CATAWBA NUCLEAR STATION
CONVENTIONAL TREATMENT PONDS
GROUNDWATER MONITORING PROGRAM

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GROUNDWATER MONITORING PROGRAM

1.0 PROGRAM DESCRIPTION

1.1 SCOPE OF WORK

This Groundwater Monitoring Program is designed to address the Duke Power Company (DPC) NPDES permit requirement for groundwater monitoring at Catawba Nuclear Station (#SC0004278, Part III, special condition #23). It has been prepared according to the guidelines set forth by the U.S. Environmental Protection Agency (EPA) in "RCRA Groundwater Monitoring Technical Enforcement Guidance Document" (September 1986), and by the EPA in "Interim Guidelines and Specifications for Preparing Quality Assurance Plans" (QAMS-500/80), and documents the methodologies of field sampling, record-keeping protocols, data quality objectives, and data validation procedures that will be used in this program.

1.2 BACKGROUND

The impoundments of interest at the Catawba Nuclear Station are associated with the Conventional Treatment System (WC) and the Sewage Treatment System (WT) (Figure 1) The WC system includes the following impoundments:

(A) a concrete-lined initial holdup pond (300,000 gallons),
(B) two parallel clay-lined settling ponds (5 million gallons each), and
(C) a polymer-lined final holdup pond (1.5 million gallons).

The WT System includes the following impoundments:

(D) a polymer-lined aeration basin divided into four cells (1.28 million gallons total), and
(E) an effluent polishing basin (525,000 gallons).

Groundwater levels at the Catawba site are in the range of 10 to 40 feet below the land surface near the center of the site, and approach the surface elevation of Lake Wylie near the lake shore. Consequently, the flow of ground water at the site is toward Lake Wylie. The flow of ground water in the vicinity of the surface impoundments is shown on Figure 2. This groundwater contour map was prepared based on data collected during the plant siting and construction

1.3 WELL LOCATION AND INSTALLATION

The sewage treatment system receives only sanitary wastes, and therefore no groundwater monitoring was installed for these two ponds.

Four ground-water monitoring wells were installed around the Conventional Wastewater (WC) Treatment System (Figure 1). Three of these wells are located downgradient of the ponds. The other monitoring well is upgradient of the pond near the plant cooling towers.

Each of the wells was installed as a Type II monitoring well as defined by S.C. regulations, screened near the water table. These wells were constructed of two-inch diameter PVC well screen and casing. Each of the wells have ten feet of well screen with a slot size of 0.010 inch. These wells were installed by a South Carolina certified driller in accordance with applicable SCDHEC regulations. Figure 3 shows a typical construction diagram for the wells. The wells are equipped with dedicated pump systems, the schematics of which are presented in Appendix A.

1.4 PARAMETERS AND FREQUENCY

Parameters, units of measure, methods, and detection limits are presented in Table 2. The parameters represent pertinent groundwater standards. Sampling frequency for all the monitoring wells is semiannually. Results will be submitted to the State within 90 days of sampling. The first sample collection occurred October 30, 1993.

1.5 DATA QUALITY OBJECTIVES

The overall quality assurance (QA) objective is to ensure that data of known and acceptable quality are provided. All measurements will be made so as to yield results that are representative of the media and conditions measured. All data will be calculated and reported in units consistent with those of other agencies and organizations to allow comparability of data bases.

The QA objectives for precision, accuracy, and completeness have been established by the laboratory(s) in accordance with EPA or other accepted agencies for each measurement variable (where possible). The objectives are outlined in the Duke Power Company Laboratory Services Procedures Manual, and are available upon request.

Detection limits for the water analyses presented in Table 2 are generally specified by the analytical methods. As stated above, appropriate methods have been selected to meet applicable standards for groundwater quality or the requirements of applicable permits. Instances may occur, however, in which the condition of the sample will not permit attainment of the desired detection limits for various parameters either because of matrix interferences or high analyte concentrations requiring sample dilution. The laboratory(s) will provide sufficient information with each data package to allow reviewers of the data to be aware of encountered sample problems.

2.0 GROUND-WATER MONITORING AUTHORITY AND RESPONSIBILITY

The Corporate environmental contact for this program is:

Mr. John S. Carter
Duke Power Company Environmental Division
13339 Hagers Ferry Road
Huntersville, North Carolina 28078
704-875-5954

The Catawba Site environmental contact is:

Ms. Cheryl T. Peed
Catawba Nuclear Station
4800 Concord Road
York, South Carolina 29745
803-831-3333

3.0 SAMPLING PROCEDURES

3.1 SAMPLING EQUIPMENT

Development, purging and sampling equipment are chosen to ensure the materials making up the equipment are compatible with the sample parameters and also comply with State and Federal regulatory requirements for sampling. Positive-gas-displacement fluorocarbon resin bladder pumps, disposable polypropylene (PP) bailers, or peristaltic pumps are used for purging and sampling the wells.

3.1.1 Equipment Cleaning Procedures

Non-dedicated, reusable water level meters, development pumps, purging, and sampling equipment are cleaned between wells in accordance with standard EPA approved cleaning procedures for field equipment described in "Standard Operating Procedures and Quality Assurance Manual", Engineering Support Branch, EPA Region IV, February 1, 1991.

3.2 GROUND-WATER SAMPLING

3.2.1 Developing the Well

After installation of new wells, and prior to initial sampling, the monitoring wells are 'developed'. Development removes silt that has settled into the bottom of the well following installation, and removes fine silt and clay particles from the well screen and sandpack surrounding the screen, to avoid future clogging of the well or poor well performance. Development involves removing an estimated ten or more well volumes from the well using a positive-gas-displacement fluorocarbon resin bladder pump with an up-and-down agitation to

loosen particles from the well screen. After development of a well, a true well depth is recorded.

3.2.2 Ground-Water Level and Total Depth Measurements

Water-level measurements are required to confirm the groundwater flow direction and to calculate the volume of standing water in the well. All monitoring wells have been surveyed by a registered surveyor to determine the elevation of the top of each well casing. All depth and water-level measurements are referenced to the top of the well casing and recorded to the nearest one-hundredth of a foot.

In non-dedicated systems, water-level measurements are made with the use of an electronic measuring device which consists of a spool of dual conductor wire, a probe attached to the end, and an indicator. When the probe comes in contact with water, the circuit is closed and a meter light and/or buzzer attached to the spool signal the contact. The probe is lowered further until it rests on the bottom of the well to determine the depth of the well. The depth and water level are used to determine that the well has not filled with silt and to calculate the volume of standing well water. The volume of well water (in liters) is calculated using the following equation:

$$V = h \times \Pi r2 \times (28.32/ft3)$$

where V = volume of standing water (liters)
h = height of standing water (feet)
= casing depth - water level
r = radius of well casing (feet)

In dedicated systems, an accurate well depth is determined, as indicated above, after development of the well and prior to installation of the dedicated water level probe and pump. This well depth is referenced until replacement of the dedicated water level probe and/or pump is necessary. The dedicated water level probe consists of a pressure transducer and electronic meter. The height of water above the probe is measured and subtracted from the depth to which the probe was placed in the well to yield the depth of the water (example: the dedicated probe is positioned 15 ft down from the top of the casing, the meter reads b feet of water above the probe, the water level is thus 9 feet below the top of the casing). The calculation of standing water is the same as for non-dedicated systems.

The total depth, water-level measurements, and calculated well volume are recorded on the Ground-Water Monitoring Data Sheet (Figure 4).

3.2.3 Purging the Well

Prior to each sampling event, the well is purged to remove the standing water which may not be representative of formation water. Purging is accomplished by pumping or bailing. If a portable pump or peristaltic pump is used, the pump or suction tube intake is placed at the top of the water column. As the water level drops, the pump or suction tube intake is lowered so that the water in the well casing is removed completely. If a dedicated bladder pump is used, the pump is placed about 1 foot above the bottom of the well. In any case, the pumping rate is sufficiently slow to prevent the recharge water from cascading down the sides of the screen (accelerating the loss of volatiles). In non-dedicated systems, the pump or tubing is removed from the well before pumping is discontinued. If a bailer is employed, extreme care is used in lowering the bailer into the well to avoid "surging" the water in the casing, which could disturb the formation deposits.

Three to five times the calculated standing water volume (V) is removed from the well during purging. The water removed is measured in a graduated container. Under normal rates of recovery, monitoring wells should be sampled within two hours of purging in accordance with EPA guidelines. In low-yield wells (wells that are incapable of yielding three to five standing water volumes), water is purged so that it is removed from the bottom of the screened interval. Low-yield wells are evacuated to dryness once; as soon as the well recovers sufficiently, the first sample is tested for pH and specific conductance (Section 3.2.4). Samples are then collected in the order of the parameters' volatilization sensitivity (Section 3.2.5).

3.2.4 Field Measurements

During purging of the well, grab samples are collected after each of the three or more well volumes are removed to obtain measurements of pH, specific conductivity, and turbidity (if greater than 50 NTU. See Section 3.2.5). Stable readings during a purging event in a well are considered those which 1) do not indicate an increasing or decreasing trend, and 2) are within 10% of each other for specific conductance, and within 0.3 units of each other for pH.

The field instrumentation is calibrated with reference standards prior to and after each sampling day as described in the DPC Laboratory Services Procedures Manual or manufacturers specifications (available upon request). The pH meter is calibrated with two different pH standards which usually bracket the expected ground-water pH (pH standards 7.0 and 4.0). The conductivity meter is calibrated with a standard nearest the expected ground-water conductivity. Calibration results are recorded on the Field Sampling Calibration Form (Figure 5). The sample readings are recorded on the Ground-Water Monitoring Data Sheet (Figure 4).

3.2.5 Sample Collection

After sufficient purging and stable field measurements, the wells are sampled for the parameters of interest. If non-dedicated or non-disposable equipment is used (i.e. cleaned in the field between wells), background wells are sampled before downgradient wells. Sampling personnel wear clean, disposable, non-powdered latex gloves at each well. Samples are collected in the order of the volatilization sensitivity of the parameters:

* Volatile organics (VOA)
* Purgeable organic carbon (POC)
* Purgeable Organic halogens (POX)
* Total Organic halogens (TOX)
* Total Organic carbon (TOC)
* Extractable organics
* Total metals
* Dissolved metals
* Phenols
* Cyanide
* Sulfate and chloride
* Turbidity
* Nitrate and ammonia
* Radionuclides

When a positive gas displacement bladder pump is used to collect samples for volatile constituents or gases, the pumping rates will not exceed 100 milliliters per minute. Once these bottles are filled, a higher pumping rate is used, but the sampling flow rate never exceeds the flow rate used while purging. VOA, POC, POX, TOX and TOC samples are collected with no headspace in the sample containers to minimize the possibility of volatilization of organics.

If ground-water samples for which metals analysis will be conducted have a turbidity of higher than 50 NTU, the sample is divided into two portions in the field. One portion is filtered through a 0.45-micron membrane filter, preserved, and analyzed for dissolved metals. The remaining portion is preserved and analyzed for total metals. Any difference in concentration between the total and dissolved fractions may be attributed to sorption of metallic ions on the particles. Both filtered and non-filtered results will be reported.

3.2.6 Sample Containers, Volume, Preservative, and Holding Time

All sample containers supplied for the collection of groundwater samples by the laboratory are new, precleaned and/or prebaked as approved by EPA procedures appropriate for the parameters of interest. Table 2 summarizes the sample containers, sample volume, preservation procedures and holding times required for each type of sample and parameter. Sample containers are kept closed until used. All sample containers are provided by DPC or vendor laboratories.

4.0 SAMPLE TRACKING

The chain of custody program allows for the tracing of possession and handling of individual samples from the time of field collection through laboratory analysis and report preparation.

4.1 SAMPLE LABELING

Sample containers are labeled at the time of sampling with the following information: sampling date and time, sample identification number, parameters of interest, preservative, and initials of sample collector. An example of a typical sample label is presented in Figure 6.

4.2 FIELD LOG Book

A Field Log Book is maintained during the course of the field work to document the following:

* Identification of well
* Well depth
* Static water level depth and measurement technique
* Presence of immiscible layers and detection method
* Well yield- high or low
* Purge volume or pumping rate
* Sample identification numbers
* Well evacuation procedure/equipment
* Sample withdrawal procedure/equipment
* Date and time of collection
* Types of sample containers used
* Identification of replicates or blind samples
* Preservative(s) used
* Parameters requested for analysis
* Field analysis data and methods
* Sample distribution and transporter
* Field observations on sampling event
* Name of collector(s)
* Climatic conditions including estimate of air temperature

This information is contained on the Ground-Water Monitoring Data Sheets (Figure 4), the Field Sampling Calibration Form (Figure 5), or the Chain-of-Custody Record and Analysis Request Form (See Section 4.3) which are filled out for each sampling event. These loose-leaf sheets are arranged in sequential order and filed by project and date. All recorded entries are made in indelible ink. Errors are corrected by drawing a line through the error, initialing and dating the correction, and starting a new entry on the next line (if necessary).

4.3 CHAIN-OF-CUSTODY RECORD AND ANALYSIS REQUEST FORM (CCRARF)

The CCRARF (Figure 7) accompanies the sample(s), traces sample possession from time of collection to delivery to the laboratory(s), and clearly identifies which sample containers have been designated for each requested parameter. The record includes the following types of information:

* Sample identification number
* Signature of collector
* Date and time of collection
* Sample type (e.g., groundwater, immiscible layer)
* Identification of well
* Number of containers
* Parameters requested for analysis
* Preservative used
* Signature of persons involved in the chain of possession * Inclusive dates of possession

4.4 SAMPLE CUSTODY, SHIPMENT AND LABORATORY RECEIPT

For the purpose of these procedures, a sample is considered in custody if it is:

* In actual possession of the responsible person;
* In view, after being in physical possession;
* Locked so that no one can tamper with it, after having been in physical custody;
* In a secured area, restricted to authorized personnel.

All samples are maintained in the custody of the sampling crew during the sampling event. At the end of each sampling day and prior to the transfer of the samples off-site, chain-of-custody entries are completed on the CCRARF for all samples. Upon transfer of custody, the chain-of-custody form is signed by a sampling crew member, including the date and time.

Samples are delivered to outside laboratories by DPC personnel or courier. All chain-of-custody forms received by the laboratory(s) are signed and dated by the respective Supervising Scientist(s) or their designee (at the DPC lab), or the laboratory sample custodian (at vendor labs) immediately following receipt by the laboratory.

The analysts at the laboratory(s) maintain a sample-tracking record that will follow each sample through all stages of laboratory processing. The sample tracking records show the date of sample extraction or preparation, and analysis. These records are used to determine compliance with holding time limits during lab audits and data validation.

Custody procedures followed by DPC laboratory personnel are described in detail in the DPC Laboratory Services Procedures Manual.

5.0 ANALYTICAL PROCEDURES

The main analytical laboratory used in this program is the DPC Laboratory Services Laboratory (S.C. Drinking Water and Wastewater Certification #99005). The organizational structure and staff qualifications of the laboratory are discussed in its generic Quality Assurance Program (QAP). The QAP and Laboratory Services Procedures Manual are available for review upon request.

Vendor laboratories that meet EPA and S.C. certification requirements may be used for analyses which cannot be performed in-house.

The analytical procedures used for this Ground-Water Monitoring Program are briefly described in Table 2. Conductivity, pH, and/or turbidity are measured in the field according to DPC Laboratory Services Procedures Manual or instrument manufacturers instructions.

6.0 INTERNAL QUALITY CONTROL CHECKS

Internal laboratory control checks used by the laboratories are described in their generic QAP and procedures manual. The laboratories demonstrate the ability to produce acceptable results using the methods specified.

Internal quality control checks for sampling procedures and laboratory analyses will be conducted with each sampling event. These checks will consist of the preparation and submittal of field blanks, trip (travel) blanks, and/or field replicates for analysis of all parameters at frequencies described in the laboratory(s) procedures manuals. Equipment rinsate blanks for laboratory-cleaned equipment will be collected quarterly.

The above field QC blanks and replicates included as internal QC checks are described as follows:

* Equipment Rinsate Blank: An equipment rinsate blank is made by placing organic-free deionized or distilled water in contact with the field sampling apparatus (bailer, pump tubing, etc.) or with the air near a well that conceivably could be a source of contamination. The water is then preserved and sealed in the same type of sample bottle as the other samples (using the same preservative source) and transported to the laboratory with the samples for analysis of the parameters of interest.

* Field Blanks: A field blank consists of sample containers filled in the field with organic free, deionized or distilled water prepared and preserved in the same manner as the samples. The field blank is transported to the laboratory with the samples and analyzed along with the field samples for the constituents of interest to check for contamination imparted to the samples by the sample container, preservative, or other exogenous sources.

* Trip Blanks: A trip (travel) blank is a sample container filled with organic-free water in the laboratory that travels unopened with the sample bottles. It is returned to the laboratory with the field samples, and analyzed along with the field samples for parameters of interest.

* Field Replicates: A field replicate is a duplicate sample prepared at the sampling locations from equal portions of all sample aliquots combined to make the sample. Both the field replicate and the sample are collected at the same time, in the same container type, preserved in the same way, and analyzed by the same laboratory as a measure of sampling and analytical precision.

7.0 VALIDATION OF FIELD DATA PACKAGE

The field data package will be reviewed by the Project Scientist for completeness and accuracy using the Field Data Validation Checklist (Appendix B). The field data package includes all of the field records and measurements developed by the sampling team personnel. The field data package validation procedure consist of:

- A review of field data contained on the Ground-Water Monitoring Data Sheets for completeness.
- A verification that equipment blanks, field blanks, and trip blanks were properly prepared, identified, and analyzed.
- A check of the Field Sampling Calibration Form for equipment calibration and instrument condition.
- A review of the Chain-of-Custody Record and Analysis Request Form for proper completion, signatures of field personnel and the laboratory sample custodian, and dates, and for verification that the correct analyses were specified.

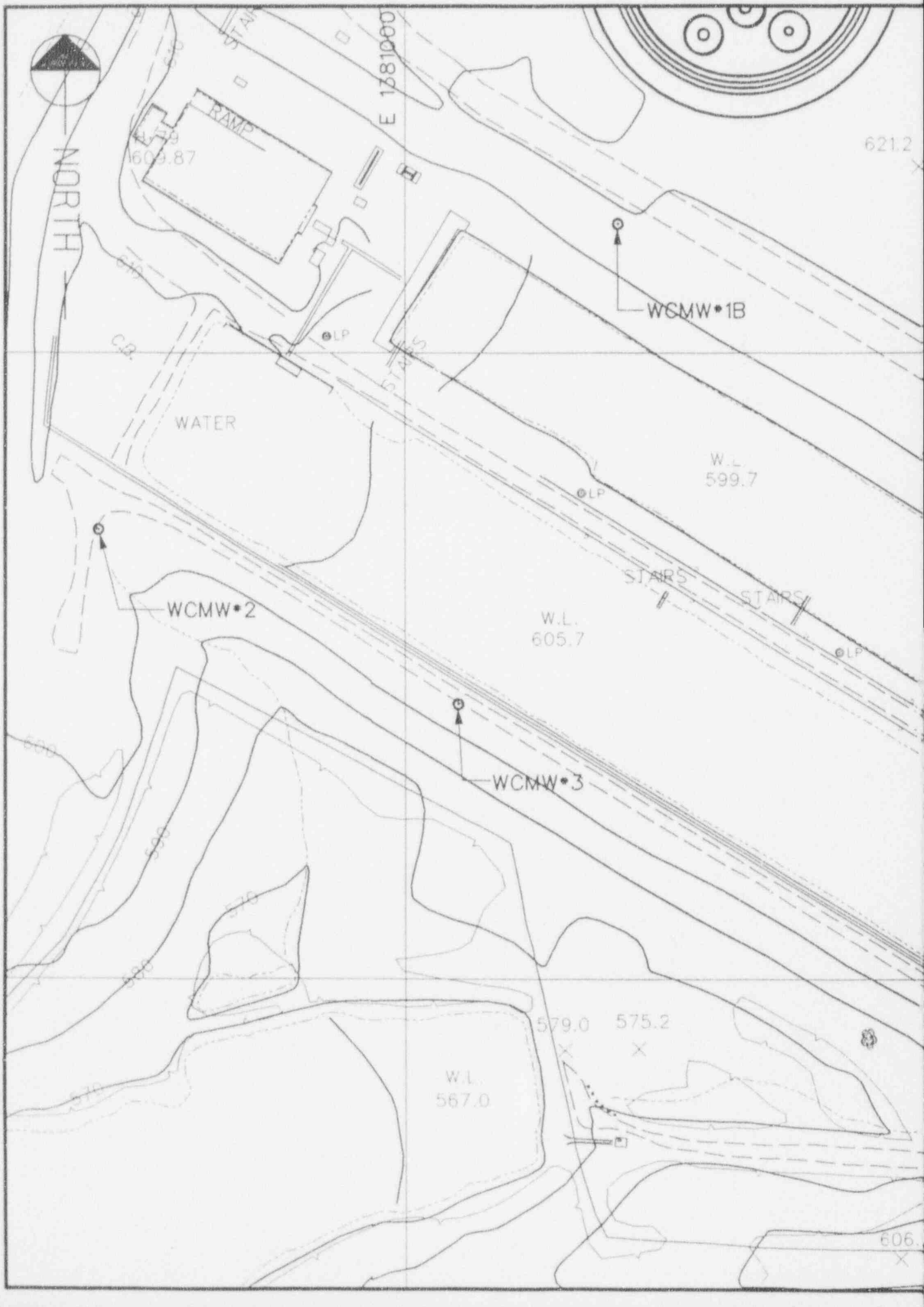
8.0 REPORT SUBMITTAL

A summary table of the field and laboratory data and a cover letter describing trends will be submitted to the South Carolina Department of Health and Environmental Control within 90 days of sampling. The State will be notified in the event that vendor lab analyses have not been completed within this time frame. All Ground-Water Monitoring Data Sheets, Field Calibration Forms, Chain-of-Custody Record and Analysis Request Forms, Laboratory(s) QA data, and Data Validation Checklists are kept in fire-proof file cabinets or microfiched, and are available upon request.

FIGURES

TABLES

APPENDICES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LP
C.B.
WATER
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599.7
LP
STAIRS
STAIRS
LP
WCMW*2
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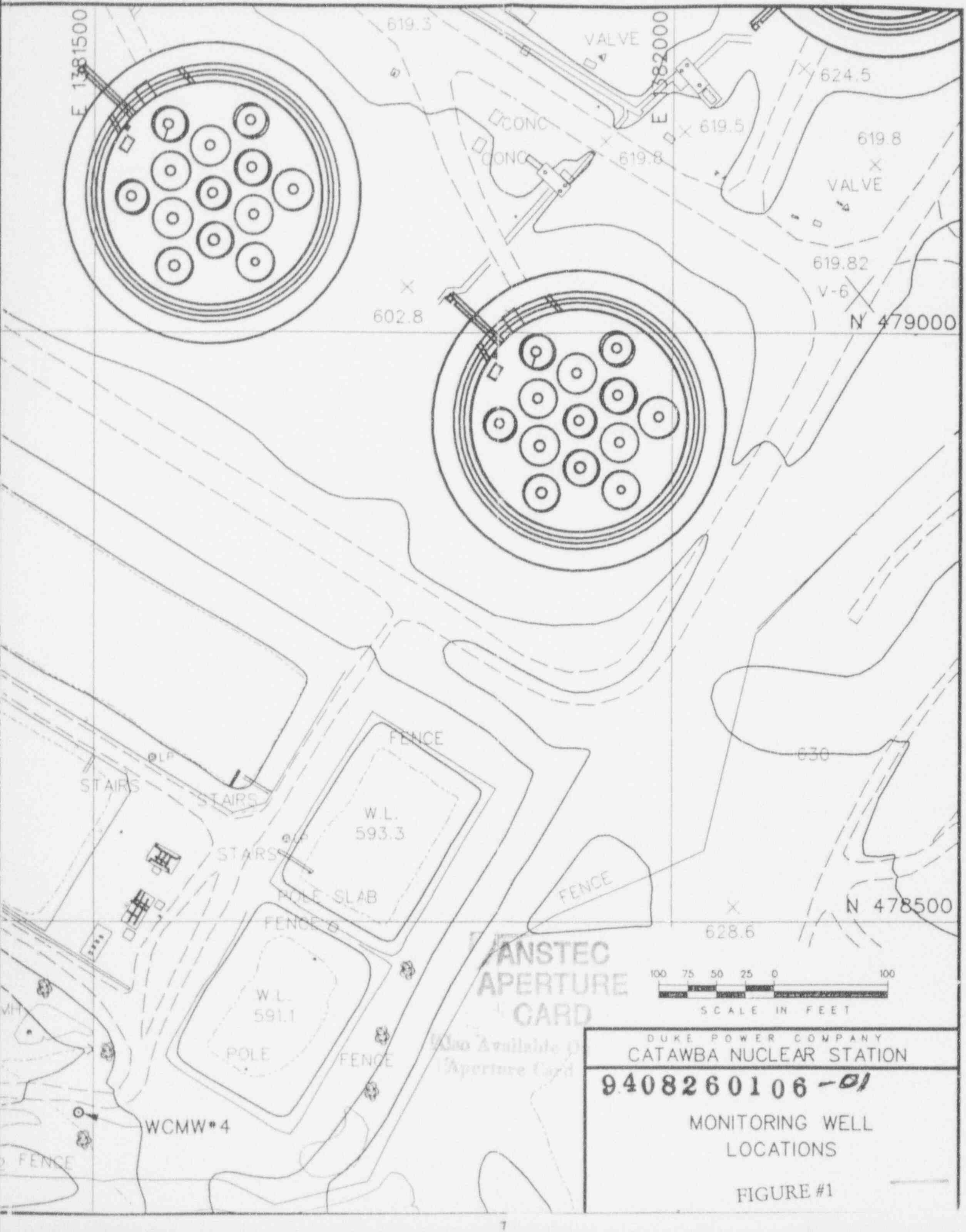
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CONC
619.8
619.8
VALVE
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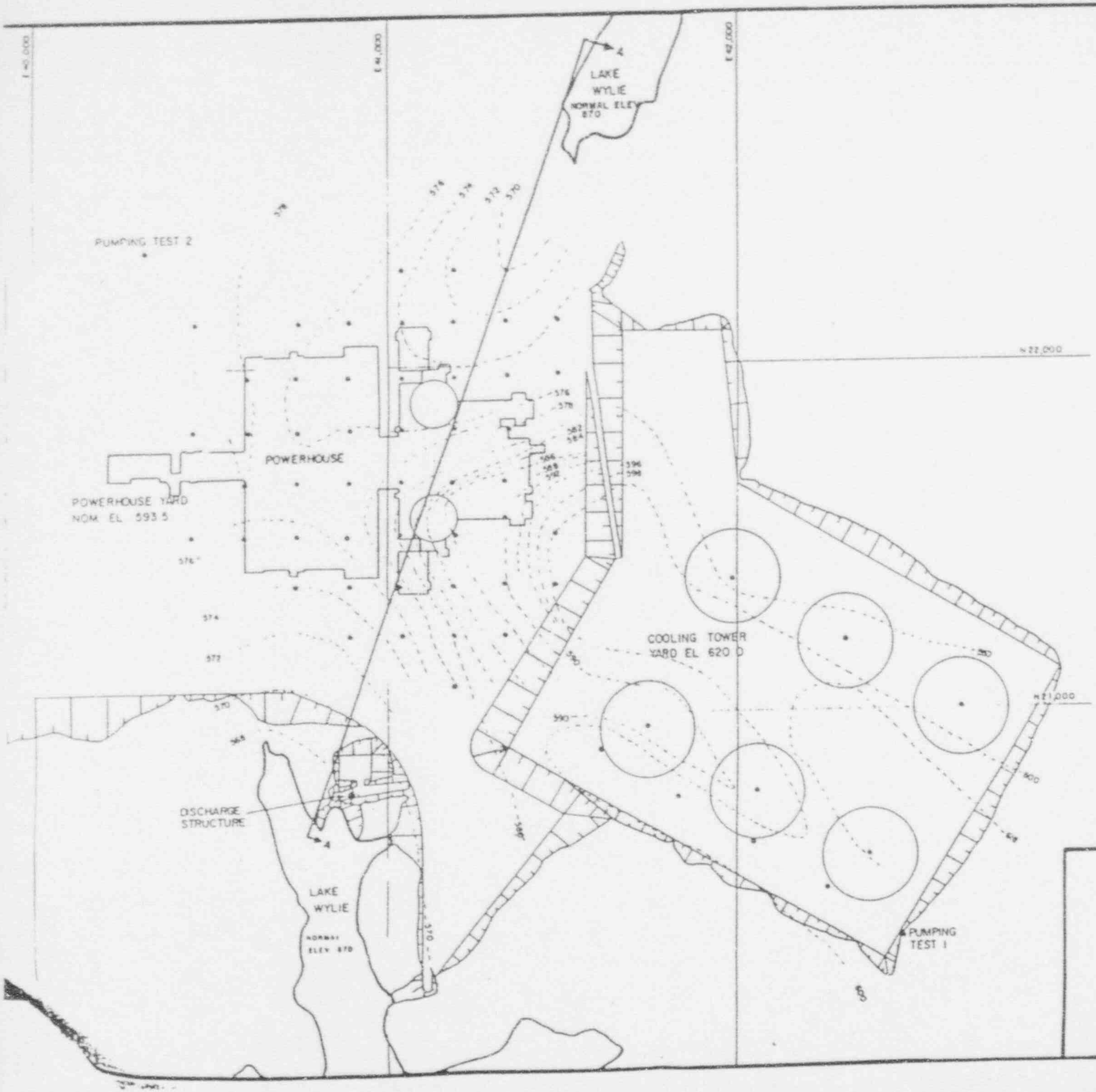
V-6
602.8
N 479000
FENCE
630
STAIRS
STAIRS
W.L.
593.3
STAIRS
POLE SLAB
FENCE
FENCE
N 478500
628.6
W.L.
591.1
POLE
FENCE
WCMW#4
FENCE
ANSTEC
APERTURE
CARD
Also Available On
Aperture Card
100 75 50 25 0 100
SCALE IN FEET
DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
9408260106-01
MONITORING WELL
LOCATIONS
FIGURE #1



0 150 300

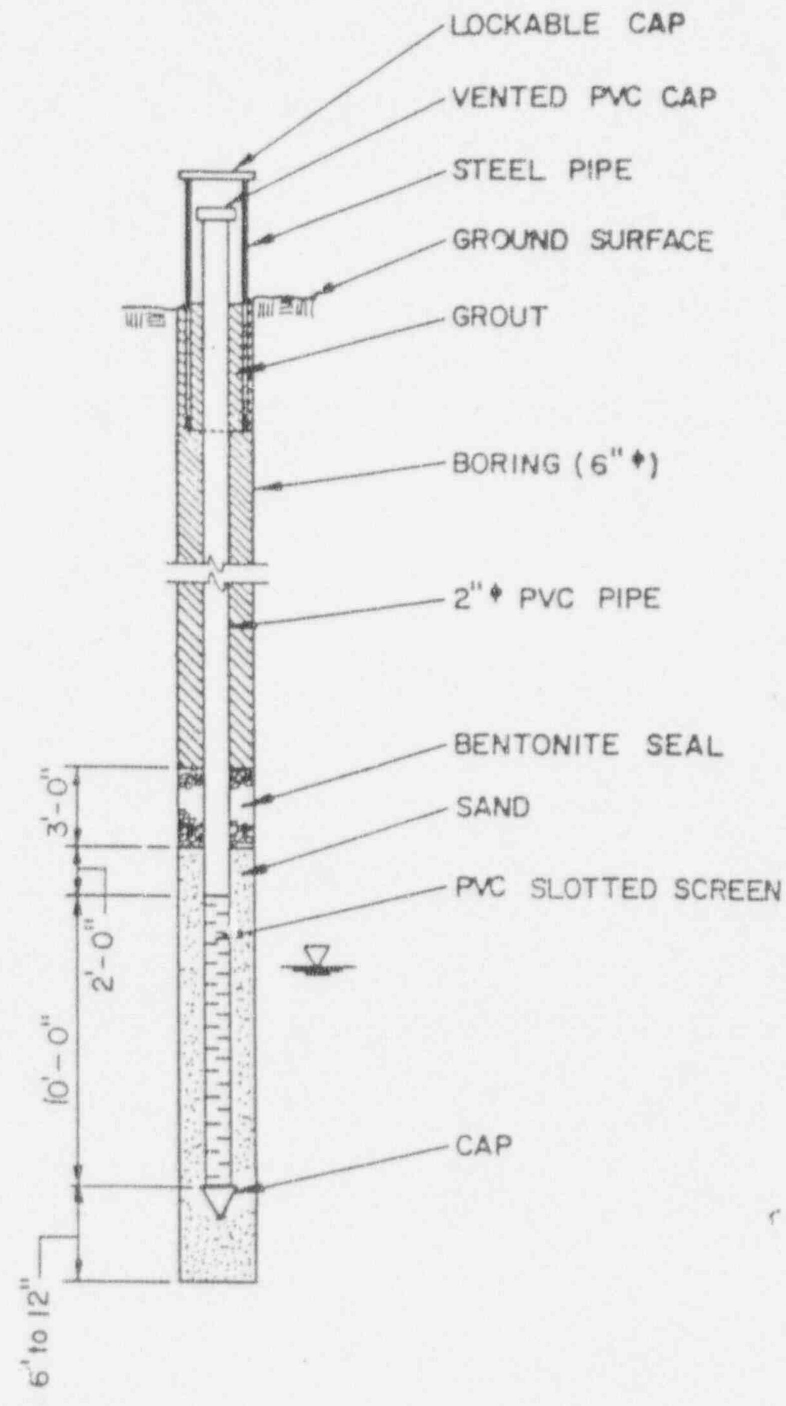
NOTES: CONTOURS FOR PLANT YARD ARE BASED ON GROUNDWATER LEVELS MEASURED DECEMBER 1971 AND JANUARY 1972. CONTOURS FOR COOLING TOWER YARD ARE BASED ON GROUNDWATER LEVELS MEASURED IN APRIL 1974

FIGURE 2.

WATER TABLE CONTOUR MAP

CATAWBA NUCLEAR STATION

ER Figure 2.4.4-2



NOTES:

1. ALL DIMENSIONS ARE APPROXIMATE.
2. ALL PVC PIPE JOINTS HAVE SCREW CONNECTORS.

FIGURE 3.

DUKE POWER CO.

GROUNDWATER MONITORING WELL DETAIL

FIGURE 4.

DUKE POWER COMPANY
GROUNDWATER MONITORING DATA SHEET

LOCATION:			
PROJECT TITLE:			
SAMPLING DATE:		FIELD CREW	

MONITORING WELL NUMBER:

WATER LEVEL METER #:

TIME SAMPLE COLLECTED:

WELL VOLUME CALCULATION

WELL DIAMETER (INCHES)	WELL DEPTH (FEET)	-	WATER LEVEL (FEET)	=	WATER COLUMN (FEET)	X	3.14 x r^2	=	VOLUME (FT^3)
2"		-		=	0.00	X	0.0218	=	0.0
4"		-		=	0.00	X	0.0873	=	0.0

LITERS PER WELL VOLUME REMOVED:

WELL VOLUME	LITERS TO REMOVE: (FT^3 x 28.32 l/FT^3)	
	2" WELL	4" WELL
1	0	0
5	0	0
10	0	0
20	0	0

OBSERVATIONS:

ODORS DETECTED:		FREE PRODUCT MEASUREMENT:	
TYPE:		METHOD:	
STRONG:		THICKNESS:	
MINOR:		OTHER:	
NONE:			

WATER LEVEL (FEET)	METHOD (P=PUMP) (B=BAIL)	VOLUME (LITERS)	EVACUATED VOLUME (LITERS)		pH (SU)	TEMP (deg C)	SPECIFIC CONDUCT. (umho/cm)		COMPLETE EVACUATION (Y/N)
						N/A			
N/A									

COMMENTS: WATER LEVEL AND WELL DEPTH REFERENCED TO TOP OF PVC WELL CASING.

REFERENCE PROBE DEPTH

Figure 5.

Form 18570 (R7-87)

FIELD SAMPLING CALIBRATION FORM

Study: ____________________

Date: __________ Water Collector: __________

Crew: __________ Surface Unit Reader: __________

Weather & Lake Conditions: ____________________

Equipment: Sonde#: __________ Other Instruments: __________

Cable#: __________

Battery#: __________

Surface Unit#: __________

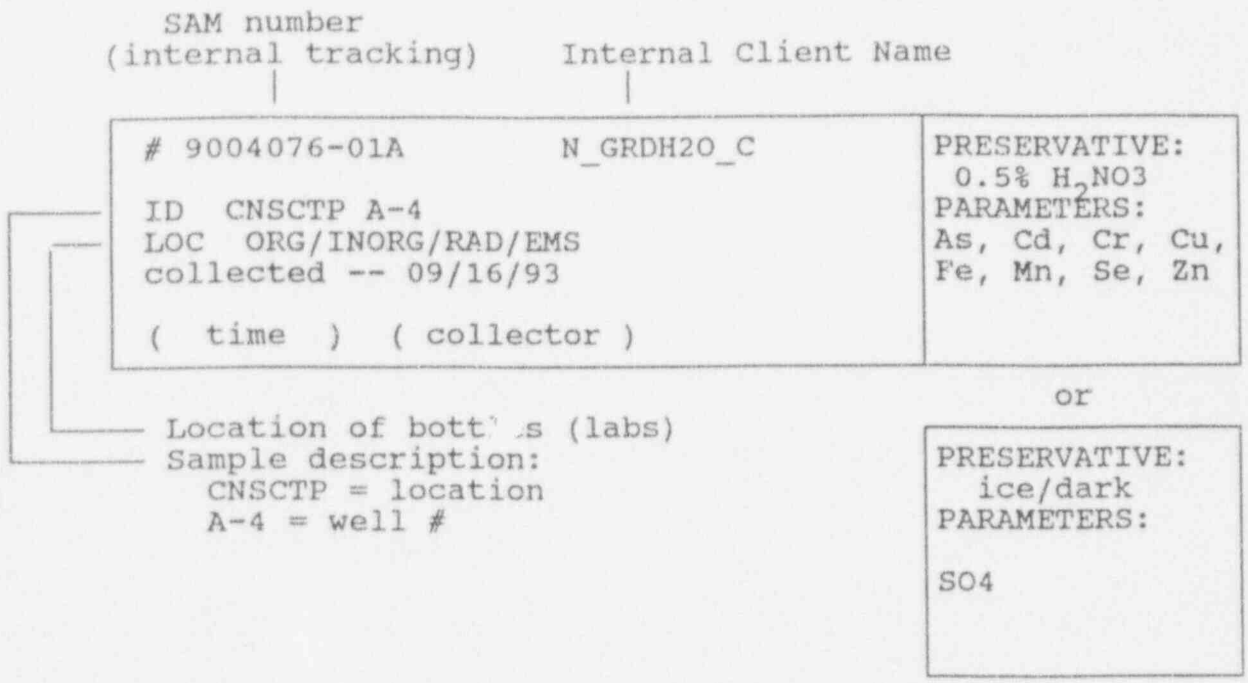
Procedure Number: PESCS/ __________ Water Quality Analyzer: 4041

Calibration Time		Time:			Time:			Time:		
Variable	Calib. Std.	Initial (Hydrolab)	→	Adj. To (Std.)	Initial (Hydrolab)	→	Adj. To (Std.)	Initial (Hydrolab)	→	Adj. To (Std.)
Temp. °C										
Therm.#:		.	-/->	.	.	-/->	.	.	-/->	.
Therm.#:		.	-/->	.	.	-/->	.	.	-/->	.
DO mg/l	W			.			.			.
	W			.			.			.
	W			.			.			.
	AW	.	→	.	.	→	.	.	→	.
pH	B	.	→	7.00	.	→	7.00	.	→	7.00
	B	.	→	4.01	.	→	4.01	.	→	4.01
	B	.	→	9.18	.	→	9.18	.	→	9.18
SP COND umho/cm	SS	.	→	.	.	→	.	.	→	.
	SS	.	→		.	→	.	.	→	.
	SS	.	→	.	.	→	.	.	→	.

KEY:

B – Buffer
W – Winkler
AW – Average Winkler
SS – Standard Solution
NA – Not Applicable
IM – Instrument Malfunction
→ – Adjusted to
-/-> – Not Adjusted to

FIGURE 6. Example Sample Label



DUKE POWER COMPANY
Production Environmental Services
Applied Science Center (MG03A)
13339 Hagers Ferry Road
Huntersville, NC 28078

CHAIN OF CUSTODY RECORD AND ANALYSIS REQUEST FORM *

Form 35226 (R2-91)

PES CLIENT CONTACT/GROUP/PHONE[1]: ______________________

CLIENT[2]: ______________________

Project Name[3]: ______________________

Results to/Phone[4]: ______________________

Address and/or PROFS[5]: ______________________

Matrix (type of samples)/QC Level[6]: ______________________

Date results requested[7]: ______________________

SAM No. with dash[8]	CHEMPLOT Number[9]	Sample Description or ID[10]	Collection[11]			ANALYSES REQUESTED by bottle type—MUST NOTE PRESERVATIVE[12] (may note special DL or Method)[13]											
			Date	Time	Name												

Preservation by[14]: | Total # of samples[15]:

Delivered by[16]:	Delivered by:	Delivered by:	Delivered by:	Delivered by:
Date/Time:	Date/Time:	Date/Time:	Date/Time:	Date/Time:
Received by:	Received by:	Received by:	Received by:	Received by:

Comments[17]: ______________________

* See instructions on back of form.

[18] White, canary, pink — PES files. Goldenrod — Returned to Client after signatures.

TABLE 1. Catawba Nuclear Station Chemical Treatment Ponds Groundwater Parameter List.

PARAMETER	METHOD	REFERENCE	DETECTION LIMIT		R61-68 (CLASS GB) STANDARD		R51-58 DRINKING STANDARD		40 CFR 143 SECONDARY DRINKING STANDARD	
Specific Conductance (field)	EPA 120.1	1	1	umhos/cm	n/a		n/a		n/a	
pH (field)	EPA 150.1	1	0.1	units	n/a		n/a		6.5-8.5 units	
Sulfate	EPA 375.2	1	1	mg/l	n/a		n/a		250	mg/l
Arsenic	EPA 206.2	1	0.001	mg/l	0.05	mg/l	0.05	mg/l	n/a	
Barium	EPA 200.7	2	0.01	mg/l	2.0	mg/l	2.0	mg/l	n/a	
Cadmium	EPA 213.2	1	0.0001	mg/l	0.005	mg/l	0.005	mg/l	n/a	
Chromium	EPA 218.2	1	0.001	mg/l	0.1	mg/l	0.1	mg/l	n/a	
Copper	EPA 220.2	1	0.0005	mg/l	n/a		n/a		1.0	mg/l
Iron	EPA 200.7	2	0.05	mg/l	n/a		n/a		0.3	mg/l
Lead	EPA 239.2	1	0.002	mg/l	0.05	mg/l	0.05	mg/l	n/a	
Manganese	EPA 200.7	2	0.003	mg/l	n/a		n/a		0.05	mg/l
Mercury	EPA 245.1	1	0.001	mg/l	0.002	mg/l	0.002	mg/l	n/a	
Selenium	EPA 270.2	1	0.002	mg/l	0.05	mg/l	0.05	mg/l	n/a	
Silver	EPA 272.2	1	0.0002	mg/l	n/a		n/a		0.1	mg/l
Zinc	EPA 200.7	2	0.004	mg/l	n/a		n/a		5.0	mg/l

References:

1. Methods for Chemical Analysis of Water and Wastes, EPA-600/4-79-020, March 1979

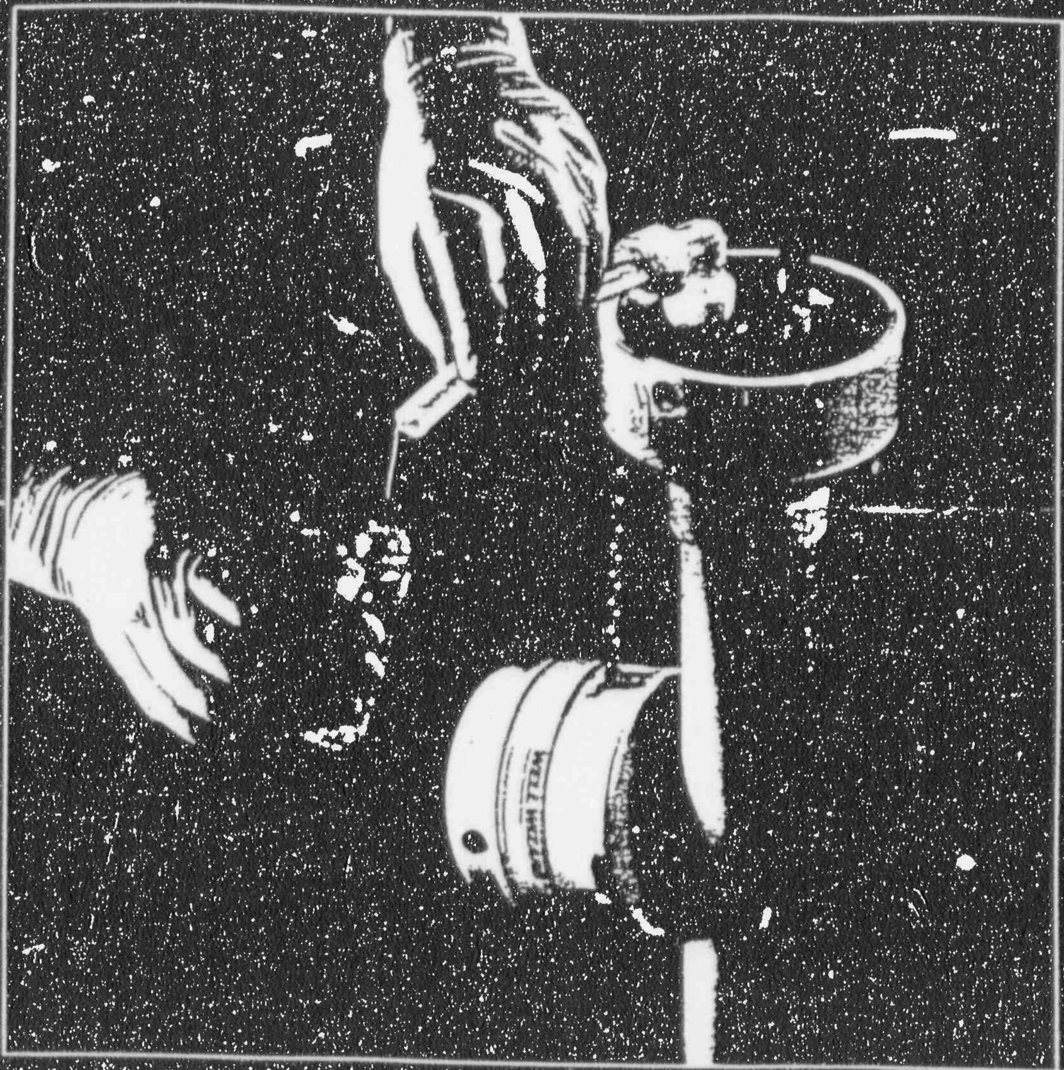
2. Technical Additions to Methods for Chemical Analysis of Water and Wastes, EPQ-600/4-82-055, December 1982.

TABLE 2. Analysis Parameters, Containers, Preservatives and Holding Times.

PARAMETER	CONTAINER	PRESERVATIVE	HOLDING TIME
Specific Conductance (field)	in-situ	n/a	n/a
pH (field and lab)	in-situ	n/a	n/a
Turbidity	in-situ	n/a	n/a
Sulfate	500 ml PET	Cool, 4°C	28 days
Metals, dissolved	500 ml PET	Filter on site HNO_3 to pH <2	6 months, except Mercury 28 days
Metals, total	500 ml PET	HNO_3 to pH <2	6 months, except Mercury 28 days

APPENDIX A.

Dedicated Pump Specifications.

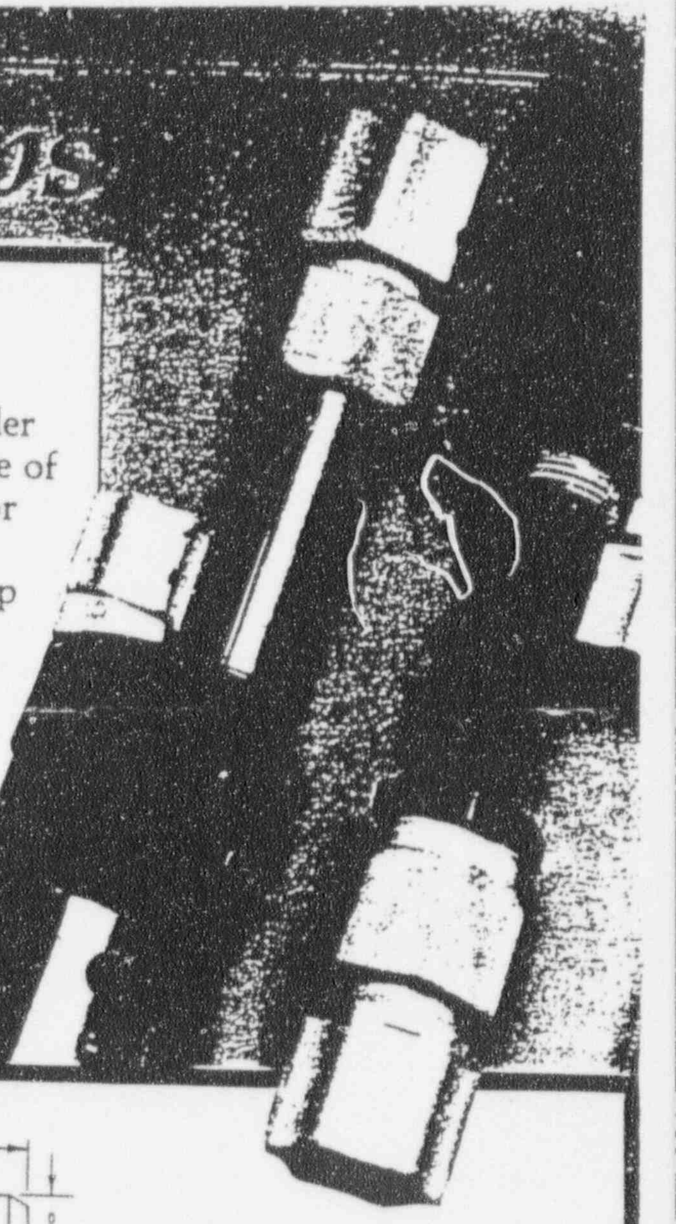


Specification & Selection Guide

WELL WIZARD®

The standard for groundwater sampling

Sampling Pumps



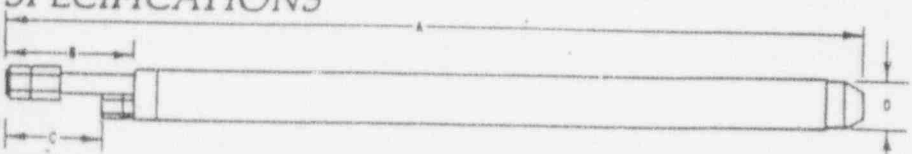
Choose the system that gives you the superior performance you deserve.

The whole reason you're selecting a dedicated bladder pump system for groundwater monitoring is because of its accuracy and long-term reliability. Don't settle for second best—get the high quality you deserve.

QED built the business of dedicated bladder pump systems. Our pumps are the heart of the system, so we spare no effort to make them the best.

Many of the details that make a superior pump are subtle modifications resulting from years of experience. They may not be obvious at first glance, but check the specs of our pumps. You'll find flow rates, pumping lifts, material quality, durability, and selection that clearly show our commitment to supplying you with the best pumps possible.

SPECIFICATIONS



MODEL NO.	BODY MATERIAL	BLADDER MATERIAL	TUBE FITTINGS †	MAXIMUM LIFT (Ft.)	A	B	C	D	PUMP WEIGHT (Lbs)
					(Dimension in inches)				
P-1100	PVC	PVC	Polypropylene	300	40.85	4.65	3.70	1.66	3
T-1100	Teflon	Teflon	Teflon	250	40.33	4.13	2.96	1.66	4
P-1101	PVC	Teflon	Polypropylene	300	40.85	4.65	3.70	1.66	3
P-1101H	PVC	Teflon	316 S.S.	600	40.75	4.50	3.70	1.66	3
ST-1101P	316 S.S.	Teflon	316 S.S.	1000	40.50	4.12	3.12	1.66	10
T-1200	Teflon/316 S.S.	Teflon	316 S.S.	300	41.14	3.93	3.06	1.50	5
P-1201	PVC/316 S.S.	Teflon	Polypropylene	300	41.23	4.02	3.06	1.50	4
P-1201H	PVC/316 S.S.	Teflon	316 S.S.	600	41.37	4.16	3.20	1.50	4
T-1300	Teflon/316 S.S.	Teflon	316 S.S.	200	46.75	3.87	2.87	1.00	3

† All Air Supply Tube Fittings: 0.25" O.D. Discharge Tube Fittings: 0.5" O.D. (Except T-1300: 0.375" O.D.)

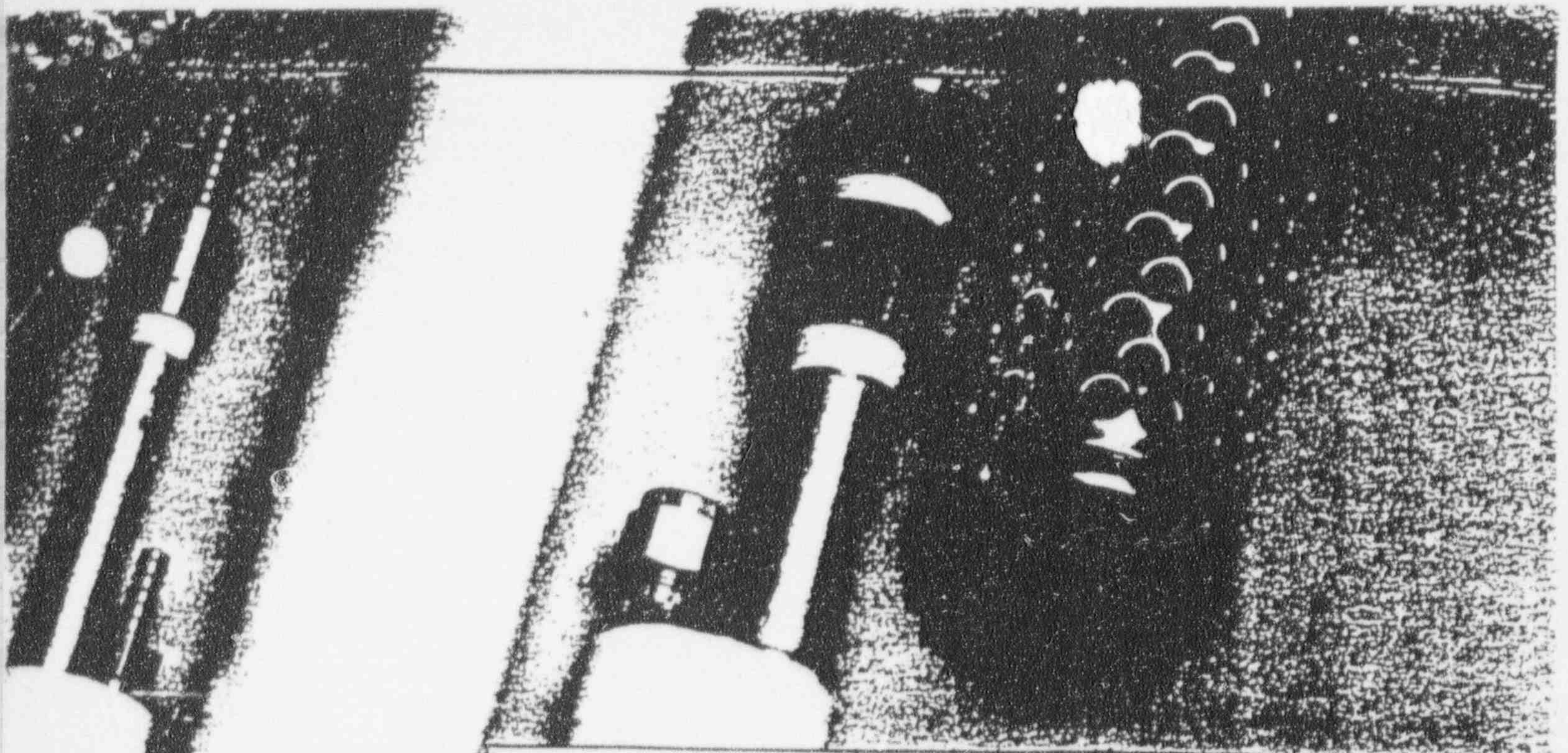
* T-1300 requires Clamp Tool No. 35188 for field attachment of tubing. Clamps are provided with pump.

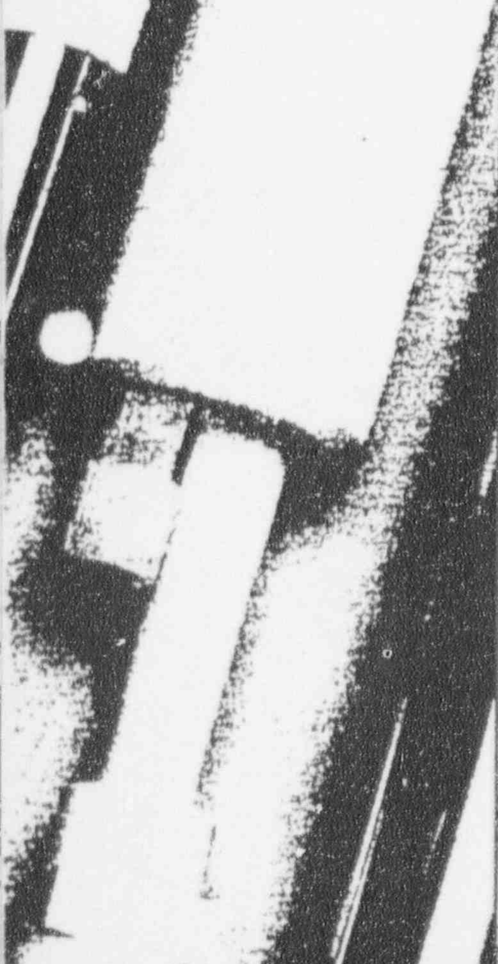
PLEASE NOTE: Intake Screens are standard on T-1300, and are optional on other models. Please consult QED.

Field Replaceable Bladders

For Pumps	W/ Hand Tool	W/O Hand Tool
T-1100	14055	14065
P-1101	14057	14067
T-1200	35315	35320
P-1201	35315	35320

Note: All kits contain 2 bladder sleeves and seal replacement sets. 35315 includes pin punch.





To build the best, start [illegible]

Bladder pump design allows construction of the highest quality materials, with consistent usage throughout the pump. All parts and fittings that contact the sample are matched for compatibility and better performance. You will achieve accurate sampling with the greatest cost-efficiency by choosing the proper pump material.

Teflon* /PTFE

For maximum sample accuracy at low contaminant levels, and longest pump life in harsh chemical environments, QED uses only the finest duPont Teflon* and other PTFE resins available.

Stainless Steel

All stainless steel is not the same. Electropolishing stainless steel has been proven to give the most inert finish for preserving water quality, with lower porosity to help it resist corrosion. That's what we use in all QED stainless parts, rather than inferior alloys with little or no protective finish. (Stainless steel pumps are not recommended for low metal sampling levels, high acid, high dissolved solids, or reducing conditions.)

PVC

Polyvinyl chloride [illegible] economical alternative when monitoring doesn't require stainless steel. We [illegible] NSF-grade PVC, extruded [illegible] specifically for QED with no markings or lubricants to [illegible] contaminate the sample.

Lab-certified cleaning

All Well Wizard pumps pass through a rigorous cleaning procedure, and are laboratory-certified to be free of all EPA 601, 602, base neutral, and [illegible] acid extractable contaminants.

Production parts are batch-treated in laboratory cleaning solution at 130°F and are rinsed with 130°F tap water. Parts are then washed with purified water (filtered, treated with activated carbon and a series of ion exchange columns). Assembly and testing steps also use purified water. [illegible]

A special 24-hour water extraction test [illegible] and the water analyzed; pumps that don't test clean are run through the procedure again until they do. Pre-assembled pumps are issued a reference number when they have been certified clean and are sealed in polyethylene bags for protection until they are installed.

CERTIFIED
CLEAN

The "secret" of bladder durability

It's no secret: We start with the most inert polymers available... go through all the process variables to find the toughest formulations... test each batch of bladder material for the equivalent of decades of service to assure reliable performance... and protect bladders with easy-to-replace inlet screen cartridges to reduce abrasion and wear.

If a bladder does malfunction, QED supplies a quick-change kit so you can easily replace just the bladder sleeve—in the field, with no waiting.

*Teflon is a registered trademark of E.I. duPont de Nemours.

APPENDIX B. FIELD DATA VALIDATION CHECKLIST

DATA VALIDATION CHECKLIST

Project Name: ______________________________
Project Number: ______________________________
Sampling Date: ________________ Validation Date: ____________
Sample Identification: ______________________________
____
Sampling Team: ______________________________
Analyzing Laboratory: ______________________________
Analyses Performed: ______________________________
____
Sample Matrix: ______________________________
QA Reporting Level: ______________________________

FIELD DATA PACKAGE DOCUMENTATION

Field Sampling Logs: 1/

	Reported No	Reported Yes	Performance Acceptable No	Performance Acceptable Yes	Not Required
1. Sampling dates noted	___	___	___	___	___
2. Sampling team indicated	___	___	___	___	___
3. Sample identification traceable to location collected	___	___	___	___	___
4. Sample location	___	___	___	___	___
5. Sample depth for soils	___	___	___	___	___
6. Collection technique (bailer, pump etc	___	___	___	___	___
7. Field sample preparation techniques	___	___	___	___	___
8. Sample type (grab, composite)	___	___	___	___	___
9. Sample container type	___	___	___	___	___
10. Preservation methods	___	___	___	___	___
11. Chain of custody form completed	___	___	___	___	___
12. Required analytical methods requested	___	___	___	___	___
13. Field (water and soil) sample logs completed properly and signed	___	___	___	___	___
14. Number and type of field QC samples collected (blanks, replicates, splits, etc.)	___	___	___	___	___
15. Field equipment calibration	___	___	___	___	___
16. Field equipment decontamination	___	___	___	___	___
17. Sample shipping	___	___	___	___	___
18. Laboratory Task Order	___	___	___	___	___

1/ Field Sampling logs = Water and/or Soil/Sediment Sampling Logs

Comments: ______________________________
____
____
____
____
____
____