

**REVISED
DETAILED STATEMENT OF WORK**

**Attached to and made a Part of contract No.
DACW57-97-D-0004**

Task Order No. DY01

Modification No. 003

**Source Water Protection Plan
Perchlorate Study GIS Development
Lake Belton and Lake Waco, Texas**

May 07, 2002

1.0 General. This Statement of Work (SOW) addresses activities associated with the Bosque and Leon River Watersheds Perchlorate project. Previous tasks in the project have resulted in a Conceptual Site Model (CSM) and data gaps in that model have been identified and prioritized by the project stakeholders. This SOW has been developed to address the field data collection effort to fill those data gaps. Detailed development of the field program will be accomplished via a Sampling and Analysis Plan (SAP). Implementation of the field program itself will be a cooperative effort between Montgomery Watson Harza (MWH) and the Brazos River Authority (BRA). The following sections describe the MWH's (Contractor) SOW for field program development and coordinated implementation on a task-by-task basis. BRA services will be authorized under a separate agreement with the U.S. Army Corps of Engineers (USACE). Schedules and budgets for all field investigation tasks outlined below will be reviewed after completion of the SAP. Some adjustments to schedule and/or budget may be required, as the field sampling scope is refined during the SAP development process.

1.3 Period of Performance. The tasks described in this SOW shall be performed within fifteen months of the notice to proceed.

1.4 Project Management. The Contractor shall perform day-to-day project management of all the tasks identified in this proposal. The project manager will be responsible for assuming that the right staff members and/ or Sub-contractors are assigned to the project and will assure schedule and budget compliance.

2.0 New Tasks. As stated above, this SOW continues efforts that were begun under previous contracts. The numbering for the tasks of this SOW should follow the sequence of those contracts.

2.5.1 Meetings. Shall increase one meeting for the project team members to discuss the draft copy of the Final Field Investigation project report. This meeting shall be held in Dallas at the MWH office.

2.7 Task 7 - Develop a Sampling and Analysis Plan. The Contractor, in conjunction with BRA, shall develop a detailed comprehensive SAP to document the procedures to be followed during field sampling activities. The document shall specify appropriate sampling equipment, decontamination procedures, methods, and will specify the data validation and QA/QC requirements for the project. The Contractor shall use the USACE's Engineering and Design Manual "Requirements for the Preparation of Sampling and Analysis Plans", EM 200-1-3, dated 01 February 2001, (This document can be found at <http://www.usace.army.mil/inet/usace-docs/eng-manuals/em200-1-3/toc.htm>.) as a reference. The comprehensive SAP document shall be prepared to assure that the proposed field program will meet project-specific goals and requirements. Incorporating information from the comprehensive SAP, a limited site specific SAP shall be written for each field related task.

2.7.1 Subtask 7.1 - The SAP shall outline specific sampling locations and the sampling equipment that will be utilized during soil, sediment, sediment pore water, groundwater, surface water and storm water sampling activities.

2.7.2 Subtask 7.2 - The SAP shall identify the specific locations and numbers of samples for the various media, sample collection methods to be utilized, sample preservation techniques, sample container requirements, chain of custody requirements, container labeling/storage /transportation requirements, and the analytical testing methods/analyses to be performed on collected samples.

2.8 Task 8 - Conduct Sediment Sampling and Surface Water Sampling within Delta Areas of Lake Waco and Lake Belton.
The Contractor shall mobilize to the delta areas of Lake

Waco and Lake Belton and will set up a grid sampling pattern for twenty sampling locations within each lake. A total of forty bulk sediment, surface water, and soil pore water samples shall be collected during this task. These samples shall be placed into containers as specified by the USACE's analytical laboratory and submitted to them for perchlorate analyses using the EPA Method 314.0.

2.8.1 Subtask 8.1 - Using a boat, GPS coordinates shall be identified for each of the forty grid points. One bulk sediment sample, one sediment pore water sample, and one surface water sample shall be collected at each grid location.

2.8.2 Subtask 8.2 - The Contractor shall collect triplicate samples on a 1 in 10 basis with a minimum of one per day. The Contractor shall send all samples collected during the project to the USACE's analytical laboratory for analysis. (USACE shall pay these costs directly to their internal laboratory and BRA will pay for all shipping costs.) The analytical method will be EPA Method 314.0 for perchlorate. The USACE's analytical laboratory shall perform the analytical testing and data review.

2.8.3 Subtask 8.3 - Field measurements and observations will also be collected at each sampling location. Field Observations are as follows:

- Cloud Cover
- Wind Velocity
- Secchi Disk Transparency
- Water Color
- Aquatic Vegetation in % Cover

Field Measurements collected through the use of a Hydrolab (multi-parameter instrument) at each sampling location are as follows:

- Temperature
- Dissolved Oxygen
- Specific Conductance
- pH
- Salinity
- Dissolved Oxygen % Saturation

2.8.4 Subtask 8.4 - The Contractor shall place ten buoys that contain filter samplers in the delta

area of Lake Belton, to understand the interactions between algal communities and perchlorate within Lake Belton. Once algae have collected on the samplers, the algae shall be harvested from the filter samplers and submitted to the USACE's analytical laboratory for perchlorate analyses using EPA method 314.0. A total of thirty algae samples (three at sequential depths at each buoy) shall be collected and analyzed during this task. If sufficient algae has not collected on the filter samplers, the Contractor will collect algae via net sampling just beneath the water surface at the ten selected sampling locations. Algae sampling will be performed once during the algae blooming season during the summer months.

- 2.8.5 Subtask 8.5** - The Contractor shall provide one person for the field sampling crew, associated pore water sampling apparatus, and algae filter samplers for this particular task. The boat, all other field sampling equipment/sampling, and the remaining field crewmember will be provided by BRA.

2.9 Task 9 - Proposed Longitudinal Stream Sampling Study.

The team has assumed that Lake Waco is relatively well mixed in comparison to Lake Belton, which is occasionally stratified. Based on this assumption, the team has agreed to focus its efforts for Lake Waco on developing a better understanding of the perchlorate concentrations entering Lake Waco, and associated flow rates and lake contributions from the South Bosque River and Harris Creek. This monitoring will allow a mass balance type procedure to be used to better refine the water budget and will also help to determine if there is a concern with the quantities and concentrations of perchlorate that are actually entering Lake Waco. To accomplish this task, the Contractor in a cooperative effort with BRA shall install automated sampling stations at the locations identified on the attached figures.

These automated stations will monitor total stream flow and will allow collection of surface water samples at specific times to assist in determining perchlorate concentrations entering Lake Waco. The frequency of sampling and the setup of the automated sampling stations are further discussed below. The project team also concluded that the automated sampling station methodology would be very useful

for monitoring the concentrations and streamflows along Harris Creek, the South Bosque River, Station Creek and Cowhouse Creek. This automated sampling station methodology would help fill the following data gaps identified during the CSM workshop:

- Longitudinal surface water and groundwater sampling on Harris Creek, the South Bosque River, Station Creek, and Cowhouse Creek to better understand surface water to groundwater interactions and how perchlorate concentrations change as surface water migrates from NWIRP to Lake Belton and Lake Waco.
- Longitudinal surface water and groundwater sampling on Harris Creek, the South Bosque River, Station Creek, and Cowhouse Creek during storm events to better understand surface water to groundwater interactions and how perchlorate concentrations vary during storm events.
- Conduct longitudinal surface water flow measurements within Harris Creek, Station Creek, Cowhouse Creek and the South Bosque River.

- Groundwater fluctuations (water level and quality) related to storm events at groundwater monitoring wells installed in close proximity to the monitoring locations along streams.
- Collect rainfall data within the watershed.

2.9.1 Subtask 9.1 - To fill the above referenced data gaps, the Contractor along with BRA shall install up to fifteen automated sampling stations along the South Bosque River, Harris Creek, Station Creek, and Cowhouse Creek. (This method of sampling is proposed because it will allow the collection of critical data over an extended period of time and will also reduce the labor-hours required to obtain, monitor and maintain equipment.) The fifteen automated sampling stations will be installed at the locations shown on the attached figures and will be refined based on the additional hydrological conceptual understanding gained during Task 1 of this SOW, and discussions with team members.

Once the team determines the final sampling locations, the cross section of the stream shall be documented by the field team members and a automated sampling station will be installed at each location. The BRA shall purchase all of the equipment and enclosures necessary for installation of each of the fifteen automated sampling stations.

2.9.2 Subtask 9.2 - The Contractor shall provide the following equipment and sub-contract services during each automated sampling station installation process:

- Provide two field crewmembers for one week to assist in setting up the automated sampling stations and surveying the stream cross-sections.
- Associated sample tubing and electrical wiring to connect flow and level sensors to the data collection equipment to be used at each automated sampling station.
- PVC pipe to run sample tubing and bubbler to the center of stream to be sampled.

2.9.3 Subtask 9.3 - One two-inch monitoring well shall be installed at each location, in an upgradient position of the automated sampling site to a depth of thirty feet by the Contractor. The monitoring well shall be installed with a five foot bentonite seal and shall be screened the entire length of the well. An integrated pressure transducer/data logger (purchased by others) will be installed in the well and wired to the sample station. Each well will be completed using an above ground stick-up completion that will include a lockable cover. Four 4" bollards will be installed around each well location. (This will allow comparison of groundwater levels and stream levels over time to assist in documenting interconnections between these systems.) These wells will also be used for the dye tracer studies in Task 12.

2.9.4 Subtask 9.4 - Once the automated sampling stations are installed, the stations will be programmed to begin sampling at the same time during the sampling event. The automated sampling stations will sample at approximately the same time during each sampling event. This will allow the team to monitor flow conditions and relative perchlorate concentrations at regular intervals. In addition, monitoring will occur at more frequent intervals during major storm events. The proposed sampling frequency and sites are outlined in the subtasks below.

Subtask 9.4.1 - South Bosque River, Harris Creek and Station Creek. The sampling stations will be programmed to collect surface water samples, stream-flow readings, and groundwater depths on the following frequency:

- Once daily for the first seven days of the project.
- Once weekly for the next three weeks.
- Once every two weeks for the remainder of the project.
- The automated samplers and flow-meter will be manually set to begin sampling again on a daily

basis when a significant storm event is anticipated. It is assumed that ten significant storm events will occur during the course of the project.

- Continuous rain gauge monitoring will be performed during the project.

Subtask 9.4.2 - Cowhouse Creek. The automated sampling station along Cowhouse Creek will be programmed to collect surface water samples and streamflow readings on a monthly basis during the project. (This stream was chosen to evaluate potential perchlorate contamination that may be migrating from Ft. Hood, since it is the largest stream flowing into Lake Belton from Fort Hood.)

The field team shall travel to each sampling station at the sampling intervals outlined above to collect samples, reload the automated sampler, download data from the data loggers, check the operation of the metering station and equipment and perform any needed maintenance activities. (Since the hold time for perchlorate is twenty-eight days, this should allow sufficient time to collect the samples and submit them to the USACE's analytical laboratory without having to pay for rush analyses, and will also reduce the amount of labor required to perform sampling activities.) The field measurements described below will also be collected from the streams during each visit to each automated sampling station.

Field Observations are as follows:

- Cloud Cover
- Wind Velocity
- Secchi Disk Transparency
- Water Color
- Aquatic Vegetation in % Cover
- Instantaneous Flow

Field Measurements collected through the use of a Hydrolab (multi-parameter instrument) are as follows:

- Temperature

- Dissolved Oxygen
- Specific Conductance
- pH
- Salinity
- Dissolved Oxygen % Saturation

2.9.5 Subtask 9.5 - The Contractor shall provide one field crewmember for the first week of sampling and one crewmember for one monitoring event per quarter throughout the duration of the project. All sampling equipment/supplies and the remaining field crewmember shall be provided by BRA. All other sampling events will be performed exclusively by BRA.

2.10 Task 10 - Lake Belton Fate and Transport Study. To improve our understanding of the flow patterns within Lake Belton, the Contractor shall perform a fluorescent dye tracer study to better identify flow patterns within the lake and determine if deep-water currents could provide a preferential flow path for perchlorate follow the thalweg, the old river channel.

2.10.1 Subtask 10.1 - The Contractor shall introduce a fluorescent dye into the Leon River prior to its juncture with the water body of Lake Belton. Using boats and portable fluorometers on the surface of the water, the dispersion of the fluorescent dye will be monitored as it moves through Lake Belton towards the dam (outlet). Water samples shall be collected and analyzed for the fluorescent dyes using the portable equipment. This study shall be performed once during each season of the year for a total of four events.

2.10.2 Subtask 10.2 - It is estimated that two boats, each equipped with a two-person field crew, a portable flourometer, and a hydrolab will be required for the above referenced study. The Contractor shall only provide two field crewmembers for this task. The boats, sampling equipment/supplies, and the remaining field crewmembers will be provided by BRA.

2.11 Task 11 - Evaluate the Importance of Anoxic Component of Lake Belton on Perchlorate Reductive Metabolism. To better understand the anoxic component of Lake Belton and

it's potential for perchlorate reductive metabolism, the Contractor shall develop a work plan for an anoxic perchlorate metabolic bench-scale study. This study will determine if perchlorate reduction is possible during anoxic conditions that are suspected to occur at the bottom of this lake. This study shall be performed during the summer when the lake is highly stratified and would represent worst-case anoxic conditions, if present. The Contractor shall then perform this study under controlled conditions.

2.11.1 Subtask 11.1 - The Contractor shall collect ten sealed samples at the sediment/mud/surface water interface at the bottom of Lake Belton. Perchlorate will be added to the sealed samples at known quantities. After a specified period of time, samples will be collected to determine if the perchlorate concentrations in the sample have been reduced by natural biodegradation. Collected samples shall be sent to the USACE's analytical laboratory for analyses.

2.11.2 Subtask 11.2 - The Contractor will collect triplicate samples on a 1 in 10 basis with a minimum of one per day. The Contractor will send all samples collected during the project to the USACE's analytical laboratory for analysis. (USACE will pay these costs directly to their internal laboratory and BRA will pay for all shipping costs.) The analytical method will be EPA Method 314.0 for perchlorate. The USACE's analytical laboratory will perform the analytical testing and data review.

2.11.3 Subtask 11.3 - One boat and a two-person field crew will be needed to complete this study effort. The Contractor shall provide one field crewmember for this task. The boat, sampling equipment/supplies, and the remaining field crewmembers will be provided by BRA.

2.12 Task 12 - Groundwater Dye Tracer Studies. The Contractor shall perform a series of limited, localized groundwater dye tracer studies to assist in verifying if and to what degree a connection between groundwater and surface water exists within various portions of the study area.

2.12.1 Subtask 12.1 - Using the monitoring wells previously installed during the longitudinal stream-sampling task (task 9), the Contractor shall add a colored fluorescent dye to each monitoring well at each automated sampling station. The Contractor will note the time and concentration of the dye as it is introduced into each well. The Contractor will then visually examine the banks of the streams within close proximity and down gradient of each well and document if the dye reaches the stream. If dye is observed, the Contractor will note the time the dye was observed and the general direction from the monitoring well to the observed dye location within the stream. If the dye is not visually observed, a different fluorescent dye shall be used as a tracer. (A fluorometer would be utilized in this instance.) This procedure will be repeated for each previously installed well. Detailed field notes will be maintained of the results encountered during this study. A total of fifteen initial dye studies shall be performed during this task. An additional fifteen fluorescent dye studies may be necessary, depending on the results of the initial dye studies. The cost for these tests have not been included in this proposal.

2.12.2 Subtask 12.2 - The contractor shall provide one field crewmember for this task. All other sampling equipment/supplies and the remaining field crewmember will be provided by BRA.

2.13 Task 13 - Additional Manual Sediment Pore Water, Surface Water and Groundwater Sampling. During the course of the project, additional sampling may be required for certain areas to supplement the periodic automated sampling events, based on the information collected. Therefore, the contractor shall include the labor and field equipment costs for collecting an additional twenty sediment pore water, twenty bulk sediment, twenty surface water and twenty groundwater samples during the course of this project.

2.13.1 Subtask 13.1 - This sampling assumes that a two-person sampling team walking to the sampling location can collect each of the samples using

portable hand held equipment. Samples collected will be placed into specified containers and shipped to the USACE's analytical laboratory to be analyzed for perchlorate concentrations using EPA Method 314.0.

2.13.2 Subtask 13.2 - The field measurements and observations described below shall be collected during each sampling event. Field Observations are as follows:

- Cloud Cover
- Wind Velocity
- Secchi Disk Transparency
- Water Color
- Aquatic Vegetation in % Cover
- Instantaneous Flow

Field Measurements collected through the use of a Hydrolab (multi-parameter instrument) are as follows:

- Temperature
- Dissolved Oxygen
- Specific Conductance
- pH
- Salinity
- Dissolved Oxygen % Saturation

2.13.3 Subtask 13.3 - The contractor shall provide all associated sampling equipment and supplies necessary to conduct this additional sampling.

2.14 Task 14 - Purchase GIS Server and software. To assist in developing the GIS database for the project, the Contractor shall purchase a Dell computer with the following specifications:

PowerEdge 6450, Pentium III Xeon 700MHz/1M Cache
Cache: None
Additional processor: Dual Processor Pentium III Xeon
700MHz w/1M Cache
Memory: 2GB SDRAM - 4 DIMMs
Bundle: None
Hardware Support: 3Yrs SILVER Support, 4Hr Onsite,
S/W Support
Primary Controller: PERC3/QC-Quad Channel Add-in RAID
Card 128MB Cache (1-Int/3-Ext Channel)
OpenManage Subscription Service: None

Hard Drive: C5 - RAID 5 on Internal Hard Drives (RAID Card required)
First Hard Drive: 73GB 10K RPM Ultra 160 SCSI Hard Drive
Second Hard Drive: 73GB 10K RPM Ultra 160 SCSI Hard Drive
Third Hard Drive: 73GB 10K RPM Ultra 160 SCSI Hard Drive
Fourth Hard Drive: 73G, HD, 10K, 80P, 1.0 IN, U3
Secondary Controller: None
First Network Adaptor: On-board NIC only
Second Network Adaptor: None
FC-AL HBAs: None
Clan NICs: None
Operating System: Windows 2000 Server with 5 Client Licenses, 4GB Utility Partition
Software Support Services: None
Tape Backup Unit: None
Tape Backup Software: None
Diskette Drive: 3.5", 1.44MB Floppy Drive
CDROM: 650MB, DVD, Internal, Black
Keyboard: None
Monitor: None
Mouse: None
Documentation: Hard Copy Documentation
Chassis Configuration: Rapid Rails for Dell Rack
Extra Power Supply/Extra Fan: None
Installation Services: None
Modem/Management Card: None
Cluster Status: None
Additional Options: Ft. Shafter BPA#DAPC50-01-A-3355 (\$0.00) and Program Management Services (\$10.00).

Once purchased, the hardware listed in Task 14 and the software listed in Subtask 14.1 shall become the property of the USACE and shall be bar-coded accordingly.

2.14.1 Subtask 14.1 - The Contractor shall purchase the following software necessary to run the server.

- Windows 2000
- Veritas Backup
- Norton Antivirus
- Oracle 9I (3 named license seats)

Arc SDE and other ESRI software needed for the project will be purchased directly by the USACE

and provided to the Contractor for use during the project.

- 2.14.2 Subtask 14.2** - The Contractor shall configure the server to internal and USACE standards during setup.

3.0 Delivery Schedule.

3.8 Task 4.1 - Project Reporting. Shall change the project reporting requirements to include the following:

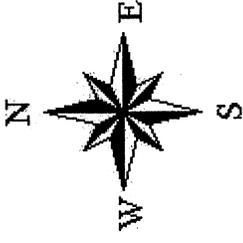
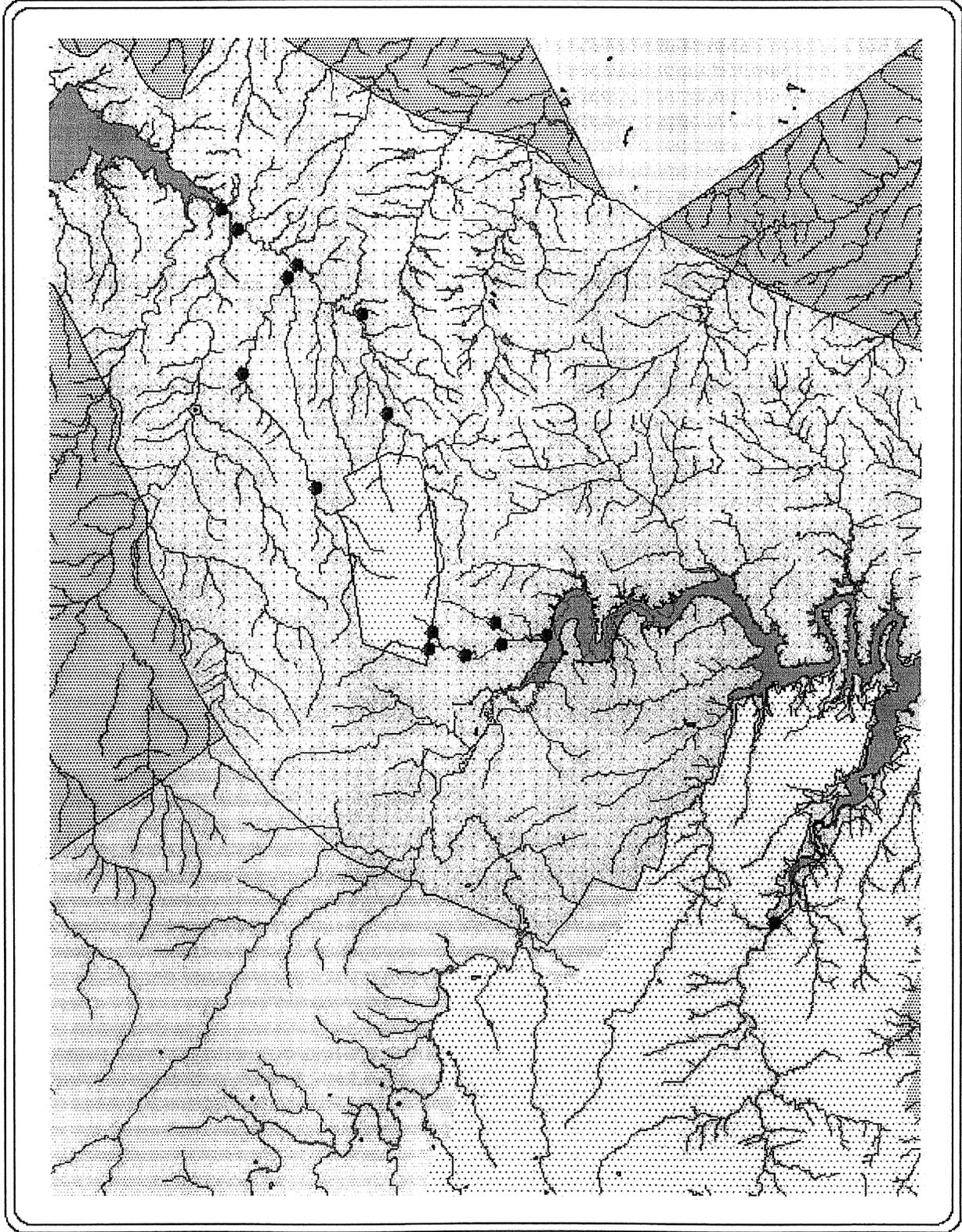
- The USACE will provide analytical laboratory data and the BRA will provide raw data collected from the automated sampling stations and converted stream flow readings to the Contractor for inclusion in the quarterly update.
- The Contractor shall provide quarterly updates regarding the data that were collected during field sampling activities.
- The Contractor shall use the perchlorate analytical data and groundwater elevation data in the project's GIS database to develop perchlorate groundwater contaminate concentration maps and groundwater gradient maps for the sampling events of May and September 2000.
- The USACE shall provide topographic contours to the Contractor, as recommended in the GIS Task 1 report. The Contractor shall overlay the contaminant contour and groundwater gradient information onto this map. The Contractor shall use these overlays to attempt to identify the leading edge of the plume (if one exists) and to determine where interconnections between groundwater and surface streams may occur.
- A Technical Memorandum shall be produced each quarter that discusses the results of the various sampling activities, lake-studies, analytical results and recommendations. This report shall include detailed data analyses, preparing data summaries, preparing various maps, coordination between USACE, BRA, TIEHH and various Sub-contractors.
- The Contractor shall also prepare a detailed draft report that incorporates the findings, analytical results and recommendations regarding the risk of exposure of perchlorate to Lake Belton and Lake Waco and groundwater.

Extensive data analyses, GIS mapping, and findings will be presented in conjunction with this report.

3.10 Deliverables Following the draft review meeting and inclusion of project team-members final comments, final revisions shall be incorporated and the report shall be finalized and distributed to all parties in electronic PDF format within thirty days of receiving the last final comment. No modeling efforts have been included in this proposal.

3.10.1 Task 7 - The Contractor shall develop the site specific Sampling and Analysis Plan for the longitudinal stream sampling and submit this SAP to the team-members within forty days of notice to proceed. The remainder of the comprehensive SAP and site specific SAP's for all other task components shall be completed and submitted to the team-members within ninety days of notice to proceed.

Proposed Monitoring Stations

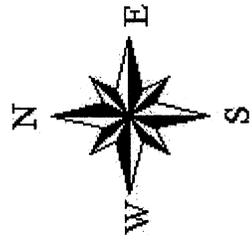
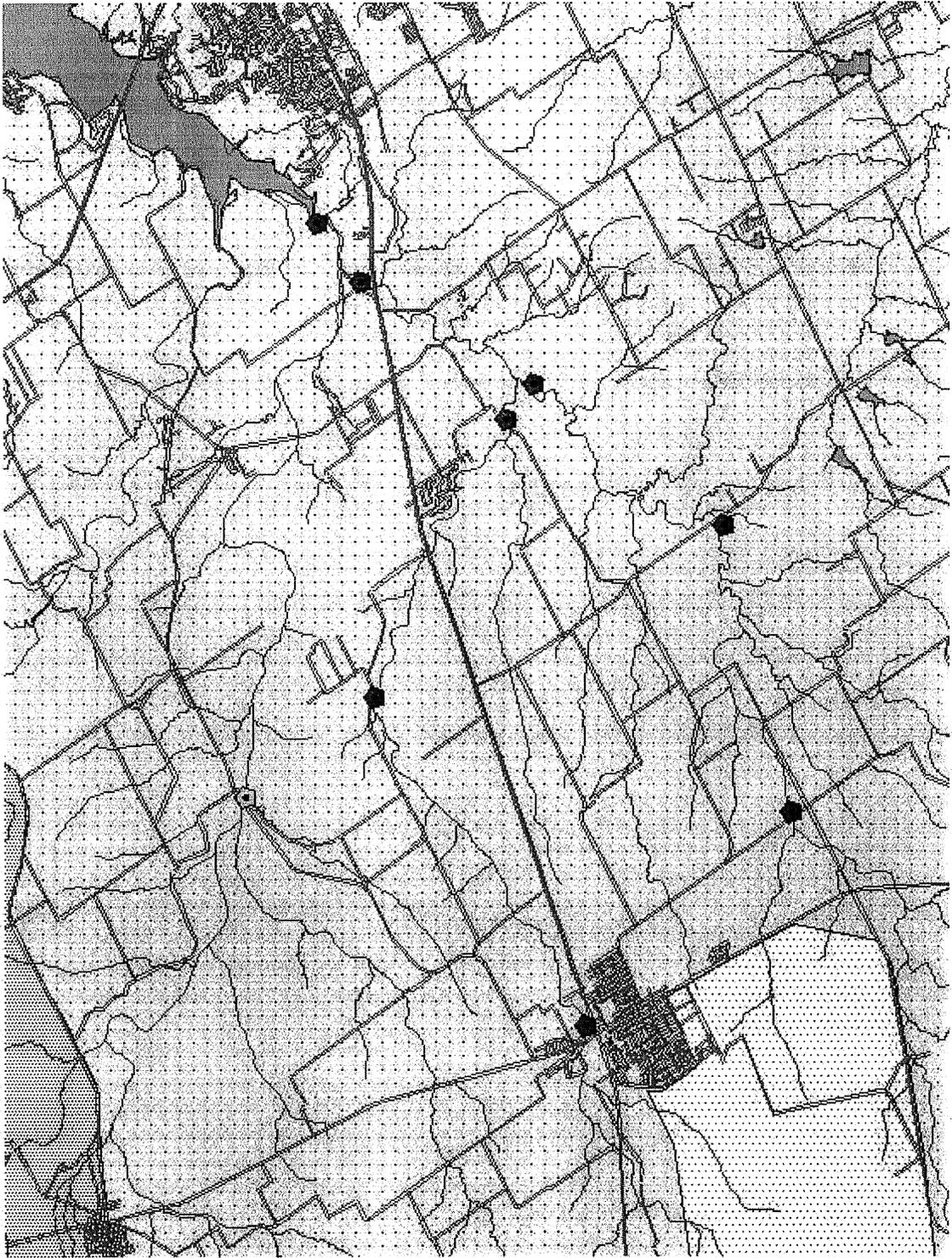


Legend

- USGS Monitoring Stations
- Monitoring Stations
- NMI/IRP
- Study Area
- Forthood Military Reservation

Proposed Monitoring Stations

NWIRP to Lake Waco

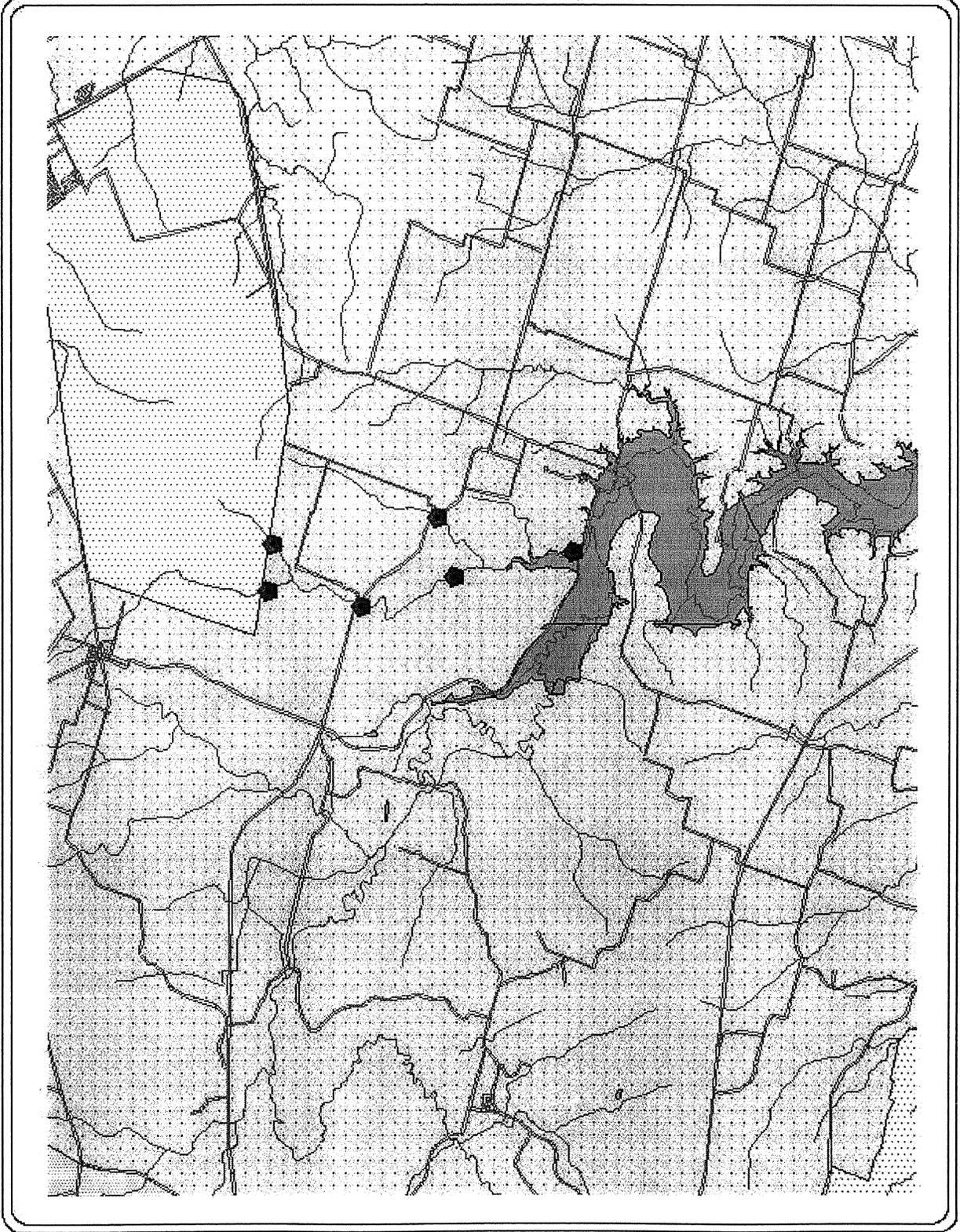


Monitoring Stations

-  USGS Monitoring Stations
-  Monitoring Stations
-  Study Area
-  NWIRP

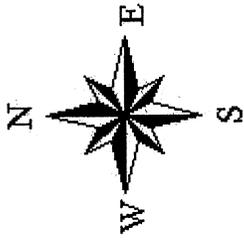
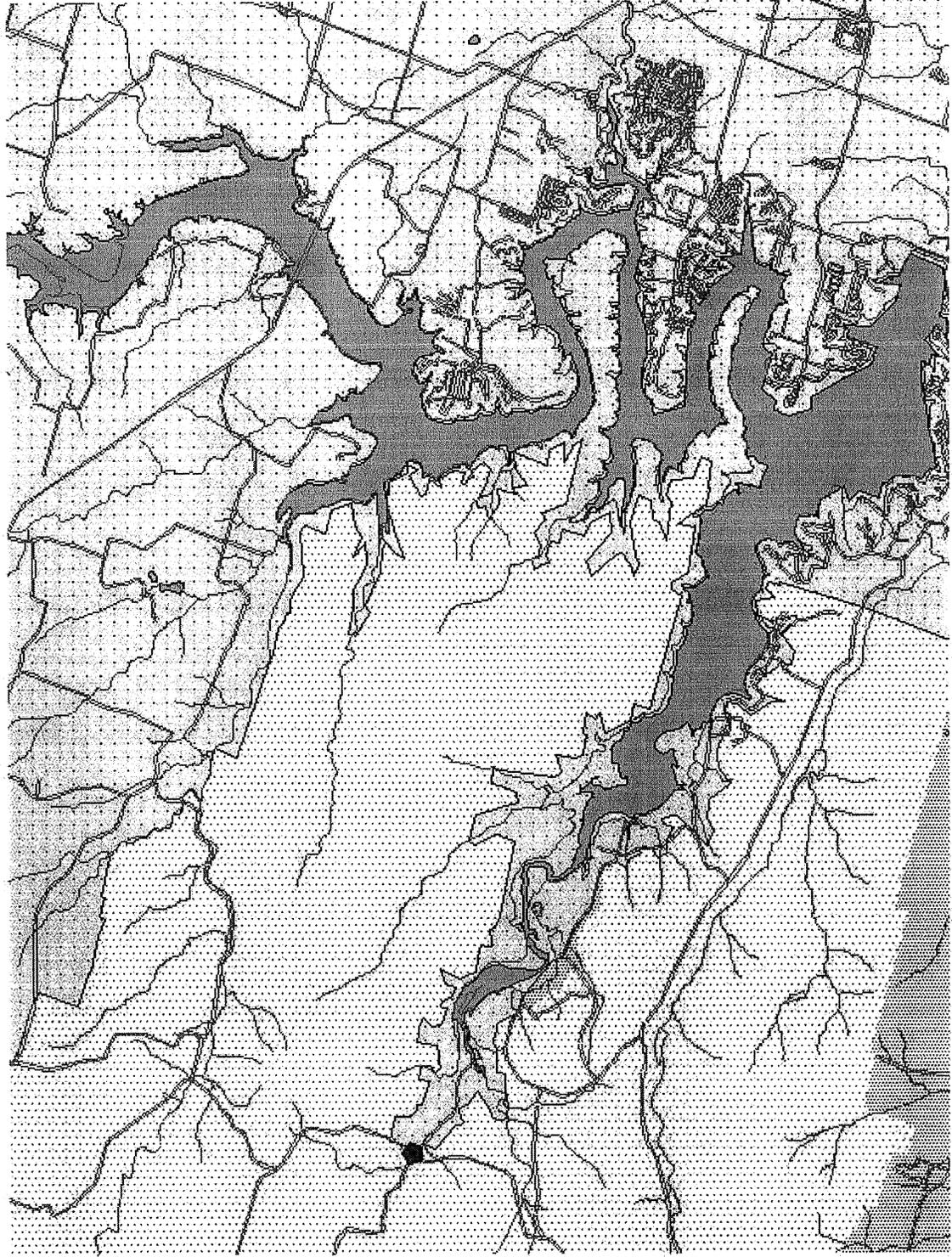
Proposed Monitoring Stations

NWIRP to Lake Belton



Proposed Monitoring Station

Cowhouse Creek



Monitoring Stations



Monitoring Stations



Study Area



Fort Hood Military Reservation