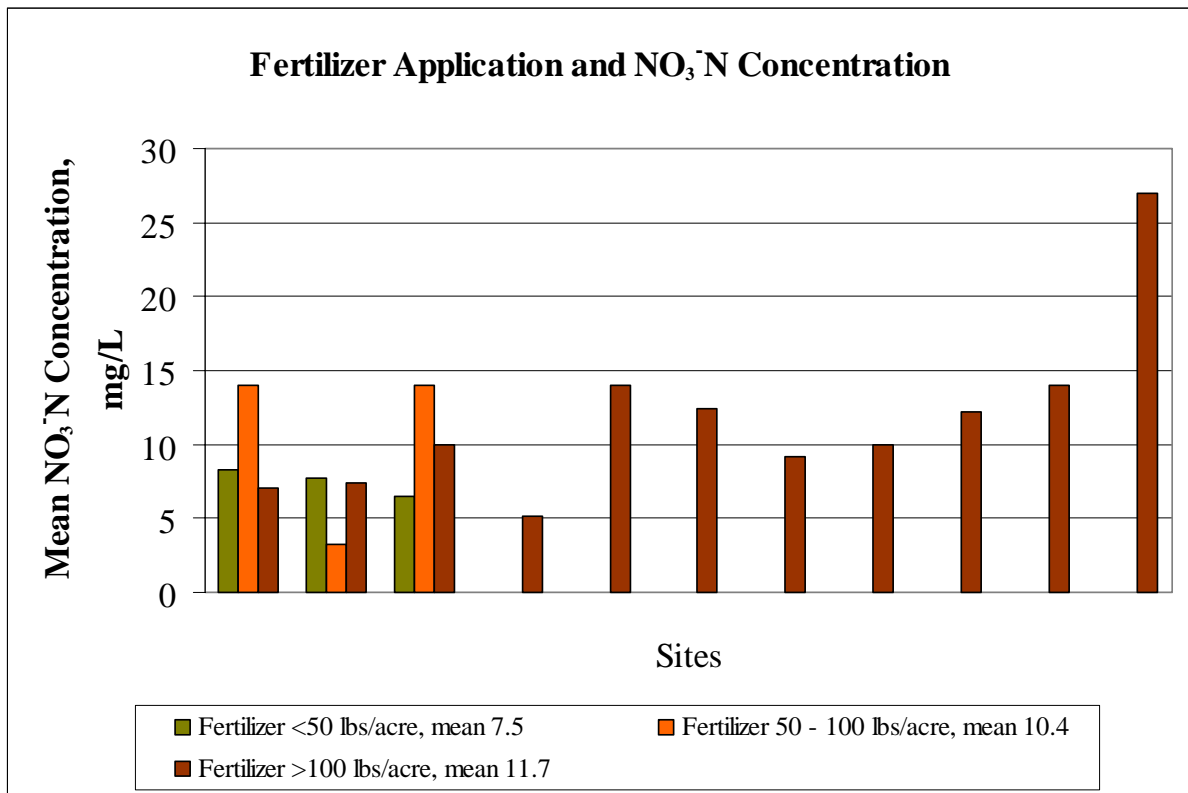


Table 3. Known fertilizer application rates and NO<sub>3</sub>-N concentration.

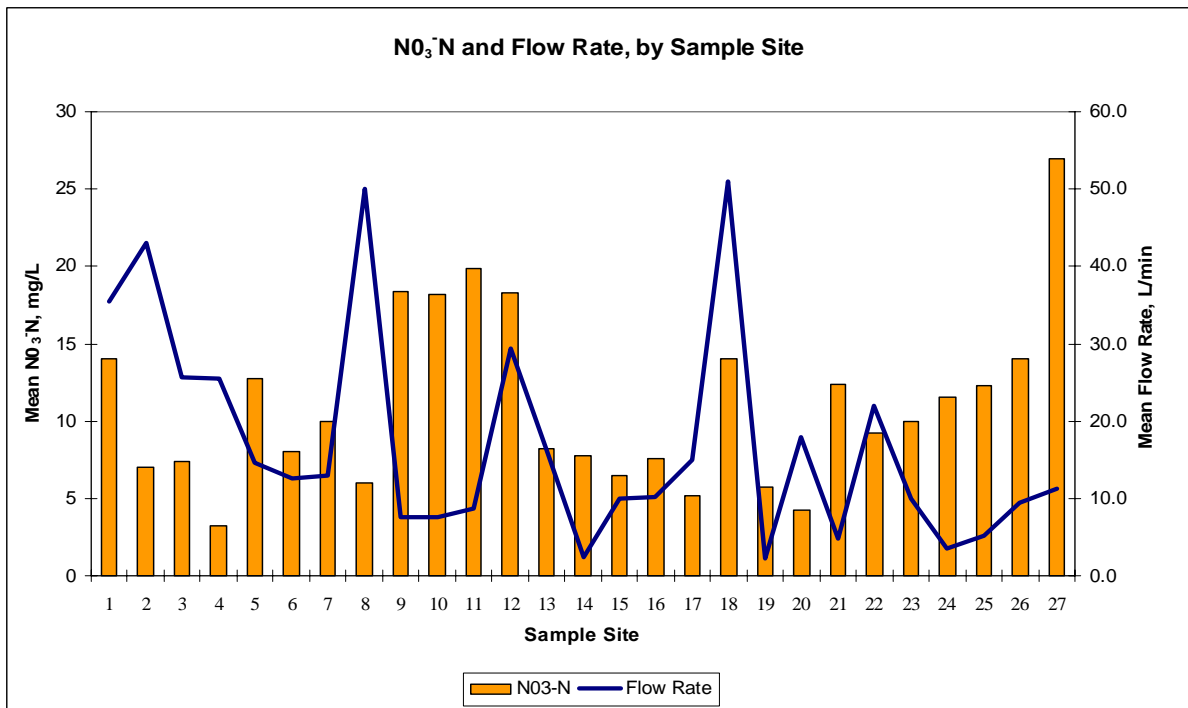


Table 4. Decreased flow rate tended to increase NO<sub>3</sub>-N concentration.

Like  $\text{NO}_2^-$ , Ammonia ( $\text{NH}_3$ ) was detected at trace levels only. Because the  $\text{NH}_3$  levels were negligible, this data was not analyzed. See Appendix B for field data.

**pH.**

The pH was slightly below neutral levels with an overall average of 6.5 (Table 5). The pH for the Palouse region ranges from 6.5 to 8.4, with 7.5 being the median (Crockett, 1995). The Cow Creek watershed pH is therefore slightly more acidic than the regional average.

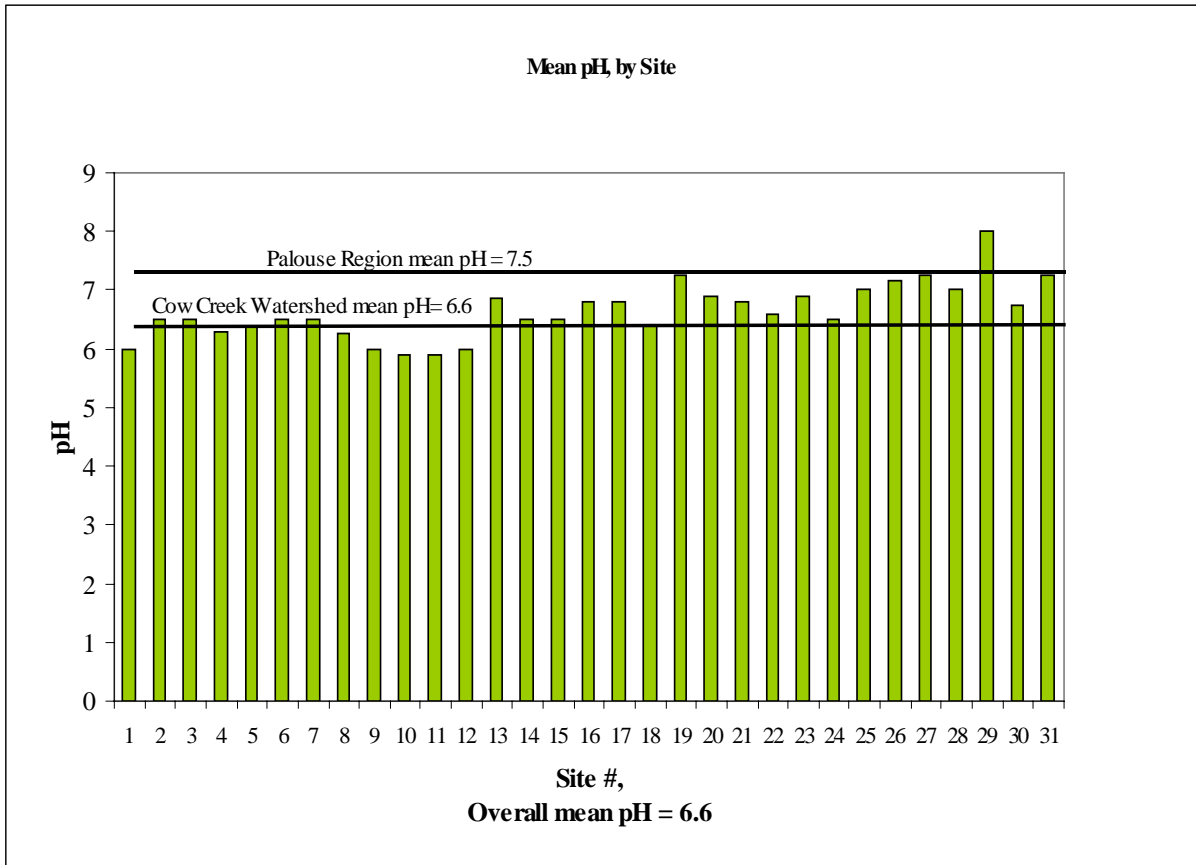


Table 5. Mean pH by site. Cow Creek Watershed mean pH is lower than the Palouse region mean pH.

**Electrical Conductivity (EC)**

The mean conductivity for this study was 205  $\mu\text{mhos}/\text{cm}^3$ , which converts to 131.2 mg/l Total Dissolved Solids (TDS). The presence of TDS indicates mineralization and ground water mineral content. The primary contributors to TDS are  $\text{Ca}^{+2}$ ,  $\text{Mg}^{+2}$ ,  $\text{Na}^+$ ,  $\text{K}^+$ ,  $\text{NO}_3^-$ ,  $\text{Cl}^-$ ,  $\text{F}^-$ ,  $\text{SO}_4^-$ , and  $\text{HCO}_3^-$  (Crockett, 1995). Drinking water standards of the U.S. Environmental Protection Agency (EPA) set the secondary maximum contaminant level for TDS at 500 mg/l (USEPA, 2002). Crockett (1995) reported that all TDS samples of the Idaho Palouse region were normally distributed and measured less than 500 mg/l. The TDS range was from 60mg/l to 260 mg/l, and the median was 192.5 mg/l. Therefore the TDS level in the Cow Creek watershed are below the regional average. Residue management had a significant impact on EC. An initial ANOVA test at the 95% confidence level ( $\alpha = .05$ ) between the

residue management EC means showed no significant difference between the means, despite the relatively high F value. However, when tested at the 90% confidence level ( $\alpha = .10$ ), there was a significant difference between the means (Table 6 and Appendix C, pg. 82). The fields with standing stubble had an EC mean of 176.9  $\mu\text{mhos}/\text{cm}^3$ , and the fields with no stubble had an EC mean of 253.7  $\mu\text{mhos}/\text{cm}^3$ . This translates to 113.2 mg/l TDS and 162.4 mg/l TDS respectively. From this, it can be inferred that not having standing stubble will increase the TDS levels in subsurface tile drain water.

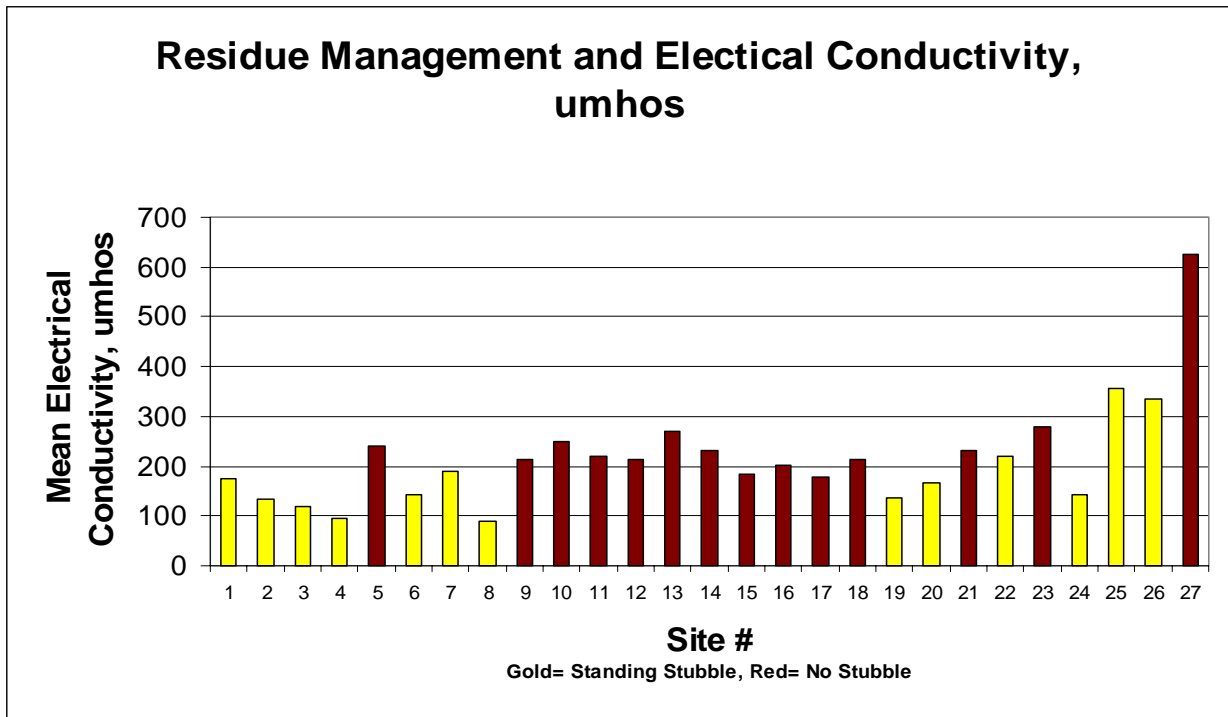


Table 6. Residue management affects on Electrical Conductivity.

## Conclusions

The primary objective of this study was to determine the nitrate concentrations in the groundwater represented by subsurface tile drain discharge. During the course of the study, other relevant and useful information was collected. The project was part of a continuing effort to characterize the groundwater of Cow Creek watershed. Because this study was not scientific research that could be replicated, few of the results are definite or conclusive. However, the results do make some strong suggestions, and some reasonable inferences can be made. These results also help to clarify understanding of the groundwater quality and nitrate contributions to surface water. Additional monitoring is needed to provide a more definite picture of tile drain water quality, especially as it relates to land-use management practices and fertilizer application rates and timing.

Elevated nitrate levels exist in the shallow groundwater of the subsurface tile drains. The study results showed an average of 10.6 mg/l for all the tile drains combined. This is higher than the Idaho Quality Ground Water Rule of 10 mg/l for groundwater. Sample site measurements ranged from below 5 mg/l to over 30 mg/l (see Appendix C).

NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> - mg/L	Total NO <sub>3</sub> - kg/day
10.6	0.24	47.8	1.1

Table 7. Overall means for nitrate-nitrogen and total nitrate contributions from the sampled subsurface tile drains to Cow Creek

There was a definite difference in the nitrate concentration from fields with standing stubble and fields with no standing stubble. Those fields with standing stubble had lower nitrate concentration levels. This infers that land use practices have a significant affect on the shallow groundwater quality that is discharged from subsurface tile drains. However, other investigations into land management practices did not yield any conclusive results, due to limited data. Fertilizer application rates in particular need more study to increase information to determine anthropomorphic nitrate contributions to drain tile water. This information could be used to determine fertilizer application rates and timing that would be optimal for both water quality and crop production. It would also be worthwhile to further study residue management and tillage practices in relation to nitrogen loading and water infiltration rates. In addition to land use practices, flow rates also affect the tile drain discharge nitrate concentration. Higher flow rates from the tile drains tended to have lower nitrate concentrations. Most importantly, a yearlong study of tile drain discharge would be needed to determine if the current high rates of nitrogen are due to seasonal precipitation and runoff events. Sampling during and after the growing season could hypothetically yield lower nitrate levels because of crop uptake and less seasonal precipitation. This yearlong monitoring would produce a better understanding of annual shallow groundwater nitrate trends.

The pH was slightly lower that Palouse region means, but it is not low enough to impair water quality. Electrical conductivity, used as an indirect measure of total dissolved solids in water, was lower in Cow Creek than is typical of the Palouse region.. It is of interest to note that EC was affected by residue management with stubble fields having lower TDS than



fields with no stubble. Further study linking land-use management practices with EC and TDS would be worthwhile.

The shallow groundwater quality represented by the discharge from subsurface tile drains is elevated for nitrate. The shallow groundwater quality is more impaired by nitrate than the deeper groundwater found in wells and springs (see Strausz, 2001), probably due to its increased susceptibility to land use practices.

## **Recommendations**

The following recommendations are based on the results of this study:

- Continue monitoring drain tile discharge to determine annual shallow groundwater nitrate trends.
- Determine the elevated levels of nitrate continue over the course of an entire growing season/year.
- Obtain accurate and extensive data of fertilizer application rates and timing to correlate fertilizer application to seasonal shallow groundwater nitrate levels.
- Determine fertilizer application rates and timing that would be optimal for both water quality and crop production.
- Study further the impacts of land-use practices such as tillage and residue management on subsurface tile drain water quality and flow rates.
- Promote tillage and residue management practices that leave standing stubble during winter periods.

This study was intended as a reconnaissance only of nitrates in subsurface tile drain water, improving the understanding of groundwater quality. It is to be used in conjunction with other studies previously done. Continued study of the Cow Creek watershed would further improve the understanding of the impact of land use on groundwater quality and lead to land management practices that could prove economically and ecologically beneficial to landowners and water users in the Cow Creek watershed.

## Literature Cited

- Barker, Raymond J., et al. 1981. *Soil Survey of Latah County Area, Idaho. United States Department of Agriculture.*
- Crockett, Janet. 1995. Idaho Statewide Ground Water Quality Monitoring Program – Summary of Results, 1991 through 1993. Idaho Department of Water Resources Water Information Bulletin No. 50 Part 2.
- Lawrence, William R. 1995. Hydrogeological assessment of the potential for future groundwater development in Genesee, Idaho. University of Idaho Manuscript Thesis.
- Omernik, James M., and Alisa L. Gallant, 1986. *Ecoregions of the Pacific Northwest.* United States Environmental Protection Agency.
- Ott, Lyman R. and Michael Longnecker. 2001. An Introduction to Statistical Methods and Data Analysis, 5<sup>th</sup> Ed. Wadsworth Group, Pacific Grove, CA.
- Pierce, Jack L. 1998. Geology and hydrogeology of the Moscow East and Robinson Lake quadrangles; Latah County, Idaho. University of Idaho Manuscript Thesis.
- Strausz, David. 2001. Ground Water Quality Technical Report No.18: A Reconnaissance of Groundwater Nitrate/Nitrite in the Cow Creek Watershed, Latah and Nez Perce County, Idaho. Vol. I of II. Idaho Department of Environmental Quality, Lewiston Regional Office.
- University of Idaho. 2003. University of Idaho Plant Science Farm precipitation information was obtained at [http://snow.ag.uidaho.edu/climate/select\\_mos.htm](http://snow.ag.uidaho.edu/climate/select_mos.htm)
- U.S. Environmental Protection Agency. 2002.  
[http://www.access.gpo.gov/nara/cfr/waisidx\\_02/40cfr143\\_02.html](http://www.access.gpo.gov/nara/cfr/waisidx_02/40cfr143_02.html) 04/16/2002.  
Title 40: Protection of Environment CHAPTER I - ENVIRONMENTAL PROTECTION AGENCY, PART 143--NATIONAL SECONDARY DRINKING WATER REGULATIONS, U.S. Environmental Protection Agency, Office of Groundwater and Drinking Water, Drinking Water Standards Division, Washington, D.C. p.614.
- Yaron, Dan, ed. 1981. Salinity in Irrigation and Water Resources. Marcel Dekker, Inc. New York and Basel, p. 24-25.

## **Appendix A**



**Ground Water Program  
Idaho Department of Environmental Quality (DEQ)**

***Lewiston Regional Office***

Dear Landowner,

With the support of the Cow Creek Watershed Advisory Group, DEQ is continuing the Cow Creek groundwater study that was initiated in the summer of 2001.

During the summer of 2001, the Lewiston Regional Office in cooperation with local landowners sampled 32 domestic drinking water wells, one municipal well, and five springs in the Cow Creek watershed. The objective of the study was to determine Cow Creek groundwater nitrate concentrations.

The majority of nitrate concentrations were below levels of concern. Of the 38 sample sites, 25 (66%) had nitrate concentrations below background concentrations of 2mg/l. However, the remaining 34% had elevated nitrate levels. In addition, four springs and one well had nitrate concentrations exceeding the Idaho Ground Water Quality Standard of 10mg/l.

The study objectives are to expand the knowledge of shallow ground water quality conditions, verify previous nitrate groundwater nitrate concentrations, and provide the landowners information for their use. This non-regulatory ground water study will focus on nitrate contribution from shallow ground water and constructed subsurface drainage ways.

We always request permission to access private property for water quality monitoring and request your project support. For this study, we would like to include constructed subsurface drainage ways that are on your property. There is no associated cost with the sampling of your constructed subsurface drainage, but your permission is certainly necessary. **Please return the enclosed permission request form as soon as possible. A postage-paid envelope has been provided for your convenience.**

If you do not own any subsurface drainage apparatus and believe you have received this letter in error, then please state this on the permission sheet and send it back to me. This will allow me to keep better records for the study. If you have any questions or concerns, contact me at Idaho DEQ, Lewiston, (208) 799- 4394 or by email at [ecrook@deq.state.id.us](mailto:ecrook@deq.state.id.us).

Thank you,  
Eric Crook  
Idaho Department of Environmental Quality  
Lewiston Regional Office

**Permission Request Form for DEQ Groundwater Study**

Dear Landowner: Please check one of the following options, then sign and fold this form and return it to us in the postage-paid envelope provided. Thank you.

\_\_\_\_\_ I grant permission for samples to be taken from my property.

\_\_\_\_\_ I grant permission for samples to be taken from my property, but only if I am contacted first.

\_\_\_\_\_ I do not grant permission for samples to be taken from my property.

Comments:

---

---

---

---

---

---

---

---

---

---

Signature: \_\_\_\_\_ Date: \_\_\_\_\_

Landowner X  
P.O. Box 1234  
Genesee, ID, 85555

If your address information is incorrect, please make the proper corrections.

## Appendix B





**Cow Creek Groundwater Study**  
**Spring 2003**  
**Sample Period 1**

Date: Feb 5- 6, 2003

UA = Information unavailable at this time

Site	Sample#	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day	NO <sub>2</sub> -N mg/L	NO <sub>2</sub> -N kg/day	Total NO <sub>2</sub> mg/L	Total NO <sub>2</sub> kg/day	NH <sub>3</sub> -N mg/L	NH <sub>3</sub> -N kg/day	Total NH <sub>3</sub> mg/L	Total NH <sub>3</sub> kg/day	pH	H <sub>2</sub> O Temp. °C	Conductivity
1	1	15	15	0.324	66	1.4256	0.04	0.000864	0.132	0.002851	0	0	0	0	6	5.5	
2	1	20	7	0.2016	30.8	0.88704	0.07	0.002016	0.231	0.006653	0	0	0	0	6.5	6	
3	1	10	9	0.1296	39.6	0.57024	0.03	0.000432	0.099	0.001426	0	0	0	0	6.5	5	
4	1	7.5	4	0.0432	17.6	0.19008	0.02	0.000216	0.066	0.000713	0	0	0	0	6.5	4.5	
5		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
6		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
7		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
8		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
9	1	7.5	18	0.1944	79.2	0.85536	0.34	0.003672	1.122	0.012118	0	0	0	0	6	6	UA
10	1	7.5	18	0.1944	79.2	0.85536	0	0	0	0	0	0	0	0	6	6	UA
11	1	7.5	23	0.2484	101.2	1.09296	0.05	0.00054	0.165	0.001782	0	0	0	0	6	5	UA
12		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
13		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
14		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
15		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
16	1	7.5	7	0.0756	30.8	0.33264	0	0	0	0	0	0	0	0	UA	UA	UA
17	1	15	5	0.108	22	0.4752	0	0	0	0	0	0	0	0	7	6.5	UA
18	1	20	11	0.3168	48.4	1.39392	0.03	0.000864	0.099	0.002851	0	0	0	0	6.5	6	UA
19	1	3	7	0.03024	30.8	0.133056	0	0	0	0	0	0	0	0	7	6	UA
20	1	15	5	0.108	22	0.4752	0	0	0	0	0	0	0	0	7	6	UA
21	1	5	11	0.0792	48.4	0.34848	0.11	0.000792	0.363	0.002614	0	0	0	0	6.5	6.5	UA
22	1	20	10	0.288	44	1.2672	0.2	0.00576	0.66	0.019008	0	0	0	0	6.5	7.5	UA
23	1	15	8	0.1728	35.2	0.76032	0	0	0	0	0	0	0	0	7	6	UA
24		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
25		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
26		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
27		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
28		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
29		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
30		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA
31		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA

## Cow Creek Groundwater Study Spring 2003 Sample Period 2

Date: Feb. 18 - 19

UA = Information unavailable at this time

Site	Sample#	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day	NO <sub>2</sub> -N mg/L	NO <sub>2</sub> -N kg/day	Total NO <sub>2</sub> mg/L	Total NO <sub>2</sub> kg/day	NH <sub>3</sub> -N mg/L	NH <sub>3</sub> -N kg/day	Total NH <sub>3</sub> mg/L	Total NH <sub>3</sub> kg/day	pH	H <sub>2</sub> O Temp. °C	Conduc- tivity	Comments
1	2	15	11	0.2376	48.4	1.04544	0	0	0	0	0.4	0.00864	0.48	0.010368	6	6	UA	NO3-N at Moser artesian well at sister's house, red roof, cow pasture: 0 ppm
2	2	20	8	0.2304	35.2	1.01376	0.05	0.00144	0.165	0.004752	0	0	0	0	6.5	6	UA	
3	2	15	9	0.1944	39.6	0.85536	0.08	0.001728	0.264	0.005702	0.3	0.00648	0.36	0.007776	6.5	5	UA	
4	2	15	2	0.0432	8.8	0.19008	0	0	0	0	0.4	0.00864	0.48	0.010368	6	4	UA	
5	1	2	13	0.03744	57.2	0.164736	0	0	0	0	0	0	0	0	6.5	5.5	UA	
6		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
7		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
8		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
9	2	7.5	20	0.216	88	0.9504	0	0	0	0	0	0	0	0	6	5	UA	
10	2	7.5	23	0.2484	101.2	1.09296	0	0	0	0	0	0	0	0	6	5.5	UA	
11	2	7.5	19	0.2052	83.6	0.90288	0	0	0	0	0	0	0	0	5.5	5	UA	
12	1	7.5	17	0.1836	74.8	0.80784	0	0	0	0	0.4	0.00432	0.48	0.005184	6	5	UA	
13	1	7.5	8	0.0864	35.2	0.38016	0	0	0	0	0	0	0	0	7	5.5	UA	
14	1	0.2	7	0.00202	30.8	0.00887	0	0	0	0	0.4	0.00012	0.48	0.000138	6.5	5	UA	
15		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
16	2	6	6	0.05184	26.4	0.228096	0.02	0.000173	0.066	0.00057	0	0	0	0	7	6.5	UA	
17	2	10	5	0.072	22	0.3168	0	0	0	0	0	0	0	0	7	6	UA	
18	2	25	14	0.504	61.6	2.2176	0	0	0	0	0	0	0	0	6.5	6	UA	
19	2	2.5	6	0.0216	26.4	0.09504	0	0	0	0	0.1	0.00036	0.12	0.000432	7	7	UA	
20	2	20	4	0.1152	17.6	0.50688	0	0	0	0	0	0	0	0	7	6.5	UA	
21	2	6	10	0.0864	44	0.38016	0	0	0	0	0.3	0.00259	0.36	0.00311	6.5	6	UA	
22	2	25	10	0.36	44	1.584	0	0	0	0	0.4	0.0144	0.48	0.01728	6.5	7	UA	
23	2	6	8	0.06912	35.2	0.304128	0	0	0	0	0	0	0	0	6.5	7	UA	
24		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
25	1	4	12	0.06912	52.8	0.304128	0	0	0	0	0.6	0.00346	0.72	0.004147	7.5	7	UA	
26	1	0	0	0	0	0	0	0	0	0	0	0	0	0			UA	
27		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
28		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
29		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
30		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
31		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	

# Cow Creek Groundwater Study

## Spring 2003

### Sample Period 3

Date: March 2-3, 2003      UA = Information unavailable at this time

Site	Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day	NO <sub>2</sub> -N mg/L	NO <sub>2</sub> -N kg/day	Total NO <sub>2</sub> mg/L	Total NO <sub>2</sub> kg/day	NH <sub>3</sub> -N mg/L	NH <sub>3</sub> -N kg/day	Total NH <sub>3</sub> mg/L	Total NH <sub>3</sub> kg/day	pH	H <sub>2</sub> O Temp.	Conduc-tivity	Comments
1	3	7.5	15	0.162	66	0.7128	0.05	0.00054	0.165	0.001782	0.2	0.00216	0.24	0.002592	6	5	UA	* broken thermometer after Site #11 Moser well
2	3	15	7	0.1512	30.8	0.66528	0	0	0	0	0.2	0.00432	0.24	0.005184	6.5	5.5	UA	
3	3	3.75	6	0.0324	26.4	0.14256	0	0	0	0	0	0	0	0	7	4.5	UA	
4	3	5	6	0.0432	26.4	0.19008	0	0	0	0	0.2	0.00144	0.24	0.001728	6	4	UA	
5	2	6	10	0.0864	44	0.38016	0	0	0	0	0.1	0.000864	0.12	0.001037	6.5	5.5	UA	
6		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
7	1	3.75	11	0.0594	48.4	0.26136	0	0	0	0	0	0	0	0	6.5	5	UA	
8		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
9	3	3.75	17	0.0918	74.8	0.40392	0	0	0	0	0.3	0.00162	0.36	0.001944	6	5	UA	
10	3	3.75	20	0.108	88	0.4752	0	0	0	0	0.3	0.00162	0.36	0.001944	6	4	UA	
11	3	3.75	16	0.0864	70.4	0.38016	0	0	0	0	0.2	0.00162	0.36	0.001944	6	4.5	UA	
12	2	10	19	0.2736	83.6	1.20384	0	0	0	0	0.1	0.00288	0.24	0.003456	6.5	*	UA	
13	2	7.5	8	0.0864	35.2	0.38016	0	0	0	0	0.2	0.00108	0.12	0.001296	7	*	UA	
14	2	0.2	5	0.00144	22	0.006336	0	0	0	0	0.3	5.76E-05	0.24	6.91E-05	6.5	*	UA	
15	2	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
16	3	7.5	9	0.0972	39.6	0.42768	0	0	0	0	0.3	0.00324	0.36	0.003888	7	*	UA	
17	3	15	5	0.108	22	0.4752	0	0	0	0	0.2	0.00648	0.36	0.007776	6.5	*	UA	
18	3	30	13	0.5616	57.2	2.47104	0	0	0	0	0.3	0.00864	0.24	0.010368	6.5	*	UA	
19	3	0	0	0	0	0	0	0	0	0	0	0	0.36	0	UA	UA	UA	
20	3	15	6	0.1296	26.4	0.57024	0	0	0	0	0.4	0	0	0	6.5	*	UA	
21	3	3	13	0.05616	57.2	0.247104	0	0	0	0	0.3	0.001728	0.48	0.002074	7	*	UA	
22	3	15	8	0.1728	35.2	0.76032	0	0	0	0	0.5	0.00648	0.36	0.007776	6.5	*	UA	
23	3	7.5	6	0.0648	26.4	0.28512	0	0	0	0	0.3	0.0054	0.6	0.00648	6.5	*	UA	
24		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
25	2	3	10	0.0432	44	0.19008	0	0	0	0	0.4	0.001728	0.48	0.002074	7	*	UA	
26	2	3	16	0.06912	70.4	0.304128	0	0	0	0	0.4	0.001728	0.48	0.002074	7.5	*	UA	
27		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
28		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
29		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
30		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	
31		UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	UA	

# Cow Creek Groundwater Study

## Spring 2003

### Sample Period 4

Date: March 14-15, 2003

UA = Information unavailable at this time

Site	Sample#	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day	NO <sub>2</sub> -N mg/L	NO <sub>2</sub> -N kg/day	Total NO <sub>2</sub> mg/L	Total NO <sub>2</sub> kg/day	NH <sub>3</sub> -N mg/L	NH <sub>3</sub> -N kg/day	Total NH <sub>3</sub> mg/L	Total NH <sub>3</sub> kg/day	pH	H <sub>2</sub> O Temp.	Conductivity umhos	Comments
1	4	40	19	1.0944	83.6	4.81536	0	0	0	0	0.3	0.01728	0.000473	7.45E-07	6	5.5	225	Moser's Artesian spring NO <sub>3</sub> -N: O ppm
2	4	40	7	0.4032	30.8	1.77408	0	0	0	0	0.2	0.01152	0.000116	6.74E-08	6.5	5	145	
3	4	40	8	0.4608	35.2	2.02752	0	0	0	0	0.4	0.02304	0.000265	1.76E-07	6.5	6	140	
4	4	40	2	0.1152	8.8	0.50688	0	0	0	0	0.3	0.01728	4.98E-05	8.26E-09	6.5	5	110	
5	3	35	16	0.8064	70.4	3.54816	0	0	0	0	0.2	0.01008	0.000232	2.7E-07	6.5	6.5	240	
6	1	10	11	0.1584	48.4	0.69696	0	0	0	0	0.2	0.00288	4.56E-05	1.04E-08	6.5	5	145	
7	2	15	11	0.2376	48.4	1.04544	0	0	0	0	0.2	0.00432	6.84E-05	2.34E-08	6.5	5	190	
8	1	40	7	0.4032	30.8	1.77408	0	0	0	0	0.2	0.01152	0.000116	6.74E-08	6.5	6	140	
9	4	12	20	0.3456	88	1.52064	0	0	0	0	0.2	0.003456	9.95E-05	4.95E-08	6	4	290	
10	4	12	18	0.31104	79.2	1.368576	0	0	0	0	0.2	0.003456	8.96E-05	4.01E-08	5.5	5.5	290	
11	4	15	25	0.54	110	2.376	0	0	0	0	0.2	0.00432	0.000156	1.21E-07	6	3	240	
12	3	60	23	1.9872	101.2	8.74368	0	0	0	0	0	0	0	0	5.5	6	180	
13	4	35	11	0.5544	48.4	2.43336	0	0	0	0	0.3	0.01512	0.00024	1.91E-07	6.5	5	290	
14	4	3	13	0.05616	57.2	0.247104	0	0	0	0	0.3	0.001296	2.43E-05	1.96E-09	6.5	5	260	
15	1	5	9	0.0648	39.6	0.28512	0	0	0	0	0.2	0.00144	1.87E-05	1.74E-09	6.5	5	210	
16	4	15	8	0.1728	35.2	0.76032	0	0	0	0	0.4	0.00864	9.95E-05	2.48E-08	6.5	6	190	
17	4	15	6	0.1296	26.4	0.57024	0	0	0	0	0	0	0	0	7	5	175	
18	4	60	19	1.6416	83.6	7.22304	0	0	0	0	0.3	0.02592	0.000709	1.68E-06	6	5	210	
19	4	3	5	0.0216	22	0.09504	0	0	0	0	0.2	0.000864	6.22E-06	1.93E-10	7.5	6	150	
20	4	20	2	0.0576	8.8	0.25344	0	0	0	0	2.5	0.072	0.000207	1.72E-08	7	6	150	
21	4	5	17	0.1224	74.8	0.53856	0.03	0.00022	0.099	0.000713	0.3	0.00216	5.29E-05	9.32E-09	7	5.5	255	
22	4	30	8	0.3456	35.2	1.52064	0.07	0.00302	0.231	0.009979	0.3	0.01296	0.000149	7.43E-08	7	6	215	
23	4	15	15	0.324	66	1.4256	0	0	0	0	0.2	0.00432	9.33E-05	4.35E-08	7.5	6	275	
24	1	3	12	0.05184	52.8	0.228096	0	0	0	0	0.2	0.000864	1.49E-05	1.11E-09	6.5	7	150	
25	3	8	14	0.16128	61.6	0.709632	0	0	0	0	0.4	0.004608	9.29E-05	2.16E-08	7	7	300	
26	3	10	14	0.2016	61.6	0.88704	0	0	0	0	0.4	0.00576	0.000116	3.37E-08	7	7	310	
27	1	15	34	0.7344	149.6	3.23136	0.34	0.00734	1.122	0.024235	0.6	0.01296	0.000635	6.71E-07	7.5	6	600	
28	1	UA	8				0				0.2				7	9	100	
29	1	UA	7				0				0.2				6.5	8.5	160	
30	1	UA	10				0				0.4				7.5	8.5	200	
31	1	UA	10				0.04				0.4				7	8	150	

# Cow Creek Groundwater Study

## Spring 2003

### Sample Period 5

Date: March 26 - 27, 2003 UA = Information unavailable at this time

Site	Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day	NO <sub>2</sub> -N mg/L	NO <sub>2</sub> -N kg/day	Total NO <sub>2</sub> mg/L	Total NO <sub>2</sub> kg/day	NH <sub>3</sub> -N mg/L	NH <sub>3</sub> -N kg/day	Total NH <sub>3</sub> mg/L	Total NH <sub>3</sub> kg/day	pH	H <sub>2</sub> O Temp.	Conductivity umhos	Comments
1	5	100	10	1.44	44	6.336	0.01	0.00144	0.033	0.004752	0.9	0.1296	1.08	0.15552	6	6	125	Moser Well: 0 mg/L NO <sub>3</sub> -N
2	5	120	6	1.0368	26.4	4.56192	0	0	0	0	0.2	0.03456	0.24	0.041472	6.5	6	120	
3	5	60	5	0.432	22	1.9008	0	0	0	0	0.6	0.05184	0.72	0.062208	6	6.5	100	
4	5	60	2	0.1728	8.8	0.76032	0	0	0	0	0.4	0.03456	0.48	0.041472	6.5	6.5	80	
5	4	15	12	0.2592	52.8	1.14048	0	0	0	0	0.4	0.00864	0.48	0.010368	6	7	240	
6	2	15	5	0.108	22	0.4752	0	0	0	0	0.3	0.00648	0.36	0.007776	6.5	9	140	
7	3	20	8	0.2304	35.2	1.01376	0	0	0	0	1.6	0.04608	1.92	0.055296	7	8	160	
8	2	60	5	0.432	22	1.9008	0	0	0	0	0.5	0.0432	0.6	0.05184	6	8	40	
9	5	7.5	17	0.1836	74.8	0.80784	0	0	0	0	0.3	0.00324	0.36	0.003888	6	6.5	135	
10	5	7.5	12	0.1296	52.8	0.57024	0	0	0	0	0	0	0	0	6	6	210	
11	5	10	16	0.2304	70.4	1.01376	0	0	0	0	0.2	0.00288	0.24	0.003456	6	6	200	
12	4	40	14	0.8064	61.6	3.54816	0	0	0	0	0.3	0.01728	0.36	0.020736	6	7	250	
13	4	15	6	0.1296	26.4	0.57024	0	0	0	0	0.2	0.00432	0.24	0.005184	7	6	250	
14	4	6	6	0.05184	26.4	0.228096	0	0	0	0	0.3	0.002592	0.36	0.00311	6.5	6	205	
15	2	15	4	0.0864	17.6	0.38016	0	0	0	0	0.4	0.00864	0.48	0.010368	6.5	6	160	
16	5	15	7	0.1512	30.8	0.66528	0	0	0	0	0.2	0.00432	0.24	0.005184	7	8	215	
17	5	20	5	0.144	22	0.6336	0	0	0	0	0.2	0.00576	0.24	0.006912	6.5	6.5	180	
18	5	120	13	2.2464	57.2	9.88416	0	0	0	0	0.2	0.03456	0.24	0.041472	6.5	5	215	
19	5	0.25	5	0.0018	22	0.00792	0	0	0	0	0.2	0.000072	0.24	8.64E-05	7.5	7.5	120	
20	5	20	4	0.1152	17.6	0.50688	0	0	0	0	0.3	0.00864	0.36	0.010368	7	7	185	
21	5	5	11	0.0792	48.4	0.34848	0	0	0	0	0.4	0.00288	0.48	0.003456	7	7	210	
22	5	20	10	0.288	44	1.2672	0.06	0.00173	0.198	0.005702	0.4	0.01152	0.48	0.013824	6.5	8	225	
23	5	6	13	0.11232	57.2	0.494208	0	0	0	0	0.2	0.001728	0.24	0.002074	7	8	280	
24	2	4	11	0.06336	48.4	0.278784	0	0	0	0	0.2	0.001152	0.24	0.001382	6.5	10	135	
25	4	6	13	0.11232	57.2	0.494208	0	0	0	0	0.3	0.002592	0.36	0.00311	6.5	9	410	
26	4	15	12	0.2592	52.8	1.14048	0	0	0	0	0.4	0.00864	0.48	0.010368	7	9	360	
27	2	7.5	20	0.216	88	0.9504	0	0	0	0	0.5	0.0054	0.6	0.00648	7	9.5	650	
28	2	UA	3								0.5				7	7	90	
29	2	UA	6								0.4				9.5	12	50	
30	2	UA	6								0.4				6	10	120	
31	2	UA	6								0.3				7.5	8.5	160	



## Appendix C





## Descriptive Statistics Overall Summary

Flow Rate L/min		NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L		Total NO <sub>3</sub> kg/day	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	16.3429	Mean	10.65647	Mean	0.243396	Mean	47.85151	Mean	1.070942
Standard Error	4.041118	Standard Error	0.587923	Standard Error	0.061332	Standard Error	2.68891	Standard Error	0.269861
Median	11.7	Median	10.6	Median	0.167616	Median	46.64	Median	0.73751
Standard Deviation	9.036216	Standard Deviation	1.314636	Standard Deviation	0.137143	Standard Deviation	6.012586	Standard Deviation	0.603428
Sample Variance	81.65319	Sample Variance	1.728268	Sample Variance	0.018808	Sample Variance	36.15119	Sample Variance	0.364126
Range	21.20476	Range	3.709677	Range	0.307707	Range	16.45926	Range	1.353909
Minimum	8.045238	Minimum	8.83871	Minimum	0.11832	Minimum	41.22963	Minimum	0.520608
Maximum	29.25	Maximum	12.54839	Maximum	0.426027	Maximum	57.68889	Maximum	1.874517
Sum	81.7145	Sum	53.28233	Sum	1.216979	Sum	239.2576	Sum	5.35471
Count	5	Count	5	Count	5	Count	5	Count	5
Largest(1)	29.25	Largest(1)	12.54839	Largest(1)	0.426027	Largest(1)	57.68889	Largest(1)	1.874517
Smallest(1)	8.045238	Smallest(1)	8.83871	Smallest(1)	0.11832	Smallest(1)	41.22963	Smallest(1)	0.520608
Confidence Level(95.0%)	11.21997	Confidence Level(95.0%)	1.63234	Confidence Level(95.0%)	0.170286	Confidence Level(95.0%)	7.465627	Confidence Level(95.0%)	0.749257

pH		H <sub>2</sub> O Temp. °C		Conductivity	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	6.563029	Mean	5.968297	TDS mg/L	131.4581
Standard Error	0.031757	Standard Error	0.418487	Mean	205.4032
Median	6.547619	Median	5.9	Standard Error	10.24194
Standard Deviation	0.07101	Standard Deviation	0.935766	Median	205.4032
Sample Variance	0.005042	Sample Variance	0.875658	Standard Deviation	14.48428
Range	0.151828	Range	2.625448	Sample Variance	209.7945
Minimum	6.493333	Minimum	4.777778	Range	20.48387
Maximum	6.645161	Maximum	7.403226	Minimum	195.1613
Sum	32.81515	Sum	29.84149	Maximum	215.6452
Count	5	Count	5	Sum	410.8065
Largest(1)	6.645161	Largest(1)	7.403226	Count	2
Smallest(1)	6.493333	Smallest(1)	4.777778	Largest(1)	215.6452
Confidence Level(95.0%)	0.088171	Confidence Level(95.0%)	1.161909	Smallest(1)	195.1613
				Confidence Level(95.0%)	130.1356

## Descriptive Statistics Sample Period 1

Flow Rate L/min		NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L		Total NO <sub>3</sub> kg/day	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	11.7	Mean	10.53333	Mean	0.167616	Mean	46.34667	Mean	0.73751
Standard Error	1.483079	Standard Error	1.443761	Standard Error	0.024836	Standard Error	6.352546	Standard Error	0.109279
Median	10	Median	9	Median	0.1728	Median	39.6	Median	0.76032
Standard Deviation	5.743941	Standard Deviation	5.59166	Standard Deviation	0.09619	Standard Deviation	24.60331	Standard Deviation	0.423237
Sample Variance	32.99286	Sample Variance	31.26667	Sample Variance	0.009253	Sample Variance	605.3227	Sample Variance	0.17913
Range	17	Range	19	Range	0.29376	Range	83.6	Range	1.292544
Minimum	3	Minimum	4	Minimum	0.03024	Minimum	17.6	Minimum	0.133056
Maximum	20	Maximum	23	Maximum	0.324	Maximum	101.2	Maximum	1.4256
Sum	175.5	Sum	158	Sum	2.51424	Sum	695.2	Sum	11.06266
Count	15	Count	15	Count	15	Count	15	Count	15
Largest(1)	20	Largest(1)	23	Largest(1)	0.324	Largest(1)	101.2	Largest(1)	1.4256
Smallest(1)	3	Smallest(1)	4	Smallest(1)	0.03024	Smallest(1)	17.6	Smallest(1)	0.133056
Confidence Level(95.0%)	3.180891	Confidence Level(95.0%)	3.096561	Confidence Level(95.0%)	0.053268	Confidence Level(95.0%)	13.62487	Confidence Level(95.0%)	0.234381

pH		H <sub>2</sub> O Temp. °C	
<i>Column1</i>		<i>Column1</i>	
Mean	6.493333	Mean	5.9
Standard Error	0.097817	Standard Error	0.1838737
Median	6.5	Median	6
Standard Deviation	0.378845	Standard Deviation	0.7121396
Sample Variance	0.143524	Sample Variance	0.5071429
Range	1	Range	3
Minimum	6	Minimum	4.5
Maximum	7	Maximum	7.5
Sum	97.4	Sum	88.5
Count	15	Count	15
Largest(1)	7	Largest(1)	7.5
Smallest(1)	6	Smallest(1)	4.5
Confidence Level(95.0%)	0.209798	Confidence Level(95.0%)	0.3943701

## Descriptive Statistics Sample Period 2

Flow Rate L/min		NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L		Total NO <sub>3</sub> kg/day	
Column1		Column1		Column1		Column1		Column1	
Mean	10.46	Mean	10.6	Mean	0.151697	Mean	46.64	Mean	0.667466
Standard Error	1.664101	Standard Error	1.257399	Standard Error	0.028296	Standard Error	5.532556	Standard Error	0.124501
Median	7.5	Median	9.5	Median	0.1008	Median	41.8	Median	0.44352
Standard Deviation	7.442085	Standard Deviation	5.62326	Standard Deviation	0.126543	Standard Deviation	24.74234	Standard Deviation	0.556787
Sample Variance	55.38463	Sample Variance	31.62105	Sample Variance	0.016013	Sample Variance	612.1836	Sample Variance	0.310012
Range	24.8	Range	21	Range	0.501984	Range	92.4	Range	2.20873
Minimum	0.2	Minimum	2	Minimum	0.002016	Minimum	8.8	Minimum	0.00887
Maximum	25	Maximum	23	Maximum	0.504	Maximum	101.2	Maximum	2.2176
Sum	209.2	Sum	212	Sum	3.033936	Sum	932.8	Sum	13.34932
Count	20	Count	20	Count	20	Count	20	Count	20
Largest(1)	25	Largest(1)	23	Largest(1)	0.504	Largest(1)	101.2	Largest(1)	2.2176
Smallest(1)	0.2	Smallest(1)	2	Smallest(1)	0.002016	Smallest(1)	8.8	Smallest(1)	0.00887
Confidence Level(95.0%)	3.483004	Confidence Level(95.0%)	2.631767	Confidence Level(95.0%)	0.059224	Confidence Level(95.0%)	11.57978	Confidence Level(95.0%)	0.260585

pH		H <sub>2</sub> O Temp. °C	
Column1		Column1	
Mean	6.5	Mean	5.825
Standard Error	0.10882	Standard Error	0.1894417
Median	6.5	Median	6
Standard Deviation	0.48666	Standard Deviation	0.847209
Sample Variance	0.23684	Sample Variance	0.7177632
Range	2	Range	3
Minimum	5.5	Minimum	4
Maximum	7.5	Maximum	7
Sum	130	Sum	116.5
Count	20	Count	20
Largest(1)	7.5	Largest(1)	7
Smallest(1)	5.5	Smallest(1)	4
Confidence Level(95.0%)	0.22777	Confidence Level(95.0%)	0.3965062

## Descriptive Statistics Sample Period 3

Flow Rate L/min		NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L		Total NO <sub>3</sub> kg/day	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	8.045238	Mean	10.7619	Mean	0.11832	Mean	47.35238	Mean	0.520608
Standard Error	1.483328	Standard Error	1.053124	Standard Error	0.025638	Standard Error	4.633746	Standard Error	0.112806
Median	6	Median	10	Median	0.0864	Median	44	Median	0.38016
Standard Deviation	6.797461	Standard Deviation	4.826021	Standard Deviation	0.117487	Standard Deviation	21.23449	Standard Deviation	0.516941
Sample Variance	46.20548	Sample Variance	23.29048	Sample Variance	0.013803	Sample Variance	450.9036	Sample Variance	0.267228
Range	29.8	Range	15	Range	0.56016	Range	66	Range	2.464704
Minimum	0.2	Minimum	5	Minimum	0.00144	Minimum	22	Minimum	0.006336
Maximum	30	Maximum	20	Maximum	0.5616	Maximum	88	Maximum	2.47104
Sum	168.95	Sum	226	Sum	2.48472	Sum	994.4	Sum	10.93277
Count	21	Count	21	Count	21	Count	21	Count	21
Largest(1)	30	Largest(1)	20	Largest(1)	0.5616	Largest(1)	88	Largest(1)	2.47104
Smallest(1)	0.2	Smallest(1)	5	Smallest(1)	0.00144	Smallest(1)	22	Smallest(1)	0.006336
Confidence Level(95.0%)	3.094166	Confidence Level(95.0%)	2.196777	Confidence Level(95.0%)	0.053479	Confidence Level(95.0%)	9.66582	Confidence Level(95.0%)	0.235309

pH		H <sub>2</sub> O Temp.	
<i>Column1</i>		<i>Column1</i>	
Mean	6.547619	Mean	4.7777778
Standard Error	0.090664	Standard Error	0.1883981
Median	6.5	Median	5
Standard Deviation	0.4154745	Standard Deviation	0.5651942
Sample Variance	0.172619	Sample Variance	0.3194444
Range	1.5	Range	1.5
Minimum	6	Minimum	4
Maximum	7.5	Maximum	5.5
Sum	137.5	Sum	43
Count	21	Count	9
Largest(1)	7.5	Largest(1)	5.5
Smallest(1)	6	Smallest(1)	4
Confidence Level(95.0%)	0.1891216	Confidence Level(95.0%)	0.434447

## Descriptive Statistics Sample Period 4

Flow Rate L/min		NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L		Total NO <sub>3</sub> kg/day	
Column1		Column1		Column1		Column1		Column1	
Mean	22.25926	Mean	12.54839	Mean	0.426027	Mean	57.68889	Mean	1.874517
Standard Error	3.279737	Standard Error	1.255387	Standard Error	0.092023	Standard Error	6.197374	Standard Error	0.4049
Median	15	Median	11	Median	0.31104	Median	52.8	Median	1.368576
Standard Deviation	17.04201	Standard Deviation	6.989701	Standard Deviation	0.478164	Standard Deviation	32.2025	Standard Deviation	2.10392
Sample Variance	290.4302	Sample Variance	48.85591	Sample Variance	0.228641	Sample Variance	1037.001	Sample Variance	4.42648
Range	57	Range	32	Range	1.9656	Range	140.8	Range	8.64864
Minimum	3	Minimum	2	Minimum	0.0216	Minimum	8.8	Minimum	0.09504
Maximum	60	Maximum	34	Maximum	1.9872	Maximum	149.6	Maximum	8.74368
Sum	601	Sum	389	Sum	11.50272	Sum	1557.6	Sum	50.61197
Count	27	Count	31	Count	27	Count	27	Count	27
Largest(1)	60	Largest(1)	34	Largest(1)	1.9872	Largest(1)	149.6	Largest(1)	8.74368
Smallest(1)	3	Smallest(1)	2	Smallest(1)	0.0216	Smallest(1)	8.8	Smallest(1)	0.09504
Confidence Level(95.0%)	6.7416	Confidence Level(95.0%)	2.56384	Confidence Level(95.0%)	0.189155	Confidence Level(95.0%)	12.73889	Confidence Level(95.0%)	0.832284

pH		H <sub>2</sub> O Temp.		Conductivity umhos	
Column1		Column1		Column1	
Mean	6.62903	Mean	5.935484	TDS mg/L	138.0129
Standard Error	0.09551	Standard Error	0.235027	Mean	215.6452
Median	6.5	Median	6	Standard Error	16.70384
Standard Deviation	0.53179	Standard Deviation	1.308574	Median	200
Sample Variance	0.2828	Sample Variance	1.712366	Standard Deviation	93.00306
Range	2	Range	6	Sample Variance	8649.57
Minimum	5.5	Minimum	3	Range	500
Maximum	7.5	Maximum	9	Minimum	100
Sum	205.5	Sum	184	Maximum	600
Count	31	Count	31	Sum	6685
Largest(1)	7.5	Largest(1)	9	Count	31
Smallest(1)	5.5	Smallest(1)	3	Largest(1)	600
Confidence Level(95.0%)	0.19506	Confidence Level(95.0%)	0.479988	Smallest(1)	100
				Confidence Level(95.0%)	34.11376

## Descriptive Statistics Sample Period 5

Flow Rate L/min		NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L		Total NO <sub>3</sub> kg/day	
Column1		Column1		Column1		Column1		Column1	
Mean	29.25	Mean	8.8387097	Mean	0.35332	Mean	41.22963	Mean	1.554608
Standard Error	6.695198	Standard Error	0.8126642	Standard Error	0.095753	Standard Error	3.888587	Standard Error	0.421312
Median	15	Median	8	Median	0.1728	Median	44	Median	0.76032
Mode	15	Mode	6	Mode	0.432	Mode	22	Mode	1.9008
Standard Deviation	34.78927	Standard Deviation	4.524723	Standard Deviation	0.497546	Standard Deviation	20.20569	Standard Deviation	2.189203
Sample Variance	1210.293	Sample Variance	20.473118	Sample Variance	0.247552	Sample Variance	408.2699	Sample Variance	4.792609
Kurtosis	2.139107	Kurtosis	-0.365439	Kurtosis	8.137106	Kurtosis	-0.54047	Kurtosis	8.137106
Skewness	1.762342	Skewness	0.6178722	Skewness	2.77666	Skewness	0.426962	Skewness	2.77666
Range	119.75	Range	18	Range	2.2446	Range	79.2	Range	9.87624
Minimum	0.25	Minimum	2	Minimum	0.0018	Minimum	8.8	Minimum	0.00792
Maximum	120	Maximum	20	Maximum	2.2464	Maximum	88	Maximum	9.88416
Sum	789.75	Sum	274	Sum	9.53964	Sum	1113.2	Sum	41.97442
Count	27	Count	31	Count	27	Count	27	Count	27
Largest(1)	120	Largest(1)	20	Largest(1)	2.2464	Largest(1)	88	Largest(1)	9.88416
Smallest(1)	0.25	Smallest(1)	2	Smallest(1)	0.0018	Smallest(1)	8.8	Smallest(1)	0.00792
Confidence Level(95.0%)	13.76219	Confidence Level(95.0%)	1.6596801	Confidence Level(95.0%)	0.196823	Confidence Level(95.0%)	7.993109	Confidence Level(95.0%)	0.86602

pH		H <sub>2</sub> O Temp.		Conductivity umhos	
Column1		Column1		Column1	
				TDS mg/L	124.9032
Mean	6.645161	Mean	7.403226	Mean	195.1613
Standard Error	0.125282	Standard Error	0.290919	Standard Error	21.02672
Median	6.5	Median	7	Median	185
Mode	6.5	Mode	6	Mode	120
Standard Deviation	0.697538	Standard Deviation	1.61977	Standard Deviation	117.0718
Sample Variance	0.486559	Sample Variance	2.623656	Sample Variance	13705.81
Kurtosis	8.575328	Kurtosis	0.667318	Kurtosis	6.929748
Skewness	2.354197	Skewness	0.883563	Skewness	2.152085
Range	3.5	Range	7	Range	610
Minimum	6	Minimum	5	Minimum	40
Maximum	9.5	Maximum	12	Maximum	650
Sum	206	Sum	229.5	Sum	6050
Count	31	Count	31	Count	31
Largest(1)	9.5	Largest(1)	12	Largest(1)	650
Smallest(1)	6	Smallest(1)	5	Smallest(1)	40
Confidence Level(95.0%)	0.255859	Confidence Level(95.0%)	0.594136	Confidence Level(95.0%)	42.94224

## Descriptive Statistics by Sample Site Site 1

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	15	15	0.324	66	1.4256
2	15	11	0.2376	48.4	1.04544
3	7.5	15	2.16	66	9.504
4	40	19	1.0944	83.6	4.81536
5	100	10	1.44	44	6.336

Sample #	pH	H <sub>2</sub> O Temp. °C	Conductivity UA
1	6	5.5	UA
2	6	6	UA
3	6	5	UA
4	6	5.5	225
5	6	6	125

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	14	Mean	1.0512	Mean	61.6
Standard Error	1.612452	Standard Error	0.358694433	Standard Error	7.0948
Median	15	Median	1.0944	Median	66
Standard Deviation	3.605551	Standard Deviation	0.802065135	Standard Deviation	15.864
Sample Variance	13	Sample Variance	0.64330848	Sample Variance	251.68
				Kurtosis	-0.8698
				Skewness	0.32
Range	9	Range	1.9224	Range	39.6
Minimum	10	Minimum	0.2376	Minimum	44
Maximum	19	Maximum	2.16	Maximum	83.6
Sum	70	Sum	5.256	Sum	308
Count	5	Count	5	Count	5
Largest(1)	19	Largest(1)	2.16	Largest(1)	83.6
Smallest(1)	10	Smallest(1)	0.2376	Smallest(1)	44
Confidence Level(95.0%)	4.476892	Confidence Level(95.0%)	0.995897464	Confidence Level(95.0%)	19.698

Total NO <sub>3</sub> kg/day	pH	Temp oC	Conductivity		Flow Rate L/min
<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	<i>Column1</i>		<i>Column1</i>
Mean	4.62528	Mean	6	TDS mg/L	112
Standard Error	1.578256	Standard Error	0	Mean	175
Median	4.81536	Median	6	Standard Error	50
				Median	175
				Mean	35.5
Standard Deviation	3.529087	Standard Deviation	0	Standard Error	17.03672504
Sample Variance	12.45445	Sample Variance	0	Median	15
				Standard Deviation	38.0952753
				Sample Variance	1451.25
Range	8.45856	Range	0	Range	92.5
Minimum	1.04544	Minimum	6	Minimum	7.5
Maximum	9.504	Maximum	6	Maximum	100
Sum	23.1264	Sum	24	Sum	177.5
Count	5	Count	4	Count	5
Largest(1)	9.504	Largest(1)	6	Largest(1)	100
Smallest(1)	1.04544	Smallest(1)	6	Smallest(1)	7.5
Confidence Level(95.0%)	4.381949	Confidence Level(95.0%)	0	Confidence Level(95.0%)	47.30162981
				Confidence Level(95.0%)	635.308
				Confidence Level(95.0%)	0.519426



## Descriptive Statistics by Sample Site Site 2

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	20	7	0.2016	30.8	0.88704
2	20	8	0.2304	35.2	1.01376
3	15	7	0.1512	30.8	0.66528
4	40	7	0.4032	30.8	1.77408
5	120	6	1.0368	26.4	4.56192

Sample #	pH	H <sub>2</sub> O Temp. °C	Conductivity
1	6.5	6	UA
2	6.5	6	UA
3	6.5	5.5	UA
4	6.5	5	145
5	6.5	6	120

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	7	Mean	0.40464	Mean	30.8
Standard Error	0.316228	Standard Error	0.163622277	Standard Error	1.391402
Median	7	Median	0.2304	Median	30.8
Standard Deviation	0.707107	Standard Deviation	0.365870534	Standard Deviation	3.11127
Sample Variance	0.5	Sample Variance	0.133861248	Sample Variance	9.68
Range	2	Range	0.8856	Range	8.8
Minimum	6	Minimum	0.1512	Minimum	26.4
Maximum	8	Maximum	1.0368	Maximum	35.2
Sum	35	Sum	2.0232	Sum	154
Count	5	Count	5	Count	5
Largest(1)	8	Largest(1)	1.0368	Largest(1)	35.2
Smallest(1)	6	Smallest(1)	0.1512	Smallest(1)	26.4
Confidence Level(95.0%)	0.877991	Confidence Level(95.0%)	0.454289212	Confidence Level(95.0%)	3.86316

Total NO <sub>3</sub> kg/day		pH		Temp oC		Conductivity		Flow Rate L/min	
Column1		Column1		Column1		Column1		Column1	
Mean	1.780416	Mean	6.5	Mean	5.7	TDS mg/L	84.8	Mean	43
Standard Error	0.719938	Standard Error	0	Standard Error	0.2	Mean	132.5	Standard Error	19.7230829
Median	1.01376	Median	6.5	Median	6	Median	132.5	Median	20
Standard Deviation	1.60983	Standard Deviation	0	Standard Deviation	0.447214	Standard Deviation	17.67767	Standard Deviation	44.1021541
Sample Variance	2.591554	Sample Variance	0	Sample Variance	0.2	Sample Variance	312.5	Sample Variance	1945
Range	3.89664	Range	0	Range	1	Range	25	Range	105
Minimum	0.66528	Minimum	6.5	Minimum	5	Minimum	120	Minimum	15
Maximum	4.56192	Maximum	6.5	Maximum	6	Maximum	145	Maximum	120
Sum	8.90208	Sum	32.5	Sum	28.5	Sum	265	Sum	215
Count	5	Count	5	Count	5	Count	2	Count	5
Largest(1)	4.56192	Largest(1)	6.5	Largest(1)	6	Largest(1)	145	Largest(1)	120
Smallest(1)	0.66528	Smallest(1)	6.5	Smallest(1)	5	Smallest(1)	120	Smallest(1)	15
Confidence Level(95.0%)	1.998873	Confidence Level(95.0%)	0	Confidence Level(95.0%)	0.55529	Confidence Level(95.0%)	158.8269	Confidence Level(95.0%)	54.7601705

## Descriptive Statistics by Sample Site Site 3

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	10	9	0.1296	39.6	0.57024
2	15	9	0.1944	39.6	0.85536
3	3.75	6	0.0324	26.4	0.14256
4	40	8	0.4608	35.2	2.02752
5	60	5	0.432	22	1.9008

Sample #	pH	Temp °C	Conductivity
1	6.5	5	UA
2	6.5	5.5	UA
3	7	4.5	UA
4	6.5	6	140
5	6	6.5	100

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	25.75	Mean	0.24984	Mean	32.56
Standard Error	10.54455	Standard Error	0.084409	Standard Error	3.574577
Median	15	Median	0.1944	Median	35.2
Standard Deviation	23.57833	Standard Deviation	0.188744	Standard Deviation	7.992997
Sample Variance	555.9375	Sample Variance	0.035624	Sample Variance	63.888
Range	56.25	Range	0.4284	Range	17.6
Minimum	3.75	Minimum	0.0324	Minimum	22
Maximum	60	Maximum	0.4608	Maximum	39.6
Sum	128.75	Sum	1.2492	Sum	162.8
Count	5	Count	5	Count	5
Largest(1)	60	Largest(1)	0.4608	Largest(1)	39.6
Smallest(1)	3.75	Smallest(1)	0.0324	Smallest(1)	22
Confidence Level(95.0%)	29.27642	Confidence Level(95.0%)	0.234358	Confidence Level(95.0%)	9.924637

Total NO <sub>3</sub> kg/day		pH		Temp °C		Conductivity umhos		Flow Rate L/min	
Column1		Column1		Column1		Column1		Column1	
						TDS mg/L	76.8		
Mean	1.099296	Mean	6.5	Mean	5.5	Mean	120	Mean	25.75
Standard Error	0.3714	Standard Error	0.158114	Standard Error	0.35355	Standard Error	20	Standard Error	10.5445
Median	0.85536	Median	6.5	Median	5.5	Median	120	Median	15
Standard Deviation	0.830475	Standard Deviation	0.353553	Standard Deviation	0.79057	Standard Deviation	28.28427	Standard Deviation	23.5783
Sample Variance	0.689689	Sample Variance	0.125	Sample Variance	0.625	Sample Variance	800	Sample Variance	555.938
Range	1.88496	Range	1	Range	2	Range	40	Range	56.25
Minimum	0.14256	Minimum	6	Minimum	4.5	Minimum	100	Minimum	3.75
Maximum	2.02752	Maximum	7	Maximum	6.5	Maximum	140	Maximum	60
Sum	5.49648	Sum	32.5	Sum	27.5	Sum	240	Sum	128.75
Count	5	Count	5	Count	5	Count	2	Count	5
Largest(1)	2.02752	Largest(1)	7	Largest(1)	6.5	Largest(1)	140	Largest(1)	60
Smallest(1)	0.14256	Smallest(1)	6	Smallest(1)	4.5	Smallest(1)	100	Smallest(1)	3.75
Confidence Level(95.0%)	1.031173	Confidence Level(95.0%)	0.438995	Confidence Level(95.0%)	0.98162	Confidence Level(95.0%)	254.123	Confidence Level(95.0%)	29.2764

## Descriptive Statistics by Sample Site Site 4

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	7.5	4	0.0432	17.6	0.19008
2	15	2	0.0432	8.8	0.19008
3	5	6	0.0432	26.4	0.19008
4	40	2	0.1152	8.8	0.50688
5	60	2	0.1728	8.8	0.76032

Sample #	pH	Temp °C	Conductivity umhos
1	6.5	4.5	UA
2	6	4	UA
3	6	4	UA
4	6.5	5	110
5	6.5	6.5	80

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	3.2	Mean	0.08352	Mean	14.08
Standard Error	0.8	Standard Error	0.026317	Standard Error	3.52
Median	2	Median	0.0432	Median	8.8
Standard Deviation	1.788854	Standard Deviation	0.058847	Standard Deviation	7.871
Sample Variance	3.2	Sample Variance	0.003463	Sample Variance	61.952
Range	4	Range	0.1296	Range	17.6
Minimum	2	Minimum	0.0432	Minimum	8.8
Maximum	6	Maximum	0.1728	Maximum	26.4
Sum	16	Sum	0.4176	Sum	70.4
Count	5	Count	5	Count	5
Largest(1)	6	Largest(1)	0.1728	Largest(1)	26.4
Smallest(1)	2	Smallest(1)	0.0432	Smallest(1)	8.8
Confidence Level(95.0%)	2.221161	Confidence Level(95.0%)	0.073068	Confidence Level(95.0%)	9.7731

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	0.367488	Mean	6.3	Mean	4.8
Standard Error	0.115795	Standard Error	0.122474	Standard Error	0.463681
Median	0.19008	Median	6.5	Median	4.5
Standard Deviation	0.258925	Standard Deviation	0.273861	Standard Deviation	1.036822
Sample Variance	0.067042	Sample Variance	0.075	Sample Variance	1.075
Range	0.57024	Range	0.5	Range	2.5
Minimum	0.19008	Minimum	6	Minimum	4
Maximum	0.76032	Maximum	6.5	Maximum	6.5
Sum	1.83744	Sum	31.5	Sum	24
Count	5	Count	5	Count	5
Largest(1)	0.76032	Largest(1)	6.5	Largest(1)	6.5
Smallest(1)	0.19008	Smallest(1)	6	Smallest(1)	4
Confidence Level(95.0%)	0.321498	Confidence Level(95.0%)	0.340044	Confidence Level(95.0%)	1.287387
				TDS mg/L	60.8
				Mean	95
				Standard Error	15
				Median	95
				Standard Deviation	21.2132
				Sample Variance	450
				Range	30
				Minimum	80
				Maximum	110
				Sum	190
				Count	2
				Largest(1)	110
				Smallest(1)	80
				Confidence Level(95.0%)	190.5923
				Mean	25.5
				Standard Error	10.61838
				Median	15
				Standard Deviation	23.74342
				Sample Variance	563.75
				Range	55
				Minimum	5
				Maximum	60
				Sum	127.5
				Count	5
				Largest(1)	60
				Smallest(1)	5
				Confidence Level(95.0%)	29.48141

## Descriptive Statistics by Sample Site Site 5

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	2	13	0.03744	57.2	0.164736
3	6	10	0.0864	44	0.38016
4	35	16	0.8064	70.4	3.54816
5	15	12	0.2592	52.8	1.14048

Sample #	pH	Temp °C	Conductivity umhos
1	6.5	5.5	UA
2	6.5	5.5	UA
3	6.5	6.5	240
4	6	7	240
5	UA	UA	UA

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	12.75	Mean	0.29736	Mean	56.1
Standard Error	1.25	Standard Error	0.17622	Standard Error	5.5
Median	12.5	Median	0.1728	Median	55
Mode					
Standard Deviation	2.5	Standard Deviation	0.352439	Standard Deviation	11
Sample Variance	6.25	Sample Variance	0.124213	Sample Variance	121
Kurtosis					
Skewness					
Range	6	Range	0.76896	Range	26.4
Minimum	10	Minimum	0.03744	Minimum	44
Maximum	16	Maximum	0.8064	Maximum	70.4
Sum	51	Sum	1.18944	Sum	224.4
Count	4	Count	4	Count	4
Largest(1)	16	Largest(1)	0.8064	Largest(1)	70.4
Smallest(1)	10	Smallest(1)	0.03744	Smallest(1)	44
Confidence Level(95.0%)	3.978062	Confidence Level(95.0%)	0.56081	Confidence Level(95.0%)	17.5035

Total NO <sub>3</sub> kg/day		pH		Temp °C		Conductivity umhos		Flow Rate L/min	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	1.308384	Mean	6.375	Mean	6.125	TDS mg/L	153.6	Mean	14.5
Standard Error	0.775367	Standard Error	0.125	Standard Error	0.375	Mean	240	Standard Error	7.354137
Median	0.76032	Median	6.5	Median	6	Standard Error	0	Median	10.5
Standard Deviation	1.550733	Standard Deviation	0.25	Standard Deviation	0.75	Median	240	Standard Deviation	14.70827
Sample Variance	2.404773	Sample Variance	0.0625	Sample Variance	0.5625	Standard Deviation	0	Sample Variance	216.3333
Range	3.383424	Range	0.5	Range	1.5	Sample Variance	0	Range	33
Minimum	0.164736	Minimum	6	Minimum	5.5	Range	0	Minimum	2
Maximum	3.54816	Maximum	6.5	Maximum	7	Minimum	240	Minimum	35
Sum	5.233536	Sum	25.5	Sum	24.5	Maximum	240	Maximum	58
Count	4	Count	4	Count	4	Sum	480	Count	4
Largest(1)	3.54816	Largest(1)	6.5	Largest(1)	7	Count	2	Largest(1)	35
Smallest(1)	0.164736	Smallest(1)	6	Smallest(1)	5.5	Largest(1)	240	Smallest(1)	2
Confidence Level(95.0%)	2.467565	Confidence Level(95.0%)	0.397806	Confidence Level(95.0%)	1.193418	Smallest(1)	240	Confidence Level(95.0%)	23.40417
						Confidence Level(95.0%)	0		

## Descriptive Statistics by Sample Site Site 6

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	10	11	0.1584	48.4	0.69696
5	15	5	0.108	22	0.4752

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	6.5	5	145
5	6.5	9	140

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	8	Mean	0.1332	Mean	35.2
Standard Error	3	Standard Error	0.0252	Standard Error	13.2
Median	8	Median	0.1332	Median	35.2
Mode					
Standard Deviation	4.242641	Standard Deviation	0.035638	Standard Deviation	18.66762
Sample Variance	18	Sample Variance	0.00127	Sample Variance	348.48
Kurtosis					
Skewness					
Range	6	Range	0.0504	Range	26.4
Minimum	5	Minimum	0.108	Minimum	22
Maximum	11	Maximum	0.1584	Maximum	48.4
Sum	16	Sum	0.2664	Sum	70.4
Count	2	Count	2	Count	2
Largest(1)	11	Largest(1)	0.1584	Largest(1)	48.4
Smallest(1)	5	Smallest(1)	0.108	Smallest(1)	22
Confidence Level(95.0%)	38.11845	Confidence Level(95.0%)	0.320195	Confidence Level(95.0%)	167.7212

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min
Column1	Column1	Column1	Column1	Column1
			TDS mg/L	91.2
Mean	Mean	6.5	Mean	142.5
Standard Error	Standard Error	0	Standard Error	2.5
Median	Median	6.5	Median	142.5
Standard Deviation	Standard Deviation	0	Standard Deviation	3.53553
Sample Variance	Sample Variance	0	Sample Variance	12.5
Range	Range	0	Range	5
Minimum	Minimum	6.5	Minimum	140
Maximum	Maximum	6.5	Maximum	145
Sum	Sum	13	Sum	285
Count	Count	2	Count	2
Largest(1)	Largest(1)	6.5	Largest(1)	145
Smallest(1)	Smallest(1)	6.5	Smallest(1)	140
Confidence Level(95.0%)	Confidence Level(95.0%)	0	Confidence Level(95.0%)	31.76538
			Mean	12.5
			Standard Error	2.5
			Median	12.5
			Standard Deviation	3.535534
			Sample Variance	12.5
			Range	5
			Minimum	10
			Maximum	15
			Sum	25
			Count	2
			Largest(1)	15
			Smallest(1)	10
			Confidence Level(95.0%)	31.76538
			Mean	12.5
			Standard Error	2.5
			Median	12.5
			Standard Deviation	3.535534
			Sample Variance	12.5
			Range	5
			Minimum	10
			Maximum	15
			Sum	25
			Count	2
			Largest(1)	15
			Smallest(1)	10
			Confidence Level(95.0%)	31.76538

## Descriptive Statistics by Sample Site Site 7

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	3.75	11	0.0594	48.4	0.26136
4	15	11	0.2376	48.4	1.04544
5	20	8	0.2304	35.2	1.01376

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	6.5	5	UA
4	6.5	5	190
5	6.5	5	190

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	10	Mean	0.1758	Mean	44
Standard Error	1	Standard Error	0.058237102	Standard Error	4.4
Median	11	Median	0.2304	Median	48.4
Standard Deviation	1.732051	Standard Deviation	0.100869619	Standard Deviation	7.621024
Sample Variance	3	Sample Variance	0.01017468	Sample Variance	58.08
Range	3	Range	0.1782	Range	13.2
Minimum	8	Minimum	0.0594	Minimum	35.2
Maximum	11	Maximum	0.2376	Maximum	48.4
Sum	30	Sum	0.5274	Sum	132
Count	3	Count	3	Count	3
Largest(1)	11	Largest(1)	0.2376	Largest(1)	48.4
Smallest(1)	8	Smallest(1)	0.0594	Smallest(1)	35.2
Confidence Level(95.0%)	4.302656	Confidence Level(95.0%)	0.250574199	Confidence Level(95.0%)	18.93169

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	0.77352	Mean	6.5	Mean	5
Standard Error	0.256243	Standard Error	0	Standard Error	0
Median	1.01376	Median	6.5	Median	5
Standard Deviation	0.443826	Standard Deviation	0	Standard Deviation	0
Sample Variance	0.196982	Sample Variance	0	Sample Variance	0
Range	0.78408	Range	0	Range	0
Minimum	0.26136	Minimum	6.5	Minimum	5
Maximum	1.04544	Maximum	6.5	Maximum	5
Sum	2.32056	Sum	19.5	Sum	15
Count	3	Count	3	Count	3
Largest(1)	1.04544	Largest(1)	6.5	Largest(1)	5
Smallest(1)	0.26136	Smallest(1)	6.5	Smallest(1)	5
Confidence Level(95.0%)	1.102526	Confidence Level(95.0%)	0	Confidence Level(95.0%)	0
				TDS mg/L	121.6
				Mean	190
				Standard Error	0
				Median	190
				Standard Deviation	0
				Sample Variance	0
				Range	0
				Minimum	190
				Maximum	190
				Sum	380
				Count	2
				Largest(1)	190
				Smallest(1)	190
				Confidence Level(95.0%)	0
				Mean	12.91666667
				Standard Error	4.805234414
				Median	15
				Standard Deviation	8.322910148
				Sample Variance	69.27083333
				Range	16.25
				Minimum	3.75
				Maximum	20
				Sum	38.75
				Count	3
				Largest(1)	20
				Smallest(1)	3.75
				Confidence Level(95.0%)	20.67526936

## Descriptive Statistics by Sample Site Site 8

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	40	7	0.4032	30.8	1.77408
5	60	5	0.432	22	1.9008

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	6.5	6	140
5	6	8	40

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	6	Mean	0.4176	Mean	26.4
Standard Error	1	Standard Error	0.0144	Standard Error	4.4
Median	6	Median	0.4176	Median	26.4
Standard Deviation	1.414214	Standard Deviation	0.020365	Standard Deviation	6.2225
Sample Variance	2	Sample Variance	0.000415	Sample Variance	38.72
Range	2	Range	0.0288	Range	8.8
Minimum	5	Minimum	0.4032	Minimum	22
Maximum	7	Maximum	0.432	Maximum	30.8
Sum	12	Sum	0.8352	Sum	52.8
Count	2	Count	2	Count	2
Largest(1)	7	Largest(1)	0.432	Largest(1)	30.8
Smallest(1)	5	Smallest(1)	0.4032	Smallest(1)	22
Confidence Level(95.0%)	12.70615	Confidence Level(95.0%)	0.182969	Confidence Level(95.0%)	55.907

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	1.83744	Mean	6.25	Mean	50
Standard Error	0.06336	Standard Error	0.25	Standard Error	10
Median	1.83744	Median	6.25	Median	50
Standard Deviation	0.089605	Standard Deviation	0.353553	Standard Deviation	14.14214
Sample Variance	0.008029	Sample Variance	0.125	Sample Variance	200
Range	0.12672	Range	0.5	Range	20
Minimum	1.77408	Minimum	6	Minimum	40
Maximum	1.9008	Maximum	6.5	Maximum	60
Sum	3.67488	Sum	12.5	Sum	100
Count	2	Count	2	Count	2
Largest(1)	1.9008	Largest(1)	6.5	Largest(1)	60
Smallest(1)	1.77408	Smallest(1)	6	Smallest(1)	40
Confidence Level(95.0%)	0.805062	Confidence Level(95.0%)	3.176538	Confidence Level(95.0%)	127.0615
				TDS mg/L	57.6
				Mean	90
				Standard Error	50
				Median	90
				Standard Deviation	70.71068
				Sample Variance	5000
				Range	100
				Minimum	40
				Maximum	140
				Sum	180
				Count	2
				Largest(1)	140
				Smallest(1)	40
				Confidence Level(95.0%)	635.3075

## Descriptive Statistics by Sample Site Site 9

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	7.5	18	0.1944	79.2	0.85536
2	7.5	20	0.216	88	0.9504
3	3.75	17	0.0918	74.8	0.40392
4	12	20	0.3456	88	1.52064
5	7.5	17	0.1836	74.8	0.80784

Sample #	pH	Temp °C	Conductivity umhos
1	6	6	UA
2	6	5	UA
3	6	5	UA
4	6	4	290
5	6	6.5	135

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	18.4	Mean	0.20628	Mean	80.96
Standard Error	0.678233	Standard Error	0.040783	Standard Error	2.9842
Median	18	Median	0.1944	Median	79.2
Standard Deviation	1.516575	Standard Deviation	0.091194	Standard Deviation	6.6729
Sample Variance	2.3	Sample Variance	0.008316	Sample Variance	44.528
Range	3	Range	0.2538	Range	13.2
Minimum	17	Minimum	0.0918	Minimum	74.8
Maximum	20	Maximum	0.3456	Maximum	88
Sum	92	Sum	1.0314	Sum	404.8
Count	5	Count	5	Count	5
Largest(1)	20	Largest(1)	0.3456	Largest(1)	88
Smallest(1)	17	Smallest(1)	0.0918	Smallest(1)	74.8
Confidence Level(95.0%)	1.883081	Confidence Level(95.0%)	0.113233	Confidence Level(95.0%)	8.2856

Total NO <sub>3</sub> kg/day	pH		Temp °C	Conductivity umhos	Flow Rate L/min
<i>Column1</i>	<i>Column1</i>		<i>Column1</i>	<i>Column1</i>	<i>Column1</i>
Mean	0.90763	Mean	6	TDS mg/L	136
Standard Error	0.17945	Standard Error	0	Mean	212.5
Median	0.85536	Median	6	Standard Error	77.5
Standard Deviation	0.40126	Standard Deviation	0	Median	212.5
Sample Variance	0.16101	Sample Variance	0	Standard Deviation	109.6016
Range	1.11672	Range	0	Sample Variance	12012.5
Minimum	0.40392	Minimum	6	Range	155
Maximum	1.52064	Maximum	6	Minimum	135
Sum	4.53816	Maximum	6	Maximum	290
Count	5	Sum	30	Sum	425
Largest(1)	1.52064	Count	5	Count	2
Smallest(1)	0.40392	Largest(1)	6	Largest(1)	290
Confidence Level(95.0%)	0.49823	Smallest(1)	6	Smallest(1)	135
		Confidence Level(95.0%)	0	Confidence Level(95.0%)	984.7266
		Confidence Level(95.0%)	1.210227	Confidence Level(95.0%)	3.630681



## Descriptive Statistics by Sample Site Site 10

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	7.5	18	0.1944	79.2	0.85536
2	7.5	23	0.2484	101.2	1.09296
3	3.75	20	0.108	88	0.4752
4	12	18	0.31104	79.2	1.368576
5	7.5	12	0.1296	52.8	0.57024

Sample #	pH	Temp °C	Conductivity umhos
1	6	6	UA
2	6	5.5	UA
3	6	4	UA
4	5.5	5.5	290
5	6	6	210

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	18.2	Mean	0.198288	Mean	80.08
Standard Error	1.8	Standard Error	0.03749	Standard Error	7.92
Median	18	Median	0.1944	Median	79.2
Standard Deviation	4.024922	Standard Deviation	0.083829	Standard Deviation	17.71
Sample Variance	16.2	Sample Variance	0.007027	Sample Variance	313.63
Range	11	Range	0.20304	Range	48.4
Minimum	12	Minimum	0.108	Minimum	52.8
Maximum	23	Maximum	0.31104	Maximum	101.2
Sum	91	Sum	0.99144	Sum	400.4
Count	5	Count	5	Count	5
Largest(1)	23	Largest(1)	0.31104	Largest(1)	101.2
Smallest(1)	12	Smallest(1)	0.108	Smallest(1)	52.8
Confidence Level(95.0%)	4.997612	Confidence Level(95.0%)	0.104088	Confidence Level(95.0%)	21.989

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	0.872467	Mean	5.9	Mean	5.4
Standard Error	0.164954	Standard Error	0.1	Standard Error	0.367423
Median	0.85536	Median	6	Median	5.5
Standard Deviation	0.368848	Standard Deviation	0.223607	Standard Deviation	0.821584
Sample Variance	0.136049	Sample Variance	0.05	Sample Variance	0.675
Range	0.893376	Range	0.5	Range	2
Minimum	0.4752	Minimum	5.5	Minimum	4
Maximum	1.368576	Maximum	6	Maximum	6
Sum	4.362336	Sum	29.5	Sum	27
Count	5	Count	5	Count	5
Largest(1)	1.368576	Largest(1)	6	Largest(1)	6
Smallest(1)	0.4752	Smallest(1)	5.5	Smallest(1)	4
Confidence Level(95.0%)	0.457987	Confidence Level(95.0%)	0.277645	Confidence Level(95.0%)	1.020133
				Mean	160
				Mean	250
				Standard Error	40
				Median	250
				Mode	7.5
				Standard Deviation	56.56854
				Sample Variance	3200
				Standard Deviation	2.924038
				Sample Variance	8.55
				Kurtosis	2.078428
				Skewness	0.383054
				Range	8.25
				Minimum	3.75
				Maximum	12
				Sum	38.25
				Count	5
				Largest(1)	12
				Smallest(1)	3.75
				Confidence Level(95.0%)	3.630681

## Descriptive Statistics by Sample Site Site 11

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	7.5	23	0.2484	101.2	1.09296
2	7.5	19	0.2052	83.6	0.90288
3	3.75	16	0.0864	70.4	0.38016
4	15	25	0.54	110	2.376
5	10	16	0.2304	70.4	1.01376

Sample #	pH	Temp °C	Conductivity umhos
1	6	5	UA
2	5.5	5	UA
3	6	4.5	UA
4	6	3	240
5	6	6	200

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	19.8	Mean	0.26208	Mean	87.12
Standard Error	1.827567	Standard Error	0.07501	Standard Error	8.0413
Median	19	Median	0.2304	Median	83.6
Standard Deviation	4.086563	Standard Deviation	0.167727	Standard Deviation	17.981
Sample Variance	16.7	Sample Variance	0.028132	Sample Variance	323.31
Range	9	Range	0.4536	Range	39.6
Minimum	16	Minimum	0.0864	Minimum	70.4
Maximum	25	Maximum	0.54	Maximum	110
Sum	99	Sum	1.3104	Sum	435.6
Count	5	Count	5	Count	5
Largest(1)	25	Largest(1)	0.54	Largest(1)	110
Smallest(1)	16	Smallest(1)	0.0864	Smallest(1)	70.4
Confidence Level(95.0%)	5.074149	Confidence Level(95.0%)	0.208261	Confidence Level(95.0%)	22.326

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min					
<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	<i>Column1</i>					
Mean	1.153152	Mean	5.9	Mean	4.7	TDS mg/L	140.8	Mean	8.75
Standard Error	0.330043	Standard Error	0.1	Standard Error	0.489898	Standard Error	20	Standard Error	1.85405
Median	1.01376	Median	6	Median	5	Median	220	Median	7.5
Standard Deviation	0.737998	Standard Deviation	0.223607	Standard Deviation	1.095445	Standard Deviation	28.28427	Standard Deviation	4.145781
Sample Variance	0.544641	Sample Variance	0.05	Sample Variance	1.2	Sample Variance	800	Sample Variance	17.1875
Range	1.99584	Range	0.5	Range	3	Range	40	Range	11.25
Minimum	0.38016	Minimum	5.5	Minimum	3	Minimum	200	Minimum	3.75
Maximum	2.376	Maximum	6	Maximum	6	Maximum	240	Maximum	15
Sum	5.76576	Sum	29.5	Sum	23.5	Sum	440	Sum	43.75
Count	5	Count	5	Count	5	Count	2	Count	5
Largest(1)	2.376	Largest(1)	6	Largest(1)	6	Largest(1)	240	Largest(1)	15
Smallest(1)	0.38016	Smallest(1)	5.5	Smallest(1)	3	Smallest(1)	200	Smallest(1)	3.75
Confidence Level(95.0%)	0.916347	Confidence Level(95.0%)	0.277645	Confidence Level(95.0%)	1.360178	Confidence Level(95.0%)	254.123	Confidence Level(95.0%)	5.147678

## Descriptive Statistics by Sample Site Site 12

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	7.5	17	0.1836	74.8	0.80784
3	10	19	0.2736	83.6	1.20384
4	60	23	1.9872	101.2	8.74368
5	40	14	0.8064	61.6	3.54816

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	6	5	UA
3	6.5	UA	UA
4	5.5	6	180
5	6	7	250

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	18.25	Mean	0.8127	Mean	80.3
Standard Error	1.887459	Standard Error	0.414918	Standard Error	8.3048
Median	18	Median	0.54	Median	79.2
Standard Deviation	3.774917	Standard Deviation	0.829836	Standard Deviation	16.61
Sample Variance	14.25	Sample Variance	0.688629	Sample Variance	275.88
Range	9	Range	1.8036	Range	39.6
Minimum	14	Minimum	0.1836	Minimum	61.6
Maximum	23	Maximum	1.9872	Maximum	101.2
Sum	73	Sum	3.2508	Sum	321.2
Count	4	Count	4	Count	4
Largest(1)	23	Largest(1)	1.9872	Largest(1)	101.2
Smallest(1)	14	Smallest(1)	0.1836	Smallest(1)	61.6
Confidence Level(95.0%)	6.006741	Confidence Level(95.0%)	1.320456	Confidence Level(95.0%)	26.43

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min					
Column1	Column1	Column1	Column1	Column1					
Mean	3.57588	Mean	6	Mean	6.5	TDS mg/L	137.6	Mean	29.375
Standard Error	1.82564	Standard Error	0.204124	Standard Error	0.5	Standard Error	35	Standard Error	12.59857
Median	2.376	Median	6	Median	6.5	Median	215	Median	25
Standard Deviation	3.65128	Standard Deviation	0.408248	Standard Deviation	0.707107	Standard Deviation	49.49747	Standard Deviation	25.19714
Sample Variance	13.33185	Sample Variance	0.166667	Sample Variance	0.5	Sample Variance	2450	Sample Variance	634.8958
Range	7.93584	Range	1	Range	1	Range	70	Range	52.5
Minimum	0.80784	Minimum	5.5	Minimum	6	Minimum	180	Minimum	7.5
Maximum	8.74368	Maximum	6.5	Maximum	7	Maximum	250	Maximum	60
Sum	14.30352	Sum	24	Sum	13	Sum	430	Sum	117.5
Count	4	Count	4	Count	2	Count	2	Count	4
Largest(1)	8.74368	Largest(1)	6.5	Largest(1)	7	Largest(1)	250	Largest(1)	60
Smallest(1)	0.80784	Smallest(1)	5.5	Smallest(1)	6	Smallest(1)	180	Smallest(1)	7.5
Confidence Level(95.0%)	5.810007	Confidence Level(95.0%)	0.649615	Confidence Level(95.0%)	6.353075	Confidence Level(95.0%)	444.7153	Confidence Level(95.0%)	40.09431

## Descriptive Statistics by Sample Site Site 13

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	
2	7.5	8	0.0864	35.2	0.38016
3	7.5	8	0.0864	35.2	0.38016
4	35	11	0.5544	48.4	2.43936
5	15	6	0.1296	26.4	0.57024

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	7	5.5	UA
3	7	UA	UA
4	6.5	5	290
5	7	6	250

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	8.25	Mean	0.2142	Mean	36.3
Standard Error	1.030776	Standard Error	0.113856	Standard Error	4.535416
Median	8	Median	0.108	Median	35.2
Standard Deviation	2.061553	Standard Deviation	0.227712	Standard Deviation	9.070832
Sample Variance	4.25	Sample Variance	0.051853	Sample Variance	82.28
Range	5	Range	0.468	Range	22
Minimum	6	Minimum	0.0864	Minimum	26.4
Maximum	11	Maximum	0.5544	Maximum	48.4
Sum	33	Sum	0.8568	Sum	145.2
Count	4	Count	4	Count	4
Largest(1)	11	Largest(1)	0.5544	Largest(1)	48.4
Smallest(1)	6	Smallest(1)	0.0864	Smallest(1)	26.4
Confidence Level(95.0%)	3.280394	Confidence Level(95.0%)	0.362342	Confidence Level(95.0%)	14.43373

Total NO <sub>3</sub> kg/day		pH		Temp °C		Conductivity umhos		Flow Rate L/min	
Column1		Column1		Column1		Column1		Column1	
Mean	0.94248	Mean	6.875	Mean	5.5	TDS mg/L	172.8	Mean	16.25
Standard Error	0.500967	Standard Error	0.125	Standard Error	0.5	Standard Error	20	Standard Error	6.495191
Median	0.4752	Median	7	Median	5.5	Median	270	Median	11.25
Standard Deviation	1.001935	Standard Deviation	0.25	Standard Deviation	0.707107	Standard Deviation	28.28427	Standard Deviation	12.99038
Sample Variance	1.003873	Sample Variance	0.0625	Sample Variance	0.5	Sample Variance	800	Sample Variance	168.75
Range	2.0592	Range	0.5	Range	1	Range	40	Range	27.5
Minimum	0.38016	Minimum	6.5	Minimum	5	Minimum	250	Minimum	7.5
Maximum	2.43936	Maximum	7	Maximum	6	Maximum	290	Maximum	35
Sum	3.76992	Sum	27.5	Sum	11	Sum	540	Sum	65
Count	4	Count	4	Count	2	Count	2	Count	4
Largest(1)	2.43936	Largest(1)	7	Largest(1)	6	Largest(1)	290	Largest(1)	35
Smallest(1)	0.38016	Smallest(1)	6.5	Smallest(1)	5	Smallest(1)	250	Smallest(1)	7.5
Confidence Level(95.0%)	1.594303	Confidence Level(95.0%)	0.397806	Confidence Level(95.0%)	6.353075	Confidence Level(95.0%)	254.123	Confidence Level(95.0%)	20.67061

## Descriptive Statistics by Sample Site Site 14

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	0.2	7	0.002016	30.8	0.00887
3	0.2	5	0.00144	22	0.006336
4	3	13	0.05616	57.2	0.247104
5	6	6	0.05184	26.4	0.228096

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	6.5	5	UA
3	6.5	UA	UA
4	6.5	5	260
5	6.5	6	205

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	7.75	Mean	0.027864	Mean	34.1
Standard Error	1.796988	Standard Error	0.015116	Standard Error	7.906748
Median	6.5	Median	0.026928	Median	28.6
Standard Deviation	3.593976	Standard Deviation	0.030232	Standard Deviation	15.8135
Sample Variance	12.91667	Sample Variance	0.000914	Sample Variance	250.0667
Range	8	Range	0.05472	Range	35.2
Minimum	5	Minimum	0.00144	Minimum	22
Maximum	13	Maximum	0.05616	Maximum	57.2
Sum	31	Sum	0.111456	Sum	136.4
Count	4	Count	4	Count	4
Largest(1)	13	Largest(1)	0.05616	Largest(1)	57.2
Smallest(1)	5	Smallest(1)	0.00144	Smallest(1)	22
Confidence Level(95.0%)	5.718824	Confidence Level(95.0%)	0.048105	Confidence Level(95.0%)	25.16283

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	6.5	Mean	TDS mg/L 148.8	Mean	2.35
Standard Error	0	Standard Error	5.333333	Standard Error	1.384136
Median	6.5	Median	0.333333	Median	1.6
Mode	6.5	Mode	5	Mode	
Standard Deviation	0	Standard Deviation	0.57735	Standard Deviation	2.768273
Sample Variance	#DIV/0!	Sample Variance	0.333333	Sample Variance	7.663333
Range	0.240768	Range	1	Range	5.8
Minimum	0.006336	Minimum	5	Minimum	0.2
Maximum	0.247104	Maximum	6	Maximum	6
Sum	0.490406	Sum	16	Sum	9.4
Count	4	Count	3	Count	4
Largest(1)	0.247104	Largest(1)	6	Largest(1)	6
Smallest(1)	0.006336	Smallest(1)	5	Smallest(1)	0.2
Confidence Level(95.0%)	0.211664	Confidence Level(95.0%)	1.434219	Confidence Level(95.0%)	4.404944

## Descriptive Statistics by Sample Site Site 15

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	5	9	0.0648	39.6	0.28512
5	15	4	0.0864	17.6	0.38016

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	6.5	5	210
5	6.5	6	160

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	6.5	Mean	0.0756	Mean	28.6
Standard Error	2.5	Standard Error	0.0108	Standard Error	11
Median	6.5	Median	0.0756	Median	28.6
Standard Deviation	3.535534	Standard Deviation	0.015274	Standard Deviation	15.5563
Sample Variance	12.5	Sample Variance	0.000233	Sample Variance	242
Range	5	Range	0.0216	Range	22
Minimum	4	Minimum	0.0648	Minimum	17.6
Maximum	9	Maximum	0.0864	Maximum	39.6
Sum	13	Sum	0.1512	Sum	57.2
Count	2	Count	2	Count	2
Largest(1)	9	Largest(1)	0.0864	Largest(1)	39.6
Smallest(1)	4	Smallest(1)	0.0648	Smallest(1)	17.6
Confidence Level(95.0%)	31.76538	Confidence Level(95.0%)	0.137226	Confidence Level(95.0%)	139.768

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	0.33264	Mean	6.5	Mean	118.4
Standard Error	0.04752	Standard Error	0	Standard Error	185
Median	0.33264	Median	6.5	Median	25
Standard Deviation	0.067203	Standard Deviation	0	Standard Deviation	185
Sample Variance	0.004516	Sample Variance	0	Sample Variance	118.4
Range	0.09504	Range	0	Range	50
Minimum	0.28512	Minimum	6.5	Minimum	160
Maximum	0.38016	Maximum	6.5	Maximum	210
Sum	0.66528	Sum	13	Sum	370
Count	2	Count	2	Count	2
Largest(1)	0.38016	Largest(1)	6.5	Largest(1)	210
Smallest(1)	0.28512	Smallest(1)	6.5	Smallest(1)	160
Confidence Level(95.0%)	0.603796	Confidence Level(95.0%)	0	Confidence Level(95.0%)	317.6538
		Mean	5.5	Mean	185
		Standard Error	0.5	Standard Error	25
		Median	5.5	Median	185
		Standard Deviation	0.707107	Standard Deviation	35.35534
		Sample Variance	0.5	Sample Variance	1250
		Range	1	Range	50
		Minimum	5	Minimum	160
		Maximum	6	Maximum	210
		Sum	11	Sum	370
		Count	2	Count	2
		Largest(1)	6	Largest(1)	210
		Smallest(1)	5	Smallest(1)	160
		Confidence Level(95.0%)	6.353075	Confidence Level(95.0%)	317.6538
		Mean	6.5	Mean	10
		Standard Error	0	Standard Error	5
		Median	6.5	Median	10
		Standard Deviation	0	Standard Deviation	7.071068
		Sample Variance	0	Sample Variance	50
		Range	0	Range	10
		Minimum	6.5	Minimum	5
		Maximum	6.5	Maximum	15
		Sum	13	Sum	20
		Count	2	Count	2
		Largest(1)	6.5	Largest(1)	15
		Smallest(1)	6.5	Smallest(1)	5
		Confidence Level(95.0%)	0	Confidence Level(95.0%)	63.53075

## Descriptive Statistics by Sample Site Site 16

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	7.5	7	0.0756	30.8	0.33264
2	6	6	0.05184	26.4	0.228096
3	7.5	9	0.0972	39.6	0.42768
4	15	8	0.1728	35.2	0.76032
5	15	8	0.1728	35.2	0.76032

Sample #	pH	Temp °C	Conductivity umhos
1	6.5	6	UA
2	7	6.5	UA
3	7	UA	UA
4	6.5	6	190
5	7	8	215

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	7.6	Mean	0.114048	Mean	33.44
Standard Error	0.509902	Standard Error	0.025036	Standard Error	2.2436
Median	8	Median	0.0972	Median	35.2
Standard Deviation	1.140175	Standard Deviation	0.055981	Standard Deviation	5.0168
Sample Variance	1.3	Sample Variance	0.003134	Sample Variance	25.168
Range	3	Range	0.12096	Range	13.2
Minimum	6	Minimum	0.05184	Minimum	26.4
Maximum	9	Maximum	0.1728	Maximum	39.6
Sum	38	Sum	0.57024	Sum	167.2
Count	5	Count	5	Count	5
Largest(1)	9	Largest(1)	0.1728	Largest(1)	39.6
Smallest(1)	6	Smallest(1)	0.05184	Smallest(1)	26.4
Confidence Level(95.0%)	1.415718	Confidence Level(95.0%)	0.06951	Confidence Level(95.0%)	6.2292

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	
Mean	6.8	Mean	TDS mg/L 129.6	Mean	10.2
Standard Error	0.122474	Standard Error	6.5	Standard Error	1.978636
Median	7	Median	0.387298	Median	7.5
Mode	7	Mode	6	Mode	7.5
Standard Deviation	0.246317	Standard Deviation	0.866025	Standard Deviation	4.424364
Sample Variance	0.060672	Sample Variance	0.75	Sample Variance	19.575
Kurtosis	-3.33333	Kurtosis	-3.33333	Kurtosis	-3.33333
Range	0.532224	Range	2	Range	9
Minimum	0.228096	Minimum	6	Minimum	6
Maximum	0.76032	Maximum	7	Maximum	15
Sum	2.509056	Sum	32.5	Sum	51
Count	5	Count	5	Count	5
Largest(1)	0.76032	Largest(1)	7	Largest(1)	15
Smallest(1)	0.228096	Smallest(1)	6.5	Smallest(1)	6
Confidence Level(95.0%)	0.305843	Confidence Level(95.0%)	0.340044	Confidence Level(95.0%)	5.493585

## Descriptive Statistics by Sample Site Site 17

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	15	5	0.108	22	0.4752
2	10	5	0.072	22	0.3168
3	15	5	0.108	22	0.4752
4	15	6	0.1296	26.4	0.57024
5	20	5	0.144	22	0.6336

Sample #	pH	Temp °C	Conductivity umhos
1	7	6.5	UA
2	7	6	UA
3	6.5	UA	UA
4	7	5	175
5	6.5	6.5	180

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	5.2	Mean	0.11232	Mean	22.88
Standard Error	0.2	Standard Error	0.012176	Standard Error	0.88
Median	5	Median	0.108	Median	22
Standard Deviation	0.447214	Standard Deviation	0.027227	Standard Deviation	1.96774
Sample Variance	0.2	Sample Variance	0.000741	Sample Variance	3.872
Range	1	Range	0.072	Range	4.4
Minimum	5	Minimum	0.072	Minimum	22
Maximum	6	Maximum	0.144	Maximum	26.4
Sum	26	Sum	0.5616	Sum	114.4
Count	5	Count	5	Count	5
Largest(1)	6	Largest(1)	0.144	Largest(1)	26.4
Smallest(1)	5	Smallest(1)	0.072	Smallest(1)	22
Confidence Level(95.0%)	0.55529	Confidence Level(95.0%)	0.033807	Confidence Level(95.0%)	2.443277

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	6.8	Mean	113.6	Mean	15
Standard Error	0.122474	Standard Error	177.5	Standard Error	1.581139
Median	7	Median	2.5	Median	15
Mode	7	Mode	177.5	Mode	15
Standard Deviation	0.119799	Standard Deviation	3.535534	Standard Deviation	3.535534
Sample Variance	0.014352	Sample Variance	12.5	Sample Variance	12.5
Range	0.3168	Range	5	Range	10
Minimum	0.3168	Minimum	175	Minimum	10
Maximum	0.6336	Maximum	180	Maximum	20
Sum	2.47104	Sum	355	Sum	75
Count	5	Count	2	Count	5
Largest(1)	0.6336	Largest(1)	180	Largest(1)	20
Smallest(1)	0.3168	Smallest(1)	175	Smallest(1)	10
Confidence Level(95.0%)	0.14875	Confidence Level(95.0%)	31.76538	Confidence Level(95.0%)	4.389954



## Descriptive Statistics by Sample Site Site 18

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	20	11	0.3168	48.4	1.39392
2	25	14	0.504	61.6	2.2176
3	30	13	0.5616	57.2	2.47104
4	60	19	1.6416	83.6	7.22304
5	120	13	2.2464	57.2	9.88416

Sample #	pH	Temp °C	Conductivity umhos
1	6.5	6	UA
2	6.5	6	UA
3	6.5	UA	UA
4	6	5	210
5	6.5	5	215

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	14	Mean	1.05408	Mean	61.6
Standard Error	1.341641	Standard Error	0.377857	Standard Error	5.90322
Median	13	Median	0.5616	Median	57.2
Standard Deviation	3	Standard Deviation	0.844913	Standard Deviation	13.2
Sample Variance	9	Sample Variance	0.713878	Sample Variance	174.24
Range	8	Range	1.9296	Range	35.2
Minimum	11	Minimum	0.3168	Minimum	48.4
Maximum	19	Maximum	2.2464	Maximum	83.6
Sum	70	Sum	5.2704	Sum	308
Count	5	Count	5	Count	5
Largest(1)	19	Largest(1)	2.2464	Largest(1)	83.6
Smallest(1)	11	Smallest(1)	0.3168	Smallest(1)	48.4
Confidence Level(95.0%)	3.725	Confidence Level(95.0%)	1.0491	Confidence Level(95.0%)	16.39

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	<i>Column1</i>	
Mean	4.637952	Mean	6.4	TDS mg/L	136
Standard Error	1.662569	Standard Error	0.1	Mean	212.5
Median	2.47104	Median	6.5	Standard Error	2.5
		Mode	6.5	Median	212.5
				Mean	51
Standard Deviation	3.717618	Standard Deviation	0.05	Standard Error	18.60108
Sample Variance	13.82068	Sample Variance	0.05	Median	30
		Kurtosis	5	Standard Deviation	41.59327
				Sample Variance	1730
Range	8.49024	Range	1	Range	100
Minimum	1.39392	Minimum	5	Minimum	20
Maximum	9.88416	Maximum	6	Maximum	120
Sum	23.18976	Sum	32	Sum	255
Count	5	Count	5	Count	5
Largest(1)	9.88416	Largest(1)	6.5	Largest(1)	120
Smallest(1)	1.39392	Smallest(1)	6	Smallest(1)	20
Confidence Level(95.0%)	4.616042	Confidence Level(95.0%)	0.277645	Confidence Level(95.0%)	51.64497
		Confidence Level(95.0%)	0.62083	Confidence Level(95.0%)	31.7654

## Descriptive Statistics by Sample Site Site 19

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	3	7	0.03024	30.8	0.133056
2	2.5	6	0.0216	26.4	0.09504
3	UA	UA	UA	UA	UA
4	3	5	0.0216	22	0.09504
5	0.25	5	0.0018	22	0.00792

Sample #	pH	Temp °C	Conductivity umhos
1	7	6	UA
2	7	7	UA
3	UA	UA	UA
4	7.5	6	150
5	7.5	7.5	120

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	5.75	Mean	0.01881	Mean	25.3
Standard Error	0.478714	Standard Error	0.006025	Standard Error	2.10634
Median	5.5	Median	0.0216	Median	24.2
Standard Deviation	0.957427	Standard Deviation	0.012049	Standard Deviation	4.21268
Sample Variance	0.916667	Sample Variance	0.000145	Sample Variance	17.7467
Range	2	Range	0.02844	Range	8.8
Minimum	5	Minimum	0.0018	Minimum	22
Maximum	7	Maximum	0.03024	Maximum	30.8
Sum	23	Sum	0.07524	Sum	101.2
Count	4	Count	4	Count	4
Largest(1)	7	Largest(1)	0.03024	Largest(1)	30.8
Smallest(1)	5	Smallest(1)	0.0018	Smallest(1)	22
Confidence Level(95.0%)	1.523482	Confidence Level(95.0%)	0.019173	Confidence Level(95.0%)	6.70332

Total NO <sub>3</sub> kg/day	pH		Temp °C	Conductivity umhos	Flow Rate L/min				
Column1	Column1		Column1	Column1	Column1				
Mean	0.082764	Mean	7.25	Mean	6.625	TDS mg/L	86.4	Mean	2.1875
Standard Error	0.026508	Standard Error	0.144338	Standard Error	0.375	Mean	135	Standard Error	0.656498
Median	0.09504	Median	7.25	Median	6.5	Standard Error	15	Median	2.75
Standard Deviation	0.053017	Standard Deviation	0.288675	Standard Deviation	0.75	Median	135	Standard Deviation	1.312996
Sample Variance	0.002811	Sample Variance	0.083333	Sample Variance	0.5625	Standard Deviation	21.2132	Sample Variance	1.723958
Range	0.125136	Range	0.5	Range	1.5	Sample Variance	450	Range	2.75
Minimum	0.00792	Minimum	7	Minimum	6	Range	30	Range	2.75
Maximum	0.133056	Maximum	7.5	Maximum	7.5	Minimum	120	Minimum	0.25
Sum	0.331056	Sum	29	Sum	26.5	Maximum	150	Maximum	3
Count	4	Count	4	Count	4	Maximum	150	Sum	8.75
Largest(1)	0.133056	Largest(1)	7.5	Largest(1)	7.5	Sum	270	Count	4
Smallest(1)	0.00792	Smallest(1)	7	Smallest(1)	6	Count	2	Largest(1)	3
Confidence Level(95.0%)	0.084361	Confidence Level(95.0%)	0.459347	Confidence Level(95.0%)	1.19342	Largest(1)	150	Smallest(1)	0.25
						Smallest(1)	120	Confidence Level(95.0%)	2.089271
						Confidence Level(95.0%)	190.592		

## Descriptive Statistics by Sample Site Site 20

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	15	5	0.108	22	0.4752
2	20	4	0.1152	17.6	0.50688
3	15	6	0.1296	26.4	0.57024
4	20	2	0.0576	8.8	0.25344
5	20	4	0.1152	17.6	0.50688

Sample #	pH	Temp °C	Conductivity umhos
1	7	6	UA
2	7	6.5	UA
3	6.5	UA	UA
4	7	6	150
5	7	7	185

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	4.2	Mean	0.10512	Mean	18.48
Standard Error	0.663325	Standard Error	0.012387	Standard Error	2.91863
Median	4	Median	0.1152	Median	17.6
Standard Deviation	1.48324	Standard Deviation	0.027699	Standard Deviation	6.52625
Sample Variance	2.2	Sample Variance	0.000767	Sample Variance	42.592
Range	4	Range	0.072	Range	17.6
Minimum	2	Minimum	0.0576	Minimum	8.8
Maximum	6	Maximum	0.1296	Maximum	26.4
Sum	21	Sum	0.5256	Sum	92.4
Count	5	Count	5	Count	5
Largest(1)	6	Largest(1)	0.1296	Largest(1)	26.4
Smallest(1)	2	Smallest(1)	0.0576	Smallest(1)	8.8
Confidence Level(95.0%)	1.841689	Confidence Level(95.0%)	0.034393	Confidence Level(95.0%)	8.10343

Total NO <sub>3</sub> kg/day		pH		Temp °C		Conductivity umhos		Flow Rate L/min	
Column1		Column1		Column1		Column1		Column1	
Mean	0.462528	Mean	6.9	Mean	6.375	TDS mg/L	107.2	Mean	18
Standard Error	0.054504	Standard Error	0.1	Standard Error	0.23936	Mean	167.5	Standard Error	1.224745
Median	0.50688	Median	7	Median	6.25	Median	167.5	Median	20
Standard Deviation	0.121875	Standard Deviation	0.223607	Standard Deviation	0.47871	Standard Deviation	24.7487	Standard Deviation	2.738613
Sample Variance	0.014854	Sample Variance	0.05	Sample Variance	0.22917	Sample Variance	612.5	Sample Variance	7.5
Range	0.3168	Range	0.5	Range	1	Range	35	Range	5
Minimum	0.25344	Minimum	6.5	Minimum	6	Minimum	150	Minimum	15
Maximum	0.57024	Maximum	7	Maximum	7	Maximum	185	Maximum	20
Sum	2.31264	Sum	34.5	Sum	25.5	Sum	335	Sum	90
Count	5	Count	5	Count	4	Count	2	Count	5
Largest(1)	0.57024	Largest(1)	7	Largest(1)	7	Largest(1)	185	Largest(1)	20
Smallest(1)	0.25344	Smallest(1)	6.5	Smallest(1)	6	Smallest(1)	150	Smallest(1)	15
Confidence Level(95.0%)	0.151329	Confidence Level(95.0%)	0.277645	Confidence Level(95.0%)	0.76174	Confidence Level(95.0%)	222.358	Confidence Level(95.0%)	3.400444

## Descriptive Statistics by Sample Site Site 21

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	5	11	0.0792	48.4	0.34848
2	6	10	0.0864	44	0.38016
3	3	13	0.05616	57.2	0.247104
4	5	17	0.1224	74.8	0.53856
5	5	11	0.0792	48.4	0.34848

Sample #	pH	Temp °C	Conductivity umhos
1	6.5	6.5	UA
2	6.5	6	UA
3	7		UA
4	7	5.5	255
5	7	7	210

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	12.4	Mean	0.084672	Mean	54.56
Standard Error	1.249	Standard Error	0.010722	Standard Error	5.4956
Median	11	Median	0.0792	Median	48.4
Standard Deviation	2.792848	Standard Deviation	0.023975	Standard Deviation	12.2885
Sample Variance	7.8	Sample Variance	0.000575	Sample Variance	151.008
Range	7	Range	0.06624	Range	30.8
Minimum	10	Minimum	0.05616	Minimum	44
Maximum	17	Maximum	0.1224	Maximum	74.8
Sum	62	Sum	0.42336	Sum	272.8
Count	5	Count	5	Count	5
Largest(1)	17	Largest(1)	0.1224	Largest(1)	74.8
Smallest(1)	10	Smallest(1)	0.05616	Smallest(1)	44
Confidence Level(95.0%)	3.467786	Confidence Level(95.0%)	0.029769	Confidence Level(95.0%)	15.2583

Total NO <sub>3</sub> kg/day		pH		Temp °C		Conductivity umhos		Flow Rate L/min	
Column1		Column1		Column1		Column1		Column1	
Mean	0.372557	Mean	6.8	Mean	6.25	TDS mg/L	148.8	Mean	4.8
Standard Error	0.047177	Standard Error	0.122474	Standard Error	0.32275	Mean	232.5	Standard Error	0.489898
Median	0.34848	Median	7	Median	6.25	Median	232.5	Median	5
Standard Deviation	0.10549	Standard Deviation	0.273861	Standard Deviation	0.6455	Standard Deviation	31.8198	Standard Deviation	1.095445
Sample Variance	0.011128	Sample Variance	0.075	Sample Variance	0.41667	Sample Variance	1012.5	Sample Variance	1.2
Range	0.291456	Range	0.5	Range	1.5	Range	45	Range	3
Minimum	0.247104	Minimum	6.5	Minimum	5.5	Minimum	210	Minimum	3
Maximum	0.53856	Maximum	7	Maximum	7	Maximum	255	Maximum	6
Sum	1.862784	Sum	34	Sum	25	Sum	465	Sum	24
Count	5	Count	5	Count	4	Count	2	Count	5
Largest(1)	0.53856	Largest(1)	7	Largest(1)	7	Largest(1)	255	Largest(1)	6
Smallest(1)	0.247104	Smallest(1)	6.5	Smallest(1)	5.5	Smallest(1)	210	Smallest(1)	3
Confidence Level(95.0%)	0.130984	Confidence Level(95.0%)	0.340044	Confidence Level(95.0%)	1.02713	Confidence Level(95.0%)	285.888	Confidence Level(95.0%)	1.360178

## Descriptive Statistics by Sample Site Site 22

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	20	10	0.288	44	1.2672
2	25	10	0.36	44	1.584
3	15	8	0.1728	35.2	0.76032
4	30	8	0.3456	35.2	1.52064
5	20	10	0.288	44	1.2672

Sample #	pH	Temp °C	Conductivity umhos
1	6.5	7.5	UA
2	6.5	7	UA
3	6.5		UA
4	7	6	215
5	6.5	8	225

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	9.2	Mean	0.29088	Mean	40.48
Standard Error	0.489898	Standard Error	0.032963	Standard Error	2.15555
Median	10	Median	0.288	Median	44
Standard Deviation	1.095445	Standard Deviation	0.073708	Standard Deviation	4.81996
Sample Variance	1.2	Sample Variance	0.005433	Sample Variance	23.232
Range	2	Range	0.1872	Range	8.8
Minimum	8	Minimum	0.1728	Minimum	35.2
Maximum	10	Maximum	0.36	Maximum	44
Sum	46	Sum	1.4544	Sum	202.4
Count	5	Count	5	Count	5
Largest(1)	10	Largest(1)	0.36	Largest(1)	44
Smallest(1)	8	Smallest(1)	0.1728	Smallest(1)	35.2
Confidence Level(95.0%)	1.360178	Confidence Level(95.0%)	0.09152	Confidence Level(95.0%)	5.98478

Total NO <sub>3</sub> kg/day		pH		Temp °C		Conductivity umhos		Flow Rate L/min	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	1.279872	Mean	6.6	Mean	7.125	TDS mg/L	140.8	Mean	22
Standard Error	0.145038	Standard Error	0.1	Standard Error	0.42696	Mean	220	Standard Error	2.54951
Median	1.2672	Median	6.5	Median	7.25	Median	220	Median	20
Standard Deviation	0.324314	Standard Deviation	0.223607	Standard Deviation	0.85391	Standard Deviation	7.07107	Standard Deviation	5.700877
Sample Variance	0.10518	Sample Variance	0.05	Sample Variance	0.72917	Sample Variance	50	Sample Variance	32.5
Range	0.82368	Range	0.5	Range	2	Range	10	Range	15
Minimum	0.76032	Minimum	6.5	Minimum	6	Minimum	215	Minimum	15
Maximum	1.584	Maximum	7	Maximum	8	Maximum	225	Maximum	30
Sum	6.39936	Sum	33	Sum	28.5	Sum	440	Sum	110
Count	5	Count	5	Count	4	Count	2	Count	5
Largest(1)	1.584	Largest(1)	7	Largest(1)	8	Largest(1)	225	Largest(1)	30
Smallest(1)	0.76032	Smallest(1)	6.5	Smallest(1)	6	Smallest(1)	215	Smallest(1)	15
Confidence Level(95.0%)	0.40269	Confidence Level(95.0%)	0.277645	Confidence Level(95.0%)	1.35877	Confidence Level(95.0%)	63.5308	Confidence Level(95.0%)	7.078589

## Descriptive Statistics by Sample Site Site 23

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	15	8	0.1728	35.2	0.76032
2	6	8	0.06912	35.2	0.304128
3	7.5	6	0.0648	26.4	0.28512
4	15	15	0.324	66	1.4256
5	6	13	0.11232	57.2	0.494208

Sample #	pH	Temp °C	Conductivity umhos
1	7	6	UA
2	6.5	7	UA
3	6.5		UA
4	7.5	6	275
5	7	8	280

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	10	Mean	0.148608	Mean	44
Standard Error	1.702939	Standard Error	0.047962	Standard Error	7.49293
Median	8	Median	0.11232	Median	35.2
Standard Deviation	3.807887	Standard Deviation	0.107246	Standard Deviation	16.7547
Sample Variance	14.5	Sample Variance	0.011502	Sample Variance	280.72
Range	9	Range	0.2592	Range	39.6
Minimum	6	Minimum	0.0648	Minimum	26.4
Maximum	15	Maximum	0.324	Maximum	66
Sum	50	Sum	0.74304	Sum	220
Count	5	Count	5	Count	5
Largest(1)	15	Largest(1)	0.324	Largest(1)	66
Smallest(1)	6	Smallest(1)	0.0648	Smallest(1)	26.4
Confidence Level(95.0%)	4.728125	Confidence Level(95.0%)	0.133163	Confidence Level(95.0%)	20.8038

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	0.653875	Mean	6.9	Mean	6.75
Standard Error	0.211032	Standard Error	0.187083	Standard Error	0.47871
Median	0.494208	Median	7	Median	6.5
Standard Deviation	0.471881	Standard Deviation	0.41833	Standard Deviation	0.95743
Sample Variance	0.222672	Sample Variance	0.175	Sample Variance	0.91667
Range	1.14048	Range	1	Range	5
Minimum	0.28512	Minimum	6.5	Minimum	6
Maximum	1.4256	Maximum	7.5	Maximum	8
Sum	3.269376	Sum	34.5	Sum	27
Count	5	Count	5	Count	4
Largest(1)	1.4256	Largest(1)	7.5	Largest(1)	8
Smallest(1)	0.28512	Smallest(1)	6.5	Smallest(1)	6
Confidence Level(95.0%)	0.585919	Confidence Level(95.0%)	0.519426	Confidence Level(95.0%)	1.52348
				Confidence Level(95.0%)	31.7654
				Confidence Level(95.0%)	5.830547

## Descriptive Statistics by Sample Site Site 24

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	3	12	0.05184	52.8	0.228096
5	4	11	0.06336	48.4	0.278784

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	6.5	7	150
5	6.5	10	135

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	11.5	Mean	0.0576	Mean	50.6
Standard Error	0.5	Standard Error	0.00576	Standard Error	2.2
Median	11.5	Median	0.0576	Median	50.6
Standard Deviation	0.707107	Standard Deviation	0.008146	Standard Deviation	3.11127
Sample Variance	0.5	Sample Variance	6.64E-05	Sample Variance	9.68
Range	1	Range	0.01152	Range	4.4
Minimum	11	Minimum	0.05184	Minimum	48.4
Maximum	12	Maximum	0.06336	Maximum	52.8
Sum	23	Sum	0.1152	Sum	101.2
Count	2	Count	2	Count	2
Largest(1)	12	Largest(1)	0.06336	Largest(1)	52.8
Smallest(1)	11	Smallest(1)	0.05184	Smallest(1)	48.4
Confidence Level(95.0%)	6.353075	Confidence Level(95.0%)	0.073187	Confidence Level(95.0%)	27.9535

Total NO <sub>3</sub> kg/day		pH		Temp °C		Conductivity umhos		Flow Rate L/min	
<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>		<i>Column1</i>	
Mean	0.25344	Mean	6.5	Mean	8.5	TDS mg/L	91.2	Mean	3.5
Standard Error	0.025344	Standard Error	0	Standard Error	1.5	Mean	142.5	Standard Error	0.5
Median	0.25344	Median	6.5	Median	8.5	Median	142.5	Median	3.5
Standard Deviation	0.035842	Standard Deviation	0	Standard Deviation	2.12132	Standard Deviation	10.6066	Standard Deviation	0.707107
Sample Variance	0.001285	Sample Variance	0	Sample Variance	4.5	Sample Variance	112.5	Sample Variance	0.5
Range	0.050688	Range	0	Range	3	Range	15	Range	1
Minimum	0.228096	Minimum	6.5	Minimum	7	Minimum	135	Minimum	3
Maximum	0.278784	Maximum	6.5	Maximum	10	Maximum	150	Maximum	4
Sum	0.50688	Sum	13	Sum	17	Sum	285	Sum	7
Count	2	Count	2	Count	2	Count	2	Count	2
Largest(1)	0.278784	Largest(1)	6.5	Largest(1)	10	Largest(1)	150	Largest(1)	4
Smallest(1)	0.228096	Smallest(1)	6.5	Smallest(1)	7	Smallest(1)	135	Smallest(1)	3
Confidence Level(95.0%)	0.322025	Confidence Level(95.0%)	0	Confidence Level(95.0%)	19.0592	Confidence Level(95.0%)	95.2961	Confidence Level(95.0%)	6.353075

## Descriptive Statistics by Sample Site Site 25

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	4	12	0.06912	52.8	0.304128
3	3	10	0.0432	44	0.19008
4	8	14	0.16128	61.6	0.709632
5	6	13	0.11232	57.2	0.494208

Sample #	Temp pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	7.5	7	UA
3	7		UA
4	7	7	300
5	6.5	9	410

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	12.25	Mean	0.09648	Mean	53.9
Standard Error	0.853913	Standard Error	0.02588	Standard Error	3.75722
Median	12.5	Median	0.09072	Median	55
Standard Deviation	1.707825	Standard Deviation	0.05176	Standard Deviation	7.51443
Sample Variance	2.916667	Sample Variance	0.002679	Sample Variance	56.4667
Range	4	Range	0.11808	Range	17.6
Minimum	10	Minimum	0.0432	Minimum	44
Maximum	14	Maximum	0.16128	Maximum	61.6
Sum	49	Sum	0.38592	Sum	215.6
Count	4	Count	4	Count	4
Largest(1)	14	Largest(1)	0.16128	Largest(1)	61.6
Smallest(1)	10	Smallest(1)	0.0432	Smallest(1)	44
Confidence Level(95.0%)	2.717533	Confidence Level(95.0%)	0.082362	Confidence Level(95.0%)	11.9571

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	0.424512	Mean	7	Mean	7.666667
Standard Error	0.113872	Standard Error	0.204124	Standard Error	0.666667
Median	0.399168	Median	7	Median	7
Standard Deviation	0.227744	Standard Deviation	0.408248	Standard Deviation	1.154701
Sample Variance	0.051867	Sample Variance	0.166667	Sample Variance	1.333333
Range	0.519552	Range	1	Range	2
Minimum	0.19008	Minimum	6.5	Minimum	7
Maximum	0.709632	Maximum	7.5	Maximum	9
Sum	1.698048	Sum	28	Sum	23
Count	4	Count	4	Count	3
Largest(1)	0.709632	Largest(1)	7.5	Largest(1)	9
Smallest(1)	0.19008	Smallest(1)	6.5	Smallest(1)	7
Confidence Level(95.0%)	0.362391	Confidence Level(95.0%)	0.649615	Confidence Level(95.0%)	2.868437
				TDS mg/L	227.2
				Mean	355
				Standard Error	55
				Median	355
				Standard Deviation	77.78175
				Sample Variance	6050
				Range	110
				Minimum	300
				Maximum	410
				Sum	710
				Count	2
				Largest(1)	410
				Smallest(1)	300
				Confidence Level(95.0%)	698.8383
				Mean	5.25
				Standard Error	1.108678
				Median	5
				Standard Deviation	2.217356
				Sample Variance	4.916667
				Range	5
				Minimum	3
				Maximum	8
				Sum	21
				Count	4
				Largest(1)	8
				Smallest(1)	3
				Confidence Level(95.0%)	3.528311



## Descriptive Statistics by Sample Site

### Site 26

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	3	16	0.06912	70.4	0.304128
4	10	14	0.2016	61.6	0.88704
5	15	12	0.2592	52.8	1.14048

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	7.5		UA
4	7	7	310
5	7	9	360

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	14	Mean	0.17664	Mean	61.6
Standard Error	1.154701	Standard Error	0.056273	Standard Error	5.08068
Median	14	Median	0.2016	Median	61.6
Standard Deviation	2	Standard Deviation	0.097467	Standard Deviation	8.8
Sample Variance	4	Sample Variance	0.0095	Sample Variance	77.44
Range	4	Range	0.19008	Range	17.6
Minimum	12	Minimum	0.06912	Minimum	52.8
Maximum	16	Maximum	0.2592	Maximum	70.4
Sum	42	Sum	0.52992	Sum	184.8
Count	3	Count	3	Count	3
Largest(1)	16	Largest(1)	0.2592	Largest(1)	70.4
Smallest(1)	12	Smallest(1)	0.06912	Smallest(1)	52.8
Confidence Level(95.0%)	4.968279	Confidence Level(95.0%)	0.242122	Confidence Level(95.0%)	21.8604

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	0.777216	Mean	7.166667	Mean	9.333333
Standard Error	0.2476	Standard Error	0.166667	Standard Error	3.480102
Median	0.88704	Median	7	Median	10
Standard Deviation	0.428856	Standard Deviation	0.288675	Standard Deviation	6.027714
Sample Variance	0.183917	Sample Variance	0.083333	Sample Variance	36.33333
Range	0.836352	Range	0.5	Range	12
Minimum	0.304128	Minimum	7	Minimum	3
Maximum	1.14048	Maximum	7.5	Maximum	15
Sum	2.331648	Sum	21.5	Sum	28
Count	3	Count	3	Count	3
Largest(1)	1.14048	Largest(1)	7.5	Largest(1)	15
Smallest(1)	0.304128	Smallest(1)	7	Smallest(1)	3
Confidence Level(95.0%)	1.065337	Confidence Level(95.0%)	0.717109	Confidence Level(95.0%)	14.97368

## Descriptive Statistics by Sample Site Site 27

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	15	34	0.7344	149.6	3.23136
5	7.5	20	0.216	88	0.9504

Sample #	Temp pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	7.5	6	600
5	7	9.5	650

NO <sub>3</sub> -N mg/L		NO <sub>3</sub> -N kg/day		Total NO <sub>3</sub> mg/L	
Column1		Column1		Column1	
Mean	27	Mean	0.4752	Mean	118.8
Standard Error	7	Standard Error	0.2592	Standard Error	30.8
Median	27	Median	0.4752	Median	118.8
Standard Deviation	9.899495	Standard Deviation	0.366564	Standard Deviation	43.5578
Sample Variance	98	Sample Variance	0.134369	Sample Variance	1897.28
Range	14	Range	0.5184	Range	61.6
Minimum	20	Minimum	0.216	Minimum	88
Maximum	34	Maximum	0.7344	Maximum	149.6
Sum	54	Sum	0.9504	Sum	237.6
Count	2	Count	2	Count	2
Largest(1)	34	Largest(1)	0.7344	Largest(1)	149.6
Smallest(1)	20	Smallest(1)	0.216	Smallest(1)	88
Confidence Level(95.0%)	88.94305	Confidence Level(95.0%)	3.293434	Confidence Level(95.0%)	391.349

Total NO <sub>3</sub> kg/day	pH	Temp °C	Conductivity umhos	Flow Rate L/min	
Column1	Column1	Column1	Column1	Column1	
Mean	2.09088	Mean	7.25	Mean	11.25
Standard Error	1.14048	Standard Error	0.25	Standard Error	3.75
Median	2.09088	Median	7.25	Median	11.25
Standard Deviation	1.612882	Standard Deviation	0.353553	Standard Deviation	5.303301
Sample Variance	2.601389	Sample Variance	0.125	Sample Variance	28.125
Range	2.28096	Range	0.5	Range	7.5
Minimum	0.9504	Minimum	7	Minimum	7.5
Maximum	3.23136	Maximum	7.5	Maximum	15
Sum	4.18176	Sum	14.5	Sum	22.5
Count	2	Count	2	Count	2
Largest(1)	3.23136	Largest(1)	7.5	Largest(1)	15
Smallest(1)	0.9504	Smallest(1)	7	Smallest(1)	7.5
Confidence Level(95.0%)	14.49111	Confidence Level(95.0%)	3.176538	Confidence Level(95.0%)	47.64806

## Descriptive Statistics by Sample Site Site 28

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	UA	8	UA	UA	UA
5	UA	3	UA	UA	UA

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	7	9	100
5	7	7	90

NO <sub>3</sub> -N mg/L	
Column1	
Mean	5.5
Standard Error	2.5
Median	5.5
Standard Deviation	3.535534
Sample Variance	12.5
Range	5
Minimum	3
Maximum	8
Sum	11
Count	2
Largest(1)	8
Smallest(1)	3
Confidence Level(95.0%)	31.76538

pH	
Column1	
Mean	7
Standard Error	0
Median	7
Standard Deviation	0
Sample Variance	0
Range	0
Minimum	7
Maximum	7
Sum	14
Count	2
Largest(1)	7
Smallest(1)	7
Confidence Level(95.0%)	0

Temp °C	
Column1	
Mean	8
Standard Error	1
Median	8
Standard Deviation	1.414214
Sample Variance	2
Range	2
Minimum	7
Maximum	9
Sum	16
Count	2
Largest(1)	9
Smallest(1)	7
Confidence Level(95.0%)	12.70615

Conductivity umhos	
Column1	
TDS mg/L	60.8
Mean	95
Standard Error	5
Median	95
Standard Deviation	7.071068
Sample Variance	50
Range	10
Minimum	90
Maximum	100
Sum	190
Count	2
Largest(1)	100
Smallest(1)	90
Confidence Level(95.0%)	63.53075

## Descriptive Statistics by Sample Site Site 29

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	UA	7	UA	UA	UA
5	UA	6	UA	UA	UA

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	6.5	8.5	160
5	9.5	12	50

NO <sub>3</sub> -N mg/L	
Column1	
Mean	6.5
Standard Error	0.5
Median	6.5
Standard Deviation	0.707107
Sample Variance	0.5
Kurtosis	#DIV/0!
Skewness	#DIV/0!
Range	1
Minimum	6
Maximum	7
Sum	13
Count	2
Largest(1)	7
Smallest(1)	6
Confidence Level(95.0%)	6.353075

pH	
Column1	
Mean	8
Standard Error	1.5
Median	8
Standard Deviation	2.12132
Sample Variance	4.5
Range	3
Minimum	6.5
Maximum	9.5
Sum	16
Count	2
Largest(1)	9.5
Smallest(1)	6.5
Confidence Level(95.0%)	19.05923

Temp °C	
Column1	
Mean	10.25
Standard Error	1.75
Median	10.25
Standard Deviation	2.4749
Sample Variance	6.125
Range	3.5
Minimum	8.5
Maximum	12
Sum	20.5
Count	2
Largest(1)	12
Smallest(1)	8.5
Confidence Level(95.0%)	22.236

Conductivity umhos	
Column1	
TDS mg/L	67.2
Mean	105
Standard Error	55
Median	105
Standard Deviation	77.78175
Sample Variance	6050
Range	110
Minimum	50
Maximum	160
Sum	210
Count	2
Largest(1)	160
Smallest(1)	50
Confidence Level(95.0%)	698.8383

## Descriptive Statistics by Sample Site Site 30

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	UA	10	UA	UA	UA
5	UA	6	UA	UA	UA

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	7.5	8.5	200
5	6	10	120

NO <sub>3</sub> -N mg/L	
<i>Column1</i>	
Mean	8
Standard Error	2
Median	8
Standard Deviation	2.828427
Sample Variance	8
Range	4
Minimum	6
Maximum	10
Sum	16
Count	2
Largest(1)	10
Smallest(1)	6
Confidence Level(95.0%)	25.4123

pH	
<i>Column1</i>	
Mean	6.75
Standard Error	0.75
Median	6.75
Standard Deviation	1.06066
Sample Variance	1.125
Range	1.5
Minimum	6
Maximum	7.5
Sum	13.5
Count	2
Largest(1)	7.5
Smallest(1)	6
Confidence Level(95.0%)	9.529613

Temp °C	
<i>Column1</i>	
Mean	9.25
Standard Error	0.75
Median	9.25
Standard Deviation	1.06066
Sample Variance	1.125
Range	1.5
Minimum	8.5
Maximum	10
Sum	18.5
Count	2
Largest(1)	10
Smallest(1)	8.5
Confidence Level(95.0%)	9.529613

Conductivity umhos	
<i>Column1</i>	
TDS mg/L	102.4
Mean	160
Standard Error	40
Median	160
Standard Deviation	56.56854
Sample Variance	3200
Range	80
Minimum	120
Maximum	200
Sum	320
Count	2
Largest(1)	200
Smallest(1)	120
Confidence Level(95.0%)	508.246

## Descriptive Statistics by Sample Site Site 31

Sample #	Flow Rate L/min	NO <sub>3</sub> -N mg/L	NO <sub>3</sub> -N kg/day	Total NO <sub>3</sub> mg/L	Total NO <sub>3</sub> kg/day
1	UA	UA	UA	UA	UA
2	UA	UA	UA	UA	UA
3	UA	UA	UA	UA	UA
4	UA	10	UA	UA	UA
5	UA	6	UA	UA	UA

Sample #	pH	Temp °C	Conductivity umhos
1	UA	UA	UA
2	UA	UA	UA
3	UA	UA	UA
4	7	8	150
5	7.5	8.5	160

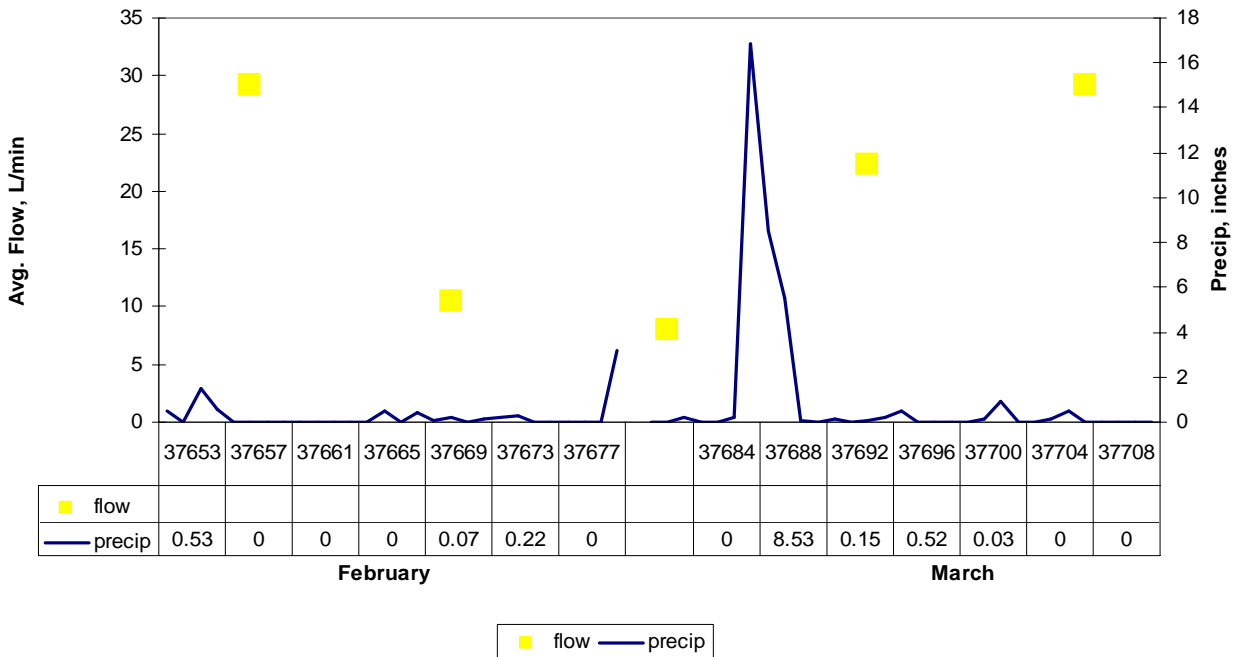
NO <sub>3</sub> -N mg/L	
Column1	
Mean	8
Standard Error	2
Median	8
Standard Deviation	2.828427
Sample Variance	8
Range	4
Minimum	6
Maximum	10
Sum	16
Count	2
Largest(1)	10
Smallest(1)	6
Confidence Level(95.0%)	25.4123

pH	
Column1	
Mean	7.25
Standard Error	0.25
Median	7.25
Standard Deviation	0.353553
Sample Variance	0.125
Range	0.5
Minimum	7
Maximum	7.5
Sum	14.5
Count	2
Largest(1)	7.5
Smallest(1)	7
Confidence Level(95.0%)	3.176538

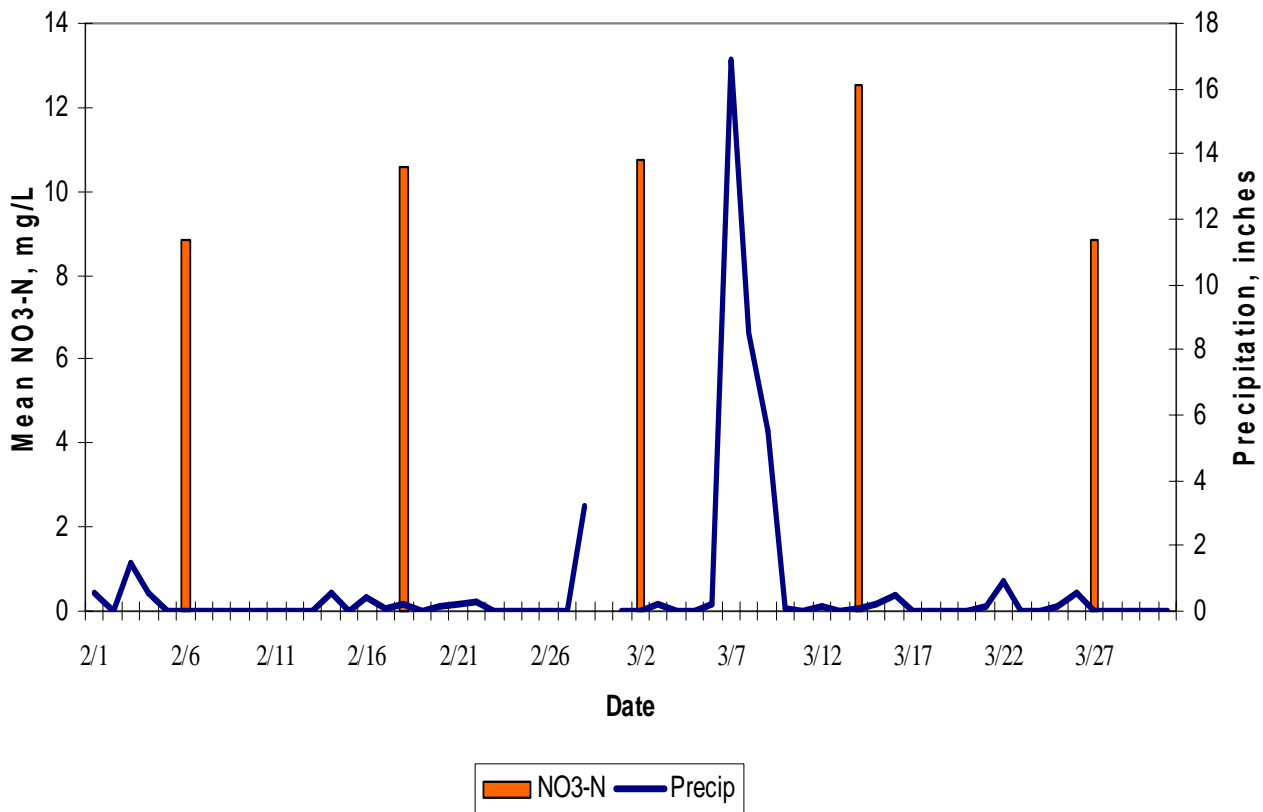
Temp °C	
Column1	
Mean	8.25
Standard Error	0.25
Median	8.25
Standard Deviation	0.353553
Sample Variance	0.125
Range	0.5
Minimum	8
Maximum	8.5
Sum	16.5
Count	2
Largest(1)	8.5
Smallest(1)	8
Confidence Level(95.0%)	3.176538

Conductivity umhos	
Column1	
TDS mg/L	99.2
Mean	155
Standard Error	5
Median	155
Standard Deviation	7.071068
Sample Variance	50
Range	10
Minimum	150
Maximum	160
Sum	310
Count	2
Largest(1)	160
Smallest(1)	150
Confidence Level(95.0%)	63.53075

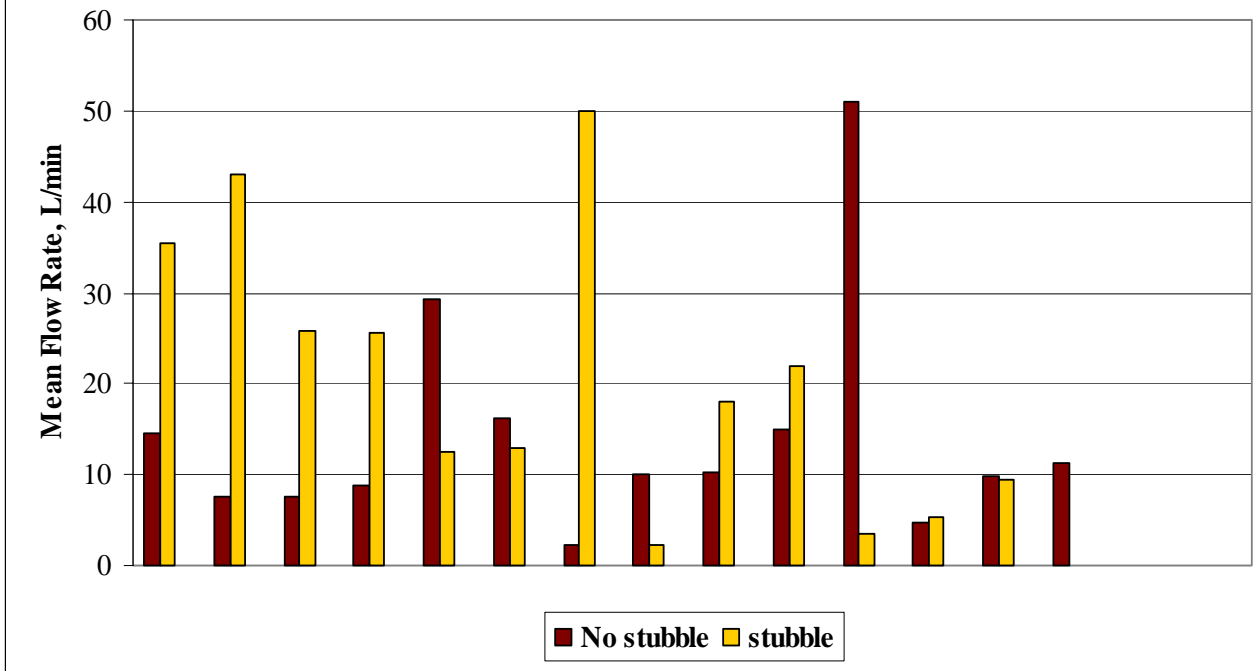
**Table 1. Precipitation and Flow Rate**



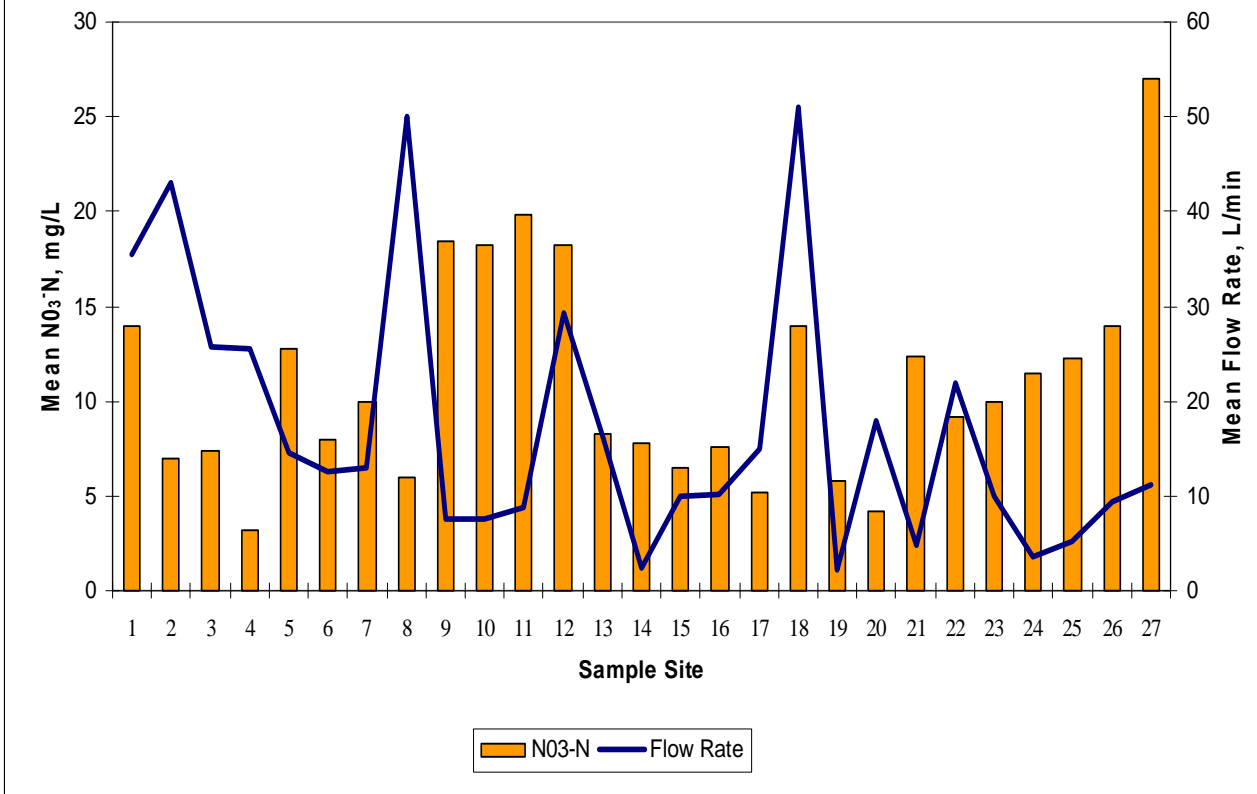
**Precipitation and NO<sub>3</sub>-N**



**Residue Management and Flow Rate**

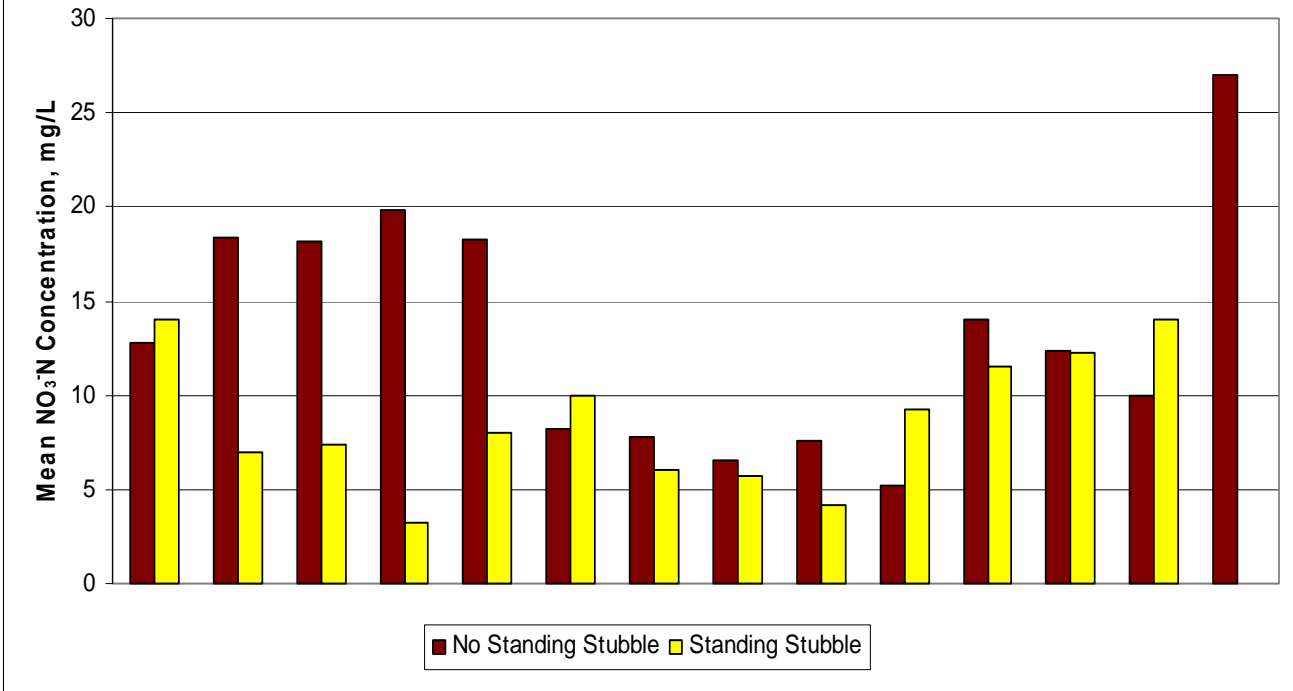


**NO<sub>3</sub>-N and Flow Rate, by Sample Site**





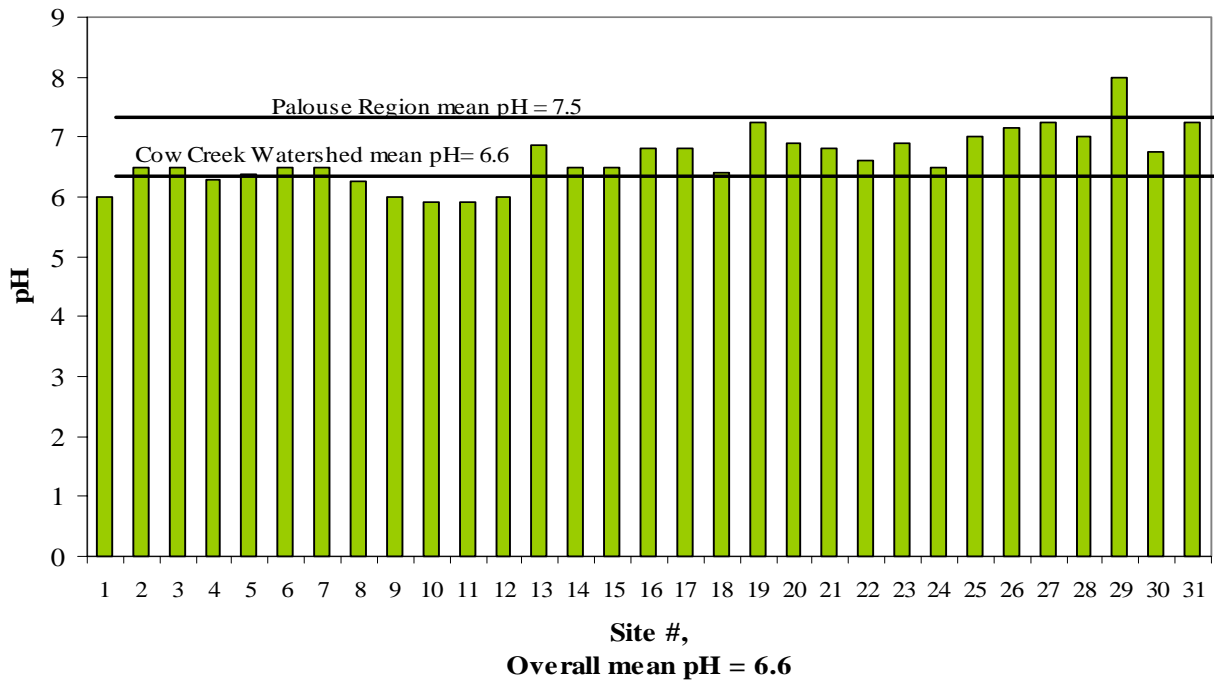
**Table 2. Residue Management and  $\text{NO}_3^- \text{N}$  Concentration**



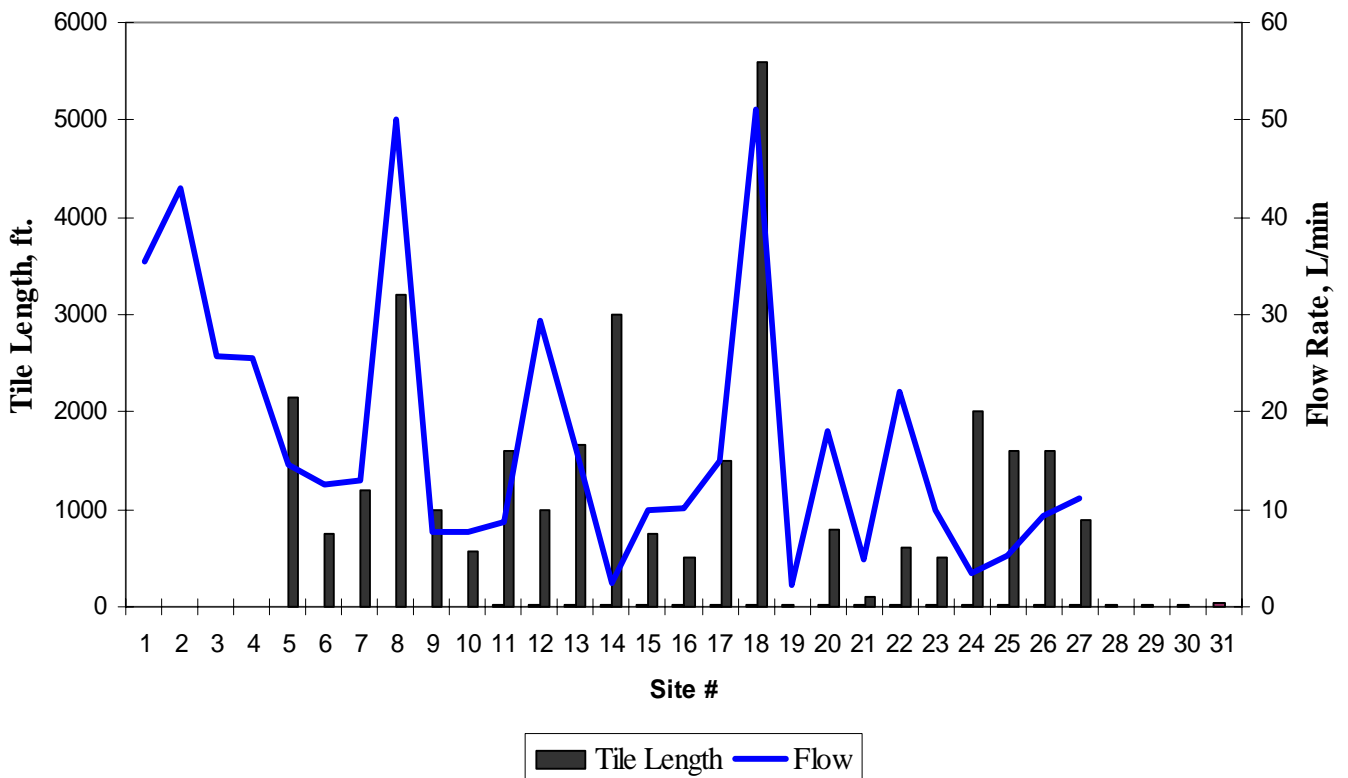
**Table 3. Fertilizer Application and  $\text{NO}_3^- \text{N}$  Concentration**

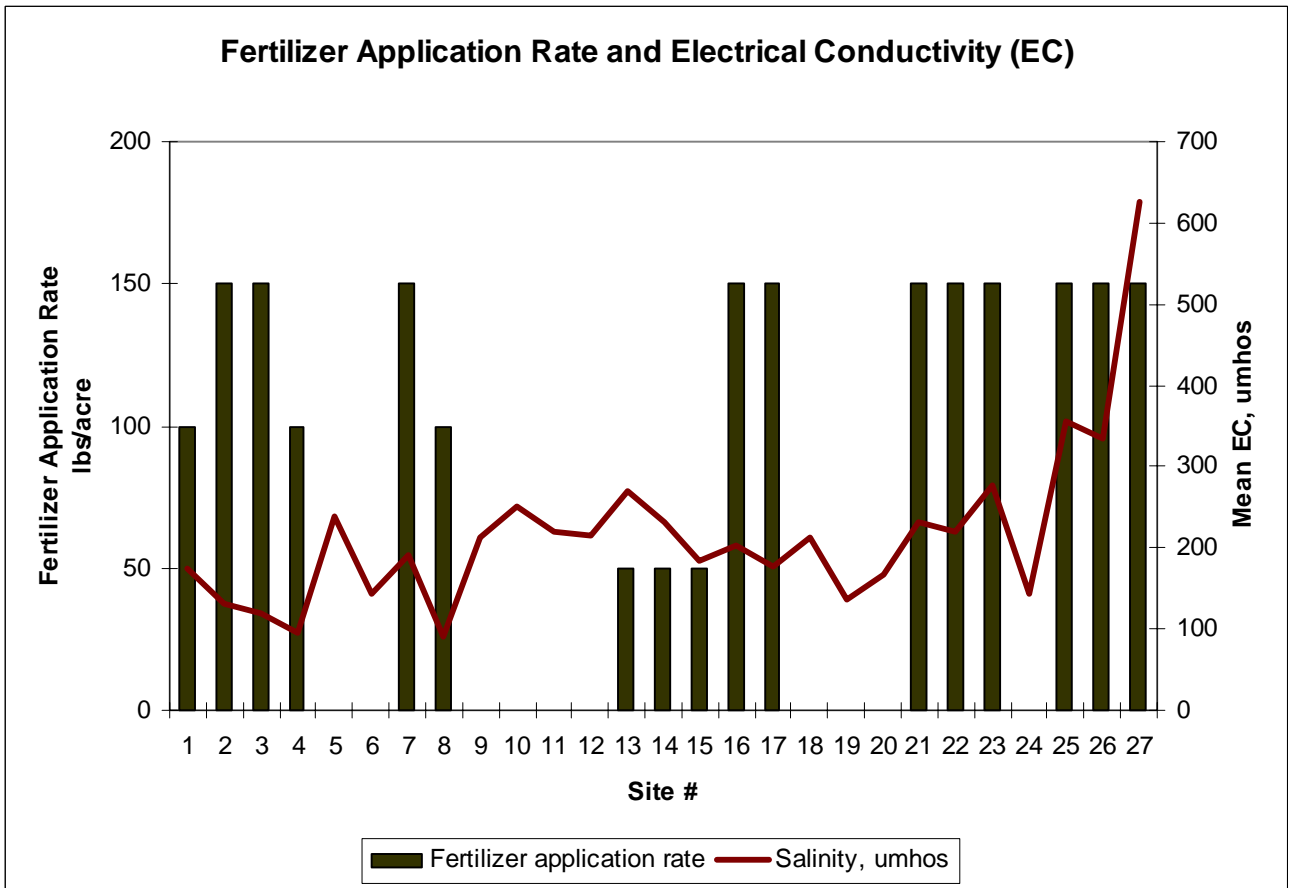
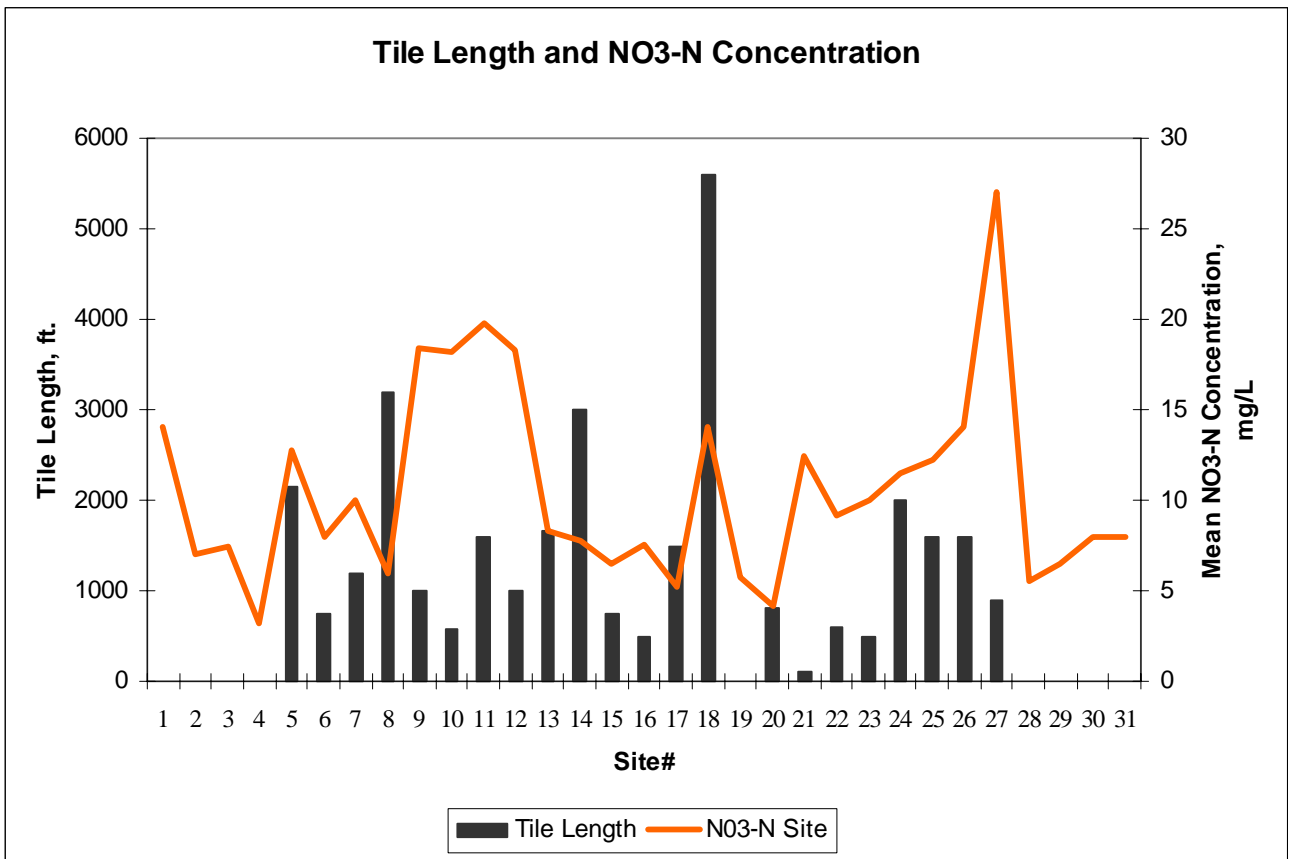


Mean pH, by Site

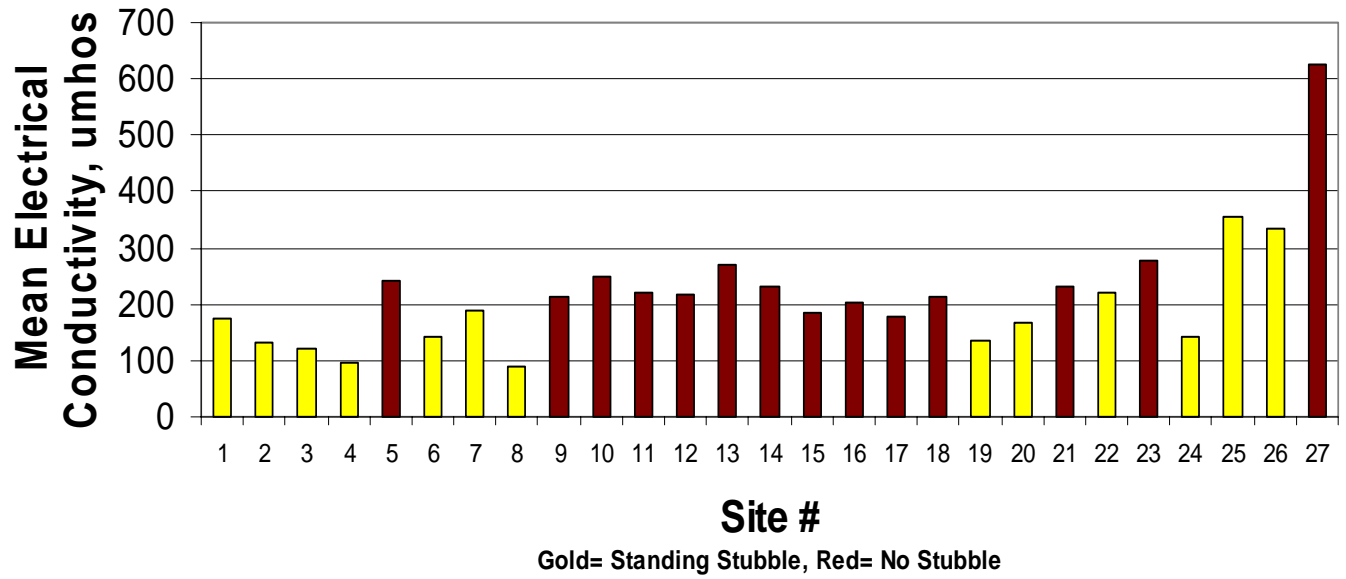


Tile Length and Flow Rate





# Residue Management and Electrical Conductivity, umhos



## Residue Management and NO3-N concentration

The SAS System  
The GLM Procedure

Dependent Variable: Nitrate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	145.0635918	145.0635918	5.43	0.0281
Error	25	667.6965934	26.7078637		
Corrected Total	26	812.7601852			

R-Square	Coeff Var	Root MSE	Nitrate Mean
0.178483	46.72976	5.167965	11.05926

Source	DF	Type III SS	Mean Square	F Value	Pr > F
ResMan	1	145.0635918	145.0635918	5.43	0.0281

The calculated significant F-Value at  $\alpha=0.05$  is 4.24. Because the observed F Value 5.43 > 4.24, the NO3-N concentration means of the tested residue management practices are statistically different (Ott and Longnecker, 2001).

### Tukey's Studentized Range (HSD) Test for Nitrate

Alpha	0.05
Error Degrees of Freedom	25
Error Mean Square	26.70786
Critical Value of Studentized Range	2.91263
Minimum Significant Difference	4.0996
Harmonic Mean of Cell Sizes	13.48148

NOTE: Cell sizes are not equal.

Means with the same letter are not significantly different.

Tukey Grouping	NO3-N Mean	N	Residue Management
A	13.293	14	No-stubble
B	8.654	13	Stubble

#### Least Squares Means

Res Man	Nitrate LSMEAN	H0: LSMean1=LSMean2 Pr >  t
1	8.6538462	0.0281
2	13.2928571	

## Residue Management and Electrical Conductivity (EC)

The SAS System

Dependent Variable: EC

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	1	39786.3871	39786.3871	4.12	0.0531
Error	25	241398.7981	9655.9519		
Corrected Total	26	281185.1852			

R-Square	Coeff Var	Root MSE	EC Mean
0.141495	45.33357	98.26470	216.7593

Source	DF	Type III SS	Mean Square	F Value	Pr > F
resman	1	39786.38711	39786.38711	4.12	0.0531

The calculated significant F-Value at  $\alpha=0.10$  is 2.92. Because the observed F Value 4.12 > 2.92, the EC means of the tested residue management practices are statistically different (Ott and Longnecker, 2001).

### Tukey's Studentized Range (HSD) Test for EC

Alpha	0.1
Error Degrees of Freedom	25
Error Mean Square	9655.952
Critical Value of Studentized Range	2.41570
Minimum Significant Difference	64.65
Harmonic Mean of Cell Sizes	13.48148

NOTE: Cell sizes are not equal.

Means with the same letter are not significantly different.

Tukey Grouping	Mean	N	Residue management
A	253.75	14	No-stubble
B	176.92	13	Stubble

#### Least Squares Means

resman	EC LSMEAN	Pr >  t
1	176.923077	0.0531
2	253.750000	

## Fertilizer Application Rates and NO<sub>3</sub>-N Concentration

The SAS System  
The GLM Procedure

Dependent Variable: Nitrate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	7	175.8249091	25.1178442	0.75	0.6362
Error	14	469.0610000	33.5043571		
Corrected Total	21	644.8859091			

R-Square	Coeff Var	Root MSE	Nitrate Mean
0.272645	53.66308	5.788295	10.78636

Source	DF	Type III SS	Mean Square	F Value	Pr > F
FertApp	7	175.8249091	25.1178442	0.75	0.6362

The calculated significant F-Value at  $\alpha=0.10$  is 2.19. Because the observed F Value  $0.75 < 2.19$ , the NO<sub>3</sub>-N concentration of the tested fertilizer application rates are statistically not different (Ott and Longnecker, 2001).

## Fertilizer Application and EC

The SAS System

Dependent Variable: EC

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	10	66749.9094	6674.9909	0.40	0.9215
Error	12	199947.9167	16662.3264		
Corrected Total	22	266697.8261			

R-Square	Coeff Var	Root MSE	EC Mean
0.250283	62.63503	129.0826	206.0870

Source	DF	Type III SS	Mean Square	F Value	Pr > F
fertapp	10	66749.90942	6674.99094	0.40	0.9215

The calculated significant F-Value at  $\alpha=.10$  is 2.19. Because the observed F Value 0.40 < 2.19, the EC means of the tested fertilizer application rates are statistically the not different (Ott and Longnecker, 2001).



## Tile Length and NO<sub>3</sub>-N concentration

The SAS System  
The GLM Procedure

Dependent Variable: Nitrate

Source	DF	Sum of Squares	Mean Square	F Value	Pr > F
Model	5	250.9457708	50.1891542	1.60	0.2112
Error	18	565.3941250	31.4107847		
Corrected Total	23	816.3398958			

R-Square	Coeff Var	Root MSE	Nitrate Mean
0.307404	50.14307	5.604533	11.17708

Source	DF	Type III SS	Mean Square	F Value	Pr > F
Tile length	5	250.9457708	50.1891542	1.60	0.2112

The calculated significant F-Value at  $\alpha=0.10$  is 2.20. Because the observed F Value 1.60 < 2.20, the EC means of the tested tile lengths are statistically the not different (Ott and Longnecker, 2001).