

TECHNICAL SPECIFICATIONS OF EQUIPMENT AND
MATERIAL FOR DEEP WELL CONSTRUCTION

I. DRILLING RIG

1. Top Head Drive Type, 4 x 4,
Truck Mounted Rotary Drilling Rig 9 Units

1.1. General

The equipment shall be a truck mounted top drive type drilling rig, driven by truck engine P.T.O. through main compound case and used for water well drilling in alluvial and hard formations.

The equipment shall be capable of drilling 219 mm (8-3/4") holes upto 200 m deep with 3-1/2" drill pipes by rotary mud or down-the-hole hammer methods.

1.2. Rig Frame

Rig frame shall be of fabricated steel construction and be covered with suitable nonslip plates where necessary. All moving parts such as chain line, etc. shall be covered with safety guard.

1.3. Compound Case

The main compound case shall be fully enclosed and oilbathed.

1.4. Rotary Head

The drill head type shall be hydraulically driven top head with hydraulically pulldown and lift system, and retract-back system in the mast. The hydraulic hoses shall be arranged properly in the mast.

Required speed range; 0 - 120 rpm at high gear and
0 - 60 rpm at low gear.

Max. load capacity; Not less than 7,000 kg.

1.5. Drawworks

The drawworks shall be hydraulic driven free-falling mechanism to enable quick lowering the drill strings.

Max. single pull; Not less than 3,000 kg.
Spooling capacity; Not less than 50 m with 14 mm (23/32")
cable.
Line speed; Not less than 0 - 60 m/min.

1.6. Mud Pump

The mud pump, duplex reciprocating type and driven by hydraulic motor. The mud pump shall be equipped with surge chamber, relief valve, piston rod lubricator, etc.

Discharge volume; Not less than 730 L/min.
Max. pressure; Not less than 19 kg/cm².

1.7. Mast

The mast shall be electrically welded with rigid structural section, raised and lowered by twin hydraulic cylinder.

Height; Not less than 11.3 m clearance above the ground.
Total gross capacity; Not less than 16,000 kg.
Hook load capacity; Not less than 6,000 kg.

1.8. Pulldown System

Pulldown system shall be by twin hydraulic cylinder located at backside of the mast frame to give enough space in the mast and smooth thrust and lifting on the hydraulic drill head.

Max. hold back; Not less than 7,000 kg.
Feed stroke; Not less than 7.5 m.
Feed speed; Not less than 0 - 30 m/min at high speed and 0 - 2.5 m/min at low speed.

1.9. Breakout System

The rig shall be equipped with hydraulically actuated pipe breakout system.

1.10. Levelling Jacks

The rig shall be equipped with four (4) hydraulic jacks, individually controlled. The jacks shall be enclosed in housing to prevent dirt damaging piston rods.

1.11. Lightings

The rig shall be provided with floodlight arrangement for night operation.

1.12. Controls

All controls and gauges necessary for drilling operation shall be grouped and fitted at the driller's control panel and platform.

1.13. Injection Pump and Oiler for D.T.H. Hammer Drilling

The rig shall be furnished with reciprocating type injection pump for injecting water, foam or other agents directly into the air line. The pump shall be hydraulically driven, and the injection rate must be adjustable from 0 to the maximum rate not less than 30 liter per minute.

The rig shall be also furnished with air line oiler for D.T.H. hammer drilling operation adjustable oil flow rate, working pressure not less than 17.5 kg/cm² (250 psi).

1.14 Truck

The truck shall be rugged heavy duty type, diesel engine driven 4 x 4 right hand steering and shall have full power P.T.O. attachment to drive the rig compound through main compound case.

- | | |
|----------------------|--|
| G.V.W.; | Not less than 16,000 kg. |
| Engine; | Diesel, 4 cycle, vertical, 6 cylinders in-line, over head valve, water-cooled, maximum output not less than 215 HP at 2,700 rpm. |
| Transmission; | Six-speed and 1 reverse, synchromesh 3rd - 6th mechanical control. |
| Brake; | To be provided with a foot brake actuating pneumatically on all wheels and in addition with mechanical parking brake. |
| Tires; | Tire size shall be not less than 11.00 - 20 - 16 PR and provided with one complete set of spare tire. |
| Cab and accessories; | To be a fabricated steel cab with full vision windshield glass, driver's and assistant's seat, windshield wipers, ventilators, outside and inside rear view mirrors and other manufacturer's standard accessories. |

1.15. Tools and Accessories

9 Units

Standard accessories for each rig

- | | |
|---|-------|
| 1) Breakout tong for 3-1/2" drill pipe | 1 pc. |
| 2) Breakout tong for 5" drill collar | 1 pc. |
| 3) Back-up wrench for 3-1/2" drill pipe | 1 pc. |
| 4) Back-up wrench for 5" drill collar | 1 pc. |
| 5) Air/water swivel, built-in type, to be fitted on the rig | 1 pc. |
| 6) Hoisting swivel for 3-1/2" drill pipe | 1 pc. |

- | | |
|--|--------|
| 7) Hoisting wire rope with safety clevis, 14 mm x 40 m | 1 roll |
| 8) Drill collar lifting plug | 1 pc. |
| 9) Travelling block, single sheave, 280 mm, 8 ton capacity | 1 pc. |
| 10) High pressure delivery hose with fittings, 50 mm | 1 pc. |
| 11) High pressure intermediate hose with fittings, 50 mm | 1 pc. |
| 12) High pressure mixer hose with fittings, 50 mm | 1 pc. |
| 13) Suction hoe with quick coupling, 100 mm x 6 m | 1 pc. |
| 14) Foot valve with fittings, 100 mm | 1 pc. |
| 15) Drill pipe hanger | 1 pc. |
| 16) Disassembling tools for drill rig and mud pump including valve seat and liner puller, special wrenches | 1 set |
| 17) D.P. trolley | 1 set |

Standard accessories for each truck

- | | |
|---|-------|
| 1) Jack | 1 pc. |
| 2) Wheel brace | 1 pc. |
| 3) Tire inflation kit with pressure gauge | 1 set |
| 4) Other standard tools for maintenance | 1 set |

1.16. Driller's Operating Tools for Each Rig 9 Units

- | | | |
|---|----------|--------|
| 1) Pipe wrench, | 1,200 mm | 2 pcs. |
| 2) - do -, | 900 mm | 2 pcs. |
| 3) - do -, | 600 mm | 2 pcs. |
| 4) - do -, | 450 mm | 2 pcs. |
| 5) Socket wrench set | | 1 set |
| 6) Hacksaw frame (250 mm) with blade (12 pcs) | | 1 set |
| 7) Files (flat, round, semi-round), | 250 mm | 1 set |

8) Chisel (cold, cape), 200 mm	1 set
9) Convex rule, 2 m	1 pc.
10) Plier, 200 mm	1 pc.
11) Cutting plier, 200 mm	1 pc.
12) Level, 150 m	1 pc.
13) Plumb bob, 50 mm	1 pc.
14) Adjustable wrench, 150 mm	1 pc.
15) - do -, 250 mm	1 pc.
16) Screw driver (minus/50 mm, 150 mm, plus/100 mm, 150 mm)	1 set
17) Machinist hammer, 450 g	1 pc.
18) Black smith hammer, 4.5 kg	1 pc.
19) Double offset wrench set (6 pcs.)	1 set
20) Taper pin punch (8 pcs.)	1 set
21) Shovel, round	1 pc.
22) Shovel, square	1 pc.
23) Wire brush (2 pcs.)	1 set
24) Grease gun, lever type with nozzle and flexible connection	1 set
25) Vernier caliper	1 pc.
26) Chain tong for 200 mm (8") pipe	2 pcs.
27) Chain tong for 150 mm (6") pipe	2 pcs.
28) Chain tong for 100 mm (4") pipe	2 pcs.
29) Bench vice	1 pc.
30) Tool box with lock and key	1 set

1.17. Drilling Accessories for Each Rig 9 Units

1) Drill pipe, 3-1/2 F.J. with 2-3/8 API IF tool joints and thread protector on both ends, 6 m long	25 pcs.
2) Drill collar, 5" O.D. with 3-1/2 IF tool joints and thread protectors on both ends, 6 m long	3 pcs.
3) Bit stabilizer for 10-5/8" bit, body size 5" with 3-1/2 IF tool joints & thread protector on both ends, 1.5 m	2 pcs.
4) - do -, for 8-3/4" bit, body size 5" with 3-1/2 IF tool joints and thread protector on both ends, 1.5 m	2 pcs.

- 5) - do -, for 6-1/4" bit body size 5" with 3-1/2 IF tool joints and thread protector on both ends, 1.5 m 2 pcs.
- 6) Sub, 2-3/8 API IF box to 3-1/2 API IF pin 3 pcs.
- 7) Sub, 3-1/2 API IF box to 4-1/2 API REG box 5 pcs.
- 8) Sub, 3-1/2 API IF box to 3-1/2 API REG box 5 pcs.
- 9) Sub, 2-3/8 API IF box to 6-5/8 API REG box 2 pcs.
- 10) Wear sub, 2-3/8 API IF box to 2-3/8 API IF pin 2 pcs.
- 11) Drag bit for soft and sticky formation, size 12-1/4" with 6-5/8 REG pin 2 pcs.
- 12) - do -, size 9-5/8" with 6-5/8 REG pin 4 pcs.
- 13) - do -, size 7-5/8" with 4-1/2 REG pin 10 pcs.
- 14) Tricone rock roller bit, size 12-1/4" with 6-5/8 REG pin for medium hard formation 2 pcs.
- 15) - do -, size 9-5/8" with 6-5/8 REG pin for medium hard formation 6 pcs.
- 16) - do -, size 7-5/8" with 4-1/2 REG pin for medium hard formation 16 pcs.
- 17) - do -, size 6-1/4" with 3-1/2 REG pin for medium hard formation 4 pcs.
- 18) - do -, size 9-5/8" with 6-5/8 REG pin for extremely hard formation, T.C. insert type 2 pcs.
- 19) - do -, size 7-5/8" with 4-1/2 REG pin for extremely hard formation, T.C. insert type 4 pcs.
- 20) - do -, size 6-1/4" with 3-1/2 REG pin for extremely hard formation, T.C. insert type 2 pcs.
- 21) Damper, 3-1/2" O.D. 1 set

22) Male tap for drill pipe, 3-1/2"	1 pc.
23) Female tap for drill pipe, 3-1/2"	1 pc.
24) Bailer, piston type, 114 mm (4-1/2") O.D.	1 set
25) Jet hopper type mud mixer with 50 mm hose connection	1 set
26) Bit breaker, size 12-1/4"	1 set
27) Bit breaker, size 9-5/8"	1 set
28) Bit breaker, size 7-5/8"	1 set
29) Bit breaker, size 6-1/4"	1 set
30) Drill pipe band, 3-1/2"	1 set
31) Hydraulic jack, 20 ton	2 sets

1.18. Air Lift Tools for Each Rig 9 Units

1) Air pipe, 1" x 5.5 m	27 pcs.
2) Discharge pipe, 4" x 5.5 m	27 pcs.
3) Drop pipe, 4"	1 pc.
4) Air lift manifold, 4"	1 pc.
5) Air swivel, 1"	1 pc.
6) Air hose, 1" x 10 m	1 roll
7) Pipe elevator, 1"	2 pcs.
8) - do -, 4"	2 pcs.

2. D.T.H. Hammer Tools 4 Units

1) D.T.H. hammer drill, high pressure valveless type, for 8" drilling	4 sets
2) - do -, for size 6", drilling	4 pcs.
3) D.T.H. hammer bit for above, size 8", button type	20 pcs.
4) - do -, size 6" button type	20 pcs.
5) Disassembling tools for hammer	4 sets

- | | | |
|-----|---|----------|
| 6) | Air hand grinder for resharpener
bit with regular and air hose | 4 sets |
| 7) | Grind stone for grinder | 400 pcs. |
| 8) | Dust collector | 4 sets |
| 9) | Air hose between air compressor and
line oiler, 2" x 10 m with fittings | 4 sets |
| 10) | Work casing for 8" D.T.H. hammer
drilling, flush joint type, size
232 mm O.D., 212 mm I.D., 5.5 m
long | 36 pcs. |
| 11) | - do -, 3.0 m long | 4 pcs. |
| 12) | - do -, 2.0 m long | 4 pcs. |
| 13) | - do -, 1.0 m long | 4 pcs. |
| 14) | Work casing for 6" D.T.H. hammer
drilling, flush joint type, size
178 mm O.D., 162 mm I.D., 5.5 m
long | 36 pcs. |
| 15) | - do -, 3.0 m long | 4 pcs. |
| 16) | - do -, 2.0 m long | 4 pcs. |
| 17) | - do -, 1.0 m long | 4 pcs. |
| 18) | Casing band, 232 mm | 4 sets |
| 19) | Casing band, 178 mm | 4 pcs. |
| 20) | Casing swivel, 2-3/8 IF x 232 mm | 4 pcs. |
| 21) | - do -, 2-3/8 IF x 178 mm | 4 pcs. |
| 22) | Casing shoe, 232 mm | 12 pcs. |
| 23) | - do -, 178 mm | 12 pcs. |
| 24) | Casing head, 232 mm | 4 pcs. |
| 25) | - do -, 178 mm | 4 pcs. |

3. High Pressure Air Compressor 4 Units

General

The air compressor shall be rotary twin screw type, two stage, oil-cooled and mounted on a trailer. The air compressor shall be equipped with horizontal-cylindrical, full-welded oil separator-receiver tank, emergency stop device and warning lamp. It shall be fully tropicalized.

Compressor Unit

The unit shall be driven by direct coupling with engine through flexible rubber, and equipped with paper cartridge type oil filter and dry paper element type air cleaner. The unloader shall be suction port closing type in connection with stepless speed regulator.

Actual free air delivery; Not less than 21.2 m³/min (750 cfm)
Working pressure; Not less than 17.5 kg/cm² (250 psi)

Diesel Engine

The diesel engine shall be vertical in-line, 4 cycle, 8 cylinders, water-cooled, direct injection.

Continuous rated output; Not less than 352 PS/2,200 rpm.
Injection pump; Bosch type.
Governor; Centrifugal, mechanical, all-speed.
Oil filter; Paper element type.
Air cleaner; Dry paper element type.

4. Air Compressor for Borehole Development 9 Units

General

The air compressor shall be rotary twin screw type, single stage, oil cooled and mounted on a trailer. The air compressor shall be equipped with horizontal-cylindrical, full-welded oil separator-receiver tank, emergency stop device and warning lamp. It shall be fully tropicalized.

Compressor Unit

The unit shall be driven by direct coupling with engine through flexible rubber, and equipped with paper cartridge type oil filter and dry paper element type air cleaner. The unloader shall be suction port closing type in connection with stepless speed regulator.

Actual free air delivery; Not less than 8 m³/min.
Working pressure; Not less than 10.5 kg/cm².

Diesel Engine

The diesel engine shall be vertical in-line, 4 cycle, 4 cylinders, water-cooled, direct injection.

Continuous rated output; Not less than 100 PS/3,000 rpm.
Injection pump; Bosch type.
Governor; Centrifugal, mechanical, all-speed.
Lubrication system; Forced lubrication by gear pump.
Oil filter; Full-flow and by-pass type.
Air cleaner; Dry paper element type.

II. VEHICLES

1. Cargo Truck with 3 Ton Crane, Long Body Type 9 Units

General

The truck shall be 4 x 2 drive right hand drive. The truck shall be long body type (rear body length not less than 6.1 m) to carry 6 m pipes and equipped with 3 ton crane. Payload not less than 7,000 kg on unpaved and wheel base not less than 5,000 mm.

Engine

The engine shall be diesel, 4 cycle, vertical, 6 cylinders, in-line, overhead valve, water-cooled.

Max. output; Not less than 190 HP/2,350 rpm.
Max. torque; Not less than 65 kgm/1,200 rpm.

Rear Body

The rear body shall be all steel construction and its dimensions shall be not less than 6,100 mm (L) and 2,370 mm (W).

Tire

The tire size shall be 11.00 - 20 or larger. One complete spare tire shall be supplied.

Crane

The crane shall have 3,000 kg capacity at 2.5 m (4-part lines). The boom shall be 2 sectioned, fully hydraulic telescoping type and elevated by double-acting hydraulic cylinder.

Retract length; Not less than 3.83 m.
Extended length; Not less than 6.2 m.
Extending speed; Not less than 2.37 m/15' sec.
Elevating speed; 0 to 75 deg./14 sec.

The winch shall be hydraulic motor driven spur gear speed reduction, provided with mechanical brake, and having not less than 750 kg single line pull and 50 m/min (at 4th layer) single line speed. The winch shall be provided with 9 mm diam. x 45 m length wire rope and 2 sheaves hook block.

The swing system shall be hydraulic motor driven, worm gear speed reduction, post-centered swing on plain bearing 360 deg. continuous rotation.

The outriggers shall be manually extended sliders and hydraulically operated jacks.

Extended width; Not less than 3,250 mm.

The hydraulic system shall consist of single gear type hydraulic pump, axial piston type hydraulic motors and multiple control valves with integral relief valve.

2. Water Lorry

6 Units

General

The mounting truck shall be 4 x 2 drive, right hand drive. Payload not less than 5,500 kg and wheel base not less than 3,280 mm. The water tank is mounted on truck chassis and equipped with a self-priming centrifugal pump. Water is loaded from storage by operating the pump unit.

Engine

The engine shall be diesel, 4 cycle, vertical, 6 cylinders, in-line, overhead valve, water-cooled.

Max. output; Not less than 165 HP/3,200 rpm.
Max. torque; Not less than 45 kgm/2,000 rpm.

Tire

The tire size shall be 8.25 - 16 or larger. One complete spare tire shall be supplied.

Water Tank

The water tank shall be one-compartment ellipse sectioned cylindrical type and fabricated throughout in mild steel plate, all internal surfaces lined with zinc metal spraying. The water tank shall have not less than 5,500 liter loading capacity, and equipped with manhole and air breather. The thickness of shell, end plate and buffer plate shall be not less than 3.2 mm.

Pump

The water pump shall be self-priming centrifugal pump, driven by transmission P.T.O., and have approx. 300 L/min capacity.

Accessories

The water tanker shall be equipped with 2 inch suction/delivery hose, hose packing, strainer, hose wrenches, etc.

3. Fuel Lorry

2 Units

General

The mounting truck shall be 4 x 2, right hand drive and same model as water lorry for standardization as well as spare parts interchangeability. Payload shall be not less than 5,100 kg (at S.G. 0.85) and wheel base not less than 3,280 mm. The fuel tank shall be two compartment having not less than 2,000 liter and 4,000 liters capacity. A gear pump driven by transmission P.T.O. Loading and unloading shall be either by pump or gravity. P.T.O. control lever shall be equipped in cab. An emergency valve control lever shall be at the rear end of tank.

Engine

The engine shall be diesel, 4 cycle, vertical, 6 cylinders, in-line, overhead valve, water-cooled.

Max. output; Not less than 165 HP/3,200 rpm.
Max. torque; Not less than 45 kgm/2,000 rpm.

Tire

The tire size shall be 8.25 - 16 or larger. One complete spare tire shall be supplied.

Fuel Tank

The fuel tank shall be two compartments ellipse sectioned cylindrical type and fabricated throughout in mild steel plate, all internal surfaces lined with zinc metal spraying. The fuel tank shall have not less than 6,400 liter (loading capacity + gas space). The thickness of shell, end plate and bulk head shall be not less than 3.2 mm. Each compartment shall have own depth gauge and bottom valve.

Pump

The pump shall be gear type, driven by transmission P.T.O., and have approx. 300 L/min capacity.

Safety Device

Safety device as emergency valve (emergency bottom valve, safety valve, operating pressure 0.2 - 0.24 kg/cm²), earth reel with wire, depth, gauge guide, shelter, fire extinguishers, etc. shall be provided.

Accessories

The fuel lorry shall be equipped with 2 inch suction/delivery hose, hose packing, strainer, hose wrenches, etc.

4. Pick-up Type Light Vehicle, 4 WD 9 Units

4 wheel drive, pick-up truck, having 3 seating capacity and deck. The engine shall be 4 cylinders, diesel type and/or having max. output not less than 79 HP/3,500 rpm. for diesel and 101 HP/4,200 rpm. for gasoline.

5. Station Wagon Type Light Vehicle, 4 WD 9 Units

4 wheel drive, station wagon, having 9 seating capacity. The engine shall be 4 - 6 cylinders diesel type and/or having not less than 79 HP/5,500 rpm. for diesel and 101 HP/4,200 rpm. for gasoline.

III. BOREHOLE TESTING EQUIPMENT

1. Submersible Pump for
100 mm Well and Generator 10 Units

1.1. General

Submersible motor pump sets shall consist of submersible motor, riser pipes, well cover, discharge elbow, compound gauge, automatic air vent, sluice valve, check valve, electrode, power cable, control panel and diesel engine generator.

1.2. Standards and codes

All submersible motor pump sets shall be in accordance with the following Japanese standards.

- 1) Japanese Industrial Standards (JIS).
- 2) Standards of the Japan Electrotechnical Committee (JEC).
- 3) Standards of the Japan Electrical Manufacturer's Association (JEM).
- 4) Other Japanese standards where applicable.
- 5) Manufacturer's standards.

1.3. Pump technical specifications

1.3.1. Pump type

The pump shall be provided with multi-stage, centrifugal submersible type and suitable submersible electric motor.

1.3.2. Pump components

The different components of the pump shall comply with the following specifications.

- a) Pump casing
The casing shall be made of 304 stainless steel. The pump casing should have rubber material casing rings.

- b) Impellers
The impeller shall be of closed type and made of 304 stainless steel.
- c) Shaft
The shaft shall be made of stainless steel.
- d) Bearings
The pump shall be provided with rubber bearings designed to have increased wearing life and stand the effect of the deep well water.

1.4. Submersible motor

The type of submersible motor shall be water sealed type. Each pump unit shall be provided with a suitable submersible electric motor designed for 3 phase, 380 volts, 50Hz, supplying and 3,000 rpm synchronous speed. Each motor shall be of the squirrel cage induction type. The motor must be suitable for the voltage fluctuation mentioned in specifications (+10%) and that the motor shall be capable of continuous operation under the specified conditions. Motor frame shall be made of stainless steel. Down case and bracket shall be made of cast iron. Motor shaft shall be of stainless steel.

1.5. Riser pipe

The riser pipes shall be lengths not exceeding 5.5 m per 1 pc, the connection type shall be pipe coupling with threads.

1.6. Control panel

Panel construction shall be indoor use. Starting method shall be saturation voltage start type of suitable rating which can operate each submersible pump.

a) Submersible motor protection device

Each control panel shall have motor protection device and protect the motor from follows.

- 1) Over-current.
- 2) Open-phase.
- 3) Inching operation.

b) Water level relay

Each control panel shall have water level relay for electrode in well. The low level electrode shall act as dry run protection stopping the pump when the water level is reached.

1.7. Generator

1.7.1. Outline of equipment construction

Indoor installation diesel generators shall be suitable rating which can operate each submersible pump. The generator sets shall be composed of diesel engine, alternator and pipe frame.

1.7.2. Alternator

Main characteristics and particulars shall be as follows.

Rating:	Continuous
Voltage:	380V.
Frequency:	50Hz.
No. of phase:	3 phase.
Power factor:	0.8
Exciter:	Static self-exciting system.
Coupling with engine:	V-belt.

1.7.3. Engine

Type:	4-cycle, water-cooled diesel engine.
Cooling system:	Water cooled by radiator.
Starting system:	Manual by cranking handle.

1.8. Principal request and supply list

Site condition:	
Temperature;	Max. 40 deg.C.
Altitude;	Max. 500 m.

Capacity:	150 L/min.
Total head:	50 m.
Pump max. dia.:	95 mm.
Motor capacity:	2.2kw.
No. of pumps:	10

Power cable:	
Size x length;	1.25 mm ² x 60 m.
Q'ty (per unit);	1 pc.

Riser pipe:	
Size x length;	40 mm x 5.5 m/1 pc.
Q'ty (per unit);	9 pcs.

Accessories (each unit):

- Diesel engine generator, 1 pc.
- Control panel, 1 set.
- Sluice valve, dia. 40 x 1 pc.
- Check valve, dia. 40 x 1 pc.
- Automatic air vent, 1 pc.
- Compound gauge, 1 pc.
- Well cover, 1 set.
- Discharge elbow, dia. 40 x 1 pc.
- Electrode for prevented low water level (with cable), 60 m x 1 pc.

2. Water Level Detector 10 Units

The unit shall be battery operated type and able to operate not less than 100 m depth.

3. Electric-conductivity Meter 10 Units

4. pH Meter 10 Units

5. Borehole Logger 3 Units

General

The equipment shall consist of normal resistivity, SP and natural gamma suitable for groundwater investigation. Micro resistivity, lateral resistivity, caliper, temperature and gamma/gamma log shall be available with optional measuring modules and probes. One logging run shall be able to simultaneously measure resistivity at two different spacings, SP and natural gamma. An auto-calibration function shall be provided. Log data shall be digitally recordable in magnetic tape or disk as required and be played back by a built-in plotter for confirmation and monitor at field site. It shall be able to transfer the data to external computer for further data processing. The winch shall be built to light weight structural with aluminum material. It shall be convertible to a power winch with attachment of a power pack.

Groundwater Log Module

Resistivity;	Normal 16, 64 inch, automatic (10 ohm-m FS to 10K ohm-m FS).
SP;	Automatic (\pm 500 mV).
Natural gamma;	20 cps to 1 Kcps.

Recorder

Type;	Color plotter (not less than 4 colors)
Recording paper;	Not less than 100 mm in width.
Chart ratio;	1/50, 1/100, 1/200, 1/500.

Data Storage

Type;	Digital recorder by GMT or floppy disc.
Capacity;	Not less than 250 Kbytes with 12 bit data accuracy.

Accessories

Hand winch, manual with sheave	1 set/unit
Cable with connector, 210 m	
Battery pack with case, 12V, 24Ah	1 pc/unit

Battery charger, 110/220 V AC	1 unit/unit
Plastic container	1 pc/unit
Pen	2 sets/unit
Recording paper	20 pcs/unit
Cassette tape or micro floppy disc	20 pcs/unit

IV. GEOPHYSICAL EQUIPMENT

1. Geoelectric Equipment 4 Units

General

The unit shall have signal averaging processor for resistivity and SP measurement with improvement of S/N ratio. Measuring results shall be indicated digitally on LCD screen. For computer processing, digital output plug shall be equipped. The unit shall have built-in memory for storing the data not less than 1,000 points. Console shall be flat panel with numerical key-board for menu-driven operation. Booster and rechargeable battery shall be incorporated in one box for portability.

Transmitter

Output voltage;	Not less than 400 volts p-p.
Output current;	Not less than 200 mA.
Range of current;	Adjustable from 1 mA to 200 mA.

Receiver

Input impedance;	Not less than 1 Meg-ohm.
Potential range;	Selectable upto 6 volts with bi-polarity.
Revolution;	16 bit.
Digital interface;	RS-232C.

Accessories

Cable with reel, 400 m	4 rolls/unit
Cable with reel, 400 m	2 rolls/unit
Electrode (stainless steel)	4 pcs/unit
Battery pack with case, 12V, 24Ah	1 pc/unit
Battery charger, 110V/220V AC	1 set/unit
Operation manual	1 set/unit
Measuring tape;	10 pcs/unit
Hammer	4 pcs/unit
Tester and tools	1 set/unit

2. Electro-magnetic Equipment

2 Units

General

The system shall be the one capable of surveying the underground distribution of Resistivity utilizing electromagnetic method in the areas where the electrode configuration and cables required for Resistivity survey cannot be placed wide enough, especially in the mountaneous area. The system shall be able to extend proper survey, whether with line source or with loop source. The system shall be the one able to survey, in simple manner, the underground structure by means of Resistivity from the data on vertical (Hz) components as well as radial (Hr) components of magnetic field, even with electric line not installed. The system shall be equipped with auto-calibration requiring neither the adjustment by knob nor reading out of data by meter and be further equipped with LCD to read out data. The system shall be the one able to correct topography effect arising from the difference of respective array levels of source and sensor. The system shall be the portable one, light in weight and easily transportable.

Transmitter

Maximum output power: Less than 1,000W;
Maximum output current: Less than 10A.
Frequency range: 0.1Hz to 7,500 Hz.
Power supply: AC 220V.
Weight: Less than 20 kg.
Dimension: Smaller than 35 x 45 x 50 cm.

Receiver

Input: Not less than 3 components.
Measuring channel: Not less than 2 components.
Data storage: Not less than 260 records.
Operating method: Interactive operation.
I/O interface: RS-232C.
Frequency range: 0.12 Hz - 8,000 Hz.
Dimension: Smaller than 25 x 35 x 35 cm.
Weight: Less than 10 kg.

Sensor (G4S type)

Frequency range: 2 Hz to 10 KHz.
Length: Less than 40 cm.
Diameter: Less than 10 cm.

System structure

MELIS Receiver.
MELIS transmitter with 400 m loop.
MELIS sensor.
Generator.

Software: FREMIS interpretation for IBM PC
 computible.
 Desk-top computer for data processing with flexible disk
 driver, printer and plotter.

V. BOREHOLE EQUIPMENT AND MATERIALS

1. Casing and Screen, Dia. 100 mm.

1.1. Well casing, size 100 mm,
 4 mm thickness 2,233 pcs.

Type; Fiber glass reinforced plastic (F.R.P.)
 casing, thread joint type.
 Nominal diameter; 100 mm.
 Thickness; Not less than 4 mm.
 Standard deflection
 load by parallel
 plate at 3 mm; 920 kg.f/m.
 Crushing load; 2,840 kg.f/m.
 Unit length; 4 m.

1.2. Well screen, size 100 mm,
 4 mm thickness 705 pcs.

Type; Fiber glass reinforced plastic (F.R.P.)
 screen, thread joint type.
 Nominal diameter; 100 mm.
 thickness; Not less than 4 mm.
 Standard deflection
 load by parallel
 plate at 3 mm; 640 kg.f/m.
 Crushing load; 1,970 kg.f/m.
 Slot width; 1 mm.
 Slot length; 55 mm. (arc length)
 Slot cutting; 4 rows with 70 deg. 27' angle at the
 axis.
 Opening area; 15%
 Unit length; 4 m.

1.3. Well casing, size 100 mm,
 5.21 mm thickness 1,715 pcs.

Type; Steel casing, seamless, API 5A H40 with
 short thread coupling joint.
 O.D.; 114.3 mm.
 Thickness; Not less than 5.21 mm.
 Minimum yield
 strength; Not less than 40,000 psi.
 Minimum tensile
 strength; Not less than 60,000 psi.
 Unit length; 6 m.

2.3. Well casing, size 150 mm
7.32 mm thickness 704 pcs.

Type; Steel casing, seamless, API 5A H-40
with short thread coupling joint
O.D.; 168.3 mm.
Thickness; Not less than 7.32 mm.
Minimum yield strength; Not less than 40,000 psi.
Minimum tensile strength; Not less than 60,000 psi.
Unit length; 6 m.

2.4. Well screen; size 150 mm
stainless steel 192 pcs.

Type; Continuous slot, V-shaped wire wound
design, outer winding securely jointed
to support rod, stainless steel
Materials; 304 SS or equivalent
O.D.; 6-5/8".
Collapsible pressure; Not less than 250 psi.
Tensile strength; Not less than 30 ton
Slot size; Not more than 0.5 mm.
Opening area; Not less than 20%.
Joint; Male/femal thread (material API 5A H-40)
Unit length; 3 m.

3. Hand Pump 470 units

The hand-pump shall be of a deep-well plunger type, capable to lift water for 1,000 l/H or more at 18 m head and installed onto any deep well of 100 mm size. The standard accessories good enough for 18 m depth and set-up tools shall be included within any hand-pump set.

4. Submersible Pump with Generator 120 Units

4.1. General

Submersible motor pump sets shall consist of submersible motor, riser pipes, well cover, discharge elbow, compound gauge, automatic air vent, sluice valve, check valve, electrode, power cable, control panel and diesel engine generator.

4.2. Standard and codes

All submersible motor pump sets shall be in accordance with the following Japanese Standards.

- 1) Japanese Industrial Standards (JIS).
- 2) Standards of the Japan Electrotechnical Committee (JEC).

- 3) Standards of the Japan Electrical Manufacturer's Association (JEA).
- 4) Other Japanese standards where applicable.
- 5) Manufacturer's standards.

4.3. Pump technical specifications

4.3.1. Pump type

The pump shall be provided with multi-stage, centrifugal submersible type and suitable submersible electric motor.

4.3.2. Pump components

The different components of the pump shall comply with the following specifications.

- a) Pump casing
The casing shall be made of 304 stainless steel. The pump casing should have rubber material casing rings.
- b) Impellers
The impeller shall be of closed type and made of 304 stainless steel.
- c) Shaft
The shaft shall be made of stainless steel.
- d) Bearings
The pump shall be provided with rubber bearings designed to have increased wearing life and stand the effect of the deep well water.

4.4. Submersible motor

The type of submersible motor shall be water sealed type. Each pump unit shall be provided with a suitable submersible electric motor designed for 3 phase, 380 volts, 50Hz, supplying and 3,000 rpm synchronous speed. Each motor shall be of the squirrel cage induction type. The motor must be suitable for the voltage fluctuation mentioned in specifications (+10%) and that the motor shall be capable of continuous operation under the specified conditions. Motor frame shall be made of stainless steel. Down case and bracket shall be made of cast iron. Motor shaft shall be of stainless steel.

4.5. Riser pipe

The riser pipes shall be lengths not exceeding 5.5 m per 1 pc, the connection type shall be pipe coupling with threads.

4.6. Control panel

Panel construction shall be indoor use. Starting method shall be saturation voltage start type of suitable rating which can operate each submersible pump.

a) Submersible motor protection device

Each control panel shall have motor protection device and protect the motor from follows.

- 1) Over-current.
- 2) Open-phase.
- 3) Inching operation.

b) Water level relay

Each control panel shall have water level relay for electrode, in well. The low level electrode shall act as dry run protection stopping the pump when the water level is reached.

4.7. Principal request and supply list

Site condition:

Temperature; Max. 40 deg.C.
Altitude; Max. 500 m.

Capacity; 120 L/min.
Total head; 40 m.
Pump max. dia.; 95 mm.
Motor capacity; 1.5 kw.
No. of pump; 110.

Power cable:

Size x length; 1.25 mm² x 60 m.
Q'ty (per unit); 1 pc.

Riser pipe:

Size x length; 40 mm x 5.5 m/1 pc.
Q'ty (per unit); 9 pcs.

Accessories (each unit):

Diesel engine generator.
Control panel, 1 set.
Sluice valve, dia. 40 x 1 pc.
Check valve, dia. 40 x 1 pc.
Automatic air vent, 1 pc.
Well cover, 1 set.
Discharge elbow, dia. 40 x 1 pc.
Electrode for prevented low water level (with cable), 60 m x 1 pc.

VI.	<u>AGENTS</u>	<u>1 LOT</u>
1)	Bentonite	150 ton
2)	C.M.C.	4 ton
3)	Foam agent	2 ton

VII. SPARE PARTS

Manufacturer's recommended spare parts for two (2) years operation shall be provided in an amount of not less than 15% on machinery cost.

- 1) Spare parts for drilling rig including truck, engine, pump and down-the-hole hammer 1 lot
- 2) Spare parts for high pressure air compressor including engine 1 lot
- 3) Spare parts for air compressor for borehole development including engine 1 lot
- 4) Spare parts for cargo truck including crane and engine 1 lot
- 5) Spare parts for water lorry including engine 1 lot
- 6) Spare parts for fuel lorry including engine 1 lot
- 7) Spare parts for pick-up truck 1 lot
- 8) Spare parts for station wagon 1 lot
- 9) Spare parts for submersible testing pump and generator 1 lot
- 10) Spare parts for borehole logger 1 lot
- 11) Spare parts for geoelectric equipment 1 lot
- 12) Spare parts for electro-magnetic equipment 1 lot
- 13) Spare parts for hand pump 1 lot
- 14) Spare parts for submersible pump 1 lot

6. 維持管理体制

ARDは、Ⅲ. 3実施体制の表3-1のようになりの数の技術者を抱えている。

(1) ARDの本庁では、井戸の資料管理を行っている。

① 各年毎の井戸建設実績を1冊の本にまとめ、きれいに整理されている。(表3-4)

実績の項目：村落名、州名、深さ、径、揚水量、柱状図、掘削日 等。

② 上記の項目の重要項目をコンピューターに入力して一覧表に整理してある。(表3-5)

このように井戸台帳が細かく整理しており、感心させられた。

(2) 各県事務所でも、維持管理班を編成し各井戸毎に調査を行い、①県事務所で修理出来るものは修理し、②修理が不可能なものは、地域オペレーションセンターへ連絡して対応している。

このように維持管理は極めてシステムチックに実施されており、全く問題がないと思われる。

(3) 各地域オペレーションセンターでは、大規模かつ良く整備されたWork Shopが完備しており、多くの機械工が整備をしている。

井戸掘用リグやこれらに付帯するトラックもここで整備され送り出される。

又、故障した場合もここで整備される。

今回無償要請が出されているリグについても同様である。

K.S.

วันที่ 1426/3126 น. 15 นอ 30

ศูนย์ปฏิบัติการ ร.พ.ช. ภาคตะวันออกเฉียงเหนือ ดยบเหนือ
รายละเอียดเกี่ยวกับชนิดและขนาดท่อ

จังหวัด นครราชสีมา
อำเภอ 10901 ตำบล อ่างทอง
หมู่บ้าน โคกมะเี หมู่ที่ 1
หมายเลขท่อ KSEb.5-101/471-87

ขนาดท่อ ϕ 4 นิ้ว จำนวนท่อที่ใช้ 60 ฟุต (60 x 9) ท่อน
 ท่อ PVC, ท่อ ASTM, ท่อ GI,

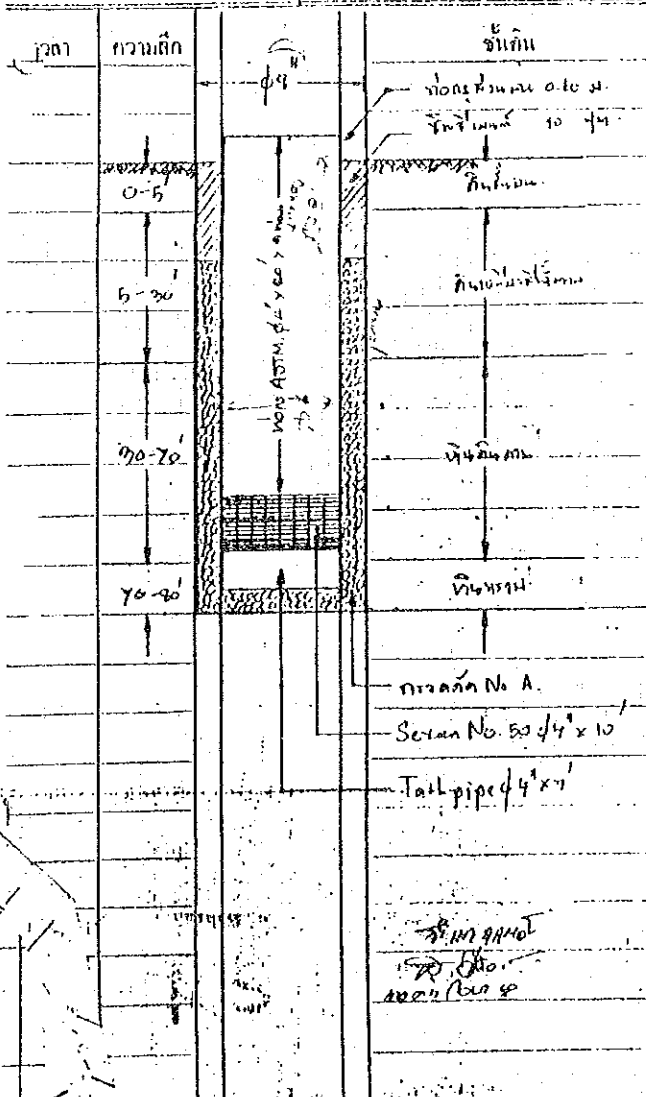
ท่อกรองน้ำ PVC, Stainless

ขนาด ϕ 4 นิ้ว เบอร์ 50 จำนวนท่อที่ใช้ 10 ฟุต (40 x 1) ท่อน

ท่อเซาะร่อง PVC, ASTM, GI,

ชุดเจาะ 101 ที่ 401 บันทึกเครื่องเจาะ กว. หนัก 400 ปอนด์ ชีตหัวเจาะ หัว สลัก หัว 1154

เริ่มเจาะวันที่ 21 เดือน มิถุนายน พ.ศ. 2529 เวลา 24 เดือน มิถุนายน พ.ศ. 2529



รายละเอียดของบ่อบาดหลังจากเจาะ

บ่อ น้ำดื่ม เติง เติม รอพักน้ำ

ลดนท่อ เรียบร้อย ยัง

ความลึกของบ่อเจาะ 75 ฟุต

ระดับน้ำแข็ง 20 ฟุต

ปริมาณน้ำ 15 GPM.

Pump test bail test อื่น ๆ

ระดับน้ำตก 20 ฟุต

ซีตบ่อบาด เรียบร้อย ยัง

แก้ก้นบ่อข้าง เรียบร้อย ยัง

จำนวนประแสท 970 กน

64 หลังกวเรือน

ลงชื่อ *[Signature]* ผู้รายงาน

(เลข สรพท. หัว 1154)

ตำแหน่ง ช่างเทคนิค 2

วันที่ 22 เดือน มิถุนายน พ.ศ. 2529

ผู้ควบคุมหน่วย *[Signature]*

ลงชื่อ *[Signature]*

(ชื่อ นามสกุล นอ. (ชื่อ))

วันที่ 21 เดือน มิถุนายน พ.ศ. 2529

ข้อควรระวังในการใช้ท่อและอุปกรณ์ต่าง ๆ ให้ถูกต้อง

** INW01 **

表 3-5 東北タイ実績
(コンピュータ資料の一部)

ประมวลผลข้อมูลทาง
การคำนวณและเปรียบเทียบ

หน้า - 8
06/10/97

จำนวน ขอบเขต

ลำดับ	หมายเลขขอบเขต	ชื่อ	สถานที่	วันที่	ประเภท	ปริมาณ	ชนิด	หน่วย	ราคา	รวม	หมายเหตุ
36	-	เมือง	เมืองหลวง	02/07/13	เมืองหลวง	80	เมืองหลวง	เมืองหลวง	-	-	เมืองหลวง
	13W-KK0036	-	สถานีวิทยุหลวง	10/05/13	สถานีวิทยุหลวง	-	สถานีวิทยุหลวง	สถานีวิทยุหลวง	-	-	สถานีวิทยุหลวง
37	พท. 25022	บ้านนา	นา	14/08/13	นา	100	นา	นา	ASTM-B-00	45	26.00.00
	13W10KK0037	-	เมือง	18/05/13	เมือง	USA	เมือง	เมือง	-	-	35 1,274
38	พท. 25023	เมือง	ศาล	09/09/13	ศาล	270	ศาล	ศาล	ASTM-B-00	20	94.00.00
	13W10KK0038	-	มหาวิทยาลัยขอนแก่น	20/08/13	มหาวิทยาลัยขอนแก่น	ASTM-B-00	มหาวิทยาลัยขอนแก่น	มหาวิทยาลัยขอนแก่น	-	-	171 -
39	-	เมือง	เมือง	05/08/13	เมือง	100	เมือง	เมือง	-	-	เมือง
	13W-KK0039	-	เมือง	25/08/13	เมือง	-	เมือง	เมือง	-	-	-
40	-	เมือง	เมือง	05/08/13	เมือง	250	เมือง	เมือง	-	-	เมือง
	13W-KK0040	-	สถานีวิทยุหลวง	00/00/00	สถานีวิทยุหลวง	-	สถานีวิทยุหลวง	สถานีวิทยุหลวง	-	-	-

7. 実施スケジュール

当国の気象は、5～10月までが雨期で、11月から4月までが乾期である。

今回の早ばつでも、雨期の雨が降らなければならない時期に降らないことが最大の問題点であることから、要請のあった資機材の供与は、63年度の出来る限り早い時期が望ましいと考える。

8. 要請の内容

今年おそった早ばつを契機として農村開発を担当しているARDは、東北地域の水開発を促進するため深井戸建設事業を最優先の緊急事業として促進することを計画した。

(1) 東北タイの早ばつ被害状況

東北部で早ばつ被害を受けているのは全部落数25千の内9千部落と約40%に当り、特に被害が大きかったのはKhon Kaen, Kalasin Yasothon, ubon Rachasima, Chaiyaplanなどで、これらの県の被害戸数は50～70%に達している。

東北タイの農家一世帯当りの年間所得が、17.4～25千バーツで当国内の最貧困地域であるが早ばつによりこれらの所得は更に低下し10千バーツ以下になり早ばつの被害は極めて深刻になっている。(表1-5参照)

(2) ARDの地下水用開発計画

ARDは村落の飲雑用水開発のため70ℓ/日・人を開発することとしている。その内訳は、

飲料水	5ℓ/日・人
雑用水	45ℓ/日・人
家畜用水	20ℓ/日・人
計	70ℓ/日・人

- ・ 雑用水：家庭用水の他菜園用水又は部落によっては苗代用水が含まれる。
- ・ 家畜用水：牛50ℓ/頭、豚20ℓ/頭となっているが平均して20ℓ/人・日としている。

(3) 深井戸建設による効果

ア、貧困地域の村落農民が用水不足で深刻な状況に追い込まれることは、民政安定上大きな問題になることから深井戸建設により農民の定着と安定が図られる。

イ、深井戸の水質は小溜池や浅井戸のものより水質が良く衛生上有利である。

ウ、井戸による給水では、大規模なかんがいは不可能であるが、飲料水及び家庭菜園等の雑用水供給のためには、ダム建設等に比し速効性があること、効果が広範囲に及ぶことから効果的である。

(4) 緊急地下水開発計画（5年間）

A R Dでは5ケ年間（1988年～1992年）に7,000本の深井戸建設を行い国家の緊急飲雑用水供給対策に対応することとしている。

本計画の達成には年間1,400本の井戸建設が必要であるが現有49台のリグでは860本/年の能力しかないため、不足分の540本を日本へ無償要請しているリグで掘削し計画を達成しようとするものである。

7,000本の深井戸は全国レベルで実施するものであるが特に早ばつ被害が大きく民政安定のための施策が求められている東北地域を最緊急地域と考え、当初の3年間は要請中の9台のリグと合せて3,000本を掘削し、16県85郡の1,269村に被益させる計画である。

表 1-5 東北タイ各県のかんばつ被害状況

	県 名		村 落 数		世 帯 数 (1,000戸)		
	全 体	被 害	全 体	被 害	全 体	被 害	
1	Nong Khai	1,012	329	32.5%	74.7	24.3	32.5%
2	Loei	707	211	29.8	70.1	10.5	14.7
3	Udon Tani	2,043	427	20.9	159.1	45.3	28.7
4	Sakon Nakhon	1,053	252	22.9	97.6	36.6	39.5
5	Nakhon Phanom	852	196	23.0	94.3	14.5	15.4
6	Khon Kaen	1,759	1,265	72.1	161.2	88.8	55.1
7	Kalasin	1,107	424	38.3	98.7	52.2	52.9
8	Mukdahan	439	147	33.5	-	11.2	-
9	Maha Sarakham	1,371	483	25.2	97.7	36.7	37.6
10	Roi-et	1,867	936	50.1	149.5	66.5	44.5
11	Yasonthon	714	486	68.1	58.1	35.0	60.2
12	Udon Ratchatani	2,496	1,285	51.5	183.4	110.3	60.1
13	Chaiyaphum	1,089	534	49.0	124.1	81.3	65.5
14	Nakhon Ratchasima	2,710	919	33.9	206.6	104.3	50.5
15	Buri Ram	1,920	593	30.9	129.4	46.6	36.0
16	Surin	1,743	513	29.4	132.4	41.6	31.4
17	Si Saket	1,690	246	14.6	138.8	23.9	17.2
合 計		24,618	9,250	37.6%	1,975.7	831.7	42.1%

IV 協力の内容

1. 要請の妥当性

当国の農村部は都市部に比べ環境条件が悪く生活水準の向上及び民政の安定のため何らかの援助が必要となってきた。

中でも飲雑用水の供給は、非常に重要であるが当国内農村部のわずか15%しか安全かつ十分な量の飲雑用水の供給を受けていない実態である。

今回、追いつけをかけるようにして起った大旱ばつは、地域農民を更に疲へいさせる結果となった。この問題を解決すべく国王を中心として、特に問題の大きい東北タイを救済すべく「Green Revolution 計画」がスタートし抜本的な援助をしようとしている。

このような状況の中で、今回当国から要請のあった緊急深井戸掘削計画は、これをもって全ての解決にならないがGreen Revolution 計画の一貫と位置付けられており緊急的なアプローチとしては極めて効果的であり無償資金協力を実施することは妥当である。

2. タイ側実施体制

現地調査の結果、タイ側の実施体制は良く整備されており日本の無償協力により井戸掘削機械が供与されても問題はない。

当国の予算年度は、10月～9月までで、1987～1988年度までの予算には無償要請中のリグが含まれたものとなっていない。

しかし、供与を受けた場合は、道路予算を一部流用して緊急的な要望である東北タイの地下水開発を推進する旨表明した。

1988～1989年度については、当初から無償供与の資機材を含めた予算要求を行うこととしている。

このことから実行体制は、組織及び予算の両面について問題ない。

3. 供与対象資機材計画、機械リスト

(1) M/Mにあるとおり、相手側の要望を踏まえた資機材供与計画は次のとおりである。

- ① Drilling Rigs
- ② Vehicles
- ③ Borehole Testing Equipment
- ④ Geophysical Equipment
- ⑤ Others (Borehole Equipment Materials, etc)

(2) ARDは、5年間に7,000本の深井戸掘削を実現するためにリグ9台を第1優先としている。

(3) これらを踏まえ次のような機材供与を提案する。

供与計画の基本方針

- ① リグは9台とし計画通り掘削を進める。
- ② D. T. Hは、実績から岩盤地帯の多いコンケンに2台、ナコンに1台の計3台とする。
- ③ 車輛は、手持車輛が比較多いトラック類は現有機械を利用することとし、不足し更に老朽化している車輛を供与することとする。

このことから Pick-up & Station Wagon を2台ずつとする。

- ④ 井戸調査機械は、揚水量試験用の水中ポンプ、水位計、電気電導度計、PH検査器の各々について3台をコンケンに、2台をナコンに計5台を供与する。又、検層機は100m用を2台(1台ずつ)とする。
- ⑤ 地質調査器は、電気探査器をナコン&コンケンに1台ずつ計2台供与する。
- ⑥ ケーシング及びスクリーンは、要請のあった1年分(540本分)の内、当面必要なφ4"だけを供与する。全体の80%(約432本分)
- ⑦ Agentsは要請内容が2年分となっているため、この半分の1年分を供与する。

ベントナイト 75 ton
 C M C 2 ton
 発泡剤 5 ton

但し発泡剤については要請量が違うため1年分として計算した。

- ⑧ スペーパーパーツは、10%程度必要と考える。

機 械 名	要請数	提案数
DRILLING RIG		
1. Top head drive type, 4×4, truck mounted, rotary drilling rig	9 units	9 台
2. D. T. H. hammer tools	4 units	3 台
3. High pressure air compressor	4 units	3 台
4. Portable air compressor for borehole development	9 units	—
VEHICLES		
1. Cargo truck (7 ton) with 3 ton crane, long body type	9 units	—
2. Water lorry	6 units	—
3. Fuel lorry	2 units	—
4. Pick-up type light vehicle, 4 WD	9 units	2 台
5. Station wagon type light vehicle, 4 WD	9 units	2 台
BOREHOLE TESTING EQUIPMENT		
1. Submersible pump for 100 mm well and generator	10 units	5 台

2. Water level detector	10 units	5 台
3. Electric-conductivity meter	10 units	5 台
4. pH meter	10 units	5 台
5. Borehole logger (100 m 用)	3 units	2 台
GEOPHYSICAL EQUIPMENT		
1. Geoelectric equipment	4 units	2 台
2. Electro-magnetic equipment	2 units	—
BOREHOLE EQUIPMENT AND MATERIALS	要請の80% (φ 4"のみ)	
AGENTS	要請の半分	
Spare Parts	10 %	

結論と提言

1. 結論

都市部に比べ生活環境整備が遅れている農村部の開発を担当している農村開発促進庁 (ARD) は、国家開発計画の中の農村開発計画に沿って、積極的に事業を実施しているが未だその恩恵を受けていない多くの地域が残っている。

農村開発の中でも、特に重要な飲雑用水の供給は緊急に必要とされており、今回の無償資金協力により供与される深井戸掘削機材と ARD 職員の努力により、7,000 本の緊急掘削計画が5年以内に完了することが強く望まれている。

特に、東北タイの開発は、国家安全保障上重要地域であるにも拘らず、他の地域に比べ大きく遅れているのが現状である。

以上のことから、この深井戸機材供与を一つの契機として、タイ国農村開発が積極的に推進され、合わせて中長期的な対策を実施することにより、タイ国農村の環境基盤、及び農業基盤の整備が進み、農村の生活向上と民生の安定が図られることを期待するものである。

2. 提言

無償資金協力により深井戸掘削機材を供与することは、今次の早ばつ対策として極めて効果的である。しかし乍らタイ側に深井戸掘削技術者も少なく、掘削地点選定を行う水理地質技術者のレベルも低いのが現状である。

このような実態から、M/Mで取りまとめたとおり、ARDから地下水開発に係る地下水技術者の短期専門家派遣について強い要請があった。ARDのこの分野での技術水準が必ずしも充分でないため、今回の無償資金協力と合わせて専門家派遣による技術協力を行なうことは極めて、効果的と考えられる。

又、ARDが進めている地下水開発及び農村開発について、ARDスタッフの日本での研修要望が出されたので、M/Mに取りまとめ、日本政府に伝達することを約した。これは、

タイ国の農村開発の重要性及び今回の地下水開発の観点から、効果的と考えられる。

3. 供与対象資機材計画、機材リスト

(1) M/Mにあるとおり、相手側の要望を踏まえた資機材供与計画は次の通りである。

- ① Drilling Rigs
- ② Vehicles
- ③ Borehole Testing Equipment
- ④ Geophysical Equipment
- ⑤ Others (Borehole Equipment Materials, etc.)

(2) ARDは、5年間に7,000本の深井戸掘削を実現するためリグ台の供与を第一優先としている。

(3) これらを踏まえ、次のような機材供与を提案する。

供与計画の基本方針

- ① リグは9台とし、計画通り掘削を進める。
- ② D. T. H (エアーパーカッション)は、過去の実績から岩盤地帯の多いコンケンに2台、ナコンラチャシマ(コーラート)の計3台供与する。
- ③ 車は、現保有台数の比較的多いトラック類はこれを利用することとし、不足し、更に老朽化している車輛について供与することとする。

このことから、Pick-up、Station wagon を2台ずつ供与する。

- ④ 井戸調査機械は、揚水量試験用の水中ポンプ、水位計、電気電導度計、Ph 検査器の各々について3台をコンケンに、2台をナコンラチャシマに計5台を供与する。又、検層機は、100 m用を2台(1台ずつ)とする。
- ⑤ 地質調査器は、電気探査器をナコンラチャシマとコンケンに1台ずつ計2台供与する
- ⑥ ケーシング及びスクリーンは、要請のあった1年分(540本分)のうち、当面必要な口径4インチのものだけを供与する。全体の80%(約432本分)
- ⑦ Agents(調泥剤)は、要請内容が2年分となっているため、一の半分の1年分を供与する。

ベントナイト	75トン
CMC	2トン
発泡剤	5トン

但し、発泡剤については要請量が違うため1年分として計算した。

- ⑧ スーパーパーツを、10%程度供与する。

VI その他

1. ミニッツ

MINUTES OF DISCUSSIONS FOR THE PRELIMINARY STUDY

On Urgent Boreholes Project in Drought-stricken Rural Areas in the Kingdom of Thailand

In response to the request of the Royal Thai Government, the Government of Japan decided to conduct a preliminary study on Urgent Boreholes Project in Drought-stricken Rural Areas (hereinafter referred to as "the Project") and entrusted the study to the Japan International Cooperation Agency (JICA). JICA sent to the Kingdom of Thailand the study team headed by Mr. Akira Ouchi, for 13 days from October 18 to 30, 1987.

The Team had a series of discussions and exchanged views with the officials concerned of the Royal Thai Government led by Mr. Sanan Vongpuapan, Secretary General of the Office of Accelerated Rural Development (ARD), the Ministry of Interior, and observed the related facilities and equipment with the Project.

As the result of the discussions and the study, both sides agreed to recommend to their respective Governments that the major points of understanding reached between them, attached herewith, should be examined towards the realization of the Project.

October, 29th, 1987

Bangkok, Thailand

和田 温之

For Mr. Akira Ouchi
The Leader of Japanese
Preliminary Study Team,
JICA

Sanan Vongpuapan

Mr. Sanan Vongpuapan
Secretary-General, Office of
Accelerated Rural Development,
Ministry of Interior
Royal Thai Government

ATTACHMENT

1. Objective

The objective of the Project is to provide the necessary equipment for urgent borehole drillings in rural areas in order to accelerate the groundwater development and to support rural inhabitant in 17 provinces in Northeast region of Thailand.

2. Executing Agency

Office of Accelerated Rural Development, Ministry of Interior, is responsible for the technical and administrative matters of the Project.

3. Undertakings of the Government of Japan

The Team will convey to the Government of Japan the intention of the Royal Thai Government that the former takes necessary measures to cooperate by providing the equipment listed in ANNEX 1 within the scope of Japanese grant aid programme.

4. Understanding of Japan's Grant Aid System

The Thai side has understood Japan's Grant Aid System explained by the team.

5. Undertaking of the Royal Thai Government

The Royal Thai Government will take the necessary measures listed in ANNEX 11, as proposed by the Team on condition that the Grant Aid would be extended to the Project.

6. Technical Cooperation

The Thai side has requested the Team the dispatchment of Japanese experts, and training of ARD staff in Japan, in the related field of this project.

M W

Kamai

ANNEX I

Recommendable Equipment list for the project
(in priority order)

1. Drilling Rigs
2. Vehicles
3. Borehole Testing Equipment
4. Geophysical Equipment
5. Others(Borehole Equipment Materials,etc.)

M. W

Aman

ANNEX 11

UNDERTAKINGS OF THE ROYAL THAI GOVERNMENT

1. To bear the following commissions to the Japanese foreign exchange bank for the banking services based upon the Banking Arrangement.
 - 1) Advising commission of Authorization to Pay
 - 2) Payment of commission
2. To ensure prompt unloading, tax exemption, custom clearance for the products purchased under the grant at a port of disembarkation in Thailand. Arrangements for prompt internal transportation, to be paid under the grant, shall be made for the products.
3. To exempt Japanese nationals from custom duties, income taxes and other fiscal levies which may be imposed in Thailand with respect to the supply of the products and services under the verified contracts. These exemptions shall be subject to the existing rules and regulations which are applicable to similar grant aid programmes.
4. To accord Japanese nationals whose services may be required in connection with the supply of the products and the services under the verified contract, such facilities as may be necessary for their entry into Thailand and stay therein for the implementation of their work.
5. To maintain and use properly and effectively the equipment purchased under the grant.
6. To bear all the expenses other than those to be borne by the grant.

M W

Kamae

JICA