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ALBUQUERQUE OPERATIONS

JEG/NRC/0787-0008

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July 31, 1987

WM Record File

WM Project 68

Docket No. _____

PDR ☒

LPDR _____

Ms. Susan Bilhorn
Nuclear Regulatory Commission
7915 Eastern Avenue
Silver Springs, MD 20910

Distribution:

Bilhorn
P. Lohaus

Gungnoli
Hiegel

(Return to WM, 623-SS)

Re: Green River Scope of Work

Dear Ms. Bilhorn:

Enclosed is a Scope of Work for additional drilling at the Green River site. This drilling is being performed in response to NRC comments transmitted to DOE on March 30, 1987. The work is scheduled to begin in August.

Should you have any questions, please contact Karen Agogino or me.

Very truly yours,
JACOBS ENGINEERING GROUP INC.

Robert C. Paul for DPD

Donald P. Dubois, Manager
Albuquerque Operations Office

DPD/KA/vk
Enclosure

cc: RSena (w/o attachments)

8708110237 870731
PDR WASTE
WM-68

PDR



EXHIBIT A

SCOPE OF WORK (SOW)

REVISION A

JULY 15, 1987

SUBCONTRACT NO. 34-6704-S-87-00--

DRILLING, MONITOR WELL INSTALLATION AND DEVELOPMENT,
CORING, AND GEOPHYSICAL LOGGING

GREEN RIVER, UTAH



EXHIBIT A

SCOPE OF WORK

JULY 15, 1987

REVISION A

SUBCONTRACT 34-6704-S-87-00--

Drilling, Monitor Well Installation, Coring, and Geophysical Logging

Summary of Key Requirements

- o Rotary drilling rig(s) with boring and coring capabilities to 200 feet.
- o Geophysical logging to depths of 200 feet.
- o Soil sampling with split spoon and split barrel samplers.
- o Required work

Drilling and installation of 12 monitor wells. Boring diameter: eight inches. Casing and screen: Four-inch-diameter Schedule 40 PVC. Estimated total drilling footage: 1070 feet.

NX coring of six holes. Estimated total coring footage: 590 feet.

Geophysical logging of three borings. Estimated total logging footage: 340 feet.

- o Optional work

Drilling and installation of up to four monitor wells. Boring diameter: eight inches. Casing and screen: Four-inch-diameter Schedule 40 PVC. Estimated depth of each hole: 75 feet.

Geophysical logging of up to four boreholes. Estimated depth of each hole: 40 to 90 feet.

- o Supervision of JEG Field Technical Representative (FTR).
- o Anti-cross-contamination procedures to be followed.
- o Drill site restoration to original condition.
- o Desired completion of required work within 45 days of start date.



REVISION A

JULY 15, 1987

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SUBCONTRACT NO. 34-6704-S-87-00--

EXHIBIT A

DATED: JULY 15, 1987

GREEN RIVER, UTAH

SCOPE OF WORK (A) WITH OPTIONS

Hydrological Drilling, Monitor Well Installation,
Coring, and Geophysical Logging
Site Characterization Project

1.0 SCOPE AND OBJECTIVES

This project is conducted by Jacobs Engineering Group Inc. (JEG) to collect hydrogeologic information at the Green River inactive uranium mill tailings site, Green River, Utah.

2.0 SITE LOCATION

The site is approximately 0.75 mile southeast of Green River, Utah (Figure 1).

3.0 SUBCONTRACTOR PERFORMANCE

Detailed specifications for drilling, water well installation, soil sampling, rock coring, and geophysical logging, are fully described in Attachments 1 and 2 to Exhibit A. The subcontract is subject to performance of these specifications.

Failure to comply with these specifications shall be considered a breach of the technical requirements and a default of the performance of this subcontract by the Subcontractor.

Further, if the Subcontractor fails to drill or install any portion of a monitoring well in accordance with the specifications, unless prior written approval is obtained from the Contracts Representative (CR), payment for all services on the affected installation shall be withheld until satisfactory repair or replacement of the well is completed by the Subcontractor.

4.0 SURFACE AND SUBSURFACE CONDITIONS

4.1 Surface

Flat, up to 20 feet of alluvium and gravel deposits cover most of the site. Bedrock is exposed in places.

4.2 Subsurface

The alluvium and gravel deposits are underlain by, in descending order, Mancos Shale, Dakota Sandstone (in some places), and the Cedar Mountain Formation. A very hard, well-cemented conglomerate of the Dakota Sandstone averaging about two feet in thickness overlies the top of the bedrock in some places (Figure 2).

5.0 BOREHOLE LOCATIONS, DEPTHS, AND QUANTITY

Boring locations shall be chosen by the FTR. The FTR shall decide the order in which the holes are to be drilled. Figure 3 shows the locations of the proposed required and optional monitor wells.

It is mutually understood and agreed that this project is exploratory in nature and that borehole locations, depths, and related parameters are approximations and subject to revision as the project progresses.

5.1 Required work

Twelve monitor wells shall be installed. Estimated well depths range from 25 to 190 feet. All borings shall be at least eight inches in diameter.

The casing and screen shall consist of four-inch, threaded, flush-jointed Schedule 40 PVC. From the bottom up, the wells shall consist of two feet of blank casing with a bottom cap, 10 to 20 feet of screen (in five- and 10-foot increments), then blank casing to approximately two feet above ground surface. Figure 4 shows a typical monitor well installation.

NX cores shall be collected from the bedrock at six borehole locations. The total estimated length of the six corings is 590 feet. The Subcontractor shall use a 10-foot-long split core barrel.

Three borings (estimated total depth of 340 feet) shall be logged with borehole geophysical equipment immediately after drilling. The geophysical logging shall be supplied by the drilling Subcontractor as provided in the Pricing Schedule. The specifications for the logging are described in Attachment 2. During logging, the drill rig shall be required to stand by, or, by direction from the TR/FTR, move to the next hole at no additional setup cost to Jacobs.

Unconsolidated alluvium or soil at four boreholes shall be sampled. A total of eight intervals shall be sampled using a split spoon (SPT) or split barrel sampler. The split spoon sampler shall be supplied by the Subcontractor. The split barrel sampler shall be supplied by JEG. The Subcontractor shall supply any necessary adaptors to connect the JEG sampler to the drill rod used.

5.2 Optional work

Up to four optional wells may be installed. Estimated well depths range from 50 to 90 feet. All borings shall be at least eight

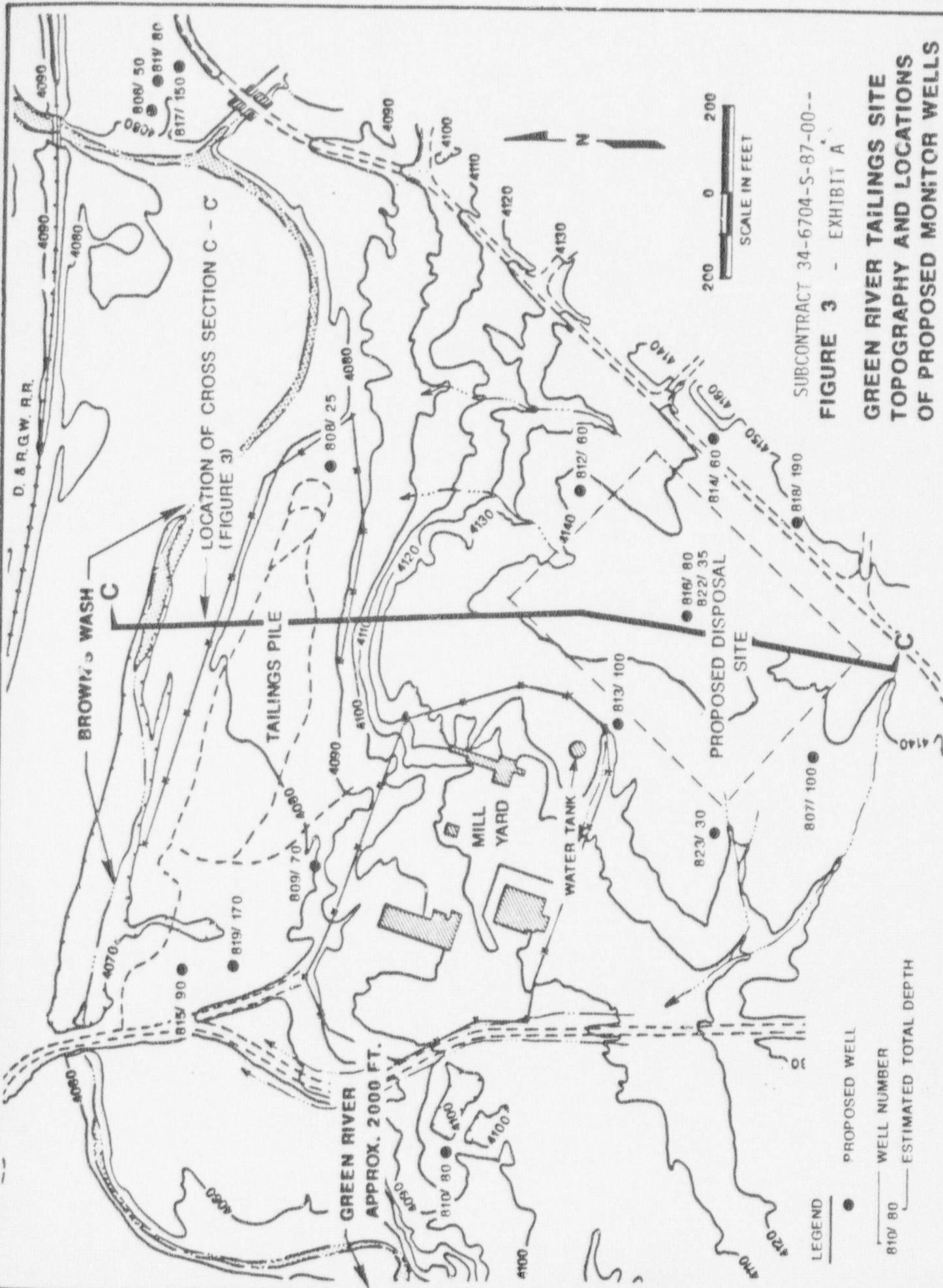


inches in diameter. The casing and screen shall consist of four-inch, threaded, flush-jointed Schedule 40 PVC. From the bottom up, the wells shall consist of two feet of blank casing with a bottom cap, 10 to 20 feet of screen (in five- or 10-foot lengths), then blank casing to approximately two feet above ground surface. Figure 4 shows a typical monitor well installation.

Up to four of the optional borings (estimated total depth of 300 feet) shall be logged with borehole geophysical equipment immediately after drilling. The geophysical logging shall be supplied by the drilling Subcontractor as provided in the Pricing Schedule. Specifications for the logging are described in Attachment 2. During logging the drill rig shall be required to stand by, or, at the option of the TR/FTR, move to the next hole at no additional setup cost to Jacobs.

6.0 MONITOR WELL DESIGN, CONSTRUCTION MATERIALS, MONITOR WELL INSTALLATION AND DEVELOPMENT, CORING, SOIL SAMPLING, AND GEOPHYSICAL LOGGING

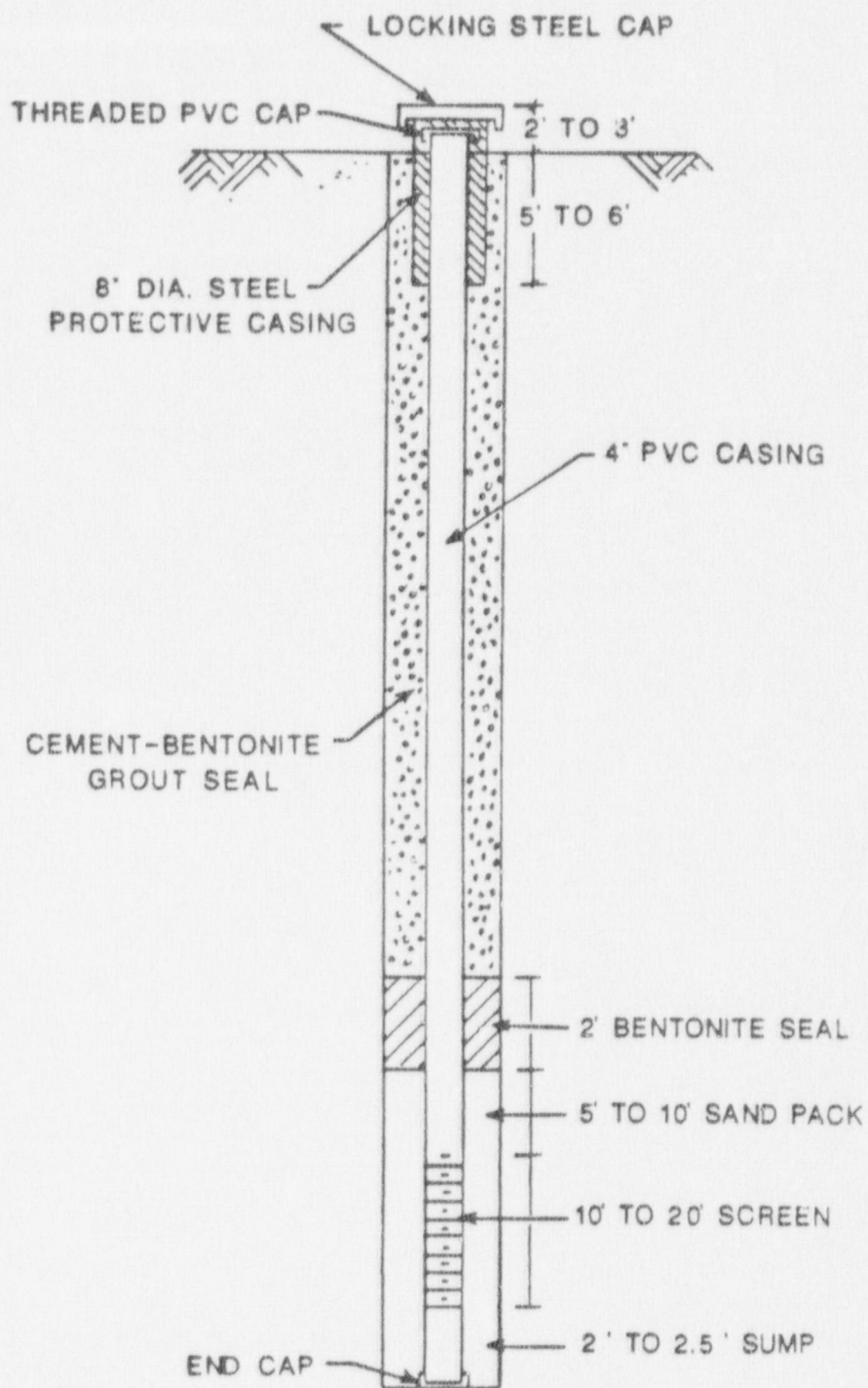
Monitor well design, construction materials, monitor well installation and development, soil sampling, and coring for this subcontract are subject to the Technical Specifications contained in Attachment 1 to Exhibit A. Specifications for geophysical logging are contained in Attachment 2 to Exhibit A.



SUBCONTRACT 34-6704-S-87-00--

FIGURE 3 - EXHIBIT A

**GREEN RIVER TAILINGS SITE
TOPOGRAPHY AND LOCATIONS
OF PROPOSED MONITOR WELLS**



NOT TO SCALE

EXHIBIT A
SUBCONTRACT 34-6704-S-87-00--

FIGURE 4
TYPICAL MONITOR WELL INSTALLATION

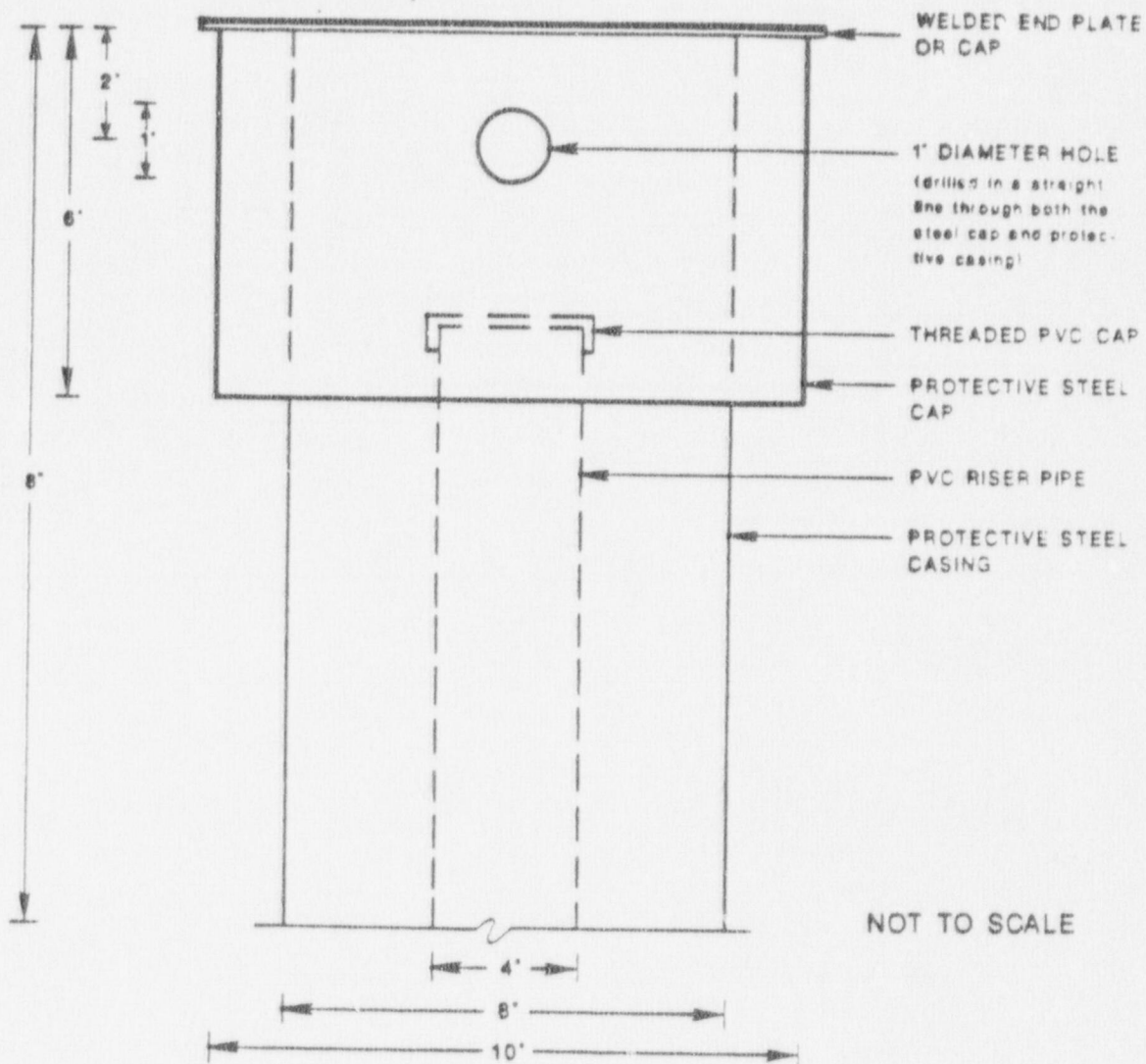
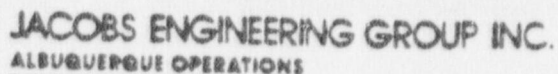


EXHIBIT A
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FIGURE 5
LOCKING PROTECTIVE CAP

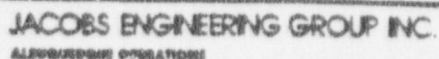


DAILY FIELD ACTIVITY REPORT

SITE NAME, ID: _____ CONTRACT NO. _____ WEEK OF: _____

FTR: _____ SUBCONTRACTOR: _____

[illegible]

Page of

SITE NAME _____

SUBCONTRACT NO. _____

SUBCONTRACTOR _____

DRILLER _____

DESCRIPTION OF GROUT MIXING EQUIPMENT

PUMP: _____

MIX CONTAINER: _____

METHOD OF VERIFICATION OF MIX PROPORTION.

WATER: (DIAGRAM AS NECESSARY) _____

BENTONITE: _____ CEMENT: _____

[illegible]



JACOBS ENGINEERING GROUP INC.

ATTACHMENT 1 TO EXHIBIT A

SUBCONTRACT NO. 34-6704-S-87-00

SPECIFICATIONS

(REVISION A)

DATED: JULY 15, 1987

DRILLING, MONITOR WELL INSTALLATION AND DEVELOPMENT,
SOIL SAMPLING, AND ROCK CORING

GREEN RIVER, UTAH



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REVISION A

ATTACHMENT 1 TO EXHIBIT A

DATED: JULY 15, 1987

SPECIFICATIONS FOR THE DRILLING, INSTALLATION,
AND DEVELOPMENT OF GROUNDWATER MONITOR WELLS

1.0 INTRODUCTION

These specifications pertain to the program described in Exhibit A which is designed to obtain hydrogeologic data at the Green River, Utah, inactive uranium mill site.

The site location map, site topography, proposed well locations, and generalized lithology beneath the sites are shown as figures in Exhibit A. It is expected that this information is generally representative of conditions at the wells to be completed for this project, but the Subcontractor shall have no claims against JEG if actual conditions encountered are different from the conditions indicated here.

2.0 DESIGN STANDARDS FOR MONITORING WELL

Guidance on monitoring well design and additional design recommendations is given in "Procedures Manual for Groundwater Monitoring at Solid Waste Disposal Facilities," USEPA Publication No. EPA/530/SW-611. The design and construction of monitoring wells shall follow as closely as practical the design for properly installed, low-yield, domestic water supply wells.

Recommended practices for the construction of such wells are set forth in "Manual of Water Well Construction Practices," USEPA Publication No. 570/9-75-001.

The well shall be constructed using noncorroding materials. The use of contaminating additives (barite, etc.) in drilling fluids shall not be permitted. Hydrocarbon-based lubricants, such as grease or oil, shall not be permitted on drill rod joints. Only nonhydrocarbon-based lubricants, such as silicon or teflon, shall be permitted for use on drill rod joints or any other downhole equipment or tools.

Materials selected for well filter construction shall be clean, inert, and insoluble (noncarbonate) aggregate. Dispersing agents (such as phosphates) or acids shall not be used in well installation or development. There shall be no attempt made to chemically disinfect the well. However, the drill rig or rigs, drill tools, and associated equipment shall be cleaned with fresh, potable water prior to commencement of drilling each hole.



3.0 DRILLING

3.1 Drill equipment and capabilities

The drilling rig used should be capable of drilling and coring in clayey or granular soil and well-consolidated bedrock, above or below the water table.

The drill rig and equipment of the Subcontractor shall be inspected by the Technical Representative (TR) to determine that the capabilities and functions are adequate for the scope of work presented in the following sections. Any change in drilling rig capabilities or other equipment must be approved in writing by the TR/FTR.

3.2 Drill site accessibility

The Subcontractor should be aware of the potential for utilities within or immediately adjacent to the area to be drilled. A copy of a map showing known utilities in the area shall be made available for information purposes to the Subcontractor following contract award.

3.3 Drilling methods

The boreholes shall be advanced using rotary mud drilling techniques. Normal or reversed-circulation rotary drilling equipment is acceptable. Acceptable drilling fluids are covered in Section 3.4, Drilling Fluids.

Drill collars shall be used to advance the hole to assure proper plumbness and alignment for protection of the PVC casing.

3.4 Drilling fluids

Bentonite-based drilling fluid is the preferred medium for drilling using potable water. Acceptable drilling fluids and additives include processed sodium bentonite (such as QuickGel or equivalent) and nontoxic, nonfermenting, nonbiodegradable synthetic polymers (such as EZ-MUD or equivalent). In all cases, no additives which contribute to bacterial growth (such as guar-based substances, plant mucilage, and the like) or which contain petroleum distillates (such as kerosene, diesel fuel, and the like) shall be introduced into the drilling fluid. The subcontractor must provide drilling water from a source which can be verified by the FTR as being potable.

No other drilling fluid or additives other than those outlined above shall be used. It is expressly understood that toxic and/or contaminating substances shall not be added to the drilling fluids, nor be permitted to enter any well or boring as a result of the Subcontractor's operations.

The recirculation of the drilling fluids shall be accomplished using a portable mud tub (pit). The mud tub (pit) shall be of sufficient size for the job, and be constructed in such a way that drilling fluids do not come into contact with the ground. Dug pits and trenches which are lined with plastic sheeting are not acceptable as mud pits or as part of the recirculation system.

Upon completion of well installation the residual drilling fluid mud may be disposed of by simply dumping it on the ground. Dumping of the mud tub shall not occur until grouting has been completed.

3.5 Anti-cross-contamination measures

The Subcontractor shall, at all times, make diligent efforts to prevent the contamination or cross-contamination of all wells and borings. This includes eliminating the deliberate or inadvertent introduction of foreign, toxic, and/or contaminating substances into the well or boring. Such items include but are not limited to oil, greases, hydraulic fluids, and fuels. To reduce the potential of contamination occurring, the drilling rigs, tools, drilling stem, mud tubs, and all other pertinent equipment shall be cleaned with live steam under the direct supervision of the TR/FTR before entering the site.

Steam cleaning shall be accomplished on a one-time basis before the above equipment enters the designated project site. Steam cleaning will not be required again unless the equipment is contaminated with hydrocarbons. Additional steam cleaning in these cases shall be under the supervision of and at the discretion of the TR/FTR.

Interior portions of equipment, such as mud pumps and hoses, which are not accessible for cleaning with steam shall be thoroughly cleaned and flushed with fresh, clean, potable water. Oils, greases, or pipe dope shall not be allowed to be used on pipe threads. Non-hydrocarbon based lubricants, such as silicon or teflon, are acceptable, however.

In addition, all PVC casing and screen must be steam cleaned inside and out prior to entering the project site. The PVC shall be stored in a noncontaminated area, elevated off the ground, and covered. Any PVC which is subsequently contaminated with hydrocarbons shall be steam cleaned again prior to use. Any PVC which is contaminated with tailings or soil shall be thoroughly rinsed with fresh, potable water.

Drilling equipment used in tailings or windblown areas shall be handled with special precautions to prevent the introduction of any

tailings into the well or boring. No hand tools, drill bits, drill stem, casing, screen, or any other equipment shall be allowed to contact the ground surface at any time. An elevated platform covered with plastic sheeting shall be required for the temporary storage of such items. At no time shall this platform be walked on or allowed to have soil or tailings deposited on it in any way. If any equipment or supplies come into contact with the ground or are otherwise contaminated, they shall be thoroughly cleaned and flushed inside and out with fresh, clean, potable water before being used again. Permanent or temporary surface casing may be required at the discretion of the TR/FTR to reduce potential downhole contamination when drilling in tailings or windblown areas.

Cross-contamination shall be minimized by thoroughly cleaning all external and internal surfaces of all drilling equipment, rigs, tools, drill bits, drilling stem, mud tubs, mud pumps, hoses, and all other appurtenant equipment after each hole is completed and before moving to the next drilling location. Cleaning shall be accomplished by completely removing all soil from the equipment described above and thoroughly flushing the interior and exterior of such equipment with fresh, clean, potable water.

The TR/FTR shall direct all contamination and cross-contamination preventative actions, and all work shall be accomplished to his satisfaction. Adherence to the TR/FTR's directions by the Subcontractor is required in this matter.

Any unused portions of opened bags of cement remaining at the completion of each well site shall be disposed of appropriately and shall not be transported to the next well location.

3.6 Lithologic and soil sampling

During the course of drilling, lithologic samples shall be collected, if possible, at five-foot intervals or at distinct changes in lithology. These samples shall consist of "grab-samples" collected from the chips removed from the borehole as drilling progresses. These lithologic samples shall be stored in air-tight plastic bags provided by JEG.

All sampling techniques and equipment shall conform to the latest American Society for Testing and Materials (ASTM) Standards. These include:

- o ASTM D3550 - Ring-lined barrel sampling.
- o ASTM D1586 - Penetration test and split barrel sampling of soils.

Copies of these specifications are available from JEG upon request.

The split spoon sampler supplied by the Subcontractor shall be two inches in outside diameter, 1-3/8 inches inside diameter, and 27 inches (mid) in length.

Split spoon and split barrel samples shall be pushed in the manner similar to that used in Shelby tube sampling, where possible. If pushing is not adequate to fill the brass liners, the spoon assembly shall be hammered down using a safety hammer by winch or cathead.

Immediately upon removal from the hole, the split barrel samples shall be placed in plastic or glass jars furnished by the Subcontractor.

Suitable shipping containers shall be provided by JEG for the loaded sample jars. JEG shall be responsible for shipping all samples.

3.7 Lost equipment, lost boreholes, and borehole abandonment

A hole shall be termed "lost" if JEG determines that the condition of the hole will prevent its successful completion or if, for any reason, it is impractical to continue operations. The term "abandonment" shall mean abandonment to suit the convenience of JEG.

If JEG determines that a hole has been lost before the required depth has been obtained and that further attempts to complete it will be impractical, JEG shall order work on the hole stopped.

A hole which is determined to be lost shall be grouted from its total depth to land surface.

If JEG determines that the borehole or well must be abandoned for reasons beyond the control of the Subcontractor, and that loss of the hole was unavoidable in spite of diligent precautions on the part of the Subcontractor, the Subcontractor shall be paid at the unit prices, as set forth in the Pricing Schedule, for services completed to date on the affected well. The hole which is abandoned shall be grouted from its total depth to land surface. Grouting of abandoned holes shall be paid for under the unit prices in the pricing schedule.

If JEG determines that a hole has been lost for reasons within the control of the Subcontractor, or because of inefficiency, negligence, incompetence, or malpractice on the part of the Subcontractor or Subcontractor's personnel, or because of the use of defective or unsuitable equipment, the Subcontractor shall not be paid for any drilling, demobilization, or other services performed in the lost hole, except to the extent that JEG determines that portions of the work performed in the lost hole have beneficial value to JEG. In addition, the Subcontractor shall be required to grout the hole from its bottom to land surface, and then move over and drill a new hole in the proper manner to replace the abandoned one. The Subcontractor shall be notified in writing of this decision.

Well sealing and abandonment must comply with the rules and regulations of the Utah State Engineer's Office, Division of Water Resources. Reports should be sent to the State Engineer's Office following completion or abandonment.

Where core holes are abandoned at the driller's option, the hole shall be sealed with bentonite pellets to a point above the water table prior to placement of grout. All grout shall be approved by the FTR for well installation procedures.

3.8 Field documentation

The TR/FTR shall maintain a "Daily Field Activity Report" (Exhibit A, Figure 6) detailing billable drilling work. The Subcontractor is required to initial this report on a daily basis and note any differences that cannot be resolved. Any differences shall be documented for future reviews and resolution between the Contractor Representative and Subcontractor.

The Subcontractor is responsible for complying with any and all state regulations/requirements regarding submission of drill logs to the applicable state office/department.

One FTR shall be assigned to the site to oversee, approve, and document the activities. The FTR must be present during activities critical to the design, documentation, and evaluation of all installations and for understanding of subsurface conditions.

3.9 Equipment decontamination

Due to the unknown nature of subsurface materials, all augers and other downhole tools shall be inspected by JEG personnel at completion of drilling at the tailings pile site. Drilling tools found to be contaminated by low-level radioactive materials shall be thoroughly washed/cleaned by the Subcontractor. The Subcontractor shall be responsible for furnishing all water and cleaning equipment to decontaminate drilling equipment. Any necessary decontamination work shall be performed at the stipulated standby time (hourly) rate.

3.10 Health physics

The Subcontractor shall take all reasonable precautions in the performance of the work under this subcontract to protect the environment and assure the safety of employees and the public. Work under this subcontract shall be conducted in compliance with the established safety regulations of the Occupational Safety and Health Administration (OSHA), the U.S. Department of Energy (DOE), and other applicable Federal, state, and local regulations and requirements. The DOE requirements which apply specifically to work activities at UMTRA Project sites are provided in the UMTRA Project Environmental, Health, and Safety Plan and additional safety requirements (Exhibit D).

For drilling work conducted on radioactive materials, JEG shall provide any necessary monitoring of personnel and equipment or special radiological health protection equipment.

All personnel and equipment in contact with radioactive tailings materials shall be monitored by JEG for contamination prior to release from the site. The Subcontractor is responsible for providing the water, equipment, and labor, under JEG direction, for any necessary decontamination of equipment. The time required for this shall be reimbursed as standby time.

Compliance inspections may be performed by JEG personnel to ensure these requirements are met. JEG shall notify the Subcontractor, in writing, of any items of noncompliance and the corrective action to be taken. The Subcontractor shall correct such items and shall document the corrective actions by letter to JEG.

The Subcontractor shall be responsible for the performance of his Subcontractor(s) in complying with these health and safety requirements. In the event that the Subcontractor, or his Subcontractor(s), fails to comply with these regulations, and requirements, JEG may, without prejudice to any other legal or contractual rights of JEG, issue an order stopping all or any part of the work; thereafter a start order for resumption of work may be issued at the discretion of JEG. The Subcontractor shall make no claim for an extension of time or for an equitable adjustment, compensation, or damages by reason of, or in connection with, such work stoppage.

The Subcontractor shall have available, at a minimum, the following personal protective equipment for each employee:

- o Hard hat.
- o Boots, steel toe and shank.
- o Eye protection.
- o Hearing protection.
- o Coveralls.
- o Work gloves.
- o Boot covers.

Reports of accidents/injuries involving Subcontractor employees and resulting in lost time or medical treatment shall be submitted to the JEG Manager of Health and Safety within 48 hours after the accident.

Due to health hazards associated with potential inhalation or ingestion of radioactive materials, precautions shall be taken by the Subcontractor to minimize the generation of dust when working on the tailings pile or contaminated areas. Excessive vehicle speed and excavation techniques which generate excessive dust shall be prohibited.

If the FTR determines that tailings have become airborne due to excessive winds or drilling conditions, the Subcontractor shall pursue one of the following alternatives:



- o The FTR, with assistance from a JEG health physicist, shall determine which test pit locations are unaffected by the windblown tailings, and work may continue at those locations.
- o The Subcontractor's employees shall wear respirators, supplied by JEG, while working at locations where the FTR has determined airborne contamination may exist. Employees shall provide written proof from a physician indicating their physical condition permits them to work in a respirator. If respirators are required, each individual shall be fit-tested by Jacobs to ensure that the respirator provides adequate protection. Employees required to wear respirators shall be clean shaven (no beards or long sideburns).
- o If the Subcontractor chooses to delay performance to avoid the use of respiratory protection equipment when such equipment is required due to field conditions, it shall do so at no cost (i.e., standby time) to JEG.

All Subcontractor employees who work at the site must attend a training session conducted by JEG which explains the required radiological safety measures to be implemented.

Eating, drinking, smoking, and chewing are prohibited in tailings-contaminated areas.

Additional guidance concerning health and safety issues is provided as Exhibit D to this Subcontract. Periodic visits by Health and Safety staff personnel may be scheduled to verify compliance.

3.11 Quality Assurance

The TR or the designated FTR shall oversee all field work including all exploratory drilling. All field work shall be performed in conformance with the specifications and procedures set forth in the Scope of Work. Periodic Quality Assurance Surveillance visits by JEG QA staff personnel may be scheduled to verify compliance with scope of work requirements.

3.12 Permits

The Subcontractor shall abide by the requirements contained in any required permits, letters of authorization, and environmental laws which are applicable to the data collection project. Copies of the applicable documents shall be transmitted to the Subcontractor by the TR prior to the start of fieldwork.

3.13 Site Restoration

The Subcontractor shall reclaim areas disturbed by drilling activities performed under this contract. As a minimum, the Subcontractor shall:

- o Recontour all disturbed areas to approximate original contours.
- o Broadcast JEG-supplied seed over disturbed areas.

4.0 MONITOR WELL CONSTRUCTION

All wells shall be designed after the following criteria. A schematic is shown on Figure 4 of Exhibit A which gives the typical well design and construction.

4.1 Boring diameter and rock coring

The wells to be installed shall consist of four-inch nominal ID screen and casing. The diameter of the drilled hole must be of sufficient size (approximately eight inches minimum ID) as to allow for the placement of a minimal thickness of two inches of sand and gravel pack, bentonite seal, and grout backfill by use of a tremie pipe of appropriate size for installing these materials around all sides of the screen and casing of the well. Oversized holes and the materials required for the annulus are the responsibility of the Subcontractor.

Nominal two-inch-diameter cores (NX-size) shall be collected from the bedrock material. The Subcontractor shall supply premanufactured and treated cardboard core boxes, capable of holding at least 10 feet of rock core. The cores shall be delivered to the FTR for logging and storage of the cores on the site. The Subcontractor shall be required to use a split core barrel, use his workman-like "best" techniques, and the best equipment to obtain full core runs. Competent core shall be stored in the cardboard core boxes. Unconsolidated, very pliable, or clayey sections of core shall be placed in clear, plastic sheeting-like core tubing or bags, sealed along with the competent core in the core boxes. For those core holes 80 feet or less in depth, the driller shall ream the core hole to an eight-inch minimum borehole diameter for installation of the four-inch monitor well. For those core holes greater than 80 feet in depth, the rig shall be offset and the eight-inch borehole shall be drilled adjacent to the core hole; in this instance, the borehole shall be abandoned per procedures described in this attachment.

4.2 Well screen location

The TR/FTR shall specify the appropriate location for the well screen within the borehole so that the completed well will function satisfactorily as a monitoring well. The most useful location and length of the screen will depend on the homogeneity and permeability of the lithologic units encountered, whether the aquifer is confined or unconfined, and the location of any contaminant plumes. In some instances, shallow well(s) may be screened above the water table where seasonal perching of groundwater is suspected. Ten to

20 feet of well screen shall be installed as directed by the FTR in each well, as established at the completion of drilling.

4.3 Gravel pack location

Gravel pack material (silica sand) shall be installed by the Subcontractor using a tremie pipe so that the filter extends from the bottom of the boring to at least seven feet and no more than ten feet above the top of the screen, unless otherwise directed by the TR/FTR. The top of the sand pack must be verified by tagging with a measured tremie pipe to assure coverage over the screen.

4.4 Temporary cap

Any well that is to be temporarily removed from service, or left uncompleted during construction for a period overnight or longer, shall be capped by the Subcontractor with a water-tight cap and equipped with some type of "vandal-proof" cover satisfying the TR/FTR and applicable state or local regulations or recommendations.

4.5 Well protection

At all times during the progress of the work, reasonable precautions shall be used to prevent tampering with the well or the inclusion of foreign material into it. On completion of the well, a lockable steel cap shall be installed by the Subcontractor to prevent material from entering the well. Figure 5 in Exhibit A shows a schematic of the locking steel cap. JEG shall provide the lock and pin. The Subcontractor shall be responsible for providing and installing the cap and casing.

The top of the PVC well riser pipe shall be surrounded by a larger diameter steel casing set in cement grout at least three feet below the surrounding ground surface. The steel casing shall project approximately two to three feet above the ground surface. A drain hole shall be made in the steel casing at ground level to eliminate trapped water.

The surface grout shall be allowed to settle for 24 hours and the Subcontractor shall then add any additional grout required to bring the grout level with ground surface. The top of the PVC monitoring well shall be fitted with a PVC cap with a 1/16-inch-diameter hole drilled in the top. The top of the PVC well casing may be cut so that its total stick-up is slightly less than the locking pin.

The protective steel casing shall be composed of standard eight-inch ID Schedule 40 steel pipe, with a locking cap made of 10-inch ID Schedule 40 steel. At the option of the subcontractor steel surface casing may be used as a protective casing.



5.0 CONSTRUCTION MATERIAL

All wells shall be constructed after the following criteria.

5.1 Well casing

Well casing shall consist of new, threaded, flush-joint polyvinyl chloride (PVC) pipe with a nominal four-inch inside diameter. All well riser pipe shall, as a minimum, conform to the requirements of ASTM Schedule 40 pipe. All riser pipe shall bear markings that identify the material as that which is specified herein. The casing shall extend from the top of the well screen to approximately two to three feet above land surface.

5.2 Well screen

The Subcontractor shall be responsible for supplying a non-contaminating, factory constructed, preslotted, flush-joint well screen. The well screen shall be constructed of ASTM Schedule 40 PVC.

The Subcontractor shall notify the TR/FTR of the screen supplier prior to purchase. The slotted well screen shall have three rows of slots cut on 120-degree centers, with 0.050-inch wide slots being 0.25 inch apart. Field slotting of well screen is not acceptable. Adjustments may be made in the placement of the well screen as the work progresses based on the gradation of the soils or rock, or the saturated thickness at the screened interval. The length of well screen shall be 10 to 20 feet (to be determined by the FTR) and attached to the bottom of an appropriate length of casing.

5.3 Bottom seal and sump

The Subcontractor shall be responsible for supplying a noncontaminating, factory-constructed, flush-joint well sump constructed of ASTM Schedule 40 PVC. Alternatively, two feet of blank casing shall be added to the bottom of the screen. The casing shall have a threaded cap or a slip cap attached by stainless steel screws securely attached to its lower end. This will complete the well string, providing a sealed bottom and a sump to act as a sediment trap.

5.4 Method of joining well screen and well casing sections

Well screen and well casing sections shall be joined by threaded, flush-jointed PVC casing to form straight, water-tight unions. No threaded couplings shall be allowed to be above land surface. Absolutely no solvents or glue shall be used in construction of the wells below land surface.

5.5 Filling of the annular space

A uniform and complete filling of the annular space with gravel pack, bentonite pellets, and grout must be achieved by the Subcontractor. Gravel pack and grout shall be introduced into the annular space by means of a tremie pipe initially extending to the bottom of the hole and slowly raised as the backfilling progresses. Bentonite pellets shall be added without a tremie pipe. Grouting and backfilling shall be done in one continuous operation until the annular space is completely filled. The drilling mud shall be flushed from the hole or lightened prior to grouting and backfilling. This will facilitate the installation of the gravel pack, bentonite, and grout.

Separate tremie pipes shall be used for grout placement and for sand tremie.

5.6 Gravel pack filter

The Subcontractor shall supply clean inert materials (silica sand) from which to construct a gravel pack which shall ensure continuous flow capability. There shall be no contamination of the gravel pack with foreign materials.

Filter pack material shall be installed using a tremie pipe from the bottom of the monitoring well to above the screened interval and shall consist of a uniformly graded sand. To allow for settlement of the sand, the initial construction shall include at least seven feet of sand above the top of the screen for a 10-foot screened interval, with an increase in sand thickness of seven feet for each additional five feet of screen. The sand shall have a gradation which shall allow no more than five percent of the sand to pass through the well screen slots (#8 to #12 sand). The Contractor shall furnish the FTR with written documentation that the sand meets the gradation specified above prior to its use.

Any unused bulk portions or opened bags of sand remaining after completion of a well site shall be properly disposed of rather than transported to the next well location. This measure is designed to help preclude cross-contamination of wells.

5.7 Bentonite seal

A bentonite seal shall then be installed directly above the graded sand filter pack. The bentonite seal shall consist of a minimum three-foot thickness of 1/4- to 3/8-inch bentonite pellets. The pellets shall have a minimum purity of 90 percent montmorillonite clay and a minimum dry bulk density of 75 pounds per cubic foot as provided by American Colloid Company, or equal. In all cases, the bentonite seal shall be allowed to set for at least one hour prior to introduction of the overlying grout seal. One hour of standby time shall be allowed for each well installed.

5.8 Grout seal

A grout seal shall be installed from the top of the bentonite seal to land surface. The grout shall be pumped into the annular space using a tremie pipe set approximately three feet above the top of the bentonite seal. The grouting shall be performed in one continuous manner until the annular space is completely filled.

The grout shall consist of neat Portland cement (ASTM C150) mixed with three pounds of commercial bentonite powder and approximately 7.5 gallons of water added to each 94-pound bag of cement. The grout shall not be installed until the FTR verifies that it has the proper mix proportions. The mixing water volume shall be determined for each batch mixed by use of a calibrated dip stick, and all quantities shall be entered for each batch on the form "Verification of Grout Mix Proportions," shown as Figure 7 in Exhibit A. Any placement of unverified mix may result in work stoppage at Subcontractor's expense and loss of payment for materials used. In this event, abandonment of the incomplete well at Subcontractor's expense may also be considered.

6.0 MONITOR WELL INSTALLATION AND DEVELOPMENT

6.1 Well string installation

The well string (casing and screen) is to be lowered slowly into the borehole using clamps, elevators, or other mechanical devices to ensure the well shall maintain alignment, plumbness, and roundness during installation. The well string shall not be dropped into place, or lowered by hand in an uncontrolled manner. The casing shall be fully supported from the top and held in tension during the placement of gravel pack, seal, and grout.

6.2 Casing alignment

All wells shall be constructed and all well casing and screen set round and true-to-line. PVC centralizers shall be used to assure alignment of the well string in the lower portion of the boreholes. The centralizers shall be placed at the bottom of the well screen and at the top of the screen. This will allow the uniform and complete filling of the annular space by gravel pack filter, seal, and grout materials.

Centralizers shall be fastened to the well casing and screen by means other than PVC bonding agents and be radially spaced about the casing at 120 degrees. Fasteners which penetrate the PVC casing and extend into the well shall not be allowed since downhole sampling equipment may be hampered in its operation. Centralizers shall be placed such that the screen and casing are centered in the hole and in a manner which shall not hinder the use of the tremie pipe while emplacing backfill materials.

6.3 Well development

After well installation is completed and the cement grout has set 48 hours, each well shall be fully developed. Development shall be accomplished by surging with air. The compressor used shall be capable of producing at least 100 to 150 pounds per square inch (psi) and of creating an uphole annular fluid velocity of 4000 feet per minute.

Each well shall be developed under the direction of the TR/FTR for a minimum of four hours, unless otherwise directed by the TR/FTR on a well-by-well basis. Development shall be considered complete only if the water yielded from the well is determined by the TR/FTR to be clear and free of all sediment and drilling fluids. If not, development shall continue after the four hours and until the clear and sediment-free criteria are met.

During and after development all sediment collected in the bottom of the well shall be removed using a bailer supplied by the Subcontractor. Absolutely no acids, dispersive agents, or explosives shall be permitted for well development.

Bailing may be used for development purposes if there is not sufficient water inflow for air development to be effective.

7.0 INSPECTION, STORAGE, INVENTORY, AND DISPOSITION OF MATERIALS/SUPPLIES

The Subcontractor shall be responsible for the delivery, acceptance, inspection, and storage at the site of all materials purchased by the Subcontractor, as stipulated in Section II, Pricing Schedule, of this subcontract.

7.1 Inspection

The Subcontractor shall ensure, by physical inspection at time of delivery or pick-up, that all materials/supplies provided through a supplier are in usable condition to perform the Scope of Work (Exhibit A) prior to acceptance and submission of invoice for payment.

7.2 Storage

The Subcontractor is responsible for providing a proper storage place/facility at the site to ensure that damage, deterioration, contamination, or theft of the materials/supplies does not occur during the term of this Subcontract. Any materials/supplies rendered unusable or lost shall be replaced by the Subcontractor at no cost to JEG.

7.3 Inventory

The Subcontractor and the JEG designated TR/FTR shall perform a physical, written inventory to ensure all materials/supplies required to perform the Scope of Work (Exhibit A) are on the site and usable prior to commencing work. The inventory, signed by the Subcontractor and TR/FTR, shall be entered in the FTR Diary and a copy made available to the JEG Contracts Administrator upon completion of the project. Upon completion of all work as determined by the TR/FTR, a final physical written inventory of all unused serviceable materials/supplies shall be performed, logged into the FTR Diary, and signed by the Subcontractor and TR/FTR. A copy must be provided to JEG Contracts by the TR within seven (7) days after completion of the work. Upon completion of the final inventory, all Subcontractor-purchased materials/supplies shall become the property of the U.S. Department of Energy/Jacobs Engineering Group Inc.

7.4 Disposition

Upon completion of the work, the JEG TR shall issue disposition instructions for the unused materials. Disposition shall be at JEG expense.

8.0 JEG SUPPLIED MATERIALS

The following materials shall be supplied by JEG for the project:

- o Locks and pins for all required and optional wells.
- o Seed for site restoration.
- o Plastic sample bags.
- o Split barrel sampler.



ATTACHMENT 2

TO

EXHIBIT A

TO

SUBCONTRACT NO. 34-6704-S-87-00--

BOREHOLE GEOPHYSICAL LOGGING SPECIFICATIONS

Summary of key requirements

- o Downhole logging of as few as three and as many as seven uncased eight-inch boreholes.
- o Logging speed: <20 feet per minute.
- o Logs to be run: natural gamma; neutron porosity; spontaneous potential; short-normal and single point resistivity; caliper; temperature.
- o Logging depths from 70 to 170 feet below the surface.
- o Anti-cross-contamination measures.
- o Supervision by JEG Field Technical Representative (FTR).
- o Desired completion date within 21 days of start.

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ATTACHMENT 2 TO EXHIBIT 4
SUBCONTRACT 34-6704-S-87-00--

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SUBCONTRACT NO. 34-6704-S-87-00--
ATTACHMENT 2
TO
EXHIBIT A

SCOPE OF WORK
SITE CHARACTERIZATION EFFORTS
GREEN RIVER, UTAH, SITE

Borehole Geophysical Logging

1.0 INTRODUCTION

This program will provide geophysical data for the Green River, Utah, mill tailings site for use in evaluating the hydrogeologic setting of the site.

The firm which subcontracts to do the geophysical logging described in the following section is subject to the approval of JEG. The names of personnel and all equipment proposed for use shall be submitted in writing to the TR along with a resume of experience for review by the TR.

The following outlines the proposed scope of services to obtain data from the site. A regional location map for the site is shown in Figure 1 of Exhibit A. The purpose of the study is to determine the hydrogeologic characteristics of the alluvium, and underlying bedrock at the site, and to evaluate the vertical and horizontal extent of underground contamination. This Scope of Work is designed to collect geophysical data from uncased wells and coreholes at each site. This information will be used as an aid in defining the lithology, moisture content, porosity, aquifers, confining units, and contamination beneath each site.

2.0 FIELD DOCUMENTATION

The Technical Representative (TR) or Field Technical Representative (FTR) shall maintain a daily record of all progress made on the project. This record shall include a list of all pay items expended each day. This record shall be in the form of a daily field activity report shown as Figure 6 in Exhibit A. The Subcontractor shall review this record each day with the FTR and acknowledge the accuracy of it by his representative's signature. If the Subcontractor disagrees with the pay items as presented by the FTR, and resolution cannot be made, the FTR shall immediately prepare a report outlining the disagreement and the Subcontractor shall indicate the validity of the disputed item(s) by signing this report, which will then be attached to the pay item summary report.

3.0 LOGGING METHODS AND EQUIPMENT

The Subcontractor shall, in this bid, provide to JEG a list and full description of the specific equipment planned to be used to perform the work described in this Scope of Work.



Prior to mobilization, the Subcontractor shall notify the TR if the logging rig and equipment proposed and approved by JEG for use under this subcontract have changed. All equipment shall be in good working condition and maintained as such.

3.1 Calibration

The Subcontractor shall calibrate all logging equipment according to API specifications and provide documentation of all shop, surface, pre-survey, and post-survey calibrations to the JEG TR/FTR. The results of the calibrations shall also be kept with each probe and be made available to the TR/FTR at any time on the site. The Subcontractor shall also provide to the TR/FTR specifications regarding tool resolution, sensitivity, range and accuracy of specifications, calibration procedures, and any other tool-specific information that is available.

3.2 Logging speed

The logging speed of all geophysical tools shall not exceed 20 feet per minute.

3.3 Logging records

At least three field copies of each log recorded shall be furnished to the on-site TR/FTR and maintained in a file on the site. Such original field logs must be unaltered to the extent that quality assurance tell-tales including recording speed tick marks, etc., are intact. These field logs shall be recorded on a scale of one inch equals 10 feet.

If magnetic tapes are used, care shall be taken by the logging Subcontractor to see that the tapes used for recording of all log data obtained at the site shall be properly stored and protected from accidental erasure. This precaution will assure availability of the tapes for later computer processing, production of finished logs at various scales, and the like.

A repeat section shall be run on each log to permit estimates and corrections for drift, and the like.

JEG personnel shall have access to the recording truck to monitor recording activities and procedures for purposes of quality assurance, and shall document various operating parameters such as logging speed.

At the conclusion of logging operations, copies of all data acquired during that time period shall become the property of JEG and shall be included in the JEG project file. The logging Subcontractor shall store all original log data and tape in their log data bank for possible future reference, log distribution, or interpretation.

3.4 Holes to be logged

The holes to be logged include only the newly drilled eight-inch boreholes or the wells installed under this Scope of Work. There shall be three to seven eight-inch boreholes with depths from 70 to 170 feet.

Holes to be logged shall be logged in accordance with the list given below. For each of the borings, the rig shall be on standby as each of these are logged. The list of logs may also be reduced in certain holes if some of the probes are not considered useful for the purposes of this investigation after first being used on a previous hole and the results thereof evaluated. The first six logs listed below are those which are considered mandatory for the Subcontractor to be capable of running in the designated holes.

Mandatory logs

- o Log 1: Natural gamma.
- o Log 2: Neutron porosity.
- o Log 3: Spontaneous potential.
- o Log 4: Short-normal resistivity or single point resistance.
- o Log 5: Caliper.
- o Log 6: Temperature.

Optional log(s)

- o Log 7: Fluid conductivity.

3.5 Anti-cross-contamination procedures

The hydrogeological investigation at each of the sites includes the collection and analysis of groundwater for a variety of chemical constituents. Some of these analyses are sensitive to the parts per billion range. For this reason the Subcontractor shall follow the anti-cross-contamination procedures listed below.

The Subcontractor shall at all times make diligent efforts to prevent the contamination or cross-contamination of all wells and borings. This includes eliminating the deliberate or inadvertent introduction of foreign, toxic, and/or contaminating substances into the well or boring. Such items include but are not limited to oil, greases, lubricating fluids, hydraulic fluids, and fuels.

To reduce the potential of contaminants being brought on the site, all downhole tools, instruments, and cable shall be thoroughly cleaned with soapy water and then rinsed with fresh potable water prior to entering the site. All oils and greases must be removed in this manner or with steam cleaning. Thereafter, after logging each hole, the equipment shall be rinsed thoroughly with fresh water to remove all fluids and dirt in order to minimize cross-contamination before moving to the next hole.

Downhole equipment shall not be allowed to contact the ground surface. However, platforms covered with plastic sheeting may be used for the temporary storage of such items. At no time shall this platform be walked on or allowed to have soil or tailings deposited on it in any way. If any equipment comes into contact with the ground, or is otherwise contaminated, it shall be thoroughly flushed with fresh, clean potable water before being used again.

The TR/FTR shall direct all contamination and cross-contamination preventative actions, and all work shall be accomplished to his satisfaction. Adherence to the TR/FTR's directions by the Subcontractor is required in this matter.

4.0 STANDARDS

Logging shall be done in accordance with API standards and specifications.