Quality Assurance Project Plan
for the
Environmental Measurement Activities Relating to the

Best Management Practices to Reduce Nitrate Impacts in Ground Water and to Assess Atrazine and Arsenic Concentrations in Private Water Wells
Project 03 – 08

Section A1: Title and Approval Sheet

United States Environmental Protection Agency (USEPA), Region 6

Name: Susan Branning

Title: Chief, Assistance Programs Branch

Signature:______________________ Date: 1/17/06

Name: Randall Rush

Title: Texas Nonpoint Source Project Manager

Signature:______________________ Date: 1/9/06

Texas State Soil and Water Conservation Board (TSSWCB)

Name: T. J. Helton

Title: Project Manager

Signature:______________________ Date: 12-18-05

Name: John Foster

Title: Quality Assurance Officer

Signature:______________________ Date: 12-19-05

Texas Cooperative Extension, Dept. of Soil and Crop Sciences

Name: Travis Miller

Title: Professor and Associate Department Head

Signature: Travis D Miller Date: 12/14/05

Name: Monty Dozier

Title: Extension Specialist – Water Resources and Project Manager/QAO

Signature: [signature] Date: 14 Dec, 2005

Name: Gaylon Morgan

Title: Extension Specialist – Small Grains and Field Demonstration Coordinator

Signature: Gaylon Morgan Date: 12/14/05

Name: Tony Provin

Title: TCE Soil, Water, and Forage Testing Lab Director

Signature: [signature] Date: 12-14-05

Name: John Pitt

Title: TCE Soil, Water, and Forage Testing Lab Manager/QAO

Signature: John Pitt Date: 12/14/05

Pg 3 the date in the header is the date printed, not the approval or revision date Lf

Section A2: Table of Contents

This is a USE CATEGORY III QAPP, as specified in EPA QA/R-5, Region 6, Dallas, TX. It is applicable to Region 6, Quality Management Plan entitled "Quality Assurance Management Plan, Texas State Soil and Water Conservation Board", approved April 21, 2005. (QTRAK # 05-205)

Section A3: Distribution List

Organizations, and individuals within, which will receive copies of the approved Quality Assurance Project Plan (QAPP) and any subsequent revisions include:

- **United States Environmental Protection Agency**

  Name: Randall Rush
  Title: Region 6, Texas Nonpoint Source Project Manager

- **Texas State Soil and Water Conservation Board (TSSWCB)**

  Name: T. J. Helton
  Title: Project Manager

  Name: John Foster
  Title: Quality Assurance Officer

- **Texas Cooperative Extension**

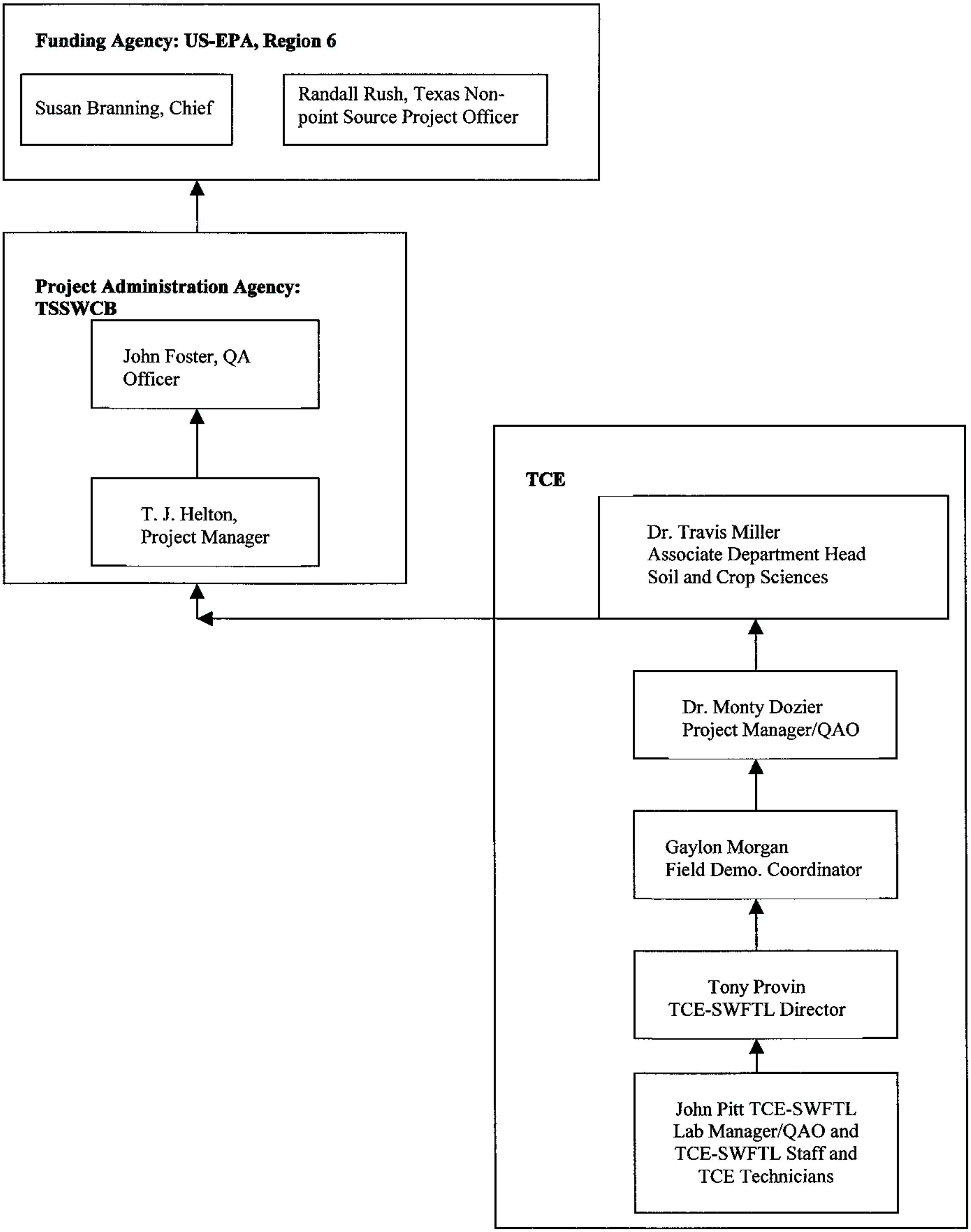
  Name: Monty Dozier
  Title: Project Manager and QAO

  Name: Gaylon Morgan
  Title: Field Demonstration Coordinator

  Name: Tony Provin
  Title: TCE Soil, Water, and Forage Testing Lab Director

  Name: John Pitt
  Title: TCE Soil, Water, and Forage Testing Lab Manager

Section A4a: Project Organization Chart:



Section A4b: Project / Task Organization and Responsibilities

The following is a list of individuals and organizations participating in the project with their specific roles and responsibilities.

Randall Rush, Texas Nonpoint Source Project Manager

United States Environmental Protection Agency, Region 6
Responsible for overseeing funding of project and insuring all federal Project mandates and deadlines are met.

T. J. Helton, Project Manager

Texas State Soil and Water Conservation Board (TSSWCB)
Responsible for overseeing the implementation of the proposed demonstration project within federal guidelines.

John Foster, Quality Assurance Officer

Texas State Soil and Water Conservation Board (TSSWCB)
Responsible for overseeing project QA.

Travis Miller, Professor and Associate Dept. Head

Department of Soil and Crop Sciences, College Station, TX
Texas Cooperative Extension (TCE)
Responsible for overall operation, integrity and success of the TCE project and completion of project responsibilities and deliverables.

Monty Dozier, Asst. Professor, Extension Specialist – Water Resources, and Project Manager and TCE Quality Assurance Officer

Texas Cooperative Extension (TCE)
Responsible for coordinating cooperation between TSSWCB and TCE for all reporting requirements and deliverables. Responsible for coordinating and conducting field level screening of water well samples. Responsible for data review, data management, equipment management and sample analysis associated with the private water well screening and zeolite demonstration portions of this project. Responsible for the design and completion of zeolite demonstration and public information related to this project. Will maintain official, approved QA Project Plan.

Gaylon Morgan, Asst. Professor and Extension Specialist – Small Grains and Field Demonstration Coordinator

Texas Cooperative Extension (TCE)
Responsible for coordinating the development, implementation, and evaluation of the winter cover crop demonstrations. Responsible for collection and analysis of all leachate samples associated with this project. Responsible for insuring laboratory procedures by contracted lab are followed, data review, data management, equipment management and sample analysis of the winter cover crop of this project.

Tony Provin, Associate Professor and Extension Lab Director

Texas Cooperative Extension (TCE)
Responsible for completing lab analysis for all soil and water samples collected from the winter cover crop demonstration. Responsible for supervision of the TCE soil, water, and forage testing lab (TCE-SWFTL).

John Pitt, Extension Associate and Extension Lab Manager

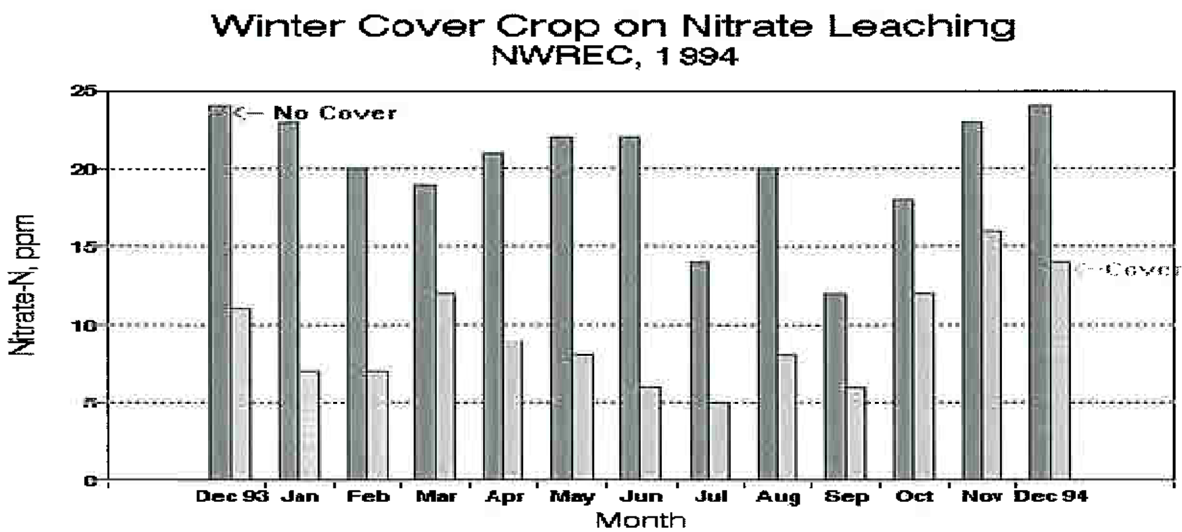
Texas Cooperative Extension (TCE)
Day to day operations of the TCE-SWFTL
Insure data integrity and TCE-SWFTL QA officer.

Section A5: Problem Definition / Background

Rural Texas relies almost entirely on groundwater for its domestic needs[1]. The contamination of groundwater from nonpoint sources related to the production of food and fiber has been noted by the Texas Commission on Environmental Quality (TCEQ[2]). Detections of atrazine and nitrates have been noted in water wells located in the Texas High Plains and Texas Rolling Plains[3]. Producers need to learn information related to best management practices (BMPs) associated with agriculture production designed to reduce the risk of nonpoint source contamination of groundwater.

One such BMP that can provide reductions in nitrate concentrations in soils is the use of a winter cover crop. In the past, cover crops were primarily planted to minimize soil loss from wind and water erosion. More recently the long-term benefits of cover crops for maintaining and improving soil characteristics, such as nutrient retention, aggregate stability, water holding capacity, organic matter, and nitrogen assimilation are being realized (Hussian et al., 1999[4]; Needleman et al., 1999[5]). The ability of cover crops to capture and recycle nitrogen and other nutrients reduces the potential for non-point source water pollution caused by nitrate leaching, soil erosion, and can reduce nitrogen fertilizer inputs (Meisinger et al.[6], 1991; Decker et al., 1994[7]; Duck and Tyler, 1996[8]).

Previous research has demonstrated a high potential for nitrate loss in the winter, which are typically the highest precipitation months of the year in Texas. Winter cover crops minimize nitrate leaching by sequestering residual nitrate leftover from the summer crop. With a winter cover crop present, the nitrate can be mined from the soil by the cover crop roots prior to the nitrate leaching beyond the crop root zones. The nutrients, including nitrate, that are recycled by the winter cover crop are then available for to following summer crop. For example, rye cover crops have been reported to decrease in soil N of 143 lbs/acre during the wet months of December through April (Kavdir and Smucker, 1999[9]). Brandi-Dohrn et al., 1997[10] reported soil solution nitrate-N collected 4 feet beneath the soil surface to be approximately 50% less in cover crop plots compared to bare soil treatments (see Figure below). Additional organic matter is also added to the soil, which will increase water holding capacity and soil structure and conserves soil moisture.



The use of zeolite has been proposed as a method to reduce contaminate concentrations in water. However, very little work exists related to setting up a system to wellhead treatment of groundwater through a zeolite filter. If this filtering system proves effective, groundwater could be treated at the wellhead to reduce atrazine and arsenic concentrations before water enters the private water well distribution system.

Finally, there is a need to conduct water well screening events for private water well users related to nitrate, atrazine, and arsenic concentrations. Private water well users can make more informed decisions related to the use and management of their individual water resource when they have information related to potential contaminate concentrations.

Section A6: Project/ Task Description

In this project, Dr. Gaylon Morgan will design and implement a cover crop demonstration. In this demonstration, three different winter cover crops will be planted and maintained as well as one bare soil treatment. Porous cup samplers will be placed below each treatment to collect nitrate-nitrogen leaching through the soil profile. This leachate will be analyzed for nitrate-nitrogen concentrations. Soil samples will be taken from each treatment at the beginning and end of the growing season to determine soil nitrate levels. Cover crop biomass samples will be taken prior to cover crop desiccation to determine the amount of nitrate-nitrogen assimilated by the crop. All information generated from this demonstration will be shared with agricultural producers at field days, continuing education unit (CEU) meetings, news letters, and through a demonstration report.

Dr. Monty Dozier will conduct the zeolite and water well screening portions of this project. The zeolite portion of this project will focus on determining the feasibility of using a zeolite filtering system to reduce atrazine and arsenic concentrations in groundwater. Groundwater samples of a known concentration will be filtered through a filtering device packed with zeolite and the concentration of the filtered water determined. From this information, the percent reductions in initial atrazine and arsenic reductions will be determined. All analysis will be done using a field-level Hach kit and appropriate Hach procedures and reagents.

For the water well assessment portion of this project, 75 samples total will be collected during a total of three annual private water screening days conducted in the High Plains and Rolling Plains of Texas. Screening days will be rotated annually to different counties in the two regions to increase the sampling area. All samples will be screened for atrazine and arsenic concentrations. Atrazine and arsenic concentrations will be determined using a Hach field kit and appropriate Hach procedures and reagents.

The Project tasks, objectives, schedules, deliverables, and subtask are as follows:

Task 1: Removal of Nitrate from Soil Profile with Winter Cover Crops.

Objective: to determine the amount of leachable nitrate that can be removed from the soil profile by winter cover crops.

Subtask 1.1: Porous cup water samplers will be inserted into the soil at a sufficient depth to catch the leached nitrogen-nitrate.

Subtask 1.2: Winter cover crops, including wheat, cereal rye, and common vetch, will be planted in the fall of 2005 and 2006, following the harvest of cotton or sorghum.

Subtask 1.3: In order to obtain adequate information on soil nitrate leaching within the cover crops, water samples will be collected from the porous cup samplers three to five times each year. Soil samples will also be analyzed for soil nitrate levels at the beginning and end of the cover crop.

Subtask 1.4: Nitrogen assimilation by each cover crop treatment will be estimated by using the cover crop biomass and nitrogen content. Approximately three weeks prior to planting cotton or sorghum, the winter cover crop will be desiccated with a burn down herbicide. The farmer will then plant cotton using his/her traditional production practices.

Schedule: The demonstration project will be initiated in the fall of 2005 and will consist of planting the winter cover crops. Following the desiccation of the winter cover crop, cotton or sorghum will be planted. The nitrogen management for the summer crop will based on soil test results. Nitrogen will be applied uniformly to the summer crop in order to prevent confounding results. In June 2007, a summary of nitrate concentration in the soil and water will be summarized along with the estimated levels of nitrate removal by the winter cover crops. Quarterly reports will be submitted at appropriate times, and the final report will be turned in at the conclusion of the project. This demonstration project will be completed by July 2007.

Deliverables: Information gained from the nitrate removal by cover crops will be presented at multiple educational events and meetings on a state and local level. Information gathered from effort will also be prepared in a newsletter distributed to all county extension offices in the Texas High and Rolling Plains. Copy of newsletter, educational agendas, and attendance sheets will be attached to reports.

Task 2: Demonstration of Zeolite as a BMP to Reduce Atrazine and Arsenic in Groundwater

Objective: to demonstrate the percent reduction in atrazine and arsenic concentrations in private well water by use of zeolite filtering media

Subtask 2.1: A measured volume of water will be spiked with known concentrations of atrazine and arsenic and passed through a zeolite filter before being pumped into a reservoir. Samples from the resevoir will be taken at 1 minute after entering the reservoir, and then at 5 minutes, 60 minutes and 24 hours and atrazine and arsenic concentrations determined. The zeolite filtering system will be placed directly in-line in the water distribution system between the water pump and the reservoir. By using this approach, an easy-to-use filtering process for these two contaminants can be demonstrated in a manner that will mimic in-line filtering systems placed between the wellhead and the end point of use of the distribution system.

Schedule: The zeolite portion of this project will be conducted in the Summer and Fall of 2005 and will be completed by December 2005. QAPP will be prepared before sampling is initiated.

Deliverables: Information gained from the zeolite study will be presented to private water well owners/users at various water quality educational programs across Texas. Information gathered from effort will also be prepared in a newsletter distributed to all county extension offices in the Texas High and Rolling Plains. Copy of newsletter, educational agendas and attendance sheets will be attached to reports.

Task 3: Assessment of Atrazine and Arsenic Concentrations in Private Water Well Samples of the Texas High and Rolling Plains.

Objective: to assess 75 private water well samples per year for atrazine and arsenic concentrations

Subtask 3.1: Annually two private water well screening events will be held in the Texas High Plains and one in the Rolling Plains of Texas.

Schedule: Sampling screening events will be conducted on-site in county locations in the Texas High Plains and Rolling Plains. Three total events per fiscal year will be conducted and all screening events will be completed by June 2007.

Deliverables: Information gained from the assessment study will be presented to private water well owners/users at various water quality educational programs across Texas. Information gathered from effort will also be prepared in a newsletter distributed to all county extension offices in the Texas High and Rolling Plains. Results of the private water screening effort will also be presented to the Ag. Chem. Subcommittee of the Texas Groundwater Protection Committee at the end of summer 2007. QAPP will be prepared and accepted before sampling is initiated. Agendas and attendance sheets will be attached to reports.

Table A6.1 Project Plan Milestones

December	**2003**	**Proposal and Contract Approved**
January	**2004**	**Contact agency personnel to initiate project** **Prepare Quarterly Report**
February	**2004**	**Determine sources for the porous cup samplers**
March	**2004**	**Teleconference with Bruce Lesikar on zeolite products**
April	**2004**	**Purchase and secure porous cup samplers** **Prepare Quarterly Report**
May	**2004**	**Meet with Bruce Lesikar on available equipment for zeolite studies**
June	**2004**	**Meet with Haskell County Extension Agent – Ag/NR to discuss possible sites for cover crop study**
July	**2004**	**Prepare Quarterly Report** **Tour of demonstration site to select porous cup sampler placement**
September	**2004**	**Make field preparations for winter cover crops and collect soil samples and determine soil moisture**
October	**2004**	**Prepare Quarterly Report** **Tour TAMU Bio. & Ag. Engineering Lab facilities to determine suitability for zeolite study** **Contact CEA-Ags in High Plains and Rolling Plains Districts to setup water screening events in 2005**

[illegible]	[illegible]	[illegible]
January	**2005**	**Prepare Quarterly Report** **Continue work on draft QAPP**
March	**2005**	**Complete QAPP and submit to TSSWCB**
April	**2005**	**Prepare Quarterly Report** **Conduct water screening event in Rolling Plains District**
May	**2005**	**Complete request for no-cost extension of project due to wet conditions that prevented year 1 cover crop field work and submit to TSSWCB** **Meet with TSSWCB personnel related to QAPP edits**
June	**2005**	**Secure Cover Crop Demo sites** **Complete edits on QAPP and submit for approval**
July	**2005**	**Prepare Quarterly Report** **Initiate field prep for cover crop demonstration**
August & September	**2005**	**Prepare zeolite demo unit** **Conduct zeolite demo and analyze results**
October	**2005**	**Prepare Quarterly Report** **Conduct water screening event in Rolling Plains Districts** **Plant cover crop and install porous cups, take soil samples, and determine soil moisture at cover crop site.**
November	**2005**	**Collect samples from cover crop project and analyze from any leaching event**
December	**2005**	**Collect samples from cover crop project and analyze from any leaching event**
[illegible]	[illegible]	[illegible]
January	**2006**	**Prepare Quarterly Report** **Collect samples from cover crop project and analyze from any leaching event and monitor soil moisture** **Secure water screening sites for 2006**
February	**2006**	**Collect samples from cover crop project and analyze from any leaching event**
March	**2006**	**Collect samples from cover crop project and analyze from any leaching event**
April	**2006**	**Collect yield data from cover crop demo site and analyze and monitor soil moisture** **Prepare quarterly report**
May	**2006**	**Conduct water screening event in High Plains Districts**
June	**2006**	**Secure Cover Crop Demo sites** **Conduct water screening event in High Plains Districts**
July	**2006**	**Prepare Quarterly Report** **Initiate field prep for cover crop demonstration**
October	**2006**	**Prepare Quarterly Report** **Conduct water screening event in Rolling Plains Districts** **Plant cover crop and install porous cups and determine soil moisture**
November	**2006**	**Collect samples from cover crop project and analyze from any**

		leaching event
December	**2006**	**Collect samples from cover crop project and analyze from any leaching event**
January	**2007**	**Prepare Quarterly Report** **Collect samples from cover crop project and analyze from any leaching event and monitor soil moisture** **Secure water screening sites for 2007**
February	**2007**	**Collect samples from cover crop project and analyze from any leaching event**
March	**2007**	**Collect samples from cover crop project and analyze from any leaching event**
April	**2007**	**Collect yield data from cover crop demo site and analyze and monitor soil moisture** **Prepare quarterly report** **Conduct water screening event in High Plains**
June	**2007**	**Prepare Draft Final Report**
August	**2007**	**Complete Final Report and Submit to TSSWCB**

******These dates are estimates of activity scheduling. Therefore the timeline may change to accommodate local coordinating committees, project administration, and weather conditions.***

Section A7: Data Quality Objectives for Measurement Data

The data quality objectives for this project are to collect water quality data related to the leaching of nitrates through the soil profile in order to demonstrate the effectiveness of cool season cover crops in reducing such nitrate losses. The project will also assess well water samples from private water wells in the Texas High Plains (TCE Districts 1 and 2) and the Rolling Plains and Big Country (TCE Districts 3, 7, and 8). Water wells will be field screened for arsenic concentrations and atrazine concentrations using on-site, field level screening techniques. Finally, a demonstration to determine the effectiveness of zeolite to reduce arsenic and atrazine concentrations in water will be conducted. Arsenic and atrazine concentrations will be determined using on-site, field level screening techniques.

Overall project management will be conducted by TSSWCB and overseen by EPA. All demonstration work and water sampling will be conducted by TCE. Analysis of all private well water samples will be conducted by TCE. Water samples collected through the zeolite demonstration will be analyzed by TCE. The leachate samples collected from the cover crop project will be collected by TCE and analyzed by the TCE Soil, Water, and Forage Laboratory (SWFTL) at College Station, TX.

TCE will establish winter cover crop demonstration plots in the Rolling Plains region of Texas and collect leachate through the growing season. Leachate will be collected using porous cups placed in the soil profile. Leachate samples collected will be analyzed for nitrate-nitrogen concentrations by the TCE SWFTL. Soil samples will also be collected and analyzed for nitrate by the TCE SWFTL. Plant material samples will also be collected from each plot and analyzed by the TCE SWFTL for crude protein.

For the water well screening program, the analytes of concern are atrazine and arsenic. All samples will be collected during water well screening events conducted with the cooperation of local TCE county offices in the Texas High Plains and Rolling Plains and analyzed using mobile screening techniques.

Table A7.1 Measurement Performance Specifications

Parameter	Matrix	Units	Methods	Reporting Limits (RLs)	% Recovery at RLs	Precision (RPD of LCS/LCS dup)	BIAS(% Rec. of LCS/LCSD mean)	Lab
Atrazine	Water	ug/L	Hach Field Kit	0.1 – 3.0[1]	75-125	20	75-125	Dozier
Arsenic	Water	ug/L	Hach Field Kit	0 - 500[2]	75-125	20	75-125	Dozier
Nitrate-nitrogen	Water	mg/L	SWFTL0038.SOP	0.01	80-120	20	75-125	TCE-SWFTL
Nitrate-Nitrogen, extractable	Soil	mg/Kg	SWFTL014R0.SOP	1.0	NA	20	NA	TCE-SWFTL
Soil Moisture	Soil	%	Theta probe	$0.01m^3.m^{-3}$	NA	20	NA	NA
Crude Protein	Plant Tissue	%	SWFTL0073R0.SOP	200 ppm	NA	20	NA	NA

[1]Hach Technical Sheet No. 1605, "Atrazine in Water Test Kit"
[2]Hach "Arsenic Test Kit 0 – 500 ppb" procedure sheet

Precision

Precision is a statistical measure of the variability of a measurement when a collection or an analysis is repeated and includes components of random error. It is strictly defined as the degree of mutual agreement among independent measurements as the result of repeated application of the same process under identical conditions for the same sample or matrix.

Laboratory precision is assessed by comparing replicate analyses of laboratory control samples. Precision results are compared to historical data and used during evaluation of analytical performance. Program-defined measurement performance specifications for laboratory control standard/laboratory control standard analyses are defined in Table A7.1.

Bias

Bias is a statistical measurement of correctness and includes multiple components of systematic error. A measurement is considered unbiased when the value reported does not differ from the true value. Bias is verified through the analysis of laboratory control standards prepared with certified reference materials and by calculating percent recovery. Results are plotted on quality control charts, which are calculated based on historical data and used during evaluation of analytical performance. Program-defined measurement performance specifications for laboratory control standards are specified in Table A7.1.

For soil samples, bias is verified through laboratory media standard results compared to replicated results of the same sample on a large volume basis.

Representativeness

Representativeness is a measure on how accurately a monitoring program reflects the actual water quality conditions. The representativeness of the data is dependent on 1) site selection, 2) the number of samples collected, 3) the number of years and seasons when sampling is performed and 5) the appropriate sampling procedures, and use of only approved analytical methods will assure that the measurement data represents
the conditions at the site. Representativeness will be measured with the completion of samples collected in accordance with the approved QAPP.

Comparability

Confidence in the comparability of data sets for this project and for water quality assessments is based on the commitment of project staff to use only approved sampling and analysis methods and QA/QC protocols in accordance with quality system requirements and as described in this QAPP and all applicable water and soil sampling references footnoted for Table A7.1. The TCE SWFTL will conduct all soil analyses. This facility offers a professional soil testing service and is involved with other studies funded through TSSWCB. Comparability is also guaranteed by reporting data in standard units, by using accepted rules for rounding figures, and by reporting data in a standard format as specified in Section B10.

Completeness

The completeness of the data is basically a relationship of how much of the data is available for use compared to the total potential data. Although 100 percent of collected data should be available, accidents, insufficient sample volume, or other problems must be expected. A goal of 80 percent data completeness will be required for data usage for the water screening and zeolite portions of this project. Should less than 80 percent data completeness occur, Monty Dozier will initiate corrective action. Data completeness will be calculated as a percent value and evaluated with the following formula:

$$\text{Completeness (\%)} = \frac{SV}{ST} \times 100$$

Where: SV = number of samples with a valid analytical report,

ST = total number of samples collected

In addition for all water analysis, trip blanks will be carried to the field to determine if contamination of samples occurred during the sampling or transportation process. Field splits are used to assess the variability of sample handling, preservation, and storage, as well as the analytical process, and are prepared by splitting samples in the field. Control limits for field splits are defined in Section B5.

Primary focus

Demonstration work will include a two year period (two growing seasons) to determine the effectiveness of cover crops in reducing nitrate-nitrogen concentrations in leachate. When leaching of surface water through the soil profile occurs, water samples will be collected by porous cups during the monitoring period. Information on the porous cups to be used in this project is in Appendix A.

For atrazine screening, the Hach "Atrazine in Water Test Kit" will be used. Technical information are in Appendix B. For arsenic, the Hach "Arsenic Test Kit (0 – 500 ppb) will be used. Technical information for both parameters are in Appendix B.

The Project Managers will coordinate with the Laboratory Manager and Staff to ensure that proper protocols are utilized. Data will be reviewed for abnormalities or results not in agreement with the specifications in Table A7.1a or b. The data will be assumed normal and appropriate for decision determinations in the event no error is found. Any unusual results will be traced for error sources. If an error is found and cannot be resolved, the data will be discarded.

Quarterly progress reports will be submitted to TSSWCB throughout the project. These reports will summarize activities as well as data collected and analyzed to date. A final report will also be submitted to TSSWCB.

Section A8: Special Training/Certification

No special training or certification is required for this project.

Section A9: Documentation and Records

Reporting will include quarterly progress reports, reimbursement requests, and a final report at the culmination of the study.

Quarterly progress reports will be submitted to TSSWCB and will note activities conducted throughout the quarter, items or areas identified as potential problems, and any variations or supplements to the QAPP. Problems encountered will be discussed by the project team and corrective actions implemented will also be included in the appropriate quarterly report. Any changes to the QAPP will be printed and copies distributed to all individuals as outlined in the distribution list by TCE QA officer.

Reimbursement requests for TCE will be handled by the Texas A&M University – TAES/TCE accounting office in College Station. A report summarizing the data collected during the project period will be included in the project's final report. Copies of all raw data, laboratory analyses, documentation records, calibration logs, and other pertinent information will be kept at the TCE Soil and Crop Sciences Unit in College Station and will be available for review for audits and other purposes. All original data in electronic forms will be archived by TCE for at least five years after termination of the project.

Leachate sample results from the winter cover crop demonstrations will be stored on file in TCE Soil, Water, and Forage Laboratory. Additional hard copies of the leachate sample results will be stored in Morgan's files.

Copies of all results from the private water well screening portion of this project and from the zeolite demonstrations will be stored in Dozier's files.

Quarterly reports and the final report will be stored on Dozier's desktop computer and will be copied on two separate CDs within two weeks of completion to insure copies will be available if computers fail or are stolen. CDs will be stored in TCE Department of Soil and Crop Sciences.

Section B1: Sampling Process Design (Experimental Design)

Three different cover crops and one bare soil will be compared for reducing nitrate leaching. Three winter cover crops (cereal rye, common vetch, and wheat) will be planted in the fall following the cotton harvest. The cereal rye, common vetch, and wheat will be planted at the recommended seeding rate of 60 lbs/A. The treatments will be arranged in a randomized complete block design, with 4 replicates. Plots will be planted with a cone planter with plot size of 44 ft^2.

The above ground biomass for each cover crop will be harvested prior to chemical dessication of the winter cover crops. A one square foot sub-sample from each cover crop plot will be hand harvested from multiple locations within each plot. The dry matter and nitrogen content will be calculated for each cover crop by analyzing the samples for crude protein in the TCE Soil, Water, and Forage Laboratory.

Within each treatment, there will be one soil lysimeter buried at a depth below the cover crop rooting zone, approximately 36 to 48 inches. See sample collection section below. The manufactures instructions for burying the lysimeters will be followed. This procedure will include augering a 2 inch diameter hole with a hand auger to the desired depth. A slurry of silica flour will be used to make good contact between the lysimeter and the soil. The vacuum/pressure line and the return flow line will be connected and tested for leaks. The lysimeters will be inserted into the hole, pushed to the bottom, into the slurry to ensure good contact with soil. A 1 ¼" plastic pipe will be placed over the vacuum/pressure and return flow lines in order to obtain the desired depth. The pipe will remain in place to protect the tubing. The hole will be back filled with soil.

Soil samples will be collected prior to the planting and following the dessication of the winter cover crops. Three soil sample cores for each depth will be collected with a hand auger or soil probe at depths of 1 foot, 2 feet, and 3 feet from each plot. For each depth, these samples will be combined and a composite sample collected for analysis. Soil samples will be transported and stored at 4 ° C until analyzed. The soil samples will be analyzed for soil nitrate by the TCE-SWFTL. Soil moisture will be measured at planting, in winter, and at cover crop dessication at depths of 6 inches, 12 inches, 24 inches, and 36 inches using the Theta probe soil moisture probe.

Seventy five private water well samples per year will be collected by individual wellowners/users according to guidelines outlined in Appendix B. Samples will be collected in a whirl-pac and delivered to a central location designated by the host county extension agent. Samples will be collected no earlier than the afternoon before the screening is conducted. Samples will be stored in a dry location at 22.5° C and analyzed within 48 hours of collection. Zeolite samples will be collected from the demonstration site in a glass amber bottle and transported to a designed screening location. These samples will be stored in a dry location at 22.5° C and screened within 48 hours of collection.

Table B1.1 Sample Constituents

Parameter	Area of Interest	Status	Reporting Units
Atrazine, water	Private wells in High Plains and Rolling Plains and zeolite demonstration	Critical	μg/L
Arsenic, water	Private wells in High Plains and Rolling Plains and zeolite demonstration	Critical	μg/L
Nitrate-nitrogen, water	Winter Cover Crop Demonstration sites	Critical	mg/L
Nitrate-nitrogen, extractable, soil	Winter Cover Crop Demonstration sites	Critical	mg/Kg
Soil Moisture	Winter Cover Crop Demonstration sites	Critical	% moisture
Crude Protein, plant tissue	Winter Cover Crop Demonstration sites	Critical	Kg/ha

For the water samples collected from the cover crop and zeolite portions of the project, Quality Control (QC) samples will be included to insure sample integrity. QC samples will include 1) field blanks (FB), 2) spiked samples of known concentrations (SP), and 3) field duplicates (FD). The purpose of these samples will be 1) to determine sample procedure efficiency and 2) to determine quantities of contamination from sample transport and analysis.

Table B1.2 Total Estimated # of Samples to be Collected and Analyzed

Parameter	Area of Interest	# of Samples
Atrazine, water	Private wells in High Plains and Rolling Plains	150
Arsenic, water	Private wells in High Plains and Rolling Plains	150
Atrazine, water	Zeolite Demonstration	12
Arsenic,water	Zeolite Demonstration	12
Nitrate-nitrogen, water	Winter Cover Crop Demonstration sites	60
Soil nitrate-nitrogen, extractable,	Winter Cover Crop Demonstration sites	48
Soil Moisture	Winter Cover Crop Demonstration sites	48
Crude Protein, plant tissue	Winter Cover Crop Demonstration sites	16

Section B2: Sampling Methods

Private water well samples will be collected by individual wellowners/users in accordance with sampling guidelines presented to the wellowners/users and reviewed by local TCE agents prior to sampling. All samples will be collected in whirl-pacs that will be distributed by the local TCE agents involved with the program along with the sampling guidelines. Samples will be collected no earlier than the day before the screening program is to be conducted and must be stored in a dry place at 22.5° C. Once samples are collected, the well owners/users will drop samples off at a central location established by the local TCE agents involved with the program. Samples will be analyzed within 48 hours of collection. A sample collection information sheet is provided in Appendix C.

For the zeolite portion of this project, samples will be collected after they pass through the zeolite in glass, amber bottles. Samples will be stored in a dry place at 22.5° C and must be analyzed within 48 hours of collection.

Water samples will be collected from the each porous cup lysimeter after each major rainfall event (5 estimated per winter growing season) each year. The solution from the soil will be pulled through the porous part of the lysimeter and collected in the lower part of the lysimeter by creating a vacuum with the vacuum pump. The vacuum pump will remain on long enough to collect an adequate sample size of 50 ml. These water samples can only be collected from moist soil and soil moisture will dictate sample timings. Water samples will be collected at bi-monthly and more frequently if necessary. Water samples will be analyzed for nitrate-nitrogen by the TCE -SWFTL

Soil samples will be collected prior to the planting and following the dessication of the winter cover crops. Three soil sample cores for each depth will be collected with a hand auger or soil probe at depths of 1 foot, 2 feet, and 3 feet from each plot. For each depth, these samples will be combined and a composite sample collected for analysis. Soil samples will be transported and stored at 4 ° C until analyzed. The soil samples will be analyzed for soil nitrate by the TCE-SWFTL. Soil moisture will be measured at planting, in winter, and at cover crop dessication at depths of 6 inches, 12 inches, 24 inches, and 36 inches using the Theta probe soil moisture probe.

The above ground biomass for each cover crop will be harvested prior to dessication of the winter cover crops with glyphosate. The dry matter and nitrogen content will be calculated for each cover crop by analyzing the samples for crude protein in the TCE Soil, Water, and Forage Laboratory.

All corrective action is the responsibility of the project manager. Corrective action will be documented in the appropriate quarterly report. Any problems that arise will be discussed and reviewed by all participants at the quarterly project team meetings.

Section B3: Sample Handling and Custody Requirements

This project involves the collection of water quality data from control/management of NPS pollution sources for demonstration purposes. All well water samples will be assigned an identification number at the time of collection and recorded in duplicate in a laboratory manual. This manual will be stored in Room 337a of the Heep Center in the Department of Soil and Crop Sciences when not in use in the field. Zeolite samples will be collected in glass, amber bottles and assigned a number to be recorded in duplicate in a laboratory manual. This manual will be stored in Room 337a of the Heep Center in the Department of Soil and Crop Sciences when not in use in the field.

The water samples collected from the porous cup samplers will be collected in new plastic vials. Two 50 ml plastic vials from each porous cup sampler within cover crop treatment will be filled and sealed. One plastic vial will be sent to the TCE-SWFTL and the other vial will be kept in a refrigerator (4° C) until the lab has processed the samples. The plastic vials will be marked with a plot number and sample date. The employee's name collecting these samples will be recorded. After water samples are collected at the demonstration site, they will be kept cool and transported promptly to the TCE-SWFTL for nitrate analysis. The water samples will be hand delivered to the laboratory.

Table B3.1 describes sample container, preservation and holding time information for the parameters of interest.

Table B3.1 Sampling Procedures and Handling Methods

Parameter	Matrix	Sample Size	Container	Preservation	Holding Time (days)
Atrazine[1]	Well Water	16 oz	plastic whirl-pac	none	48 hours
Arsenic[1]	Well Water	16 oz	plastic whirl-pac	none	48 hours
Atrazine[2]	Filtered Water	1 L	Amber glass	none	48 hours
Arsenic[2]	Filtered Water	1 L	Amber glass	none	48 hours
Nitrate-Nitrogen, extractable[3]	Soil Leachate	0.5 L	Plastic vials	none	28 days
Soil nitrate[3]	Soil	0.5 L	D-492 SWFTL bag	Air dry	180 days
Crude Protein[3]	Plant Tissue	500 g	Cloth bags	Oven dry	48 hours

[1] Samples collected during private well water screening portion of project.
[2] Samples collected from zeolite demonstration portion of project.
[3] Samples collected from cover crop demonstration portion of project.

Section B4: Analytical Methods Requirements

Well water samples and samples from the zeolite demonstration collected during this project will be analyzed by TCE using mobile screening techniques as prescribed by Hach. A listing of analytical methods requirements are listed in Table B4-1. Methodologies for atrazine and arsenic are included in Appendix D.

Soil samples, porous cup, and forage samples will be analyzed by the TCE Soil, Water, and Forage Lab. Methodologies for analysis of Nitrate-nitrogen, phosphorus, and potassium in the soil are included in Appendix E.

In the event of a failure in the analytical system, the project manager will be notified. The laboratory director and the project manager will then determine if the existing sample integrity is intact, if re-sampling can and should be done, or if the data should be omitted.

Table B4.1 Analytical Methods Requirements

Parameter	Matrix	Procedure	Equipment Used	EPA or [1]SWFTL Method Number	Method Detection Limit (MDL)	Method Quantification Limit (MQL)
Atrazine	Water	Immunoassay	Pocket Colorimeter[1]		0.1 µg/L	0.1µg/L
Arsenic	Water	Sulfamic acid, zinc, and mercuric bromide reaction	Color test strip[2]		0.0 µg/L	0.0 µg/L
Nitrate-nitrogen	Water	Keeney/Nelson	[3]Lachat	0038	0.05 mg/L	0.25 MG/L
Nitrate-Nitrogen, extractable	Soil	Keeney/Nelson	[3]Lachat	00014	0.1 mg/kg	0.05 MG/KG
Soil Moisture-	Soil	volumetric	Theta sensor	NA	NA	NA
Crude Protein	Plant Tissue	McGeehan and. Naylor.	Elementar Rapid N	0073	200 ppm	

[1]Hach Technical Sheet No. 1605, "Atrazine in Water Test Kit"
[2]Hach "Arsenic Test Kit 0 – 500 ppb" procedure sheet
[3] Latchet 8000 Flow Injection Analyzer

Section B5: Quality Control Requirements

The TCE-SWFTL at College Station will determine the precision of their analyses. Quality assurance of field sampling methods will be done through review of TCE personnel by project manager. Quality control (QC) samples will be included to insure sample integrity. Field QC samples will include 1) field blanks and 2) field duplicates. For the zeolite and well water portions of this project, standards secured from Hach will be used to calibrate all Hach field screening kits.

All analyses will have the precision and accuracy of data determined on the particular day that the data was generated. This requires the analysis of a minimum of one duplicate and one spike each time a particular parameter is measured. Larger batches of samples require that additional precision and accuracy checks be made which will represent 10 % of the total batch. Depending on the analysis, certain methodologies require that water blanks, standards and reagent blanks be analyzed to verify that no instrument or chemical problem will affect data quality. Table B5.1 and Appendix D outline the required analytical quality control for the parameters of interest.

Table B5.1 Required Quality Control Analyses

Parameter	Matrix	Area of Interest	Blank	Standard	Duplicate	Spike
Atrazine	**Water**	Private wells in High Plains and Rolling Plains	**A**	**A**	**A**	**A**
Arsenic	**Water**	Private wells in High Plains and Rolling Plains	**A**	**A**	**A**	**A**
Atrazine	**Water**	Zeolite Demonstration	**A**	**A**	**A**	**A**
Arsenic	**Water**	Zeolite Demonstration	**A**	**A**	**A**	**A**
Nitrate - Nitrogen	**Water**	Winter Cover Crop Demonstration sites	**B**	**B**	**B**	**B**
Nitrate – Nitrogen, extractable	**Soil**	Winter Cover Crop Demonstration sites	**B**	**B**	**B**	
Soil Moisture	**Soil**	Winter Cover Crop Demonstration sites	**B**	**B**	**B**	**B**
Crude Protein	**Soil**	Winter Cover Crop Demonstration sites		**B**	**B**	

A: Where specified, blanks and standards shall be performed each day that samples are analyzed.
B: Calibration and quality control of samples per method and instrument used as outlined in Appendix E

Duplicate - duplicates are used to assess precision. A duplicate is prepared by splitting aliquots of a single sample in the field. Both samples are carried through the entire transportation, preparation and analytical process. Duplicates are performed at a rate as described in the table above.

Precision is calculated by the relative percent deviation (RPD) of duplicate results as defined by 100 times the difference (range) of each duplicate set, divided by the average value (mean) of the set. For duplicate results, X_1 and X_2, RPD is calculated from the following equation:

$$\mathbf{RPD = \{ (X_1 - X_2) / (X_1+X_2)/2 \} * 100}$$

Matrix spikes (MS) - A matrix spike is an aliquot of sample spiked with a known concentration of the analyte of interest. Percent recovery of the known concentration of added analyte is used to assess accuracy of the analytical process. The spiking occurs prior to sample preparation and analysis. Matrix spike samples are routinely prepared and analyzed at a rate as described in the table above. The MS may be spiked at a level less than or equal to the midpoint of the calibration or analysis range for each analyte. The MS is used to document the accuracy of a method due to sample matrix and not to control the analytical process. Percent Recovery (%R) is defined as 100 times the observed concentration, minus the sample concentration, divided by the true concentration of the spike. MS recoveries are indicative of matrix-specific biases and are plotted on control charts maintained by the laboratory. Measurement performance specifications for matrix spikes are not specified in this document, and MS data should be evaluated on a case-by-case basis.

The formula used to calculate percent recovery, where %R is percent recovery; SSR is the observed spiked sample concentration; SR is the sample concentration; and, SA is the spike added; is:

$$\%R = (SSR - SR)/SA * 100$$

If control limits are exceeded, the TCE-SWFTL manager will inform the project manager and project QAO. The project manager and QAO will be responsible for determining and documenting what actions related to control limits are taken and reporting such information to the project manager. The project manager will then include this information in the next scheduled quarterly report and the final project report.

Section B6: Equipment Testing, Inspection, & Maintenance Requirements

Manufacturers' recommendations for scheduling testing, inspection, and maintenance of each piece of equipment will be followed or exceeded. Records of all tests, inspections, and maintenance will be maintained and log sheets kept showing time, date, and analyst signature. These records will be available for inspection by the TSSWCB.

To minimize downtime of all measurement systems, all field measurement and sampling equipment, in addition to all laboratory equipment, must be maintained in a working condition. Also, backup equipment or common spare parts will be made available, where possible, in the case that a piece of equipment fails during use, so measurement tasks may be resumed. All staff who use chemicals, reagents, equipment whose parts require periodic replacement and other consumable supplies receive instruction concerning the remaining quantity (unique for each supply) which should prompt a request to order additional supplies.

Failures in any testing, inspections, or calibration of equipment will result in a corrective action reports (CAR) and resolution of the situation will be reported to the TSSWCB in the quarterly report. Copies of all CARs will be maintained by the Project Leader.

Section B7: Instrument Calibration and Frequency

All instruments used in obtaining environmental measurement data will be calibrated prior to use according to manufacturer recommendations.

For the field level screening of private water well samples for atrazine and arsenic the following methods will be employed; 1.) arsenic concentrations will be determined using a *Hach arsenic test kit* (# 28000-28) for arsenic concentrations of 0 to 500 *ug*/L, and 2.) atrazine concentrations will be determined using the *Hach atrazine in water test kit* (# 27635-87). It should be noted that arsenic and atrazine concentrations for the zeolite demonstration will be determined in this same manner. Calibration of Pocket Colorimeter will be done in accordance with approved Hach procedures.

For the TCE SWFTL, all instruments or devices used in obtaining environmental measurement data will be used according to appropriate laboratory practices. All instruments or devices used in obtaining environmental measurement data will be calibrated prior to use. Laboratory equipment and devices needing calibration and recalibration are numerous and varied. Thus, each instrument has a specialized procedure for calibration and a specific type of standard used to verify calibration.

Standards used for instrument or method calibrations shall be of known purity and be National Institute for Standards and Testing (NIST) traceable whenever possible. When NIST traceability is not available, standards shall be manufactured by a company that has verified standard results against NIST standards. All certified standards will be maintained traceable with certificates on file in the laboratory. Dilutions from all standards will be recorded in the standards log book and given unique identification numbers.

Generally, calibrations are performed with a minimum of four standards of increasing concentrations and a calibration blank. Instrument calibration for each analyte will achieve an r^2 value of 0.990 or higher. The frequency of calibration recommended by the equipment manufacturer or as stated in the SOPs, as well as any instructions specified by applicable analytical methods, will be followed. Calibration shall be verified immediately after a set of standards is analyzed and continuously throughout an analytical run, after every sample batch, and at the end of an analysis to verify that the instrument or method has not drifted or changed since calibration. The initial calibration verification and continuing calibration verification will be matched to the generated standard curve and screened for acceptability. Laboratory standards will be checked to verify that the concentrations are those which are prescribed for the analytical method.

All information concerning calibration will be recorded by the person performing the calibration and will be accessible for verification during either a laboratory or field audit.

All calibration procedures used in the laboratory will meet or exceed the calibration frequencies published in the test methods used for this project. Additional calibration procedures will be conducted if laboratory personnel determine additional calibration is warranted as beneficial to this project.

Section B8: Inspection/Acceptance for Supplies and Consumables

Each new supply will be tested to verify the new supplies function correctly and are not contaminated.

Section B9: Data Acquisition Requirements (Non-Direct Measurements)

No data from non-direct measurements will be used in this project.

Section B10: Data Management

Field Collection and Management of Samples

Soil samples will be collected from each site at depth increments of 1 ft, 2 ft, and 3 ft as outlined in Section B1 and B2. Composite samples will be placed in a clean plastic bucket, thoroughly mixed and then placed in a TCE Soil Sample Bag (TCE Item D-592). A sample information section is provided on the Sample Bag and includes: Sample I.D., Name, Address, State, and Zip Code. Samples will then be placed in an ice chest to moderate temperature fluctuations and transported to the laboratory.

Leachate samples will be collected only from selected plots using porous cups in accordance with Section B1 and B2. Samples will be placed in approved laboratory containers and labeled with a unique sample identification number. The number will include the corresponding sampler number and the number of the bottle according to its order of collection. The field technician also records all pertinent information (e.g., site, date, time, and number of bottles retrieved) in the field notebook. Samples and forms will be kept together during transport to the TCE Soil, Water and Forage Testing Laboratory.

Plant tissue samples will be collected as outlined in Section B1 and B2. Tissue samples will be placed into clean paper sacks marked with a unique identifying number corresponding to the plot from which it was obtained. Samples will then be placed in burlap sacks for transport to the laboratory.

Zeolite and water well samples will be collected and handled according to Section B1 and B2.

Chain of Custody Forms

A COC form is used to record sample identification parameters and to document the submission of samples from the field staff to the analytical laboratory staff. A copy of the COC is found in Appendix G.

Sample Data Entry

As laboratory analyses are completed, laboratory personnel will provide the sample results to the respective study manager. Results will be compiled into a field and laboratory data report and submitted to the TCE QA officer who will review the QA/QC requirements and convey the information to the project manager. The project manager will check for abnormalities or problems by examining all field and laboratory data reports. In the instance where an abnormality is noted, the project manager will compare all necessary sample data, that is, field notebook, COC form , sample results, and field and laboratory data report for the sample in question. If necessary, corrections will be made to the field and laboratory data report with appropriate documentation maintained. Final field and laboratory reports will be compiled and submitted to TSSWCB within the appropriate quarterly progress report.

Archives and Data Retention

Original data will be stored on paper or electronically in accordance with the record-retention schedule outlined in Section A9.

Information Dissemination

Pertinent TCE data will be sent to TSSWCB for dissemination to the public according the project deliverables. Summaries of the data will be presented in the final project report.

Section C1: Assessments and Response Actions

The proper use of approved equipment and standard methods when obtaining environmental samples and producing field or laboratory measurements must involve periodic verification. Project manager will verify that proper equipment is available and that all personnel involved in the field activities have received sufficient training to properly take samples. The application of procedures will be verified biennially and documented in the appropriate quarterly report. This verification constitutes the biennial field performance audit. Staff in the field will be observed during actual field operations to verify that procedures are properly applied. A member of the TSSWCB will perform this audit. The project manager will be responsible for contacting the TSSWCB QAO to schedule the biennial audits.

All laboratory samples will have the precision and accuracy of data determined on the particular day that the data were generated. Depending on the analysis, certain methodologies require that water blanks, standards, and reagent blanks be analyzed to verify that no instrument problem will affect data quality.

To minimize downtime of all measurement systems, all field measurement and sampling equipment, in addition to all laboratory equipment, must be maintained in a working condition. Also, backup equipment or common spare parts will be made available if any piece of equipment fails during use so that repairs or replacement can be made quickly, allowing measurement tasks to be resumed. Site specific check lists and maintenance records will be used to assist with proper equipment upkeep.

Data collection and analytical results will be reviewed semi-annually by the project manager and field demonstration coordinator to ensure that the data collection program is obtaining the desired results. During this semi-annual review, any necessary modification to the data collection efforts will be implemented to improve the integrity, validity and usefulness of the data.

Project manager will attach to appropriate quarterly reports any corrective action reports from the lab.

Section C2: Reports to Management

The field measurement and sampling for the project will be done according to the approved QAPP. The project manager will be required to report on the proper implementation of the procedures outlined in this QAPP and thereby the status of the data quality. The QAO, at the TSSWCB, will be informed of any quality assurance problems encountered, and solutions adopted, during quarterly reports submitted to TSSWCB.

Upon completion of the project, the final report will contain a detailed quality assurance section to address the accuracy, precision and completeness of the measurement data used in the project's conclusions. It will also discuss any problems encountered and solutions made. This final project QA report is therefore the responsibility of the project manager with any assistance required from the Laboratory Manager, and laboratory and field technical assistance personnel. All reports detailed in this section are contract deliverables and will be provided to TSSWCB.

Section D1: Review, Validation, and Verification Requirements

The TCE monitoring personnel will be responsible for reviewing, validating and verifying the measurement and sample data and the routine assessment of measurement procedures for precision and accuracy. It will be the responsibility of the TCE QA officer to verify that the data is representative. The data's precision, accuracy, and comparability will also be the responsibility of Dozier (well water and zeolite) and Morgan (winter cover crop). The TCE SWFTL director will have responsibility for the data's precision and accuracy of all samples from the winter cover crop and soils submitted for analysis by the TCE SWFTL. Furthermore, the TCE SWFTL director will have the responsibility of determining that the percent mean recovery criteria is met, or will justify acceptance of a lesser percentage for all samples submitted to the TCE SWFTL.

Whenever the procedures and guidelines established in this QAPP fail to meet the specified levels of data quality, corrective action will be required. Corrective action may be initiated by the QAOs if variances from proper protocol are noted. The responsibility for insuring that corrective actions are made will be the responsibility of the project manager. Project manager and the field demonstration coordinator may also initiate corrective action on his own initiative, if situations arise that require immediate attention. Documentation of any corrective action procedures will be provided by the project manager as appropriate, along with the results of the implemented changes through the use of quarterly reports.

Section D2: Verification and Validation Methods

All data will be verified to ensure they are representative of the samples analyzed and locations where measurements were made, and that the data and associated QC control data conform to project specifications. The staff and management of the respective field, laboratory, and data management tasks are responsible for the integrity, validation, and verification of the data generated by each task. The field and laboratory tasks ensure the verification of raw data, electronically generated data, and data in hard copy format.

The project manager will be responsible to evaluate and verify all data against project specifications. The project manager will check for errors related to data generated from this project. Should an error be identified, the project manager will meet with the individual responsible for the task in question. If the error can not be corrected, the data will be rejected and not be reported as part of this project.

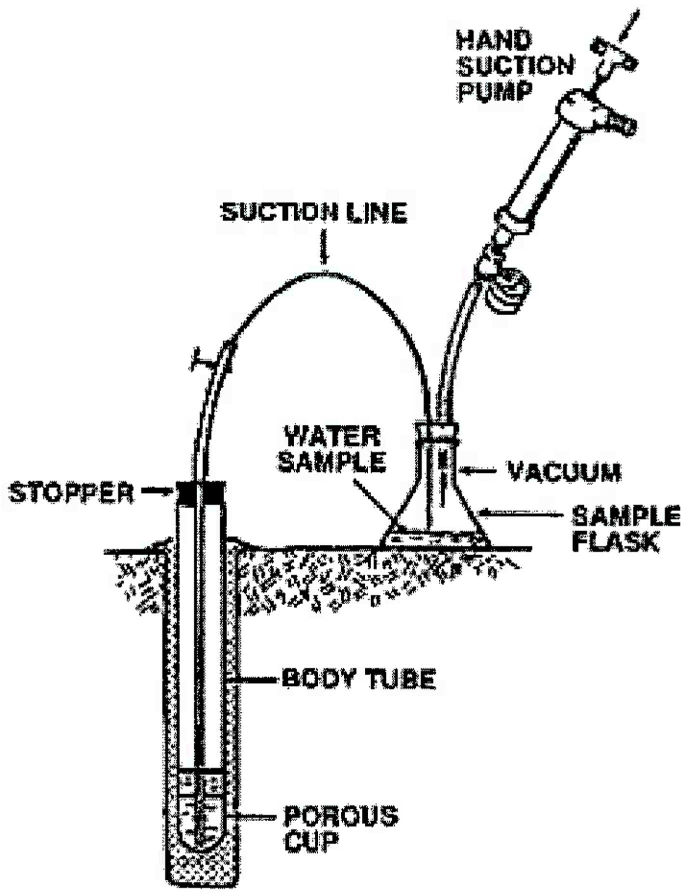
Finally, the project manager will validate that all reported data meets the quality objectives of the project and are suitable for reporting to the TSSWCB.

Section D3: Quality Objectives Reconciliation

By following the guidelines described in this QAPP, and through careful sampling design, the data collected in this project will be representative of the actual conditions and will be comparable to similar applications. The comparability of the data produced is predetermined by the commitment of the TSSWCB staff and the TCE-SWFTL. Table A7.1 in Section A7 "Data Quality Objectives" lists the required accuracy limits for the parameters of interest. The completeness of the data will be affected by the reliability of the equipment, frequency of field and laboratory errors or accidents, and unexpected events.

Representativeness and comparability of data, while unique to each individual collection site, is the responsibility of the project manager and the field demonstration coordinator. The project manager will review the final data to ensure that it meets the requirements as described in this QAPP. Analysis of data using the methods and procedures described in Section A7 will be the final indicator of data validity. Project manager will review all quarterly and final reports before submission to TSSWCB.

Appendix A: Porous Cup Schematic


HAND
SUCTION
PUMP
SUCTION LINE
WATER
SAMPLE
VACUUM
STOPPER
SAMPLE
FLASK
BODY TUBE
POROUS
CUP

Appendix B: Field Screening Methods for Atrazine and Arsenic

Appendix C: Private Well Sampling Form

Instructions for Collecting and Submitting

Water Samples for Screening

Information:

1.) Secure a water-sampling bag from your local Extension Office.
2.) Using a permanent marker such as a "Sharpie", write your name, address, and telephone number on the sampling bag. **(do this before you collect the sample).**

Collecting the Sample:

1.) Use a faucet as close to the well as possible for making the collection. If an inside faucet is used, remove the aerator before making the collection.
2.) Rinse and dry the exterior of the faucet to prevent exterior contamination of your water sample. If possible, wipe off with a Chlorox-type towelette or paper towel wet with a light bleach solution to kill any bacteria present on faucet. Allow solution to dry before sampling.
3.) Turn on the water full force and let it run at full force for three minutes.
4.) Reduce the water flow to a small stream.
5.) Tear off the perforated strip above the yellow twist ties from the top of the bag. Grasp the small white tabs below the yellow twist ties of the water-sampling bag and pull the bag open. **(be careful not to touch the inside of the bag with you fingers).**
6.) Holding the yellow twist ties, fill the sampling bag three fourths full and then whirl the bag top over bottom to close it. Some water may leak out but don't worry. Tie the twist ties together.
7.) Place bag in a 32oz. styro-foam or similar-sized plastic cup and deliver the sample to the designated drop off point. The cup reduces risk of spillage.

Submitting the Samples:

The samples can be submitted on the following days at the following location(s):

Date	Times	Location

Please Note: Samples should be delivered the day they are collected to insure accurate results.

Appendix D: Hach Screening Procedures for Atrazine and Arsenic

Appendix E: TCE Soil, Water, and Forage Testing Laboratory Soil Anaylsis Procedures

Soil Analysis Tests

The Texas Cooperative Extension Soil, Water and Forage Testing Laboratory provides the following suite of tests that evaluates the nutrient status of soil samples. The major suites include routine, routine plus micronutrients, routine plus detailed salinity, and a combination of the tests.

NO_3-N: modification of Keeney, D.R. and D.W. Nelson. 1982. Nitrogen-inorganic forms. IN Methods of Soil Analysis. Part 2. Eds. Page, Miller and Keeney. Am. Soc. Agron. Madison, WI.

Appendix F: Chain of Custody Form

Appendix G: List of Acronyms

CAR – Corrective Action Report

CEU – Continuing Education Unit

COC – Chain of Custody

DQO – Data Quality Objectives

EPA – Environmental Protection Agency

MDL – Method Detection Limit

NPS – Non-Point Source pollution

PD – Percent Deviation

QA – Quality Assurance

QAO- Quality Assurance Officer

QAPP – Quality Assurance Project Plan

QC – Quality Control

RPD – Relative Percent Deviation

ST – total number of samples collected

SV – number of samples with a valid analytical report

TCE – Texas Cooperative Extension

TCE-SWFTL – Texas Cooperative Extension Soil, Water, and Forage Testing Laboratory

TCEQ – Texas Commission of Environmental Quality

TSSWCB – Texas State Soil and Water Conservation Board

USEPA – United States Environmental Protection Agency

X_1 – sample with reporting value

X_2 – duplicate of sample with reporting value

Appendix H: Work Plan

Task 1: Removal of Nitrate from Soil Profile with Winter Cover Crops.

Costs: $32,514 (Federal), $39,371 (Non-federal), $71,885 (Total), This task is 33% of Total

Objective: to determine the amount of leachable nitrate that can be removed from the soil profile by winter cover crops.

Subtasks 1.1: Porous cup water samplers will be inserted into the soil at a sufficient depth to catch the leached nitrogen-nitrate.

Subtasks 1.2: Winter cover crops, including wheat, cereal rye, and clover, will be planted in the fall of 2005 and 2006, following the harvest of cotton or sorghum.

Subtasks 1.3: In order to obtain adequate information on soil nitrate leaching for the entire year, water samples will be collected from the porous cup samplers five times each year. Soil samples will also be analyzed for soil nitrate levels at the beginning and end of the cover crop.

Subtasks 1.4: Nitrogen assimilation by each cover crop treatment will be estimated from using the cover crop biomass and nitrogen content. Approximately three weeks prior to planting cotton or sorghum, the winter cover crop will be desiccated with a burn down herbicide.

Subtasks 1.5: Soil moisture levels will be monitored at planting, during winter, and prior to crop dessication to determine the impact that winter cover crops have on the soil moisture for each treatment.

Schedule: The demonstration project will be initiated in the fall of 2005 and will consist of planting the winter cover crops. Following the desiccation of the winter cover crop, cotton or sorghum will be planted. The nitrogen management for the summer crop will based on soil test results, nitrogen will be applied uniformly over all treatments. In June 2005, a summary of nitrate concentration in the soil and water will be summarized along with the estimated levels of nitrate removal by the winter cover crops. Quarterly reports will be submitted at appropriate times, and the final report will be turned in at the conclusion of the project. This demonstration project will be completed by August 2007.

Deliverables: Information gained from the nitrate removal by cover crops will be presented at multiple educational events and meetings on a state and local level. Information gathered from effort will also be prepared in a newsletter distributed to all county extension offices in the Texas High and Rolling Plains. Copy of newsletter, educational agendas, and attendance sheets will be attached to reports.

Task 2: Demonstration of Zeolite as a BMP to Reduce Atrazine and Arsenic in Groundwater

Costs: $27,940 (Federal), $39,371 (Non-federal), $67,311 (Total), This task is 31% of Total

Objective: to demonstrate the percent reduction in atrazine and arsenic concentrations in private well water by use of zeolite filtering media

Subtask 2.1: Groundwater will be spiked with known concentrations of atrazine and arsenic and passed through a zeolite filter before being pumped into a livestock tank. Samples from the livestock tank will be taken at 1 minute after entering the tank, and then at 5 minutes, 60 minutes and 24 hours and atrazine and arsenic concentrations determined. The zeolite filtering system will be placed directly in-line in the water distribution system between the water pump and the livestock tank. By using this approach, an easy-to-use filtering process for these two contaminants can be demonstrated in a manner that will mimic in-line filtering systems placed between the wellhead and the end point of use of the distribution system.

Schedule: The zeolite portion of this project will be conducted in the Spring and Summer of 2005 and will be completed by December 2005. QAPP will be prepared by before sampling is initiated.

Deliverables: Information gained from the zeolite study will be presented to private water well owners/users at various water quality educational programs across Texas. Information gathered from effort will also be prepared in a newsletter distributed to all county extension offices in the Texas High and Rolling Plains. Copy of newsletter, educational agendas and attendance sheets will be attached to reports.

Task 3: Assessment of Atrazine and Arsenic Concentrations in Private Water Well Samples of the Texas High and Rolling Plains.

Costs: $37,887 (Federal), $39,371 (Non-federal), $77,258 (Total), This task is 36% of Total

Objective: to assess 75 private water well samples per year for atrazine and arsenic concentrations

Subtask 3.1: Annually two private water well screening events will be held in the Texas High Plains and one in the Rolling Plains of Texas.

Schedule: Sampling screening events will be conducted on-site in county locations in the Texas High Plains and Rolling Plains. Three total events per fiscal year will be conducted and all screening events will be completed by June 2007.

Deliverables: Information gained from the assessment study will be presented to private water well owners/users at various water quality educational programs across Texas. Information gathered from effort will also be prepared in a newsletter distributed to all county extension offices in the Texas High and Rolling Plains. Results of the private water screening effort will also be presented to the TCEQ ag. chem. Subcommittee of the Groundwater Committee at the end of summer 2007. QAPP will be before sampling is initiated. Agendas and attendance sheets will be attached to reports.