

SPECIFICATION TITLE PAGE
 SPECIFICATION NO. B-314-C-X28018
 QA LEVEL II
 CONSTRUCTION SPECIFICATION FOR
 SHAFT DRILLING AND RIG SERVICES
 BWIP EXPLORATORY SHAFT
 PROJECT B-314

Prepared By:

Kaiser Engineers, Inc./Parsons Brinckerhoff Quade & Douglas, Inc.

For the U.S. Department of Energy

Contract No. DE-AC06-80RL10000

**INFORMATION
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SHAFT DRILLING AND RIG SERVICES

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SHAFT DRILLING AND RIG SERVICES

PART 1 - GENERAL

1.1 SCOPE

This Specification describes the requirements for drilling the vertical hole for the BWIP Exploratory Shaft and rig services for casing installation, mud circulation and cementing.

1.1.1 Work Included in the Drilling Subcontractor's Scope of Work

- 1.1.1.1 Furnishing and setting up the drill rig and related equipment on the drill rig pad constructed by Others.
- 1.1.1.2 Using special Owner-furnished bits, drill pipe, and tools (see Appendix C), to drill a vertical 144-inch diameter bore hole from the bottom of a starter hole, at 104 feet below the top of the drill rig pad, to a depth of approximately 640 feet below the top of the drill rig pad.
- 1.1.1.3 Placing the 112-inch inside diameter casing into its installed location in the 144-inch diameter bore hole in coordination with the Contractor who will assist the Subcontractor in erecting casing sections from horizontal to vertical position.
- 1.1.1.4 Following cementing of the 112-inch inside diameter casing, the Subcontractor, using special Owner-furnished bits, drill pipe, and tools, shall drill a vertical 110-inch diameter bore hole from the bottom of the 112-inch diameter casing to a depth of 3,960 feet below the collar of the hole.
- 1.1.1.5 Placing of the 72-inch inside diameter casing into its installed location in the 110-inch diameter bore hole in coordination with the Contractor who will assist in erecting the casing sections from horizontal to the vertical position.
- 1.1.1.6 Furnishing, *and assisting the contractor in* operating and maintaining the drilling fluid system under the supervision of the Mud Engineer.
- 1.1.1.7 Assist the Contractor with maintenance and repair of Owner-furnished equipment and tools. The Contractor will provide any welding services and materials required.
- 1.1.1.8 Providing rig services as required for cementing operations of the 112" ID and 72" ID casings, and for cement plugging, if required.

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- 1.1.1.9 Removing the drill rig and cleaning the drill rig pad area.
- 1.1.1.10 Recording of all data directly pertinent to the boring of the bore hole and operation of the drill rig. This information shall take the form of a daily log and drilling report.

1.1.2 Work Not Included, to be performed by the Contractor

The following exploratory shaft work will be performed by the Contractor.

- 1.1.2.1 Erection of safety and security fencing to include all gates and locks as required by the boring Subcontractor.

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- 1.1.2.2 ~~Provision and~~ Maintenance of the drilling fluid additives storage area. <

- 1.1.2.3 Welding of the 112" ID and 72" ID casings during installation in the bore hole.

- 1.1.2.4 Cementing of the 112" ID and 72" ID casings.

- 1.1.2.5 Removal of drill cuttings from mud pit.

1.1.3 Work Not Included, to be Performed by Others. The following exploratory shaft work will be performed by Others:

- 1.1.3.1 Construction and maintenance of all access roads to the shaft boring site.

- 1.1.3.2 Initial site grading.

- 1.1.3.3 Site paving as required by the Owner.

- 1.1.3.4 Installation and repairs to the drill rig pad proper.

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- 1.1.3.5 Construction of the drilling fluid pits, ~~and additives storage area~~ <

- 1.1.3.6 Construction of the starter hole from ground level to a depth of 104 feet.

- 1.1.3.7 Installation of the 156-inch diameter casing in the starter hole.

- 1.1.3.8 Primary utility services (power, water and communications) to the site.

- 1.1.3.9 Installation and maintenance of any special recording, monitoring or testing devices as required by the Owner, except those specified herein.

1.2 DEFINITIONS

1.2.1 BWIP

BWIP shall mean the Basalt Waste Isolation Project under DOE.

1.2.2 Blooie Line

Blooie line shall mean the cuttings discharge line. This line carries the discharged drilling fluid and drilled solids to the drilling fluid system.

1.2.3 Contractor

The organization responsible to the Owner for the construction and construction management of the Exploratory Shaft, Phase I.

1.2.4 Drawings

Drawings shall mean those design drawings listed in the "Special Conditions".

1.2.5 Drill Rig Pad

Drill rig pad shall mean the area that contains the pipe rack pad, drilling pad, shaft collar, and headframe footings, all shown on drawings.

1.2.6 Drilling or Boring Subcontractor, or Subcontractor

That party contracted by the Contractor to furnish and operate the drill rig.

1.2.7 ES

ES shall mean the Exploratory Shaft, a component of BWIP's site characterization program.

1.2.8 Grout

Grout shall mean the material(s) used to fill the annular space between the bored hole and the outer surface of the shaft casing.

1.2.9 Mud Engineer

A specialist in the testing, preparation, design, application, use and treatment of drilling fluids and those organic and inorganic materials which are used to supplement and/or enhance these fluids for the purpose of advancing and supporting a bored hole in a rock or mineral medium. The Mud Engineer will be a separate Subcontractor on the ES project.

1.2.10 Long Hole

Long hole shall mean the lowermost part of the bored hole.

1.2.11 Owner

Owner shall mean the U.S. Department of Energy (DOE) or its appointed representative.

1.2.12 Seller

Seller, as used in Appendix A, Bidder and Seller Information Requirements, shall mean the Subcontractor.

1.2.13 Shaft Collar

Shaft collar shall mean that part of the drill rig pad which supports the top of the shaft casing. The top surface of the collar is the zero point from which all down-shaft measurements are taken.

1.2.14 Site

Site shall mean the immediate vicinity of BWIF Exploratory Shaft at Hanford, Washington.

1.2.15 Starter Hole

Starter hole shall mean the first and uppermost part of the exploratory shaft.

1.2.16 Surface Hole

Surface hole shall mean the intermediate part of the bored hole, below the starter hole and above the long hole.

1.3 CITED REFERENCES

Work performed and materials furnished hereunder shall conform to the publications listed below to the extent specified herein.

API - American Petroleum Institute

- Std. 4A - Specifications for Steel Derricks
- Std. 7 - Specifications for Rotary Drilling Equipment
- Std. 9A - Specification for Wire Rope
- RP-5C1 - Recommended Practice for Care and Use of Casing, Drill Pipe and Tubing

RP-9B - Recommended Practice on Application, Care and Use of
Wire Rope for Oil Field Service

IADC - International Association of Drilling Contractors

Standard Daily Drilling Report

Safety Manual

Rig Inspection Procedure

OSHA - Occupational Safety and Health Act

OSHA 2201, General Industry Safety and Health Standards

OSHA 2202, Construction Industry Safety and Health Standards

CAC - California Administrative Code

Title 8, Industrial Relations Safety Orders

Sub-Chapters 14 and 15 (Petroleum)

WISHA - Washington Industrial Safety and Health Act

269-24 WAC, General Safety and Health Standards

1.4 SAFETY

The Subcontractor shall comply with the safety plan developed by the Contractor and approved by the Owner. The safety plan shall incorporate applicable sections of the OSHA, WISHA, State of California and API specifications and regulations cited in Section 1.3. The cited IADC manual and procedures are recommended. The plan shall contain at least the following: Training sessions, timely bulletins, appropriate and required safeguards and equipment, markings, and inspections.

1.5 RECORDS AND SUBMITTALS

1.5.1 Records

The following records and observation shall be part of the Subcontractor's general responsibility.

1.5.1.1 The IADC Daily Drilling Report form shall be kept as the standard daily report. The original and two copies shall be submitted daily to the Owner. The general remarks section shall contain an accurate record of work conditions, work performed and time required for all work to nearest quarter hour. Safety related activities and events shall also be reported on a daily basis.

- 1.5.1.2 Automatic drilling recorders shall be used to measure the rate of penetration, drilling weight, rpm, torque and air pressure. All rig operations such as depth, round trip time, lost circulation intervals, equipment breakdown, mud conditioning time, and other important drilling data shall be clearly identified on the recorder charts. An original and one copy of the drilling recorder charts shall be submitted daily to the Owner.
- 1.5.1.3 Bit and cutter records shall be maintained daily and filed in the field office. A complete record shall be furnished to the Owner weekly. Records shall show bit type and serial number, footages, depths, rotary speeds, bit weights, cutter serial numbers, replacements, repairs, etc.
- 1.5.1.4 Accurate pipe tallies, including type, usage, measurements, etc., shall be provided by the Subcontractor and be available at the drill site for inspection at all times. Copies of steel line measurements of pipe and casing shall be furnished as directed by the Contractor. The ~~Sub~~ Contractor shall keep an accurate record of the total number of joints of all drill pipe, drill collars and tubing on location at all times.
- 1.5.1.5 The Contractor will be responsible for the inventory control of all Owner-furnished and reimbursable items.
- 1.5.1.6 Compressor records showing operating hours, discharge pressures, and air volumes on a continuous record shall be submitted to the Owner with the daily drilling report.
- 1.5.1.7 Accurate records of water volumes and mud consumed or lost shall be submitted with the daily drilling reports.

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1.5.2 Submittals

The Subcontractor shall provide the following documentation for review and acceptance prior to commencing the Work, except as noted otherwise and as indicated on the attached form titled "Bidder and Seller Information Requirements" (Appendix A).

- 1.5.2.1 Drilling programs for the surface hole and the long hole to include, but not be limited to, operations prior to commencing drilling, drilling from bottom of starter hole to water tables, drilling to bottom of surface hole, and drilling the long hole.
- 1.5.2.2 Drilling fluid circulation system design and program.
- 1.5.2.3 A schedule of supervisory personnel.

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- 1.5.2.4 A time table of work commencement and completion.
- 1.5.2.5 Safety program as described in Section 1-4.
- 1.5.2.6 A certified report verifying the accuracy of all shaft dimensions shall be submitted upon completion of the Work.

1.6 NONCONFORMING CONDITIONS

The Subcontractor shall identify each nonconforming condition relative to this Specification and the Drawings and shall notify the Contractor of each such condition. Disposition to "use as is" or to "repair" for each nonconforming condition shall require approval by the Contractor as a condition of acceptance of the Work.

PART 2 - PRODUCTS

2.1 OWNER-FURNISHED TOOLS AND EQUIPMENT

The Owner will furnish for the work the shaft drilling items listed in Appendix C. All Owner-furnished items, will be delivered to and picked up from the drill site by Others. A visual field inspection of all Owner-furnished equipment, machinery, tools, or other items shall be conducted jointly by the Contractor and the Subcontractor. If any defects are found therein sufficient to make use of any such items unsuitable or unsafe, the Subcontractor shall immediately notify the Contractor in writing of such defect or defects.

2.2 SUBCONTRACTOR FURNISHED TOOLS AND EQUIPMENT

Minimum equipment and services to be furnished and operated by the Subcontractor are listed in Appendix D.

- 2.2.1 The Subcontractor's equipment, special tools and materials may be inspected by the Contractor and inventoried upon arrival at the drill site; they shall be in good operating condition and shall be subject to periodic inspection by the Contractor for the purpose of judging them safe and in usable condition.
- 2.2.2 At the time of original inspection any equipment, special tools and materials considered by the Contractor to be unsatisfactory for the performance of the work, as required herein, shall be placed in acceptable condition by repair or removed from the drill site and replaced with satisfactory equipment or materials. If at any time during the contract term, the Subcontractor's equipment, tools, and materials do not meet the contract specifications, as determined by the Contractor, such equipment, special tools and materials shall be either repaired or replaced with equipment, tools and materials acceptable to the Contractor.

2.3 UTILITY CONNECTIONS

The Contractor will provide the equipment and materials sufficient to connect to the primary utility services and maintain their link to the drill rig.

2.3.1 Power will be available at 2.4 kV, 3 phase, 60 Hz. The Contractor will furnish and install all equipment and material required for the work.

2.3.2 Included in the water distribution system shall be storage capacity for a minimum of 40,000 gallons of fresh water, furnished by the Subcontractor.

2.4 MAINTENANCE AND REPAIR

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2/9/83 The Subcontractor will be allowed reasonable repair and maintenance time on his equipment in accordance with the contract. Upon completion of the work, all the Subcontractor's debris and waste material shall be removed by the Subcontractor to an ~~area~~ ^{area} designated by the Contractor. The Contractor will provide labor and equipment to maintain adequate clearance at the blooie line, and for pit cleaning and cuttings removal to the permanent muck storage area.

2.5 LOSS OR DAMAGE TO EQUIPMENT AND TOOLS

The Subcontractor shall take precautions to prevent any damages to, or destruction of equipment, including all drilling tools, and rig supporting machinery and appliances for use above the surface, and of any other type of equipment including in-hole equipment which is directly involved in the boring of the shaft. When it is necessary to fish for tools in the hole, the Subcontractor shall notify the Contractor of the existing conditions immediately, and shall initiate necessary action as soon as practicable.

PART 3 - EXECUTION

3.1 SITE LOCATION

The site of this work is within the administrative area of the Hanford government reservation near Richland, Washington.

The site is located in flat country, with a surface slope gradient of less than 25 ft/mi. Sand dunes form the local relief of 3 to 6 ft. Loess and glaciofluvial deposits overlie basalt bedrock to a depth of about 600 ft. The area lies within the Cold Creek Syncline of the Pasco Basin, a part of the Columbia Plateau. The average elevation is 640 ft above mean sea level.

An exploration borehole RRL-2 was drilled nearby, within 300 ft of the proposed exploratory shaft center, see Appendix B.

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3.2 SITE ARRANGEMENT

3.2.1 Drill Pad

A concrete pad, suitable for erection thereon of the Subcontractor's drill rig, a 104-ft-deep by 156-in.-ID cased starter hole (see reference Specification No. B-314-C-S28003, "Starter Hole"), and drilling fluid pits have been bentonite treated constructed by Others.

3.2.2 Drilling Fluid Circulating System

All equipment in the drilling fluid circulating system as specified in Section 3.9 shall be provided by the Subcontractor. The Drilling Subcontractor shall consult with the Mud Engineer in the design of the fluid circulating system and shall obtain his concurrence as to its adequacy, and shall submit the mud circulating system design for approval by the Contractor.

3.3 DRILLING METHOD

Drilling will be under the overall direction of the Contractor. The hole shall be drilled using rotary drilling methods with stabilized bottom hole assembly which will include the following:

- 3.3.1 Full gauge bottom hole stabilizer immediately above the cutter head assembly or as an integral part of the drill collar mandrel.
- 3.3.2 Stabilizer near the top of the drill collar, 1/2-inch undersize.
- 3.3.3 Stabilizer rollers will be steel and will be maintained at required gauge.
- 3.3.4 While drilling, weight on the bit shall not be allowed to exceed 65 percent of the combined buoyed weight of the bit, reamer, stabilizer, drill collar mandrel, and drill collar weights. Rotary torque shall not exceed 60,000 foot-pounds without approval by the Contractor.
- 3.3.5 Drilling operations shall be conducted using reverse air assist circulation with air and drilling fluid (mud) as the circulating media. Air assist shall be furnished by tubing suspended inside the drill pipe. The air shall be injected inside the tubing to develop lift which will circulate the mud and cuttings from the bottom of the hole to the surface. The method is also known as "air assist reverse circulation".
- 3.3.6 A qualified Mud Engineer will be on the site 24 hrs/day, during the surface hole drilling and casing installation and cementing. A qualified Mud Engineer will be on call or on site 24 hr/day during drilling of lower hole, on site during casing and cementing.

- 3.3.7 Local cement plugging may be needed to eliminate large and continuous drilling fluid losses. This work shall be performed under the provisions of the casing cementing specification (B-314-C-x28048).
- 3.3.8 Operations in the use of drilling fluid shall be under the supervision of the Contractor, assisted by the Mud Engineer.

3.4 SURVEYS AND BORE HOLE LOGS

The contractor shall perform and document all surveys and logs under the responsibility and direction of the Owner.

- 3.4.1 Directional surveys shall be conducted using a down hole, direct digital 2-film recording, non-magnetic gyroscopic survey instrument.

- 3.4.1.1 Directional surveys shall be made every 30 feet of hole advanced (each connection) or as directed by the Contractor. A gyroscopic survey (in and out) shall be run upon completion of drilling the long hole. After cementing the 112-in casing a gyroscopic survey shall be run at 25-ft stations, in and out.

- 3.4.1.2 A current plot of the directional surveys will be maintained at the rig by Others.

- 3.4.2 A caliper log shall be run upon completion of drilling the surface hole prior to running the 112-in. casing, and upon completion of drilling the long hole prior to running the 72-in. ID casing. Additional caliper log surveys including Sonar Caliper surveys may be run as directed by the Contractor.

- 3.4.3 Other logs such as temperature, cement bond, etc., may be run as directed by the Owner.

3.5 TOLERANCES

The Contractor will work in conjunction with the Subcontractor in drilling the hole free of excessive horizontal displacement as noted below.

- 3.5.1 Maximum horizontal distance of any point of the hole centerline shall not be displaced more than 0.4 ft from a line extended through two points on the hole centerline; one reference point being 90 ft above, and the other being 180 ft above the point in question. In addition, deviation at any point in the shaft shall not exceed 2.5 ft from a straight line drawn between the center of the shaft at the surface and the center of the shaft at the depth 3,960 ft; and the center of the shaft at elevation 3,960 ft shall not deviate more than 3.0 ft from a vertical line as projected from the center of the shaft at the surface.

- 3.5.2 If the surveys indicate the presence of excessive horizontal displacement in an interval of the hole drilled, the Subcontractor shall correct this condition to the satisfaction of the Contractor.
- 3.5.3 The alignment of the drill rig and of the substructure or its component parts is the responsibility of the Contractor. If at any time drill rig or substructure become misaligned, the Contractor and Drilling Subcontractor shall realign immediately.
- 3.5.4 The Contractor will monitor the alignment of the drill rig and its substructure over the bored hole.

3.6 ABNORMAL CONDITIONS

Due to the nature of work under this contract, it is not possible to anticipate all the unusual conditions which may be encountered while drilling. If abnormal conditions such as severe loss of circulation or hole caving arise, the Contractor shall bring this information to the immediate attention of the Owner. No change in the work shall be undertaken by Contractor unless a written change order has been issued by the Owner.

If it is necessary to fish for items lost in the hole, the Subcontractor shall notify the Contractor and initiate action to commence fishing operations as soon as practicable.

3.7 LOST OR ABANDONED HOLE

- 3.7.1 The hole shall be termed "lost" if the Owner determines that the condition of the hole will prevent its successful completion, or if it becomes impractical to continue drilling. If the Owner determines that a hole has been lost before required depth has been attained, and that further attempts to complete it will be impractical, he will order work on the hole stopped, investigate the circumstances contributing to its loss, and notify the Contractor of his decision in writing. The Owner may, order the commencement of work at an alternate location. Drilling and other work at the alternate location shall be performed in accordance with provisions to be agreed upon in the Contract.
- 3.7.2 The hole shall be termed "abandoned" if the Owner determines that it does not suit the convenience of the Owner under conditions established for its scope.

3.8 CASING INSTALLATION AND CEMENTING

- 3.8.1 The Subcontractor shall assist, when required and as directed by the Contractor, in the logging of the borehole, including hole deviation and caliper logging.

- 3.8.2 The Subcontractor shall provide labor and tools, as required, to assist in the conditioning of the hole and the drilling fluid, before insertion of each casing string. This work shall be done as directed by the Contractor and in collaboration with the Mud Engineer.
- 3.8.3 As directed by the Contractor, the Subcontractor shall assist in the installation of each casing string, providing rig services, including labor, when required.
- 3.8.4 The Subcontractor shall assist in the cementing of each casing string, by providing rig services and labor for raising and lowering of cementing pipes, and assistance in logging services as required and directed by the Contractor. Grouting equipment, grout pipes and logging tools for this work will be supplied by Others, under the Contractor's direction.

3.9 DRILLING FLUIDS SYSTEM

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assisted by
 The system employed to circulate, clean, and maintain the mud and condition the mud as required shall be furnished, ^{by the subcontractor} operated and maintained by ^{the Contractor,} the Subcontractor. It shall be an open pit, gravity settling system. Mud shall be circulated using air assist and gravity return. The Subcontractor shall include in this system all required components, including all necessary pumps, mixers, vessels or containers, and compressors. Mud pits and mud return line will be provided by Others but shall be inspected and modified by the ~~Sub~~ Contractor as required. The components of the system shall include but not be limited to the following: <

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 3.9.1 Additions and Mixing Section, where drill fluid additives are added or injected in wet or dry form and mixed into the fluid. This section shall be a metal ^{truck} provided with hopper(s) pumps and mixing equipment adequate to insure homogeneous mixing of all additives. The capacity of this unit shall be adequate to provide a large volume (a slug) of specially mixed drilling fluid on demand to counter special conditions during shaft drilling. <

3.9.2 Desanders for the removal of sand sized particles in association with the addition and mixing of additives into the fluid, provided with pumps as required.

3.9.3 Air compressors as required to provide air-assisted circulation of the drilling fluid.

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 3.9.4 Weirs, meters, pipes and other appurtenances required for drilling fluid operations and not supplied by Others, *will be furnished by the Contractor* <

3.9.5 An Owner's representative shall be given the necessary facility and opportunity to collect drill cuttings samples.

3.10 COMMENCEMENT AND COMPLETION

Two weeks prior to commencing the work, Subcontractor shall submit his best estimates for the time of completion, including time for demobilization after work is completed. Such estimates will show approximate dates of completion for intermediate works, such as 144-inch hole, 112-inch casing placement and cementation, 110-inch hole etc. These estimates shall be updated monthly by the Subcontractor. The Subcontractor will maintain an around-the-clock year-round operating schedule.

PART 4 - DRAWINGS AND ATTACHMENTS

4.1 DRAWINGS

The KE/PB drawings listed in the "Special Conditions" are made a part of this Specification:

4.2 ATTACHMENTS

The documents listed below are attached to and made a part of this Specification.

- Appendix A, Bidder and Seller Information Requirements
- Appendix B, Stratigraphic Log of RRL-2, and Estimated Unrestrained Water Inflow
- Appendix C, Owner-Furnished Tools
- Appendix D, Subcontractor-Furnished Equipment and Materials

PART 5 - REFERENCES

5.1 GEOTECHNICAL REPORT

The geotechnical report titled "Final Report Foundation Investigation, Headworks/BWIP Exploratory Shaft, Hanford Site, Washington" dated March, 1982 is given as a reference document. These soils investigation results are provided for Bidder's/Subcontractor's information. Arrangements may be made with the Owner for viewing existing soil samples, and for reviewing existing soils reports with an on-site geologist.

5.2 ROCK MECHANICS STUDY

The most recent rock mechanics tests performed on core samples recovered from the exploratory borehole RRL-2 are included in the report titled "Principal Borehole Report RRL-2" to be published by Rockwell in January, 1983.

5.3 SPECIFICATIONS

The following KE/PB Specifications are provided as reference documents:

- B-314-C-S18003, Drill Rig Pad
- B-314-C-S28003, Starter Hole
- B-314-C-S28004, 112" ID Steel Casing
- B-314-C-S28005, 72" ID Steel Casing
- B-314-P-X28028, Drilling Mud
- B-314-C-X28048, Casing Cementing

BWSP01A: 02/03/83

BIDDER AND SELLER INFORMATION REQUIREMENTS

TYPE OF INFORMATION	PREAWARD BY BIDDER			POSTAWARD BY SELLER				COPIES REQUIRED WITHOUT REVIEW
	COPIES WITH EACH BID	REVIEW DATA REQUIRED (WEEKS AFTER AWARD)	BIDDER PROMISE SUBMITTAL (WEEKS AFTER AWARD)	REPRODUCIBLE TO BE SUBMITTED FOR REVIEW	CERTIFIED DRAWINGS TO BE SUBMITTED AFTER REVIEW			
					PAPER PRINTS	REPRODUCIBLE *		
					PAPER	PERMANENT		
1. DRAWING LIST AND SCHEDULE								
2. DIMENSIONED OUTLINE DRAWINGS AND/OR CATALOG INFORMATION								
3. SCHEMATIC PIPING DIAGRAMS								
4. ELECTRICAL AND INSTRUMENTATION INFORMATION								
5. SHOP DETAIL DRAWINGS								
6. FOUNDATION OUTLINE AND ANCHOR BOLT LOCATIONS								
7. LOAD DIAGRAMS								
8. DATA SHEETS, AS NOTED THEREON								
9. PERFORMANCE DATA AND CURVES								
10. CERTIFIED TEST AND INSPECTION REPORTS								
11. BILLS OF MATERIAL								
12. INSTALLATION INSTRUCTIONS								
13. MAINTENANCE AND OPERATING MANUALS								
14. NAMEPLATE DATA, AND MOTOR LIST								
15. CALCULATIONS								
16. PRELIMINARY DESIGN DRAWINGS								
17. FINAL DESIGN DRAWINGS								
18. IADC Daily Report				Para 1.5.1.1				
19. Drilling Records				Para 1.5.1.2				
20. Bit and Cutter Records				Para 1.5.1.3				
21. Drill Pipe Records				Para 1.5.1.4				
22. Compressor Records				Para 1.5.1.6				
23. Water Volume Records				Para 1.5.1.7				
24. Drilling Program				**	3			
25. Fluid Circulation System				**	3			
26. Schedule of Supervisors				**	3			
27. Time Table of Work				**	3			
28. Safety Program				**	3			
29. Certified Accuracy Report				**	3			
30.								

* Reproducible required only for data larger than 11" x 17"

NOTE-BIDDER

** One reproducible plus 6 copies

SEE SHEET 2 OF 2 FOR DEFINITIONS AND INSTRUCTIONS.

DEFINITIONS

1. DRAWING LIST AND SCHEDULE A complete list of all drawings and data by title that the Bidder expects to furnish on this order. Schedule to show, in weeks after award, submittal of each type of review and certified drawings.
2. DIMENSIONED OUTLINE DRAWINGS AND/OR CATALOG INFORMATION Drawings to scale showing the relative size, configuration, and location of all material to be furnished. Show two or more views of unit, clearances and area required for operation and maintenance. Show unit in relation to nearby structures and other equipment or operating floor, location of utility connections and direction of rotation, if applicable. When submitting data for "off the shelf" equipment/materials, catalog cuts and information are acceptable provided they are submitted in ample detail.
3. SCHEMATIC PIPING DIAGRAMS Show equipment to be interconnected, flow quantities, pipe sizes, valves and instruments.
4. ELECTRICAL AND INSTRUMENTATION INFORMATION Show all data pertaining to instrumentation, control and power electrical equipment. Include "one-line", "elementary" wiring, panel interior wiring and exterior interconnection wiring, dimensioned outlines of enclosures with raceway entries shown.
5. SHOP DETAIL DRAWINGS Show all necessary details and data required for fabrication and maintenance. For structural details show all connections and member sizes.
6. FOUNDATION OUTLINE AND ANCHOR BOLT LOCATIONS Show all data required for foundation design including location, blockouts, embedded items, grout required, and size, type and projection of anchor bolts.
7. LOAD DIAGRAMS Show total static and dynamic loads and load centers.
8. DATA SHEETS Sheets shall be completed for the equipment proposed with all information noted thereon.
9. PERFORMANCE DATA AND CURVES
10. CERTIFIED TEST AND INSPECTION REPORTS Reports by recognized commercial laboratories of indicated chemical and physical tests of materials as required by the specifications. In addition where applicable, weld inspection and stress relieving records and code nameplate rubbings shall be furnished.
11. BILLS OF MATERIAL Show for each unit: item no., shop order no., mark or name, part no., or pattern no., and drawing reference.
12. INSTALLATION INSTRUCTIONS Complete, detailed and sequenced instructions for original installation and for removals and replacements as well as erection information.
13. MAINTENANCE AND OPERATING MANUALS Complete installation, starting and operating instructions. Complete descriptions of preventive and repair maintenance, including detailed lubrication chart showing every lubrication point, grade of lubricant, lubrication schedule and amount of oil or grease required for refill after drainage. Manuals include parts list with recommended spares.
14. NAMEPLATE DATA AND MOTOR LIST
15. CALCULATIONS Shall be checked and stamped by a registered professional engineer, licensed to practice in the state where installation occurs.
16. PRELIMINARY DESIGN DRAWINGS Seller provided design services such as pre-engineered buildings, silos and other structures, conveyor systems, bins and chute design, large ductwork and supports.
17. FINAL DESIGN DRAWINGS Same as Item No. 16.

INSTRUCTIONS

1. DIMENSIONS Shown on all but schematic drawings and diagrams shall be in feet and inches, unless noted otherwise.
2. CERTIFIED DRAWINGS Shall be so marked by Seller. They shall conform to Seller's drawings as finally accepted by the Purchaser and shall be forwarded at commencement of manufacture. The drawings shall be revised and resubmitted to reflect any changes approved during the manufacturing period.
3. REPRODUCIBLE PERMANENT PRINTS Shall be cloth, "Chronaflex", or "Mylar". They shall depict the material as shipped and shall be forwarded upon completion of shipment.
4. EQUIPMENT NUMBERS Shall be used for reference and identification of the units on all data required hereunder.

APPENDIX B

FORMATION	STRATIGRAPHY BASED ON BORING RRL-2			TEST INTERVAL THICKNESS	PREDICTED UNRESTRAINED INFLOW IN GPM	
	MEMBER OR SEQUENCE	DEPTH (ft)	THICKNESS (ft)		10' Ø	20' Ø
SADDLE MOUNTAINS BASALTS	BEDIMENTS		013			
	ELEPHANT MOUNTAIN MEMBER	803	83			
	RATTLESNAKE RIDGE INTERBED	888	97	187	4405	4937
	POMONA MEMBER	783	158			
	SELAM INTERBED	841	45	93	38	43
	ESQUATZEL MEMBER	988	118			
	GOLD CREEK INTERBED	1104	63	132	18	18
	UMATILLA MEMBER	1187	232			
	MASTON INTERBED	1389	124	24	DRY	
	PRIEST RAPIDS MEMBER	1623	166			
WANAPUM BASALTS	PRIEST RAPIDS MEMBER	1889	80	40	4288	4738
	PRIEST RAPIDS MEMBER	1749	60	38	4388	4860
	ROZA MEMBER	1822	173			
	UPPER FRENCHMAN SPRINGS MEMBER		781	316	8765	10798
	LOWER FRENCHMAN SPRINGS MEMBER		400		22456	24832
	VANTAGE INTERBED	2883	4	75	18	20
GRANDE RONDE BASALTS	UPPER GRANDE RONDE	2887	308	184	10254	11338
	BENTIMEL BLUFFS THROUGH RUNNER	2883	282	39	DRY	
	MIDDLE GRANDE RONDE	3288	220		143	158
	MCCOY CANYON TOP	3478	132		148	181
	UMTANUM	3807	232		153	188
	VERY HIGH MgO	3838	63			
	SCHWANA	3892	81			
		3873				

Stratigraphic Log of RRL-2, and Estimated Unrestrained Water Inflow.

APPENDIX C
OWNER-FURNISHED TOOLS

The following tools and equipment are unique items required by the special nature of the shaft to be bored and as such are to be provided by the Owner.

<u>Item</u>	<u>Quantity</u>	<u>Description</u>
1. Rotary Hose	2	12 in (305 mm) inside diameter (I.D.) rotary hose with 12 in (305 mm) 150 lb (68 kg) flange on both ends, length 50 ft (15.3 m)
2. Swivel	1	1,000 ton (900 t) rotary swivel with 12 in (305 mm) I.D. for direct or reverse circulation. Swivel consists of gooseneck with riser and long bale
3. Kelly	1	13-9/16 in (344 mm) square fabricated kelly with 13-3/8 in (340 mm) left hand box on box upper end and 13-3/8 in (340 mm) pin on lower end (fabricators recommended threads, top and bottom); 42 ft (12.8 m) long shoulder to shoulder
4. Saver Sub	4	13-3/8 in (340 mm) saver sub, compatible with kelly and mandrel. 72 lb/ft (107 kg/m) X-95 upset with aluminum thread protectors; lengths: 2-5 ft (1.5 m), 1-10 ft (3.1 m), 1/-15 ft (4.6 m)
5. Drill Pipe	150	13-3/8 in (340 mm) 72 lb/ft (107 kg/m) X95 upset. Joints compatible with kelly and mandrel. Length 30 ft (9.1 m) shoulder to shoulder. With aluminum thread protectors.
6. Drill Collar Mandril	1	12 in (305 mm) I.D. x 16 in (406 mm) outside diameter (O.D.), 13-3/8 in (340 mm) tool joint box up (joint compatible with kelly and drill pipe) and 84 in (2.1 m) flanged connection down. Lower mandrel to have 110 in (2.8 m) stabilizer built as integral part. Length 60 ft (18.3 m) shoulder to shoulder. Stabilizer with set of

<u>Item</u>	<u>Quantity</u>	<u>Description</u>
6. Drill Collar Mandril (Cont)		stabilizer rollers with tungsten carbide inserts. Upper portion of stem tapered to provide elevator shoulder
7. Donut Weights	40	Split cast iron donut weights, all 16-5/8 in (15.9 m) I.D. x 18 in (457 m) high; 25 - 84 (2.1 m) O.D., 15 - 60 in (1.5 m) O.D.
8. Drill Collar Clamp	1	Drill collar for 60 in (1.5 m) and 84 in (2.1 m) donut weights
9. Stabilizer	1	110 in (2.8 m) diameter slip on flanged stabilizer complete with stabilizer rollers with tungsten carbide inserts
10. Extenders	2	Set of stabilizer extenders from 110 in (2.8 m) to 144 in (3.7 m) complete with bolts
11. Bit Body	1	144 in (3.7 m) diameter low profile bit body for simple reverse circulation. 84 in (2.1 m) diameter connecting flange. With mounts and steel tooth cutters
12. Bit Body	2	110 in (2.8 m) diameter low profile bit body for simple reverse circulation. 84 in (2.1 m) diameter connecting flanges. With mounts and tungsten carbide insert cutters
13. Fasteners	10	Set drill collar flange bolts and nuts
14. Left Hand Tubing	Lot	25 joints, 3-1/2 in (89 mm), 7.2 lb/ft (10.7 kg/m), N80, 8rd left hand thread range 2 tubing. 1 - 10 ft (3.05 m), 1 - 5 ft (1.5 m), 1 - 3 ft (0.9 m), 2 - 1 ft (0.3 m) pup joints of the same size

<u>Item</u>	<u>Quantity</u>
15. Casing Elevators	Lot
16. Casing Spider (strongback)	1
17. Varco Power Tongs	1

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