

Scollard Member Coal, Alix Area

Drilling Report, 1982

**Alberta
Geological Survey**



Alberta
RESEARCH COUNCIL
Natural Resources Division



SCOLLARD MEMBER COAL, ALIX AREA.

DRILLING REPORT, 1982

by

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1983

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INTRODUCTION

The Alberta Geological Survey, a department of the Alberta Research Council (ARC), in its fourth year of a five year contract with Alberta Energy and Natural Resources (AENR), cored five testholes in the Alix area northeast of the City of Red Deer (Fig. 1) to supplement information obtained from twenty-nine testholes drilled during the 1981 drilling program. In addition, one testhole was cored in the Camrose area (Fig. 1) to provide information to a previous study conducted in the area.

This report discusses methods of preparations and operations (drilling, coring, logging, cementing, and reclamation) which are similar to those used in previous years. Also included are a cost analysis of the coring program and individual performance graphs for each testhole cored. In conclusion, a program evaluation with recommendations pertaining to the 1982 program is presented.

Field operations started on May 31 and were completed on June 24. During this period six testholes were successfully completed in eighteen 24-hour working days. Excellent weather, a high core recovery rate (93%) and good drilling personnel and equipment were all contributing factors to a successful drilling season.

METHODS OF PREPARATIONS

SELECTION OF DRILLING LOCATIONS

Data on the same general area, obtained from 1974, 1978 and 1981 ARC drilling programs, were utilized to determine the locations for the five holes to be cored in the Alix region. For this purpose consideration was also given to physiographic features and type and thickness of drift. The Battle Formation was used as a marker for determining the "total depth" for each testhole. Data from a 1975 ARC drilling program was researched to establish the location for the one testhole cored in the Camrose area.

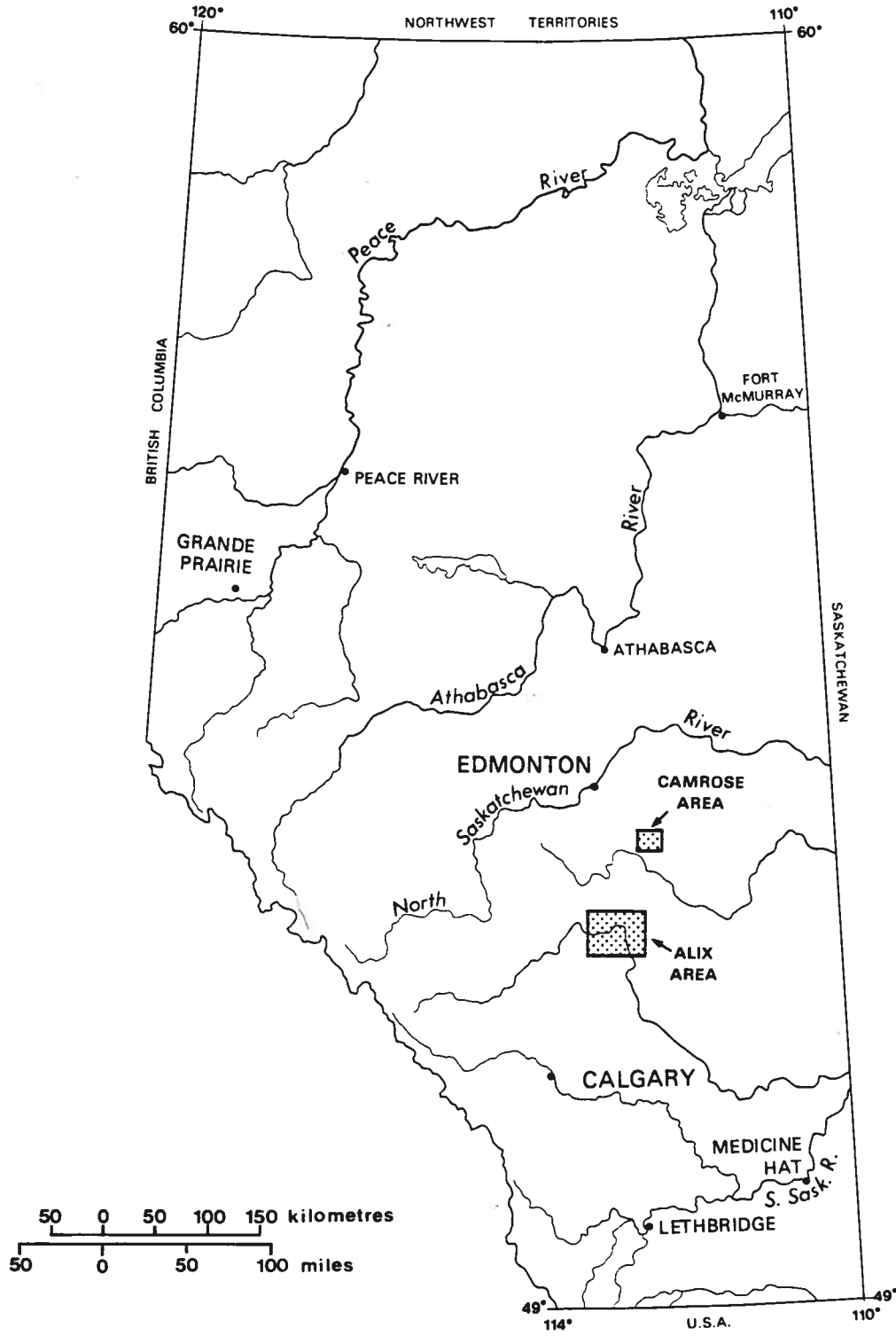


Figure 1. Area of study

| Irish, 1970 | | Cool Coal Seams Zones | |
|-------------------------|----------------------|-------------------------------|-----------------------|
| Wapiti Formation | Paleocene | Paskapoo Formation | |
| | | Lignite | |
| | | Scollard Member | |
| | | No 14 ARDLEY - WABAMUN | |
| | | No 13 Nevis | |
| | Cretaceous | Edmonton Group | Battle Fm |
| | | | Whitemud Fm |
| | | Horseshoe Canyon Formation | No 12 THOMPSON |
| | | | No 11 Carbon-Paton |
| | | | No 10 Marker seam |
| | | | No 9 Big Island |
| | | | No 7 Weaver - Daly |
| | | | No 5 Newcastle |
| No 2 Clover Bar | | | |
| No 1 DRUMHELLER | | | |
| Upper Belly River Group | Bearpaw | | |
| | LETHBRIDGE COAL MBR. | | |
| | Oldman | | |
| | TABER | | |
| | Foremost | | |
| | ? | | |
| | Lea Park | | |
| | Upper Milk River | | |
| | | | |
| K ₁ | Crownsnest Volcan | | |

FIGURE 2

Table of Formations and Coal Zones

TENDERS

Tenders for coring were invited through the Edmonton Journal and the Calgary Herald on April 2, and 3, 1981, and the contract was awarded to Sky-Line Drilling Ltd., of Calgary on May 4. Because BPB Instruments of Calgary had provided the logging services for 1981, and the 1982 program was primarily an extension of the 1981 program with only six testholes involved, BPB was requested to provide the 1982 geophysical logging services. For details of contracts, see Appendices A and B.

GOVERNMENT CLEARANCE

An application for an Exploration Approval and a Deep Drilling Permit was submitted to the Energy Resources Conservation Board (ERCB) on March 10, 1982. The Approval and Permit, without any special conditions attached, were received on April 25, and May 11, 1982, respectively.

The counties of Lacombe, Red Deer and Camrose, in which drilling operations were to be carried out, were informed in writing on April 19 of the exploration work to be done. None of the three counties expressed any objections.

A geophysical license and permit, required to conduct exploration work in the province of Alberta were in force during the 1982 program.

PERSONNEL

Three permanent employees of ARC participated in the drilling program:

| | |
|----------------|--------------------|
| R.A. Rahmani | Project Manager |
| J.R. Nurkowski | Geologist |
| A. Bosman | Operations Manager |

Two geology university students were hired to assist in preparing the 1982 program, however, their main responsibility in the field was to process the core (washing, measuring, logging, boxing and labelling) as it was retrieved at surface. Two local high school students from Lacombe were hired for assistance. A field schedule of one geology student and one high school

student on a 12 hour day or night shift, over a 5 day period, followed by two days off, was used.

VEHICLES AND COMMUNICATIONS

Five vehicles were obtained through the Alberta Government Central Vehicle Service Pool and employed as follows:

- one sedan, used by the project manager
- one sedan, used by the operations manager
- one half-ton truck, used by the geologist
- one half-ton truck, used for crew shift changes
- one Econoline Van, used as a drill site office unit.

Due to the relatively short duration of the 1982 program, it was decided not to install mobile telephones or mobile radios in any of the vehicles.

METHODS OF OPERATIONS

DRILLING LOCATIONS

Because the drilling contractor employed a 12 m long tractor-trailer combination for the storing of water, corepipe, casing, drilling materials and all auxiliary drilling equipment, large drillsite areas were required. Consequently, only one testhole could be drilled on crown land (road allowance). The remaining five testholes were drilled on privately owned land for which permit arrangements were made with the landowners prior to drilling.

In the field, exact hole locations were obtained by measuring the distance from the nearest northeast section corner to the drill site. Ground elevations of the testholes were obtained from N.T.S. 1:50,000 scale topographic maps.

CORING

Four bids were received for the 1982 coring program, and after careful consideration of all factors, the lowest bid submitted by Sky-Line Drilling Ltd. of Calgary was accepted. The following equipment was provided for the program by the contractor:

One Ingersoll-Rand, Cyclone drill rig, model TH60-1980, equipped with one Gardner Denver 5 x 6 inch mud pump, an Ingersoll-Rand Spiro-Flo, 600cfm - 250psi air compressor, a hydraulic injection pump, and an Eastman drilling recorder. Additional drilling equipment included 305 metres of wireline core pipe with two complete split-tube core barrels and one tractor-trailer unit which contained the water tank and housed the core pipe, core barrels, casing, a welder, a powerplant, tools, spare parts and a supply of drilling materials.

The drill rig was operated by a driller and two helpers per shift and supervised by a tool push on a 24 hour basis. A "Daily Drilling Report" was kept by each driller recording all events and times as related to his shift including all the consumed "chargeable" items. The report was checked and signed by the driller and an ARC representative at the end of each shift. The report became the basis for payment for all charges and costs incurred by the contractor.

Six coreholes were successfully completed with the following results:

| Hole no. | drilled (m) | cored (m) | recovered (m) | recovered (%) |
|----------|-------------|-----------|---------------|---------------|
| CH1-82 | 14 | 83 | 74.5 | 90 |
| CH2-82 | 22 | 206 | 192.5 | 93 |
| CH3-82 | 22 | 260 | 247.5 | 95 |
| CH4-82 | 43 | 121 | 113.0 | 93 |
| CH5-82 | 42 | 119 | 110.0 | 92 |
| CH6-82 | 18 | 85 | 77.0 | 91 |

Operational procedures were identical for each hole. After the overburden was drilled with a 22 cm insert drill bit and cased off with 18 cm steel casing, the hole was cleaned out with a 15.5 cm rock bit, after which continuous coring was carried out in each hole until "total depth" was reached. Because of the relatively soft nature of all rocks penetrated, it was possible to core with insert-type core bits. The diameter of all core was 7.6 cm.

From previous drilling experience, the 1982 area was known to present some serious problems of lost circulation. It was, therefore, decided to start drilling and coring with air as the circulation medium, on an

experimental basis. Results from the first testhole were in general very good and the entire program was subsequently completed in the same manner. Penetration rates and core recovery rates were as good or slightly better than in previous programs where mud was used, and all core was extremely clean and almost of an in-situ quality.

Occasionally during coring, and especially at greater depth or when coring through cohesive materials, it became difficult to remove the drill cuttings from the hole, consequently air pressure would build up. To alleviate such conditions a biodegradable detergent was injected into the air system, which had the effect of almost immediately reducing the air pressure, and drill cuttings moving much more freely to the surface.

During coring, the water level would vary considerably, but some water was always present. This fact reduced concern about encountering natural gas. In Ch3-82, which was cored to 305 m, the hydrostatic water level remained for the most part constant at about 30 m below surface. As coring progressed, it was noticed that from about 250 m it took longer for the air compressor to build up sufficient pressure in the bottom of the hole to start moving the entire column of water. By the time the total hole depth was reached it became apparent that the depth limits of the air compressor had been reached. In addition, the performance of the drill rig (notably rotary and draw-works) indicated also that for the purpose of wireline coring, the maximum depth limit of this particular drill rig is effectively about 300 metres.

During the course of the program three incidents occurred involving the inner core barrel. Under normal coring conditions with sufficient water in the hole, the empty core barrel may be simply dropped down the hole through the outer core pipe, after which coring resumes. In such cases the water controls the rate of descent of the core barrel. But in these holes the hydrostatic water level fluctuated greatly during coring. In each, a sudden drop of the water level went unnoticed by the driller and when the core barrels were dropped serious damage was done to the core barrels and the core bits. In one instance repairs could be made in the field, but on two occasions the core barrel had to be taken to the manufacturer for major repairs. Two mechanical breakdowns took place as well. In one, the drill's main gear box broke down; in the other instance a faulty sand-line motor had to be repaired. Total breakdown time for all the above described

interruptions amounted to 55 hours, not including the two days required to overhaul the gear box, which had to be done in Calgary.

For the first time, all core was photographed on the drillsite. A Pentax ME camera and Kodak Colour 64ASA film were used.

GEOPHYSICAL LOGGING

BPB Instruments Ltd. of Calgary provided the logging services. As requested by ARC, one gamma-density-caliper log and one gamma-focused electric log were obtained from each hole. All logs were recorded on tape and all final log copies were recorded on the North American metric standard (i.e. metric numbers on inch-divided paper).

Because core holes are completed at a much slower rate than drill holes, the 1982 core holes were logged under a "call-out" contract option, rather than the "stand-by" option used in previous years.

CEMENTING

After logging, each core hole was cemented off from total depth to surface, in accordance with ERCB regulations. For this purpose, ready mixed cement was delivered to each drill site by a bulk cement dealer. Normally, cementing of holes does not present any problems, but this year an unfortunate situation developed on CH4-82. This hole was cored to a depth of 164 metres, and as soon as geophysical logging of the hole was completed, 120 metres of core pipe was run back into the hole for the purpose of cementing. Cement was then pumped down the core pipe until the cement returned along the outside of the core pipe to the surface. After cementing was completed removal of the core pipe from the hole became almost at once a problem. Increasingly more pull was required to extract the first five lengths of core pipe. On the sixth length maximum pull was reached, and it became impossible to recover any additional pipe. The remaining 90 metres of pipe could not be freed, even by rotating the pipe (a method frequently used to free stuck pipe). At this time, the contractor decided to bring in McCullough Services Inc., a firm which specializes in solving down-hole problems. Upon arrival McCullough first ran "free point" measurements. After the location of the lowermost free tool joint was established, the free portion of pipe was backed-off, with the

aid of an explosive charge. In this manner an additional 42 metres of pipe were recovered. Due to unfavorable conditions down the hole (cement, etc.), no further attempt was made to recover the remaining 48 metres of pipe. Instead, the hole was simply cemented off and abandoned. The total cost of this incident was considerable and required 22 hours for resolution. The remaining five testholes were cemented without difficulties.

RECLAMATION

Because all 1982 holes were cored, only small amounts of drill cuttings were left behind on each drill site. Consequently, it was possible to effectively clean up all drill sites with a four-wheel drive Bobcat tractor and a light truck. All cuttings were disposed of in an approved land-fill site.

SUBMISSION OF DATA

In compliance with the Coal Conservation Act, all specified information, except the core, derived from the 1982 program was submitted to the ERCB in August.

During the past year, the coal group handled thirty-three coal related enquiries from industry and government.

PROGRAM EVALUATION AND RECOMMENDATIONS

DRILLING SITES

The benefits derived from a preliminary study of an area to be explored are invaluable. These studies make it possible to establish a realistic drill hole pattern and a total depth target for each test hole well in advance. In addition, such studies may reveal adverse or costly drilling conditions (sand, gravel, thick glacial deposits) in certain areas, which can then be avoided. It is therefore recommended that detailed geological studies of future program areas be continued.

When selecting actual drilling locations in the field and air is to be used as the circulation medium, only those locations which provide good

drainage should be considered. Drilling or coring with air usually causes large amounts of water to be discharged from the hole and it is imperative that this water be instantly diverted from the drilling site. All work on a water-saturated drilling site becomes more difficult; moreover drilling equipment frequently becomes stuck on such sites, creating additional problems.

CORING

As in two previous years (1979, 1980) coring was done by wireline method. Again this method has, at least for ARC's particular program requirements, proved to be the most effective and economical way in which to obtain quality core.

Notwithstanding the two mechanical breakdowns which occurred, the drilling and coring equipment provided by the drilling contractor performed reasonably well.

Except for the core barrel damage described earlier, the use of air for coring worked very satisfactorily, it contributed to clean and excellent core quality, but more importantly, it eliminated the adverse effects when coring through zones of loss circulation. However, to prevent the costly core barrel damage experienced during the 1982 program, it is absolutely essential that the hydrostatic water level in the hole be accurately monitored throughout the entire coring process. Whenever the exact water level in the hole cannot be ascertained, the core barrel should be let down by the wireline cable.

If in future programs the air-coring method is to be used, the following points warrant consideration:

1. Only those drill sites should be selected which provide good drainage;
2. Hydrostatic water levels may fluctuate greatly during coring; and
3. Hole conditions are unfavourable for containing the flow of natural gas when encountered.

The photographing of the core on the drilling site did not require much additional time. The photographs were of good quality and will be retained for study, publication and record. It is recommended that all core from future programs be photographed in the field.

GEOPHYSICAL LOGGING

All six test holes were logged and every log requested by ARC was obtained. Log quality was very good and the average logging time per hole was about two hours. Good logging equipment and well-qualified field personnel contributed greatly to a trouble-free logging program.

Due to the nature of the 1982 program (core holes being completed at a rate of only one per three days), the "call out" option for logging services was selected, with very favorable results.

Tenders submitted by logging firms generally have several options available with respect to the price schedule (e.g. logging charges per metre, per hour/day/month, a total contract price package, or any combination thereof). Additionally, the service is usually offered on a "stand by" or a "call out" basis. In order to obtain the most effective and economical contract arrangement for each particular logging program, it is essential that all aspects of a program be carefully studied before a contract is awarded.

CEMENTING

Except for the complications experienced on CH4-82, all other testholes were cemented without difficulty. Ready mixed cement was delivered to each drill site which saved considerable time and labour. It is suggested that this convenient method should continue wherever practical.

RECLAMATIONS

Drill site reclamation work was carried out by ARC personnel in less than two days, and to date (March, 83) none of the sites have been inspected by Department of Environment officials.

CONCLUSIONS

Under the prevailing 1982 contract terms, suggestions and opinions regarding day to day field operations could be freely expressed by ARC personnel at any time. However, the contractor was not obliged in any way to

implement them, except for those relating to safety or government regulations. Plainly stated, the contractor was always willing to discuss matters, but ultimately it was he who decided what equipment and by what methods the drilling/coring portion of the program was to be completed.

Notwithstanding the above and based on the cementing problems encountered on CH4-82, contractors should be strongly discouraged from:

1. cementing the entire hole in one stage, without removing any pipe from the hole during this stage; and
2. using the large diameter and costly core pipe for the purpose of cementing.

It should be pointed out that all drilling and coring was carried out under a "Footage rate" contract term. Consequently, the incurred costs of breakdowns (e.g. repairs, replacement parts, working time lost and third party services) were not chargeable to ARC.

Nevertheless, it was indeed unfortunate that the contractor, who was sincerely interested in providing good service, suffered these financial losses, particularly since most of the incidents which occurred during the summer could have been avoided.

Regarding drilling permits, the cooperation received from the landowners in obtaining permission to drill the five holes on private land was excellent and is acknowledged.

APPENDIX A

DRILLING CONTRACT

Four bids for drilling were received for the 1982 drilling program. The bid of Sky-Line Drilling Ltd. of Calgary, Alberta was accepted. The main terms of the contract read as follows:

| | | |
|-------------------------|----------|------------|
| Drilling rate per foot | \$ 8.25 | |
| Drilling rate per hour | \$150.00 | |
| Coring rate per foot | \$ 15.45 | (wireline) |
| Coring rate per hour | \$150.00 | (wireline) |
| Standby rate per hour | \$ 80.00 | |
| Cementing rate per hour | \$135.00 | |

The bid price of \$8.25 per foot for drilling applied to the drilling of the surface hole only, and included the setting of casing and the cost of drilling bits. The bid price of \$15.45 per foot for coring included all downhole consumables such as core bits and core catchers. All hole conditioning materials were to be paid by the client, including transportation cost and a 10 percent handling charge. Core boxes were to be supplied by the client.

Standby rates were in effect during third party geophysical logging, and during any delays not caused by the contractor.

The drilling contractor was to be responsible for the condition of the hole until the geophysical contractor reached the bottom of the hole for the first time.

The client agreed to pay the contractor \$35.00 per working day per man towards living allowances. The working schedule was to consist of two shifts of twelve hours each per day for five days, followed by two days off. The number of men per rig-crew was to be three, plus one toolpush.

Drilling equipment to consist of the following:

1. One rotary type Cyclone drill, model TH60R, equipped with one 5 x 6 Gardner Denver mud pump, an air compressor, a hydraulic top drive rotary system and a Geolograph.
2. One 12m long covered tractor-trailer combination which contained a 2000 gallon water tank, 305 metres of corepipe, casing, drilling materials and a welder.

The contractor to provide and maintain adequate insurance including:

- (a) Comprehensive General Liability insurance;
- (b) Automobile insurance; and
- (c) Equipment insurance.

The contractor shall comply with the provisions of the Workers' Compensation Act and the Occupational Health and Safety Act.

Locating drilling sites was to be the responsibility of the client, drilling sites being large enough to accommodate the required equipment.

It was agreed to commence drilling on May 31, 1982.

APPENDIX B

GEOPHYSICAL LOGGING CONTRACT

Because the 1982 program was basically an extension of the 1981 program with only six testholes to be cored, tenders for geophysical logging services were not invited. Instead BPB Instruments of Calgary was requested to provide the 1982 geophysical logging services on a "call-out" basis.

Call Out Rates

The following charges included field digitization of all logs, plus one field print, two final prints and originals of all logs.

1. Logging Charges

Coal Combination Sonde

Natural gamma, long spaced and bed resolution density and caliper log

| | |
|---------------------|-------------------|
| First 300 metres | \$ 6.20 per metre |
| Second 300 metres | \$ 5.58 per metre |
| Third 300 metres | \$ 5.02 per metre |
| Subsequent metreage | \$ 4.52 per metre |

Neutron-Neutron log

| | |
|---------------------|-------------------|
| First 300 metres | \$ 1.45 per metre |
| Second 300 metres | \$ 1.30 per metre |
| Third 300 metres | \$ 1.16 per metre |
| Subsequent metreage | \$ 1.00 per metre |

Focussed Electric log

| | |
|---------------------|-------------------|
| First 300 metres | \$ 1.70 per metre |
| Second 300 metres | \$ 1.53 per metre |
| Third 300 metres | \$ 1.36 per metre |
| Subsequent metreage | \$ 1.19 per metre |

The above metreage charges applied from the surface to the deepest reading.

A minimum charge of \$975.00 per 24 hour period would also apply, excluding mileage and cassette charges, and either this minimum charge or the metreage rate, whichever is greater, would be charged.

2. Mileage Charges

Mileage charges to be charged, from Calgary at the following rates

On "good" roads \$ 0.65 per km

On "difficult" roads \$ 0.85 per km

3. Cassette Tapes

Cassette tapes for digitization \$ 6.00 per tape

Extra services such as computer processing, and additional logging tools would be available at an extra charge upon request.

DRILLING STATISTICS

| | |
|---|--------------------|
| Total number of test holes completed | 6 |
| Metres drilled and cased | 162 (532 feet) |
| Metres cored | 875 (2,868.5 feet) |
| Metres recovered | 814.5 (93%) |
| | |
| Total standby hours | 24 |
| Total cementing and driving hours | 40 |
| Total dayrate hours | 12 |
| | |
| Gallons of drilling detergent used | 13 |
| Metres of casing used (not recovered) | 130 |
| | |
| Average hole depth | 173 metres |
| Average drilling and coring time per hole (includes logging and cementing) | 70.3 hours |

COST ANALYSIS

Sky-Line Drilling

| | |
|-------------------------------------|-------------|
| Total feet drilled 532 @ \$8.25 | \$ 4,389.00 |
| Total feet cored 2868.5 @ \$15.45 | \$44,318.32 |
| Total standby hours 24 @ \$80.00 | \$ 1,920.00 |
| Total cementing hours 40 @ \$135.00 | \$5,400.00 |
| Total dayrate hours 12 @ \$150.00 | \$ 1,800.00 |
| Cost of drilling materials | \$ 3,181.20 |
| Man days subsistence 132 @ \$35.00 | \$ 4,620.00 |

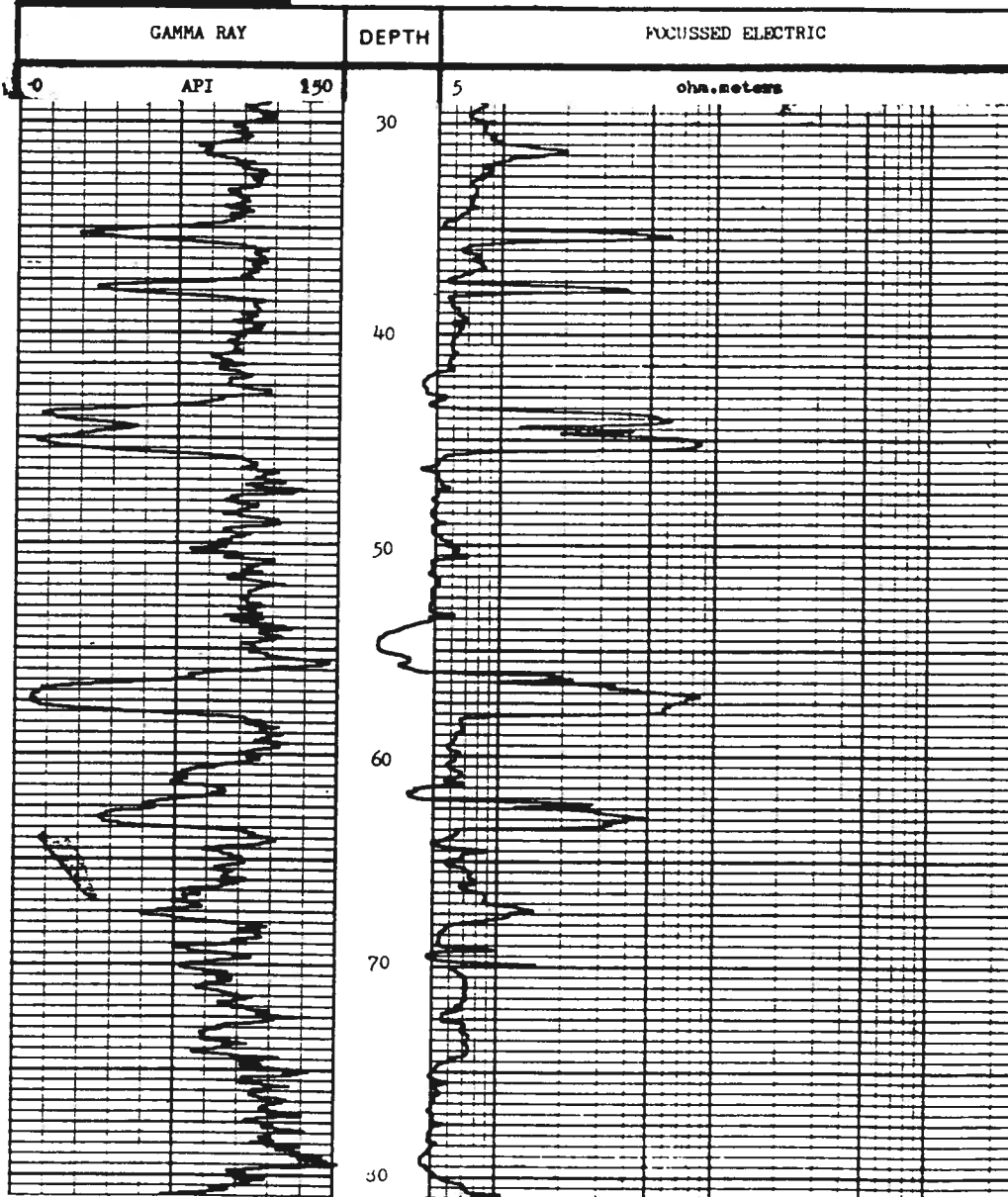
Subtotal \$65,628.52 \$ 65,628.52

| | |
|--------------------------------------|--------------|
| BPB Instruments, geophysical logging | \$ 10,071.65 |
| BPB Instruments, computer services | \$ 930.00 |
| Cement and transportation costs | \$ 4,227.97 |
| Materials and supplies | \$ 2,650.00 |
| ERCB slabbing of core | \$ 7,551.72 |
| Vehicle rental and operational costs | \$ 3,965.00 |
| Drilling permits land owners (5) | \$ 750.00 |
| Personal expenses, Council personnel | \$ 6,832.00 |

Total cost of 1982 coal drilling program \$102,606.86



FOCUSSED ELECTRIC & GAMMA RAY



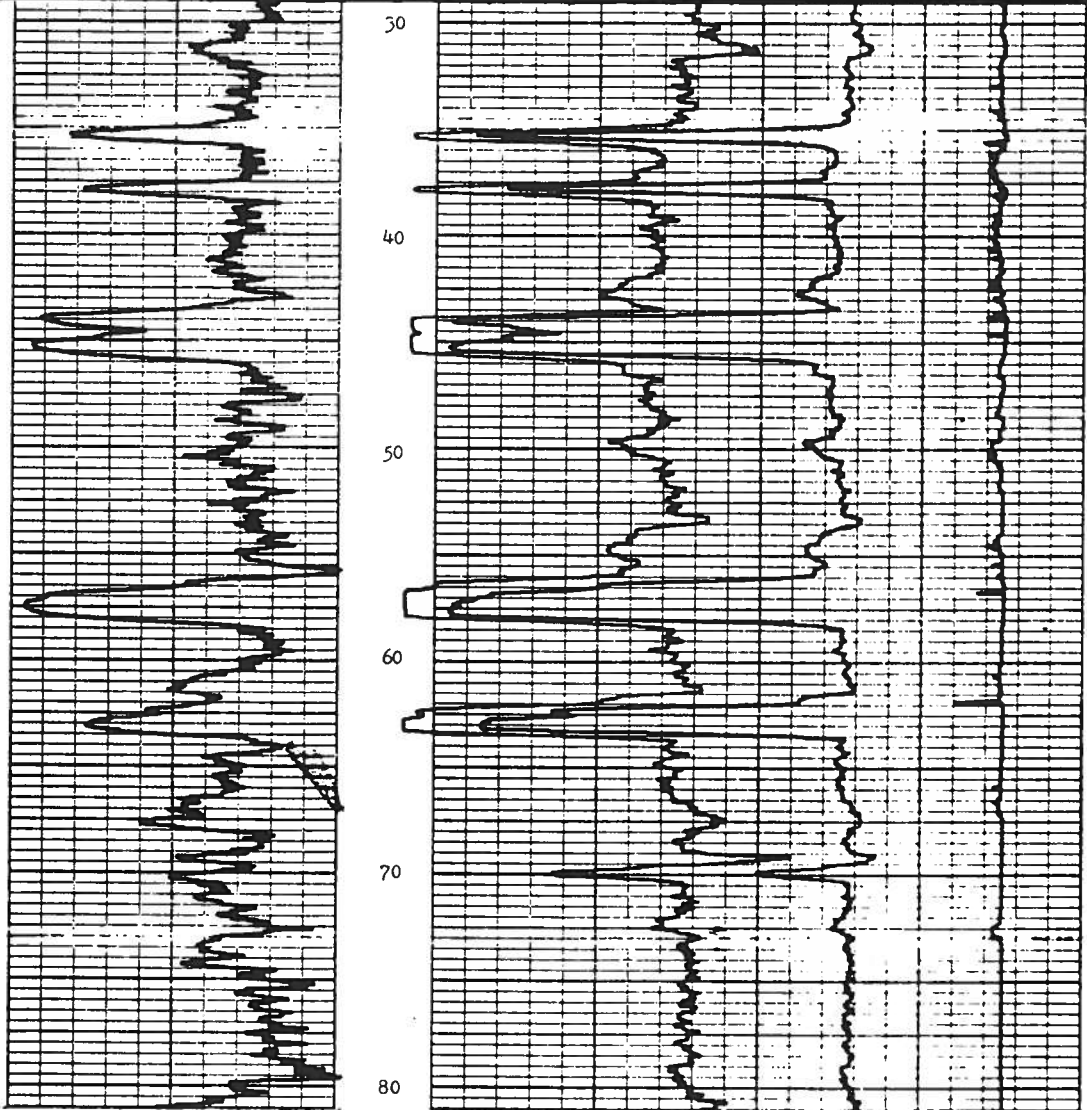


LOG SHEET
GAMMA RAY
L. S. DENSITY
CALIPER

| GAMMA RAY | DEPTH | BULK DENSITY g/cm ³ | CALIPER INCHES |
|-----------|-------|-----------------------------------|-------------------|
|-----------|-------|-----------------------------------|-------------------|

| HOLE SIZE CORRECTION DATA | | | | | | | | | | | | | | | | |
|---------------------------|-----|----|-----|----|-----|----|-----|----|----|----|----|----|----|----|----|----|
| 2 | 125 | 13 | 135 | 14 | 145 | 15 | 155 | 16 | 17 | 18 | 19 | 20 | 21 | 22 | 23 | 24 |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | |
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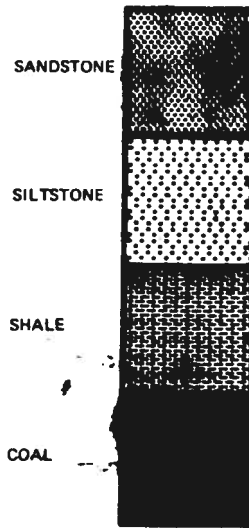
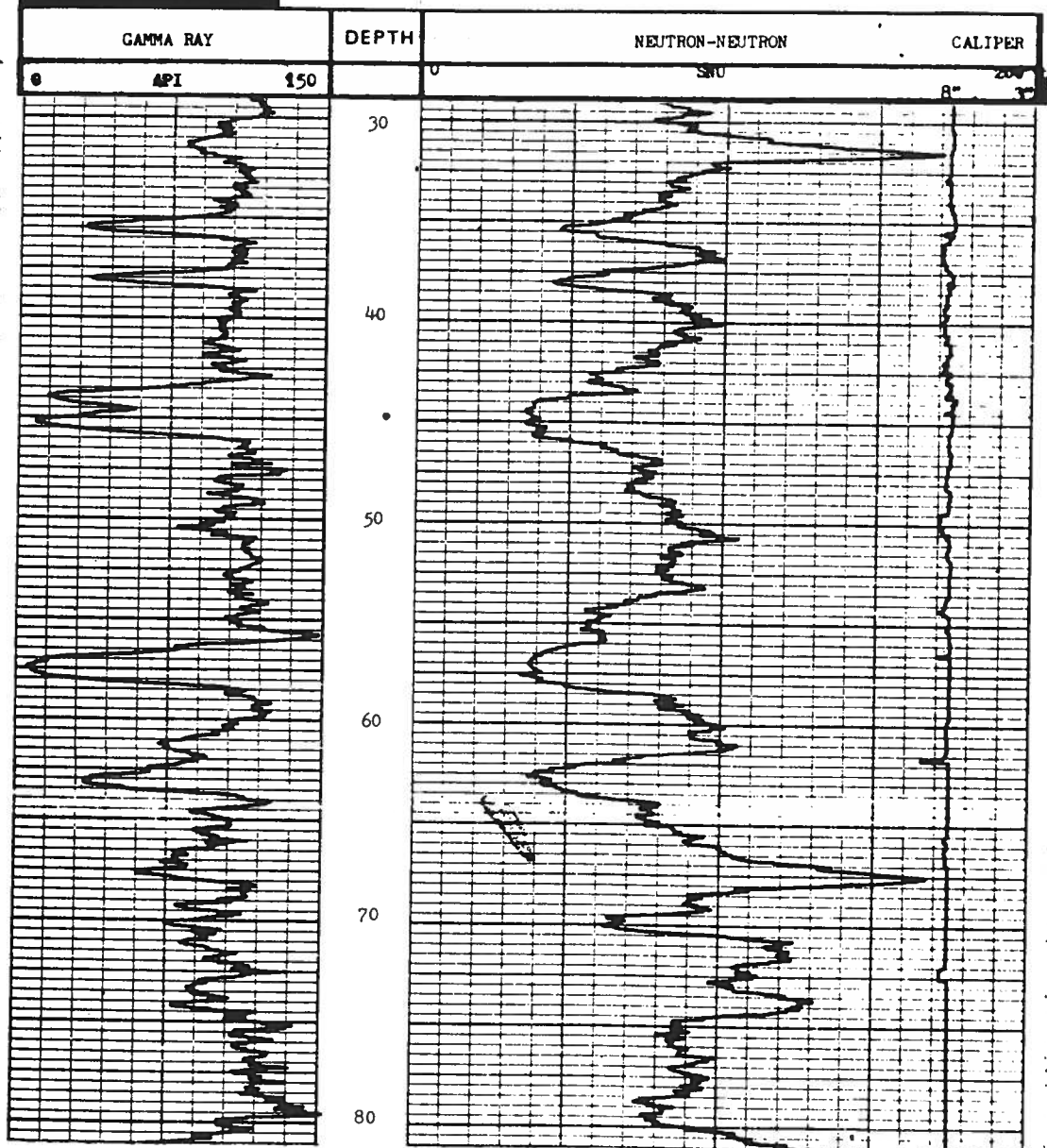
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COAL DENSITY CURVE
ROCK DENSITY CURVE

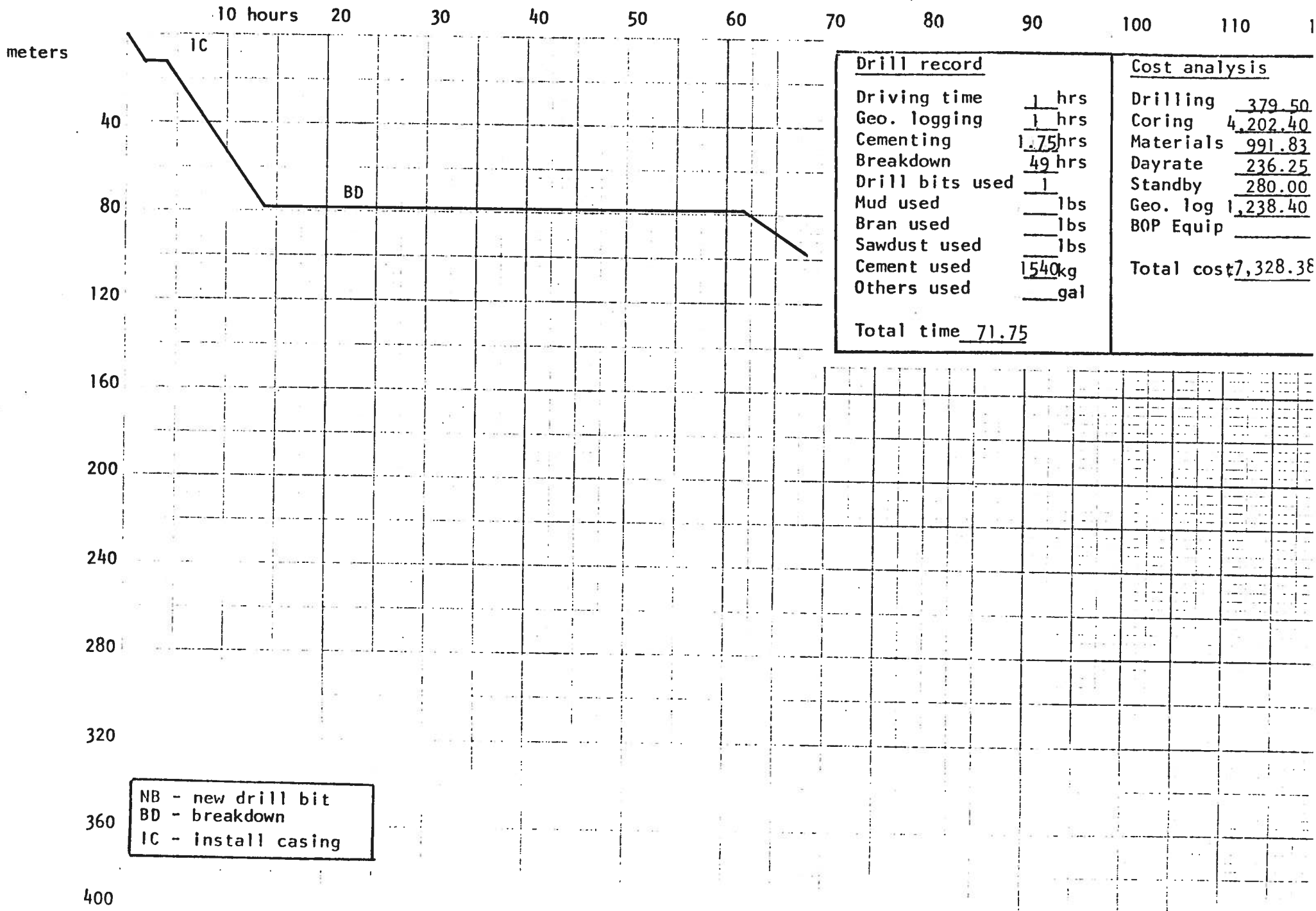


GAMMA RAY/NEUTRON-NEUTRON/CALIPER LOG



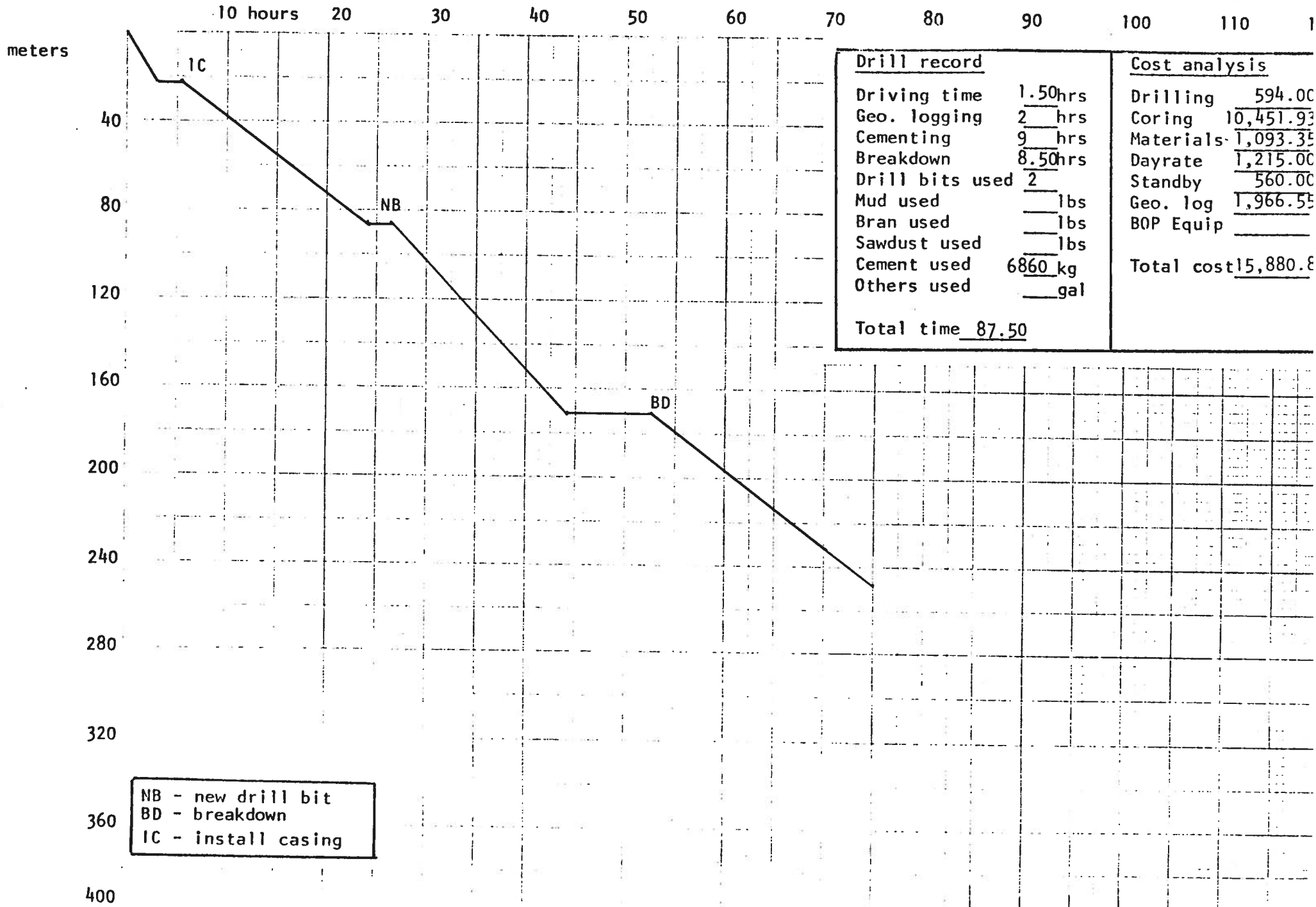
APPENDIX F

PERFORMANCE GRAPHS OF INDIVIDUAL TESTHOLES



| Drill record | | Cost analysis | |
|-------------------------|-----------------|---------------|-----------------|
| Driving time | <u>1</u> hrs | Drilling | <u>379.50</u> |
| Geo. logging | <u>1</u> hrs | Coring | <u>4,202.40</u> |
| Cementing | <u>1.75</u> hrs | Materials | <u>991.83</u> |
| Breakdown | <u>49</u> hrs | Dayrate | <u>236.25</u> |
| Drill bits used | <u>1</u> | Standby | <u>280.00</u> |
| Mud used | <u> </u> lbs | Geo. log | <u>1,238.40</u> |
| Bran used | <u> </u> lbs | BOP Equip | <u> </u> |
| Sawdust used | <u> </u> lbs | | |
| Cement used | <u>1540</u> kg | | |
| Others used | <u> </u> gal | | |
| Total time <u>71.75</u> | | Total cost | <u>7,328.38</u> |

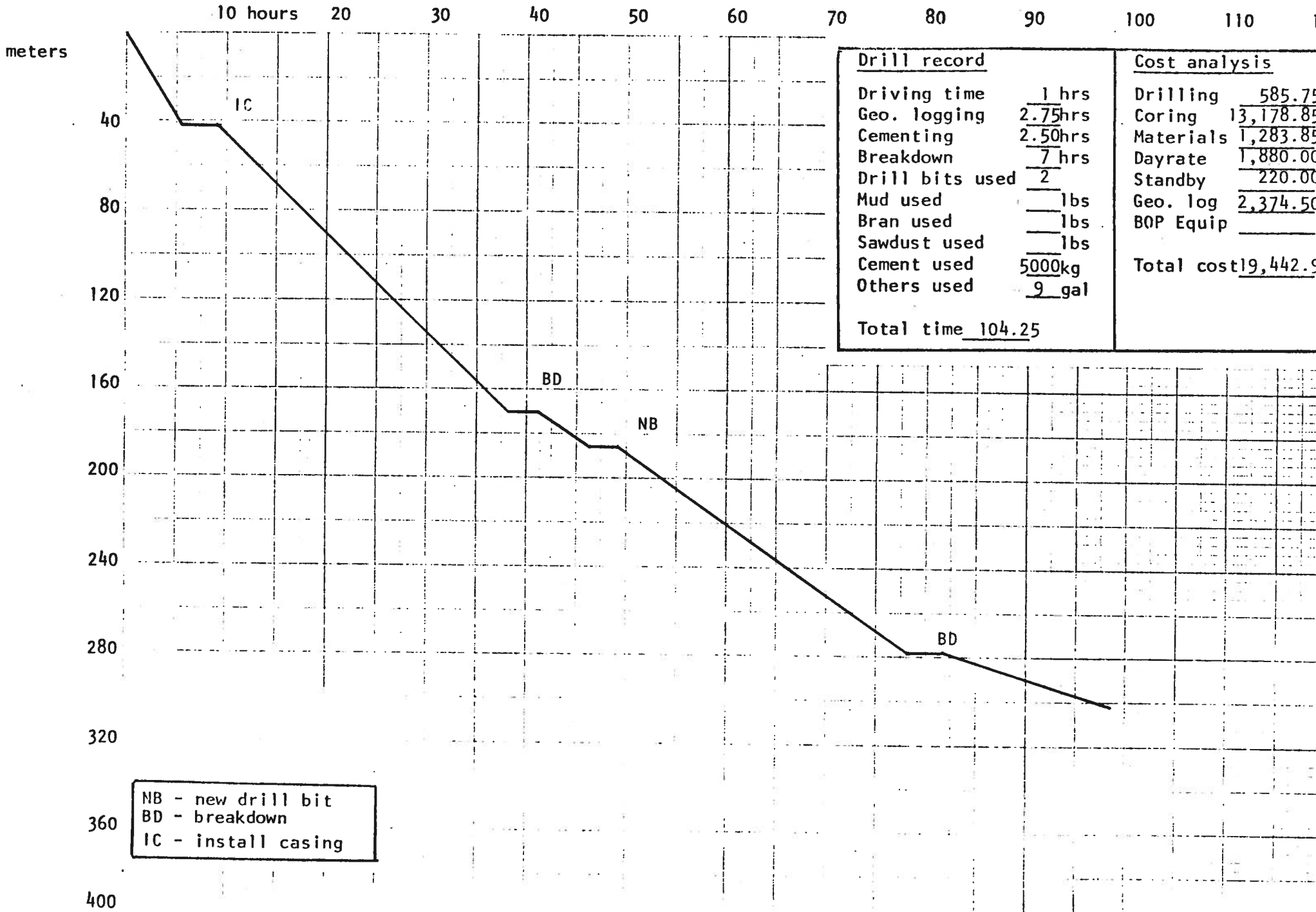
NB - new drill bit
 BD - breakdown
 IC - install casing



| Drill record | | Cost analysis | |
|-------------------------|---------|---------------|------------------|
| Driving time | 1.50hrs | Drilling | 594.00 |
| Geo. logging | 2 hrs | Coring | 10,451.93 |
| Cementing | 9 hrs | Materials | 1,093.35 |
| Breakdown | 8.50hrs | Dayrate | 1,215.00 |
| Drill bits used | 2 | Standby | 560.00 |
| Mud used | ___ lbs | Geo. log | 1,966.55 |
| Bran used | ___ lbs | BOP Equip | ___ |
| Sawdust used | ___ lbs | | |
| Cement used | 6860 kg | | |
| Others used | ___ gal | | |
| Total time <u>87.50</u> | | Total cost | <u>15,880.83</u> |

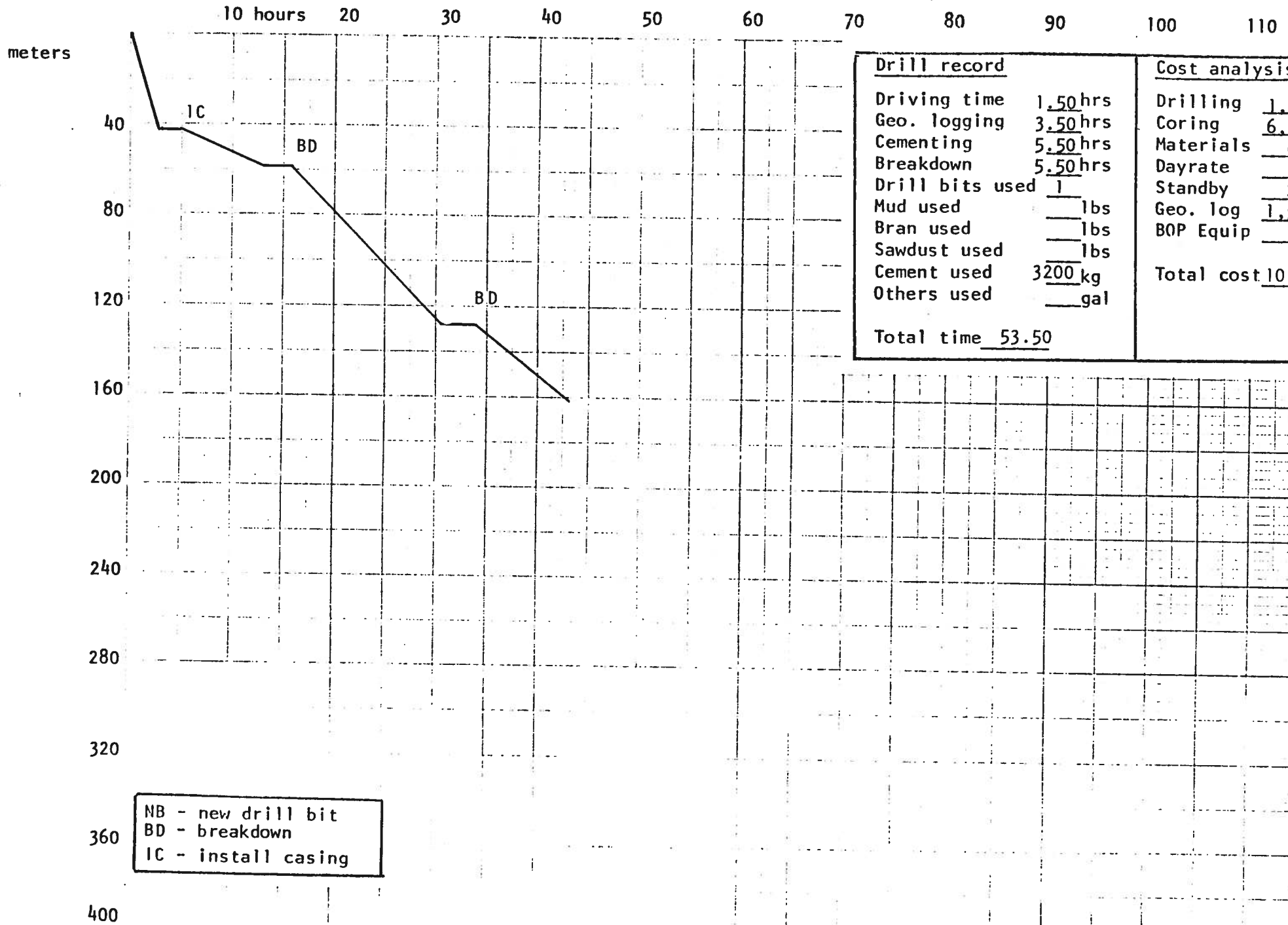
NB - new drill bit
 BD - breakdown
 IC - install casing

CH 3 - 82 N/E Sec 12 Tp 40 R 26 W4



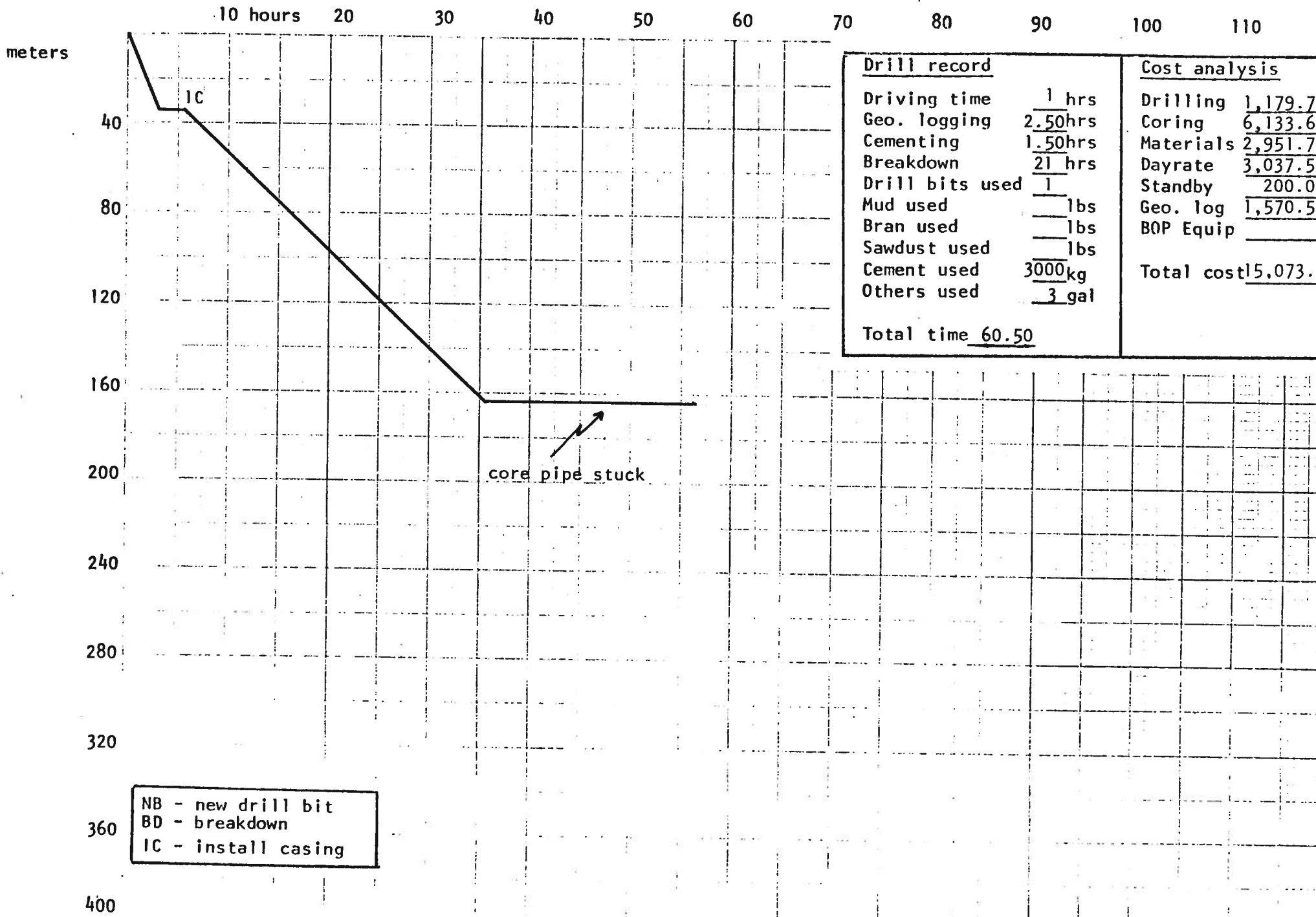
| Drill record | | Cost analysis | |
|-------------------|---------|----------------------|-----------|
| Driving time | 1 hrs | Drilling | 585.75 |
| Geo. logging | 2.75hrs | Coring | 13,178.85 |
| Cementing | 2.50hrs | Materials | 1,283.85 |
| Breakdown | 7 hrs | Dayrate | 1,880.00 |
| Drill bits used | 2 | Standby | 220.00 |
| Mud used | ___ lbs | Geo. log | 2,374.50 |
| Bran used | ___ lbs | BOP Equip | _____ |
| Sawdust used | ___ lbs | | |
| Cement used | 5000kg | | |
| Others used | 9 gal | | |
| Total time 104.25 | | Total cost 19,442.50 | |

CH 5 - 82 N/E Sec 36 Tp 40 R 25 W4



| Drill record | | Cost analysis | |
|------------------|----------|-------------------|--------|
| Driving time | 1.50 hrs | Drilling | 1,155. |
| Geo. logging | 3.50 hrs | Coring | 6,025. |
| Cementing | 5.50 hrs | Materials | 680. |
| Breakdown | 5.50 hrs | Dayrate | 742. |
| Drill bits used | 1 | Standby | 280. |
| Mud used | ___ lbs | Geo. log | 1,532. |
| Bran used | ___ lbs | BOP Equip | ___ |
| Sawdust used | ___ lbs | | |
| Cement used | 3200 kg | | |
| Others used | ___ gal | | |
| Total time 53.50 | | Total cost 10,415 | |

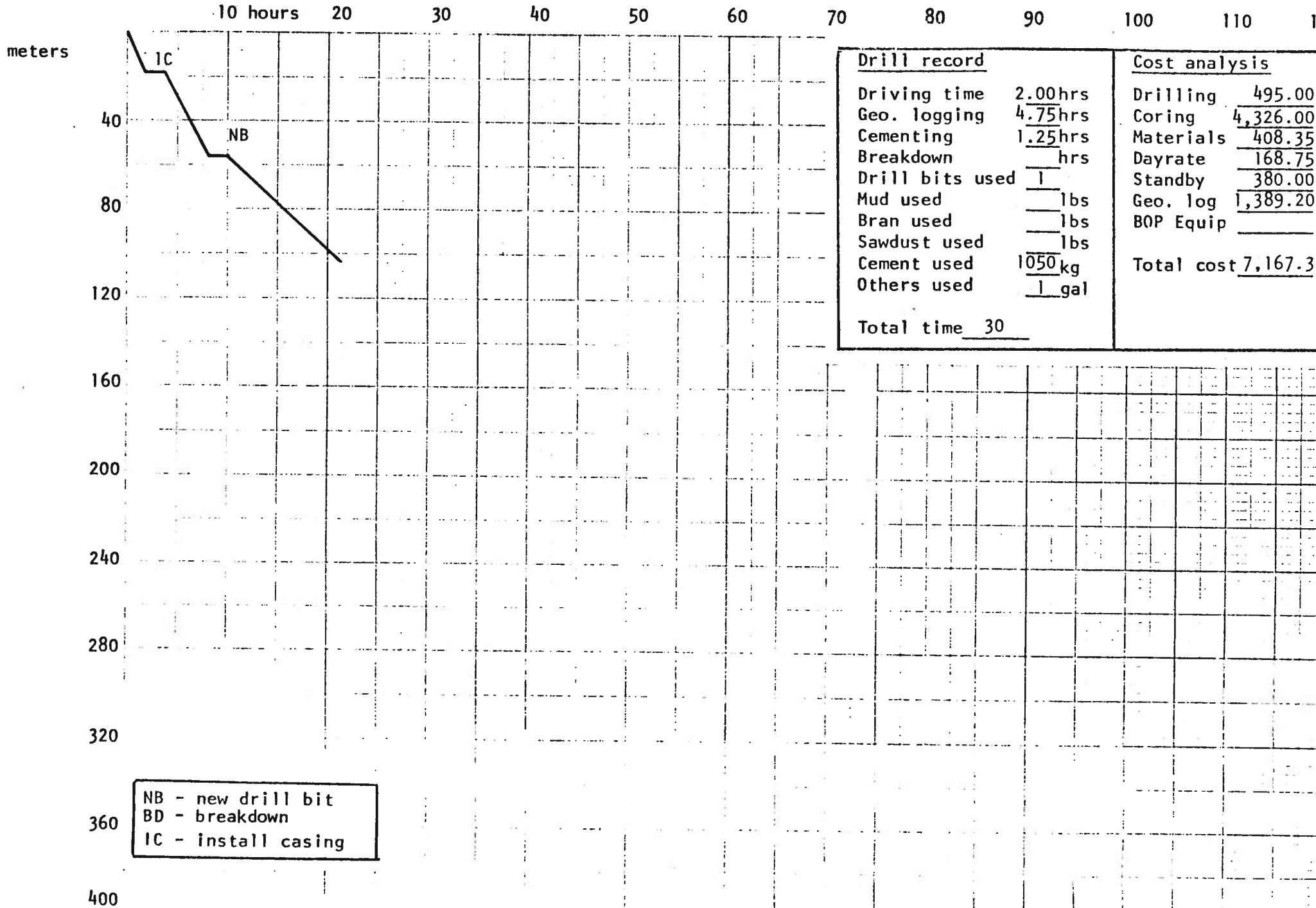
NB - new drill bit
 BD - breakdown
 IC - install casing



| Drill record | | Cost analysis | |
|-------------------------|-----------------|---------------|----------------|
| Driving time | <u>1</u> hrs | Drilling | <u>1,179.7</u> |
| Geo. logging | <u>2.50</u> hrs | Coring | <u>6,133.6</u> |
| Cementing | <u>1.50</u> hrs | Materials | <u>2,951.7</u> |
| Breakdown | <u>21</u> hrs | Dayrate | <u>3,037.5</u> |
| Drill bits used | <u>1</u> | Standby | <u>200.0</u> |
| Mud used | <u> </u> lbs | Geo. log | <u>1,570.5</u> |
| Bran used | <u> </u> lbs | BQP Equip | <u> </u> |
| Sawdust used | <u> </u> lbs | | |
| Cement used | <u>3000</u> kg | Total cost | <u>15,073.</u> |
| Others used | <u>3</u> gal | | |
| Total time <u>60.50</u> | | | |

NB - new drill bit
 BD - breakdown
 IC - install casing

CH 6 - 82 N/E Sec 32 Tp 47 R 18 W4



| Drill record | | Cost analysis | |
|----------------------|----------|---------------|----------|
| Driving time | 2.00hrs | Drilling | 495.00 |
| Geo. logging | 4.75hrs | Coring | 4,326.00 |
| Cementing | 1.25hrs | Materials | 408.35 |
| Breakdown | _____hrs | Dayrate | 168.75 |
| Drill bits used | 1 | Standby | 380.00 |
| Mud used | _____lbs | Geo. log | 1,389.20 |
| Bran used | _____lbs | BOP Equip | _____ |
| Sawdust used | _____lbs | | |
| Cement used | 1050 kg | Total cost | 7,167.3 |
| Others used | 1 gal | | |
| Total time <u>30</u> | | | |

NB - new drill bit
 BD - breakdown
 IC - install casing