4. FIELD ACTIVITIES

The following sections describe the field activities and procedures to be used to meet the DQOs described in Section 3. Prior to commencing any sampling activities, a prejob briefing will be held with all work-site personnel to review the requirements of the LTMP, HASP, and other work control documentation, and to verify that all supporting documentation has been completed. Additionally, following sampling, a postjob review will be conducted. Both prejob briefings and post-job reviews will be conducted in accordance with Management Control Procedure (MCP)-3003, "Performing Pre-Job Briefings and Post-Job Reviews."

The OU 3-13 Group 5 groundwater monitoring and sampling will include collection of several types of data, including water levels, water samples, and geophysical logs of selected wells.

4.1 Sampling and Monitoring Well Network

Group 5 groundwater monitoring and sampling will include collection of several types of data, including water levels, water samples, and geophysical logs of selected wells. The samples will be collected from a network of existing groundwater wells. The first round of sampling will be considered a baseline sampling round and be nearly inclusive of all groundwater monitoring wells in the vicinity of the INTEC facility and downgradient to the Central Facilities Area landfills. Following this baseline sampling round, monitoring activities will consist of sampling of a selected subset of the INTEC monitoring wells.

In order to monitor COC flux originating from the former INTEC injection well (CPP-23) three wells (USGS-41, USGS-48, and USGS-59) completed through the HI interbed will be sampled below the interbed. This will be accomplished by using inflatable packers to seal the borehole below the HI interbed and then collecting the sample from the interval below the packer. Wells suitable for sampling below the HI interbed must have the following characteristics:

- The HI interbed must be present in the borehole
- The well must be completed as an open borehole through the HI interbed.
- The wells must be downgradient from the injection well.
- The well must be able to maintain a seal using an inflatable packer.

In order to select appropriate wells for this sampling, lithologic and geophysical logs will be reviewed and a borehole televiewer log will be collected from prospective wells. A preliminary review of the lithologic logs indicates that the wells to be selected for this sampling will come from the following group of wells: USGS-41, USGS-43, USGS-45, USGS-46, USGS-47, USGS-48, USGS-49, USGS-51, USGS-59, and a new well. Based on the review of the geophysical and borehole televiewer logs, the wells chosen to sample below the HI interbed may be revised.

4.2 Sampling and Monitoring Locations

The following discussion includes locations for the groundwater sampling.

4.2.1 Groundwater Sampling Locations.

A general discussion of the wells to be included is provided in Section 4.1. The majority of the existing groundwater wells will be included in the baseline sampling network. These wells are listed in

Table 4-1 and shown on Figure 4-1. However, for the long-term monitoring the number of wells will be significantly reduced. These wells are listed in Table 4-2 and shown on Figure 4-2, with the exception of the three wells to be determined to monitor contaminants below the HI interbed. The total number of wells for long-term monitoring is 20 and includes 11 facility monitoring wells, six plume monitoring wells, and three wells to monitor the flux originating from the former INTEC injection well. Possible wells for monitoring the flux from the former injection well below the HI interbed are shown on Figure 4-3.

Table 4-1. The INTEC groundwater wells for baseline sampling.

INEEL Name			
ICPP-MON-A-021	USGS-34	USGS-46	USGS-85
ICPP-MON-A-022	USGS-35	USGS-47	USGS-111
LF2-08	USGS-36	USGS-48	USGS-112
LF2-09	USGS-37	USGS-49	USGS-113
LF2-10	USGS-38	USGS-51	USGS-114
LF2-11	USGS-39	USGS-52	USGS-115
LF2-12	USGS-40	USGS-57	USGS-116
LF3-08	USGS-41	USGS-59	USGS-121
LF3-09	USGS-42	USGS-67	USGS-122
LF3-10	USGS-43	USGS-77	USGS-123
LF3-11	USGS-44	USGS-82	MW-18
USGS-20	USGS-45	USGS-84	

Table 4-2. The INTEC groundwater wells for long-term monitoring.

INEEL Name			
USGS-40	USGS-52	USGS-57	USGS-59
USGS-42	USGS-121	USGS-67	USGS-41
USGS-47	USGS-122	USGS-85	
USGS-48	USGS-123	USGS-112	
USGS-49	MW-18	LF3-08	
USGS-51	USGS-113	USGS-48 (below HI interbed)	

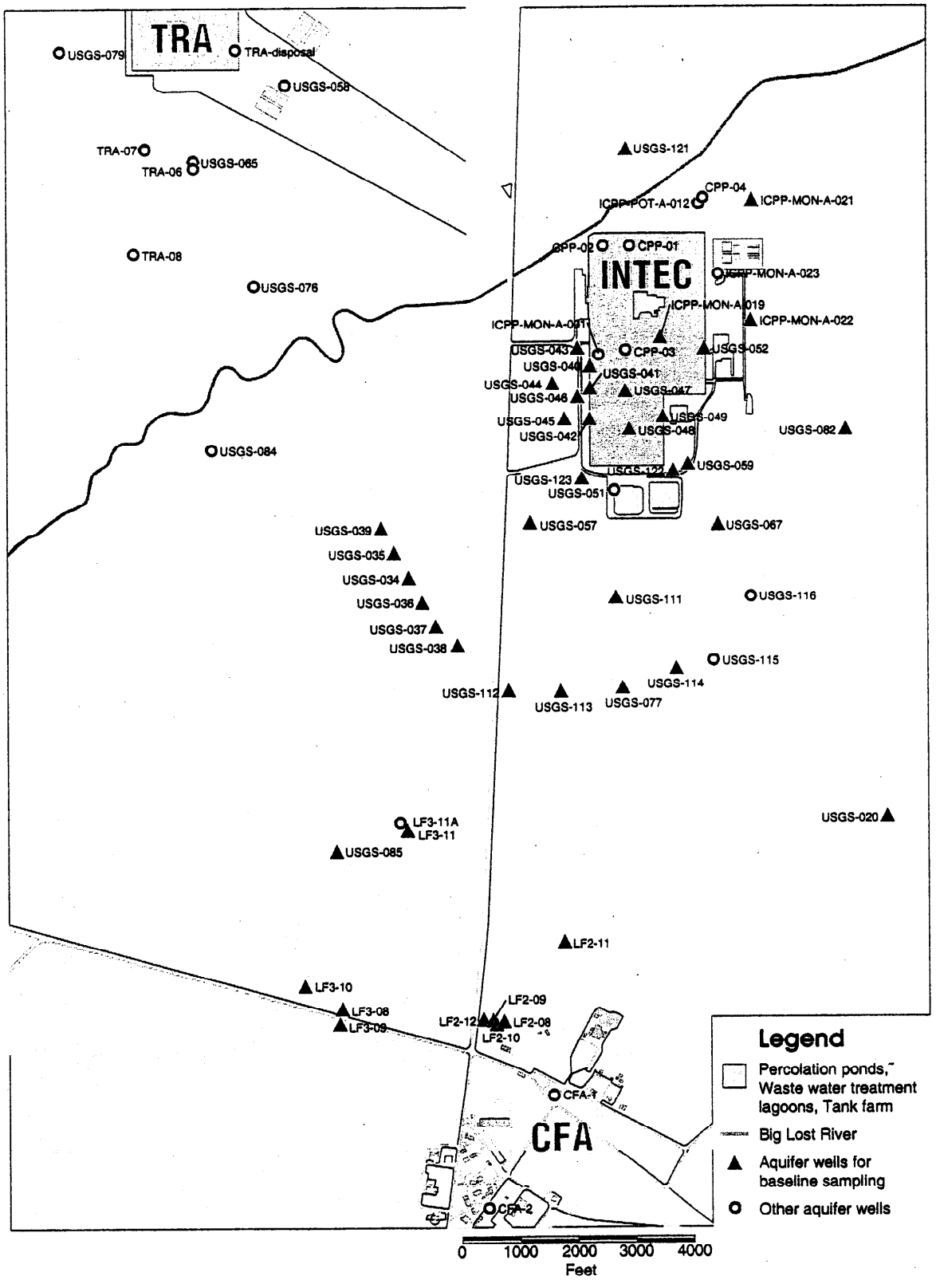

Figure 4-1. The INTEC groundwater wells for baseline sampling and water-level measurement.

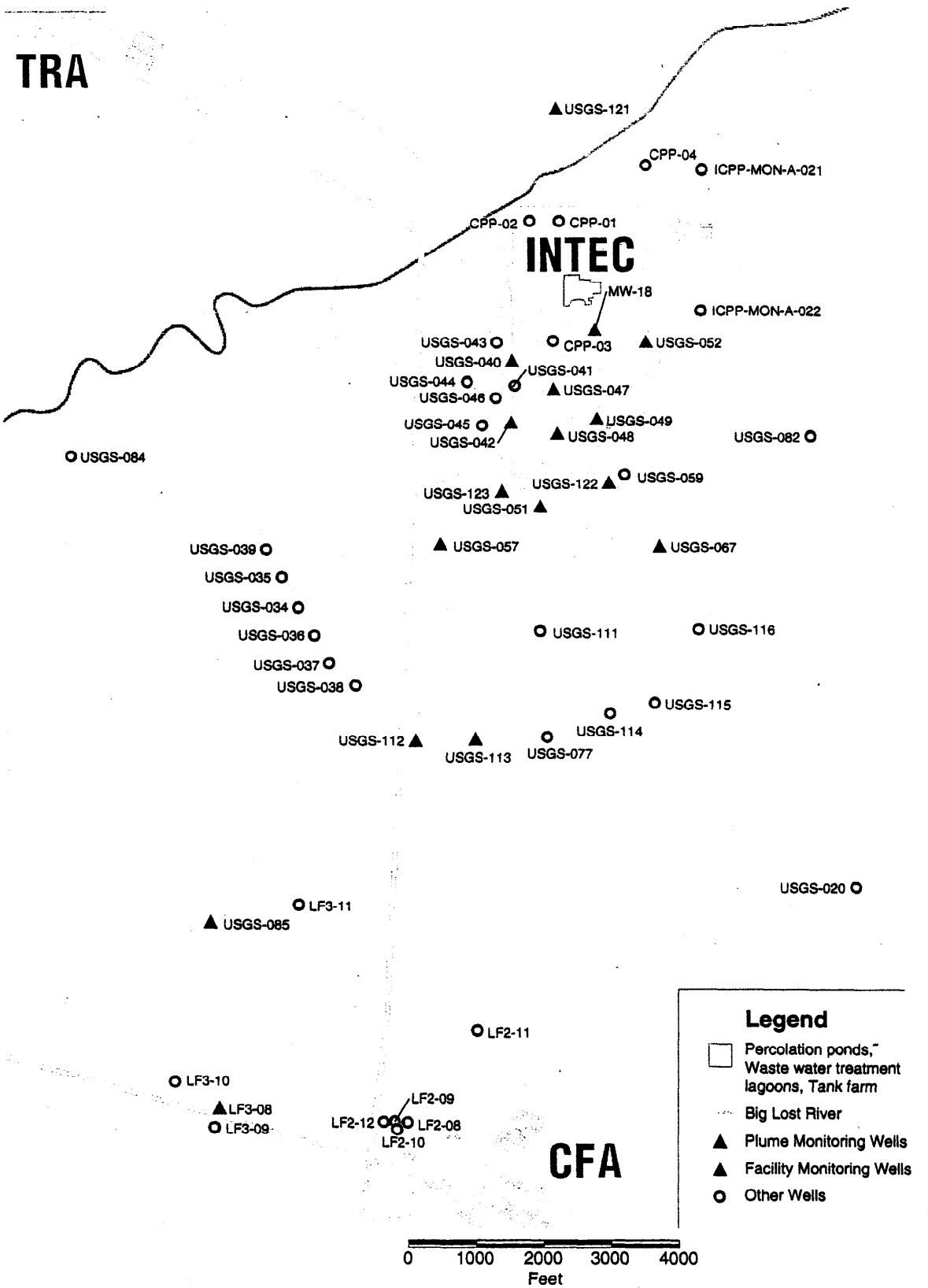

Figure 4-2. INTEC groundwater wells for long-term monitoring.

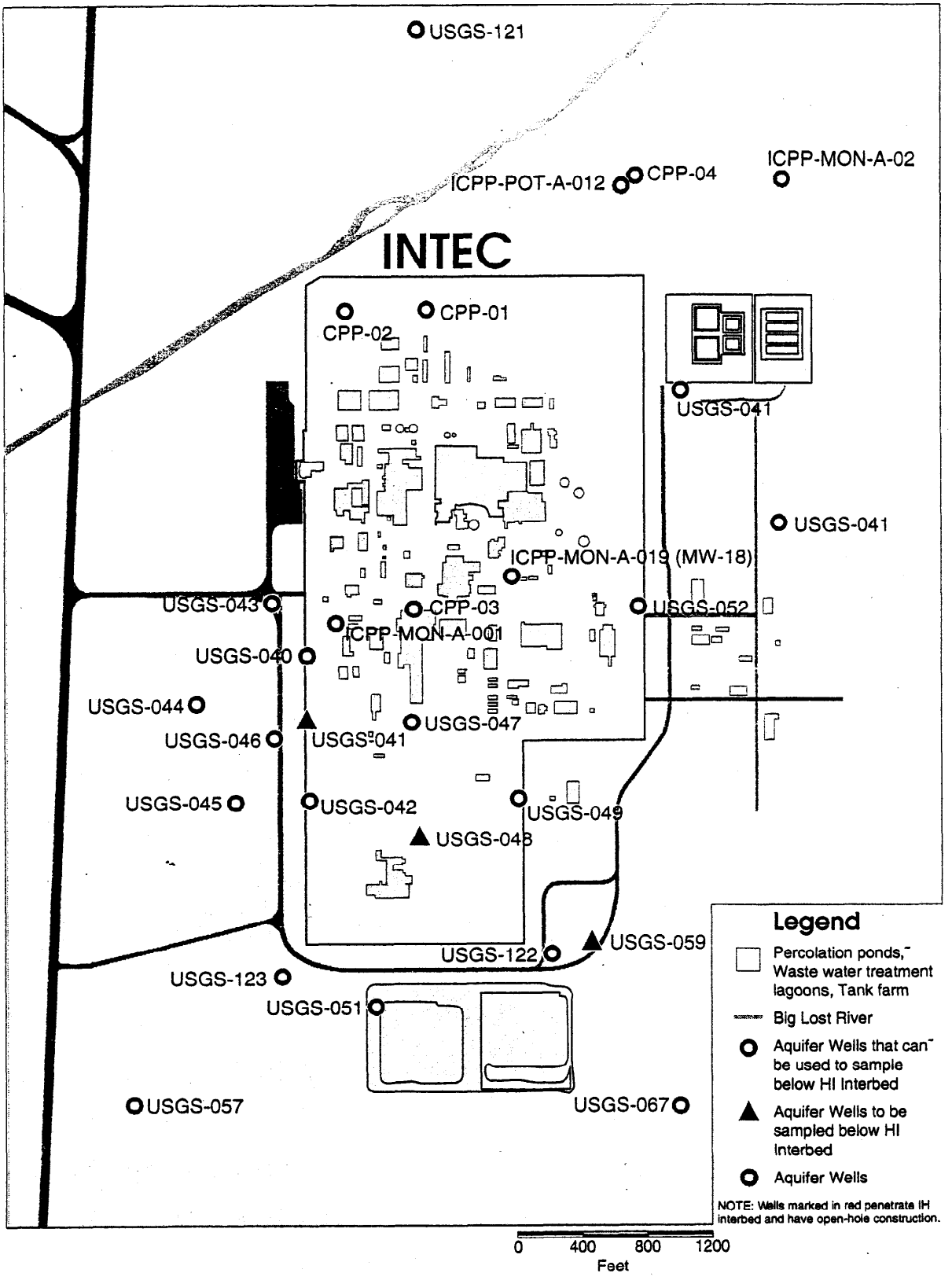

Figure 4-3. INTEC groundwater wells for long-term monitoring of the COC flux from the former injection well below the HI interbed.

All of the selected monitoring wells, with the exception of well MW-18, have dedicated sampling pumps installed.

4.2.2 Groundwater Level Monitoring Locations

With the exception of the production wells, all existing INTEC area groundwater monitoring wells and several wells from surrounding areas will be included in the water level monitoring network. The water level information is essential for the determination of hydraulic gradients in the vicinity of the INTEC facility, to quantify the COC flux across the INTEC fence line, and to refine the site conceptual and OU 3-13 numerical model. The water level information from the surrounding areas will serve to constrain the contouring of the water table along the edges of the area of interest. The wells for the water level monitoring are listed, along with relevant construction information, in Table 4-3 with locations shown on Figure 4-4.

In order to quantify vertical hydraulic gradients across the HI interbed, wells that will be sampled below the HI interbed will also have water level measurements taken above and below the packer after conditions stabilize following installation of the packer.

4.3 Schedule

Table 4-4 lists the sampling and monitoring schedule for Group 5 monitoring under this LTMP.

4.4 Data Types

4.4.1 Groundwater Samples

4.4.1.1 QA/QC Samples. For groundwater monitoring and sampling, collection of quality assurance/quality control (QA/QC) samples is required. Duplicate samples and field blank samples will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less. Equipment rinsate samples are required for samples collected from wells that do not have dedicated sampling equipment.

Quality requirements will be satisfied by collecting QA/QC samples (duplicates, field blanks, equipment rinsate, and performance evaluation) during the groundwater sampling according to the schedule presented in Table 4-5.

4.4.1.2 Groundwater Sample Analytes. After the baseline sampling round is completed, sampling will continue as outlined in Table 4-4. The analytes will consist of the COCs identified and hazardous substances. Table 4-6 lists the analytes for the first 7 years of monitoring, after which the analyte list will be reviewed.

4.4.2 Groundwater Level Monitoring

Water level measurements will be collected from all existing INTEC facility groundwater monitoring wells.

4.5 Corrective Actions

In the event a discrepancy is discovered by field personnel or auditors, some form of corrective action will be initiated. The level of action taken is related to the level of the discrepancy. Corrective actions can range from field changes caused by unforeseen field conditions to DOE reportable incidents. All corrective actions will be addressed in accordance with MCP-598, "Deficiency Screening and Resolution," and MCP-2811, "Design and Engineering Change Control."

Table 4-3. Monitoring wells for the water level monitoring.

INEEL Name				
ICPP-MON-A-021	LF3-11	USGS-42	USGS-57	USGS-112
ICPP-MON-A-022	USGS-20	USGS-43	USGS-59	USGS-113
LF2-08	USGS-34	USGS-44	USGS-65	USGS-114
LF2-09	USGS-35	USGS-45	USGS-67	USGS-115
LF2-10	USGS-36	USGS-46	USGS-76	USGS-116
LF2-11	USGS-37	USGS-47	USGS-77	USGS-121
LF2-12	USGS-38	USGS-48	USGS-82	USGS-122
LF3-08	USGS-39	USGS-49	USGS-84	USGS-123
LF3-09	USGS-40	USGS-51	USGS-85	MW-18
LF3-10	USGS-41	USGS-52	USGS-111	TRA-08

Table 4-4. Groundwater (Group 5) sampling and monitoring frequency.

Sampling or Monitoring Activity	Frequency			
Groundwater sampling	Semiannual for year 1	Annual for years 2 through 7	Biannual for years 8 thorugh 16	Every 5 years for years 17 through 100
Water level measurements	Monthly for year 1	Quarterly for year 2	Semiannual for years 3 through 4	Annual for years 5 through 100

Table 4-5. The QA/QC samples for groundwater sampling.

Activity	Type	Comment
Groundwater sampling	Duplicate	Field duplicates will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Field blank	Field blanks will be collected at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Trip blanks	Trip blanks will be collected when VOC samples are taken at a frequency of 1 per 20 samples or 1 per day, whichever is less.
	Equipment rinsate	Equipment rinsate samples will be collected if the well does not have a dedicated pump. A minimum of 1 rinsate sample will be collected per sampling event, or 1 per day or 1 per 20 samples, whichever is less.
	Performance evaluation	Per MCP-2864, one performance evaluation sample will be submitted for each round of sampling in which radionuclide samples, other than tritium, are collected.

VOC = volatile organic compound

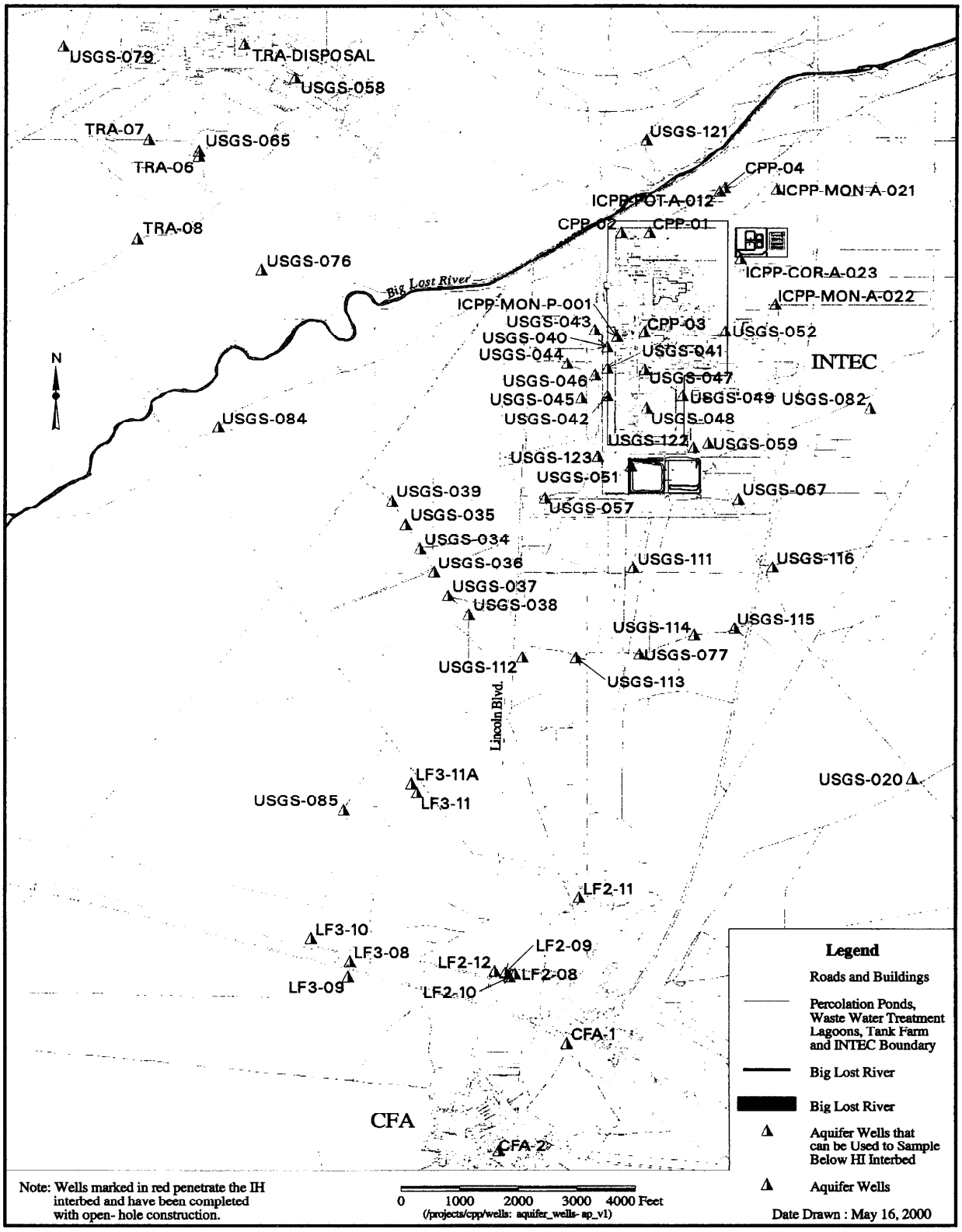

Figure 4-4. INTEC groundwater wells for water levels.

Table 4-6. Group 5 sampling analytes for years 1 through 7.

Field	COCs	Analytical Method[a]	Detection Limits (pCi/L)
Temperature	Gross-alpha	GFP	2
pH	Tritium	LSC	2000
Alkalinity	Gross-beta	GFP	4
Specific conductance	Technetium-99	LSC or GFP	1
	Iodine-129	MS	0.1
	Strontium-90	GFP	0.8
	Plutonium isotopes (Pu-238, -239, -240, and -241)	ALS	0.05
	Uranium isotopes (U-234, -235, and -238)	ALS	0.05
	Am-241	ALS	0.05
	Np-237	ALS	0.05
	Cs-137	GMS	3
	Mercury	SW7421	0.2 µg/L

a. Methods used for radionuclide analysis are laboratory-specific. The laboratory shall use standard operating procedures based on standard analytical methods provided to the INEEL Sample Management Office. The references that may be used to develop the laboratory standard operating procedures are in Wells 1995.

GFP = Gas flow proportional
LSC = Liquid scintillation counting
MS = Mass spectrometry
ALS = Alpha spectometry
GMS = Gamma screen
SW7421 = Cold vapor

5. SAMPLING AND MONITORING PROCEDURES AND EQUIPMENT

This section describes the sampling and monitoring procedures and equipment to be used for the planned groundwater monitoring. Prior to any sampling activities, a presampling meeting will be held to review the requirements of the LTMP and HASP and to ensure all supporting documentation has been completed.

5.1 Groundwater Sampling

5.1.1 Groundwater Elevations

Prior to sampling, all groundwater elevations will be measured using either an electronic measuring tape (Solinst brand or equivalent) or a steel-type measure as described in Standard Operating Procedure (SOP)-11.9, "Measurement of Groundwater Levels." Measurement of all groundwater levels will be recorded to an accuracy of 0.003 m (0.01 ft).

5.1.2 Well Purging

All groundwater wells will be purged prior to sample collection. During the purging operation, a Hydrolab (or equivalent) will be used to measure specific conductance, pH, and temperature. Well purging procedures are provided in the INEEL Technical Procedure (TPR)-EM-GW-56, "Sampling Groundwater." A sample for water quality analysis can be collected after a minimum of three well casing volumes of water have been purged from the well and when three consecutive water quality parameters are within the following limits:

pH	$\pm$ 0.1
Temperature	$\pm$ 0.5°C
Specific conductance	$\pm$ 10 µmhos/cm

5.1.3 Groundwater Sampling

Prior to sampling, all nondedicated sampling equipment that comes in contact with the water sample will be cleaned following the procedure outlined in SOP-11.5, "Field Decontamination of Sampling Equipment." Following sampling, all nondedicated equipment that came in contact with the well water will be decontaminated prior to storage per SOP-11.5, with the exception that the isopropanol steps for decontamination will be omitted.

Prior to purging, the water level in each well will be measured. The well will then be purged a minimum of three well-casing volumes until the pH, temperature, and specific conductance of the purge water have stabilized, or until a maximum of five well-casing volumes have been removed. A flow-through cell will be used to collect water quality measurements. If the well goes dry prior to purging three well-bore volumes, purging will be considered complete and samples collected thereafter. If parameters are still not stable after five volumes have been removed, samples will be collected and appropriate notations will be recorded in the logbook.

Micropurge sampling will occur during the semiannual sampling. The details of micropurge sampling are in TPR-151, "Groundwater Sampling Using the Micropurge Method," and are briefly described in the following sentences. The low-flow pumps used for micropurge sampling will have the capacity to vary the flow rate from less than 1 gpm to 8 gpm. The flow rates for each well will be

determined by measuring drawdown during pumping. The drawdown will not exceed 0.1 m (0.3 ft) from static conditions. The low-flow micropurge pumps will be placed with the intake located at the approximate midway point of the pumps that are currently in the well. Stabilization of parameters such as pH, specific conductance, and temperature should be used to determine that formation water is being pumped.

Groundwater samples will be collected for the analyses defined in Section 4. The requirements for containers, preservation methods, sample volumes, holding times, and analytical methods will be specified in the analytical laboratory Statement of Work.

During the semiannual groundwater sampling, groundwater samples from 20 wells will be collected using both the high flow (15–25 gpm) pumps currently in the wells and using a micropurge method that pumps at approximately 1 gpm. The paired data from both methods will be evaluated by comparison to historical data and using a student t-test to determine if the data sets are statistically equivalent. If the micropurge data is determined to be equivalent to the standard method data, subsequent groundwater samples will be collected by this method. Adopting the micropurge method will substantially reduce the amount of waste water generated during sampling and significantly reduce the costs associated with the monitoring program.

Sample bottles for groundwater samples will be filled to approximately 90 to 95% of capacity to allow for content expansion or preservation. Samples requiring acidification will be acidified to a pH < 2 using ultra-pure nitric acid. The following is the preferred order for sample collection:

1. Temperature, pH, specific conductance, and dissolved oxygen (during purging)
2. Radionuclides (unfiltered)
3. Mercury (unfiltered).

5.1.4 Personal Protective Equipment

The personal protective equipment (PPE) required for this sampling effort is discussed in the project HASP. Prior to disposal, all PPE will be characterized based on groundwater and field screening results, and a hazardous waste determination shall be made as per the requirements set forth in MCP-62, "Waste Generator Services-Low Level Waste Management."

5.2 Groundwater Level Monitoring

Water levels will be measured monthly for the first year and quarterly thereafter. All groundwater elevations will be measured using either an electronic measuring tape (Solinst brand or equivalent) or a steel type measure as described in SOP-11.9, "Measurement of Groundwater Levels." Measurement of all groundwater levels will be recorded to an accuracy of 0.003 m (0.01 ft).

6. SAMPLING CONTROL

Strict sample control is required on this project. Sample control ensures that unique sample identifiers are used for separate samples. It also ensures that documentation of sample collection information is such that a sampling event may be reconstructed at a later date. The following sections detail unique sample designation, sample handling (including shipping), and radiological screening of samples.

6.1 Sample Identification Code

A systematic 10-character identification (ID) code will be used to uniquely identify all samples. Uniqueness is required to prevent the same ID code from being assigned to more than one sample.

When the first three characters of the code are GWM, this indicates that the sample originated from groundwater monitoring activities. The next three numbers designate the sequential sample number for the project. The seventh and eighth characters represent a two-character set (e.g., 01, 02) for designation of field duplicate samples. The last two characters refer to a particular analysis and bottle type. Refer to the sample and analysis plan (SAP) tables in Appendix B for specific bottle code designations.

In this example, a groundwater sample collected in support of the SRPA monitoring might be designated as 5OM09001AB where (from left to right):

- 5OM designates the sample as being collected for Group 5 long-term SRPA groundwater monitoring
- 090 designates the sequential sample number
- 01 designates the type of sample (01 = original, 02 = field duplicate)
- AB designates gross alpha/beta analysis.

A SAP table/database will be used to record all pertinent information (well designation, media, date, etc.) associated with each sample ID code. The SAP tables for the groundwater sampling are presented in Appendix B.

6.2 Sample Designation

6.2.1 General

A SAP table format was developed to simplify the presentation of the sampling scheme for project personnel. The following sections describe the information presented in the SAP table/database (Appendix B).

6.2.2 Sample Description Fields

The sample description fields contain information related to individual sample characteristics.

6.2.2.1 Sampling Activity. The sampling activity field contains the first six characters of the assigned sample number. The sample number in its entirety will be used to link information from other sources (e.g., field data and analytical data) to the information in the SAP table for data reporting, sample

tracking, and completeness reporting. The sample number will also be used by the analytical laboratory to track and report analytical results.

6.2.2.2 Sample Type. Data in this field will be selected from the following:

REG for a regular sample

QC for a quality control sample.

6.2.2.3 Media. Data in this field will be selected from the following:

GROUNDWATER for water collected from the groundwater wells

WATER for other water samples (e.g., rinsates, field blanks, trip blanks).

6.2.2.4 Collection Type. Data in this field will be selected from the following:

GRAB for grab

COMP for composite

TBLK for trip blanks

FBLK for field blanks

RNST for equipment rinsates

DUP for duplicate samples.

6.2.2.5 Planned Date. This data, or event identifier, is related to the planned sample collection start date.

6.2.3 Sample Location Fields

This group of fields pinpoints the exact location for the sample in three-dimensional space, starting with the general AREA, narrowing the focus to an exact location geographically, and then specifying the DEPTH in the depth field. The DEPTH identified in the depth field will correspond to the completion interval of the well.

6.2.3.1 Area. The AREA field identifies the general sample-collection area. This field should contain the standard identifier for the INEEL area being sampled. For this investigation, samples are being collected from INTEC; thus, the area identifier will be "INTEC."

6.2.3.2 Location. This field may contain geographical coordinates, x-y coordinates, building numbers, or other location-identifying details, as well as program-specific information such as a borehole or well number. Data in this field will normally be subordinated to the AREA. This information is included on the labels generated by the Sample Management Office (SMO) to aid sampling personnel.

6.2.3.3 Type of Location. The type of location field supplies descriptive information concerning the exact sample location. Information in this field may overlap that in the location field, but it is intended to add detail to the location. An example would be "groundwater well."

6.2.3.4 Depth. The DEPTH of a sample location is the distance in feet from surface level or a range in feet from the surface.

6.2.4 Analysis Types

6.2.4.1 AT1–AT20. These fields indicate analysis types (radiological, chemical, hydrological, etc.). Space is provided at the bottom of the form to clearly identify each type. A standard abbreviation should also be provided if possible.

6.3 Sample Handling

Analytical samples for laboratory analyses will be collected in precleaned containers and packaged according to American Society for Testing and Materials or EPA-recommended procedures. The QA samples will be included to satisfy the QA/QC requirements for the program as outlined in the QAPjP and in Section 4. Qualified analytical laboratories (SMO approved) will analyze the samples.

6.3.1 Sample Preservation

Water samples will be preserved as indicated in the analytical laboratory SOW.

6.3.2 Chain-of-Custody Procedures

The chain-of-custody procedures will be followed per MCP-244, and the QAPjP (DOE-ID 2000a). Sample containers will be stored in a secured area accessible only to the field team members.

6.3.3 Transportation of Samples

Samples will be shipped in accordance with the regulations issued by the U.S. Department of Transportation (DOT) (49 CFR 171 through 49 CFR 178) and EPA sample handling, packaging, and shipping methods (40 CFR 262). Samples will be packaged in accordance with the requirements set forth in MCP-244.

6.3.3.1 Custody Seals. Custody seals will be placed on all shipping containers in such a way as to ensure that tampering or unauthorized opening does not compromise sample integrity. Clear plastic tape will be placed over the seals to ensure that the seals are not damaged during shipment.

6.3.3.2 On-Site and Off-Site Shipping. An on-Site shipment is any transfer of material within the perimeter of the INEEL. Site-specific requirements for transporting samples within INEEL boundaries and those required by the shipping and receiving department will be followed. Shipment within the INEEL boundaries will conform to DOT requirements as stated in 49 CFR Parts 171–178. Off-Site shipment will be coordinated with Packaging and Transportation personnel, as necessary, and will conform to all applicable DOT requirements.

6.4 Radiological Screening

Following sample collection, samples will be surveyed for external contamination, and field screened for radiation levels. If necessary, a gamma-screening sample will be collected and submitted to the Radiation Measurements Laboratory (RML) located at TRA-620 for a 20-minute analysis prior to shipment off-Site. Determination of the need for RML screening will be made by the radiological control technician (RCT) in the field.

If it is determined that the contact readings on the samples exceed 200 mr/hr beta/gamma, the samples will be held for analysis in the INTEC Remote Analytical Laboratory.