PRELIMINARY ASSESSMENT OF THE LIGNITE RESOURCES AND SURFACE MINING POTENTIAL THAR COAL DEPOSIT THAR PARKAR DISTRICT, SIND PROVINCE PAKISTAN

PRIVATE SECTOR POWER PROJECT

USAID CONTRACT NO. 391-0494-C-00-0540-00

By

JOHN T. BOYD COMPANY

MINING AND GEOLOGICAL ENGINEERS

Pittsburgh, Pennsylvania, U.S.A.

Subcontractor To

INTERNATIONAL RESOURCES GROUP, LTD.

Washington, D.C., U.S.A.

Report No. 2150.6

MAY 1994

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May 27, 1994
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Director General
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Subject: Preliminary Assessment of the Lignite Resources and Surface Mining Potential of the Thar Coal Deposit Study Area Sind Province, Pakistan

Gentlemen:

John T. Boyd Company (BOYD) was approved to complete a mineability assessment of the Thar Coal Deposit, Thar Parkar District, Sind Province, Pakistan, in December 1992. The work scope for this project was developed in Control Work Plan No. CWP-4.15.0, an integral part of USAID Contract No. 391-0494-C-00-0540-00 between the United States Agency for International Development (USAID) and the International Resources Group, Ltd. (IRG).

The objective of this study is to prepare a preliminary estimate of the lignite resources and the surface mining potential of thick lignite seams in a select area of the Thar Coal Deposit as identified by the Coal Reap Program. The area selected for this study was mutually defined and agreed upon via exploration work and the experience and expertise of the United States Geological Survey, the Geological Survey of Pakistan, and BOYD.

We appreciate the assistance and cooperation extended by various Pakistani federal and provincial agencies as well as USAID during the course of this study.

Respectfully submitted,

JOHN T. BOYD COMPANY
By:

James W. Boyd
President

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1.0 GENERAL STATEMENT

The Government of Pakistan (GOP), assisted by the United States Agency for International Development (USAID), has established an active program for the encouragement and support of private sector investment in the Pakistan electric power industry. As part of the GOP's program to encourage private sector investment in Pakistan, the GOP and USAID jointly developed an exploration scheme to identify Pakistan's indigenous coal resources. Technical assistance to the GOP is funded by USAID and provided in part by International Resources Group, Ltd. (IRG) and its subcontractors. John T. Boyd Company (BOYD) is a subcontractor to IRG.

The United States Geological Survey (USGS) and the Geological Survey of Pakistan (GSP) embarked upon the exploration of the coal resources in Pakistan in 1985 and discovered the Thar Coal Deposit (Thar) in 1991. Figure 1.1, following this text, shows the location of the Thar in relation to other identified coalfields of Pakistan. From 1991 through March 1994, USGS/GSP drilled 28 holes in the Thar over an area of approximately 5,000 sq km. Figure 1.2, following this text, shows the approximate location of the coal-bearing area. The northern boundary of the deposit is the Pakistan-India border and the southern boundary is the Rann of Kutch. The eastern and western boundaries of the deposit are still unknown. Both the USGS and GSP have published reports on the results of their joint exploration program.

In June 1993, BOYD, USGS and GSP identified the most favorable area of the Thar. This area comprises less than 15% of the known coal deposit. BOYD designed the exploration program, supervised the drilling over the period November 1993 to January 1994 and shipped the cores recovered to the United States for geotechnical and analytical testing.

This report is based on wide-centered drilling and represents a preliminary, conceptual opinion of the surface mining potential for the selected study area. Data from the USGS/GSP are incorporated where appropriate. Additional exploration, hydrogeological, and engineering studies are required before this coal deposit can be developed.

Resource tonnages are expressed as in-place metric tonnes and do not consider geologic allowances or losses during mining operations. All costs are expressed in constant US dollars as of May 1994.

The Thar Coal Deposit represents the largest coal resource available for electrical power generation in Pakistan. Given the documented power shortage in the country, the Thar could potentially have a significant impact in reducing this deficit if properly developed.

Respectfully submitted,

JOHN T. BOYD COMPANY
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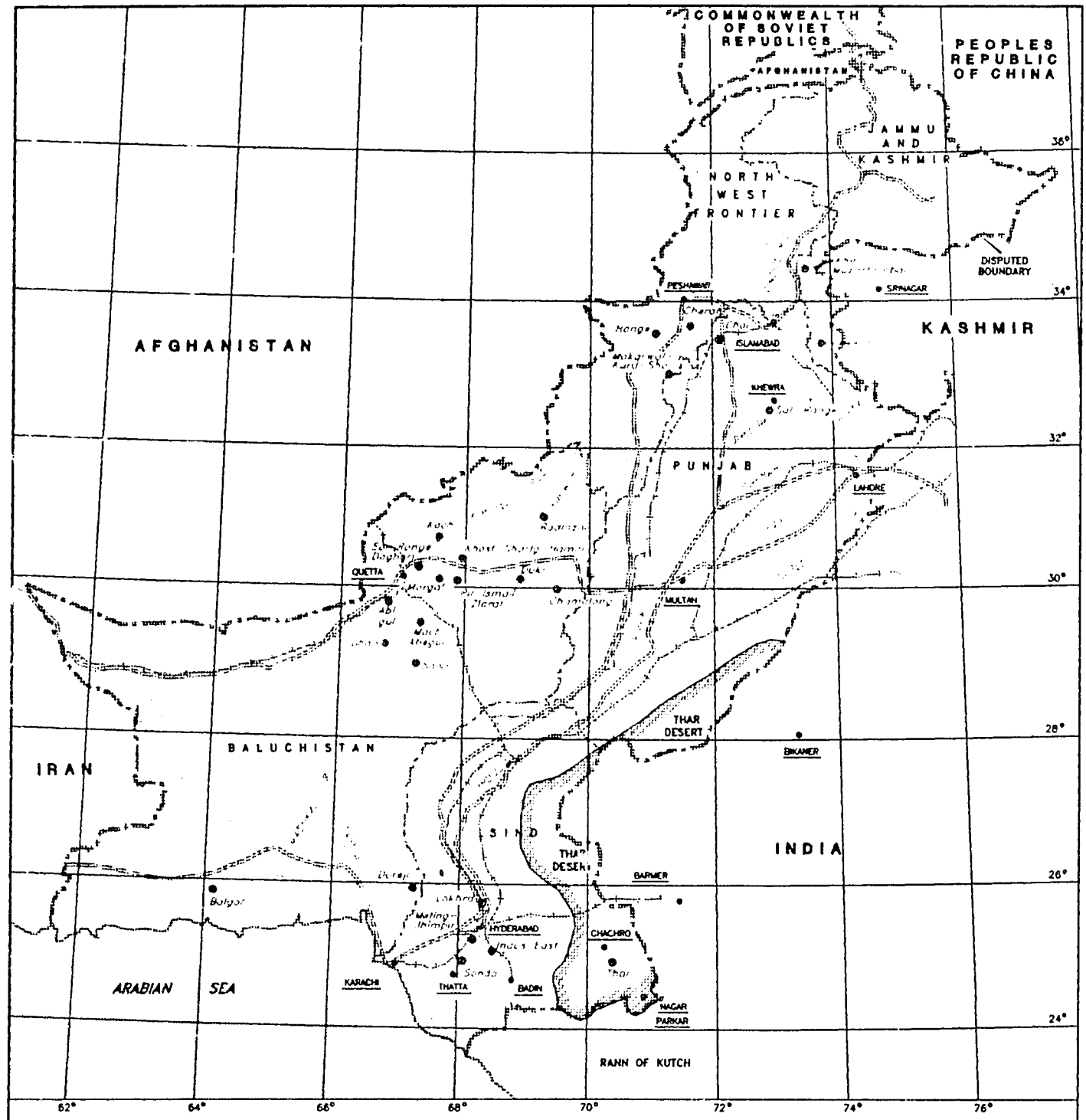


LEGEND

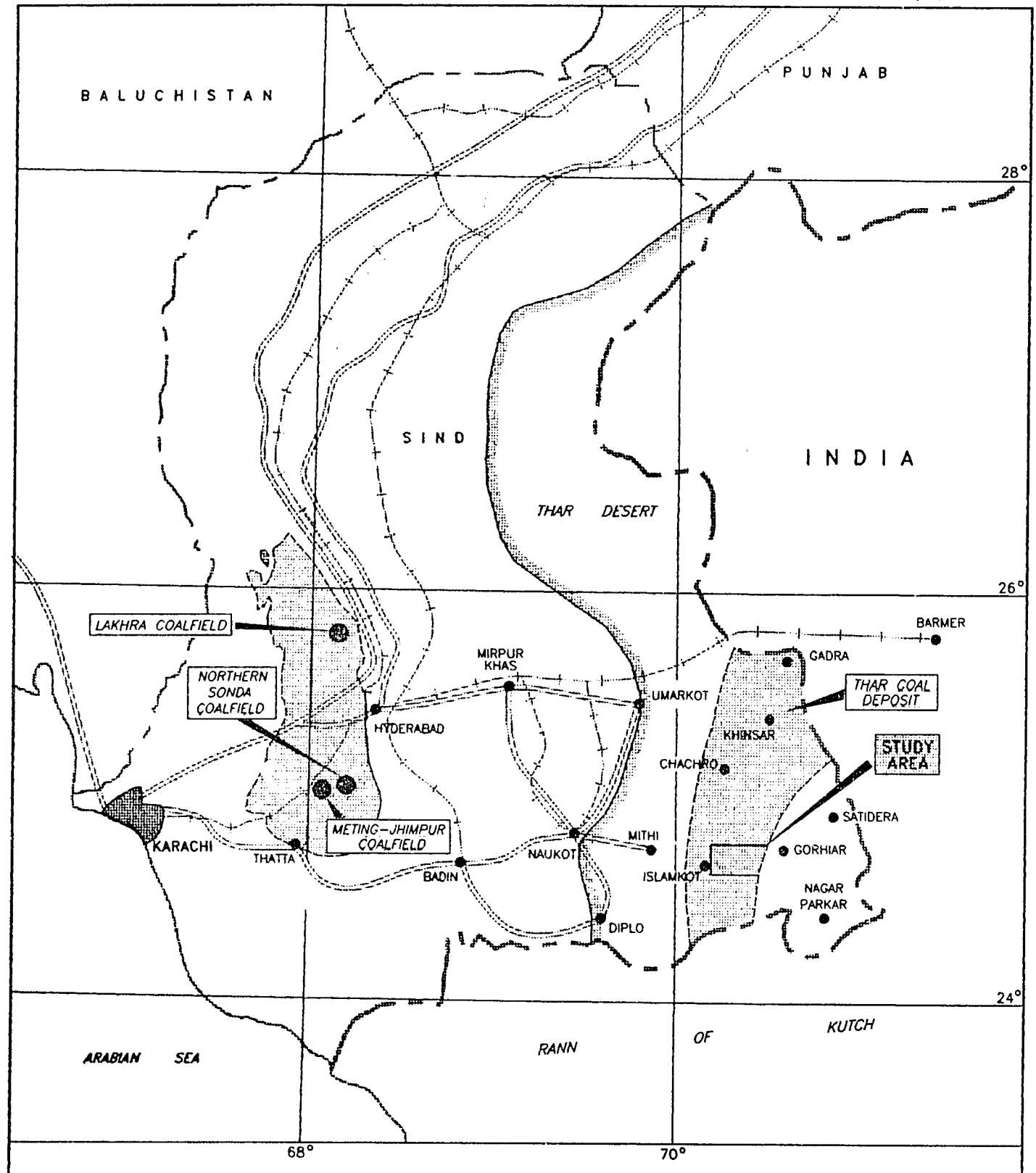
- PROVINCE BOUNDARY
- RAILROADS
- ROADS
- RIVERS
- Duroji ● MAJOR COAL FIELDS
- THAR DESERT BOUNDARY (APPROX.)

MAP OF PAKISTAN
SHOWING
MAJOR COAL FIELDS
Prepared For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
Scale : 9,000,000 (Approx.)

May 1994

John T. Boyd Company
Mining and Geological Engineers

FIGURE 1.1



LOCATION MAP
PORTION OF PAKISTAN
Showing
THAR COAL DEPOSIT STUDY AREA
THAR PARKAR DISTRICT, SIND PROVINCE, PAKISTAN
Prepared For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
Scale 1 : 3,000,000 (Approx.)

May 1994

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FIGURE 1.2

2.0 SUMMARIZED FINDINGS

John T. Boyd Company (BOYD) has completed an independent assessment of the coal resources and surface mining potential of a selected study area in the Thar Coal Deposit. Following are our principal findings, conclusions and recommendations. The following sections of this report with figures, tables, appendix and exhibits support these summarized findings.

2.1 The Thar Coal Deposit (Thar) is located in the Thar Desert in the Thar Parkar District of the Sind Province approximately 380 km east-northeast of the city of Karachi.

2.2 The Thar was discovered in 1991 during a joint exploration program undertaken by the United States Geological Survey (USGS) and the Geological Survey of Pakistan (GSP). USGS/GSP have drilled a total of 28 holes in the Thar over the period 1991-1994.

2.3 BOYD, USGS, and GSP mutually agreed upon an area most favorable for further exploration in mid-1993. BOYD designed a 10-hole exploration program for the selected favorable study area and supervised the drilling over the period November 1993 to early January 1994. The study area encompasses approximately 65,000 hectares (650 sq km) and is bounded by the towns and villages of Islamkot to the southwest, Khario Ghulam Shah to the south, Lunio to the southeast, Vakrio to the northeast, and Rangho Nun to the northwest.

2.4 The study area is remote and only accessible by four-wheel drive vehicles. The nearest electrical power supply from the national power grid is in the town of Islamkot, a distance of approximately 5 km from the western edge of the study area. A telephone line parallels the main sand track traversing the study area in an east-west direction. No other services are available.

2.5 The structure of the deposit in the study area is characterized by a broad elongated dome with gentle dips of less than 1 to 4 meters per kilometer. Based on the exploration drilling, high-angle normal faults are expected to form the eastern limits of the deposit and the southern boundary of the study area. The magnitude of strata displacement varies from 10 to 40 meters.

2.6 The seam zones in Thar are lignites situated in the Bara Formation, Eocene Era, Tertiary Age. The coal-bearing sequence is approximately 60 meters thick with a cumulative coal zone thickness that can approach 30 meters. Lignite is contained in three major seam zones designated A, B, and C (in descending stratigraphic order). Seam Zone A is projected to subcrop within the study area based on structure contour maps of the coal zone and the overlying oxidized zone.

2.7 The seam zone thicknesses and intervals between zones vary considerably. Because of the variability, the estimated in-place seam resources are considered to be in the inferred reliability category. Additional drilling is required to confirm seam zone correlation and thickness for future mining studies.

2.8 The total in-place seam resources within the study area are estimated to be 19.7 billion tonnes. The associated in-place stripping ratio for the resource is 5.6:1 (bank cubic meters of overburden/interburden : in-place seam tonne). The average cumulative coal zone thickness for the study area is 23 meters.

2.9 Based on available hydrogeological reports for the region and BOYD supervised pumping tests, the coal-bearing formation contains a significant aquifer above Seam Zone A, occasional aquifers between Seam Zones B and C, and a large aquifer below the Seam Zone C. All aquifers in the coal formation are under pressure. Water volumes vary depending on the aquifer. Field conductivity tests indicate that all aquifers tested are brackish.

2.10 The estimated quantity and in-seam quality (dry basis) of the lignite resources within the study area are:

Seam Zone Designation	Estimated In-Place Seam Tonnes (millions)	Average In-Seam Quality (dry basis) Ash (%)	Volatile Matter (%)	Fixed Carbon (%)	Sulfur (%)	Calorific Value (Btu/lb)
A	3,699	21.54	47.38	31.08	3.37	9,780
B	10,807	18.22	49.65	32.13	2.72	10,380
C	5,200	16.85	49.94	33.21	1.41	10,420
Average	19,706	18.48	49.30	32.22	2.50	10,280

Additional drilling is recommended to identify poorer quality areas in Seam Zone A as well as to obtain samples for more detailed coal quality testing.

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2.11 Conceptual mine plans are developed for three cases and are based on the following:

	Average Thickness (m)
Overburden	150
Interburden	24
Seam Zones	23.5

Pit design requires the establishment of relief wells to depressurize the lower two aquifers that have the potential to uplift (heave) the pit bottom. These wells must be installed while mining the oxidized zone. Based on the geological and mechanical properties of the strata, BOYD recommends using bucket wheel excavators to mine the dune sand and shovel/truck units to mine the remaining strata. Shovel/truck units are selected over additional bucket wheel excavators for maneuverability and work versatility (i.e., shovel/truck units for both overburden and coal). Equipment units assigned to each case are:

Annual Production Level Tonnes (Million)	No. of Units		
	Bucket Wheel Excavators	Shovel/Truck	
		Rock	Coal
2.5	2	3	3
3.5	2	3	3
7.0	3	6	3

2.12 A summary of the 15-year conceptual mine plans is shown below:

		Case I	Case II	Case III
Annual Coal Production Tonnes (Millions)		2.5	3.5	7.0
Years required for mine development		5	5	5
Prestrip Material	(BCM-000)	112,856	122,136	154,316
Est. Development Cash Cost	($-000)	97,293	145,812	167,033
Capital Expenditures ($-000)				
Initial		286,159	330,204	414,654
Replacement		251,739	318,940	334,470
Subtotal		537,898	649,144	749,124
Contingency (20%)		107,580	129,829	149,825
Total		645,478	778,973	898,949
Est. Work Force at Full Production		440	526	548
Est. Average Production Costs			$/Tonne	
Labor		9.42	6.80	3.58
Operating and Supply		14.91	11.41	7.40
Mine Administration		0.91	0.61	0.31
Interest		2.58	2.10	1.15
Corporation G&A		1.00	1.00	0.50
Total Cash Cost		28.82	21.92	12.94
Depreciation & Amortization		20.50	20.96	12.15
Total Cost		49.32	42.88	25.09
Gross Realization for 10% ROI		88.00	68.50	40.60

2.13 The federal and provincial governments are offering an incentive package to entice private sector development of electrical power generation; this includes a payment of 6.5 cents per kilowatt-hour produced regardless of the fuel type. The estimated gross realization per tonne needed to yield a 10% review on investment (ROI) as a percentage of the 6.5 cents per kilowatt-hour payment for electrical power is:

Annual Production Level Tonnes (Millions)	Estimated Gross Realization ($/tonne)	Coal Cost as a Percentage of 6.5 Cents per Kilowatt-Hour
2.5	88.00	117.7
3.5	68.50	91.5
7.0	40.60	54.3

3.0 GEOLOGY AND RESOURCES

3.1 Location, Topography and Access

The Thar Coal Deposit (Thar) is located in the eastern section of the Sind Province and situated in the Thar Desert (average annual rainfall less than 15 cm). The study area within the Thar encompasses approximately 65,000 hectares (650 sq km) bounded by the towns of Islamkot to the southwest, Kharlo Ghulam Shah to the south, Lunio to the southeast, Vakrio to the northeast, and Rangho Nun to the northwest (see Exhibit 1).

Physiographically, the study area is situated on a desert plateau with sand dunes being the most prominent surface feature. The dunes are aligned in a northeast-southwest direction and range from 15 to 50 meters in height. Flat to rolling terrain exists between the dunes which is seasonably planted for livestock crops by local villagers. The dunes are stabilized with scrub trees and vegetation but show evidence of erosion by the annual monsoons. Maximum relief within the study area is 94 meters.

Vehicular access to the study area is by unimproved sand tracks which are passable in fair weather. The main sand track to the town of Nagar Parkar (location of the granite/china clay quarries) courses through the southern part of the study area in an east-west direction (see Exhibit 1). Transport for the general public is provided by privately owned four-wheel and six-wheel drive trucks. Paved roads for the region extend to the towns of Mithi, Diplo, and Umarkot. Mithi is the

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closest town with paved road access to the national highway network which is approximately 25 kilometers west-southwest of the study area.

Rail service is provided by Pakistan Railways to Umarkot (main line) and to Naukot (branch line). The branch line from Mirpur Khas to Naukot is serviced by steam locomotive and is narrow gauge.

Electric power is provided by the Water and Power Development Authority (WAPDA) to the towns of Mithi, Diplo, Islamkot, Chachro, and Umarkot. Telephone service is available in all these towns including Nagar Parkar. The telephone line to Nagar Parkar parallels the main east-west sand track traversing the study area.

3.2 General Geology

The depth of cover above the first coal zone, Seam Zone A (including surface features), ranges from 52 to 210 meters within the study area. This strata consists of dune sand, an oxidized zone, and the coal-bearing formation as shown by Figure 3.1, Generalized Stratigraphic Section, following this text.

The dune sand is stabilized and has sufficient silt to sustain sparse vegetation and seasonal crops for livestock. The thickness of the dune sand is variable, ranging from 17 to 81 meters as indicated by drilling results. Surface features account for an additional 15 to 50 meters of dune sand. At the base of this unit is the local aquifer that supports most of the population in the district. This aquifer is seasonal in flow and largely dependent on precipitation for recharge.

The oxidized zone consists of sandy claystones, siltstones, silty sandstones and clay. This unit has ironstone concretions and siderite nodules and is distinguished from other subsurface units by its iron oxide and limonite staining. USGS considers this unit a subrecent alluvium. The thickness of this oxidized unit varies from 38 to 107 meters. The oxidized zone is generally considered nonwater-bearing. The oxidized zone lies unconformably above the coal formation.

The coal-bearing sequence consists of claystones, siltstones, sandstones, water-bearing sand zones, minor siderite bands and nodules, lignite and associated underclays belonging to the Bara Formation, Eocene Era, Tertiary Age. This sequence of strata is approximately 60 meters thick with a cumulative coal thickness that can approach 30 meters. The lignite is in six seams and/or benches that are grouped into three major seam zones. These three seam zones are designated A, B, and C for this report.

The structure of the bedrock strata is formed by a broad elongated dome dipping in all directions from the structural high at drill holes TP-9 and STP-4 (see Exhibit 2). Dip of the strata within the study area varies from less than 1 meter per kilometer (0.1%) to 4 meters per kilometer (0.4%).

Based on exploration drilling, high-angle normal faults are expected in the eastern section of the study area and effectively form the boundary of the lignite resource area. It is assumed that the faults only affect the coal-bearing formation and basement granite as indicated by geologic cross sections (see Exhibit 3 Series). The displacement varies from 10 to 40 m, and fracturing of the strata is

expected near fault zones. Verification and accurate plotting of faults require additional close-spaced drilling.

A subcrop of Seam Zone A has been projected based on structure of the oxidized zone and top of Seam Zone A. It appears that the oxidized zone has eroded Seam Zone A. Additional drilling is required to further delineate the Seam Zone A subcrop.

3.3 Coal Resources

The in-place lignite resources are estimated for the three seam zones as shown on Table 3.1, following this text. These resources were estimated for the study area based on drilling data from both the USGS/GSP Coal Reap Program (designated TP holes) and the recent BOYD program (identified as STP holes). The drilling data was rectified to account for core losses within the seam zones in accordance with geophysical logs (when available). Appendix A, located in the "Appendix" section of this report, is a listing of drill hole data.

As indicated by the geologic cross sections (Exhibit 3 Series) and the isopach maps (Exhibit 4 Series), the seam zone thicknesses as well as intervals between zones are variable. The intervals between seam zones range from 0 to 30 meters, and the individual seam zone thickness ranges from 0 to 19 meters. Because of this variability, this resource estimate is considered to be in the inferred category of reliability. Additional drilling is required to verify seam zone correlation and increase the level of resource reliability.

The resources were estimated using a specific gravity of 1.30 and 2.10 for coal and in-seam parting material, respectively. The minimum seam thickness considered for the resource estimate is 0.50 m. The resource estimate reflects the common surface mining practice of split loading (discarding in-seam parting material in-pit when loading coal). The minimum in-seam parting material thickness estimated to be segregated (and subsequently discarded) from the coal is 0.50 m.

The total in-place seam resources within the study area are estimated at 19.7 billion tonnes. The associated in-place stripping ratio for the resource is 5.6:1 (bank cubic meters of overburden/interburden : in-place seam tonne). The average cumulative coal zone thickness for the study area is 23 meters.

3.4 Hydrogeology

Based on available studies for the region and BOYD's supervised pumping tests, the coal-bearing formation has a significant aquifer above Seam Zone A, occasional aquifers between Seam Zones B and C, and a large aquifer below Seam Zone C. All aquifers in the coal formation are under pressure. Volumes of water vary depending on the aquifer. Table 3.2, following this text, presents the raw data gathered during the pumping tests performed for drill holes STP-3, STP-7, and STP-8. (See Exhibit 1 for drill hole location.)

The provincial agency, Sind Arid Zone Development Authority (SAZDA), provided and operated the equipment utilized for the pump tests. Each tested aquifer was pumped for approximately one hour with volume tests taken every

15 minutes of elapsed time. One water sample per aquifer was obtained half-way through each pump test. Based on observations during pump tests, it appears that recharge of the aquifers is nearly immediate. The water test data provides only a general indication of the volumes and quality present. Considerable additional detailed study is required prior to mine development to accurately construct a hydrogeological model of the deposit.

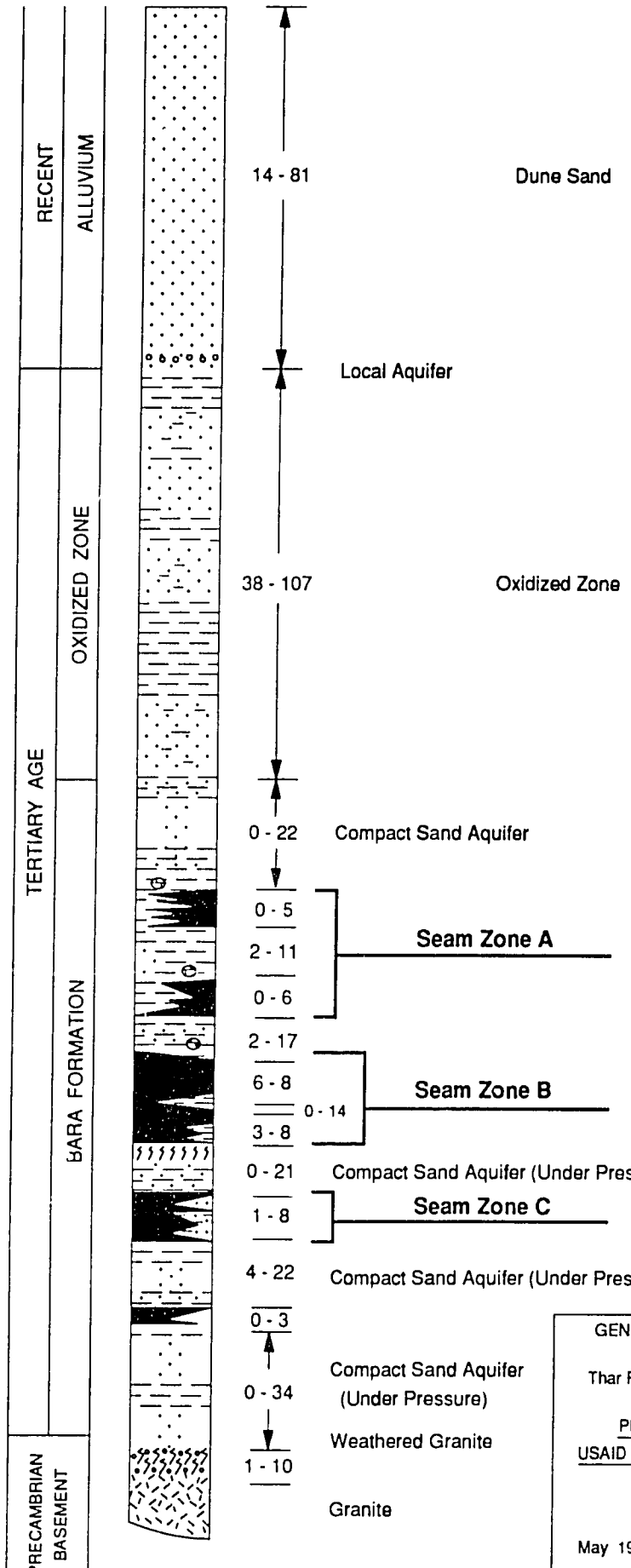
Field electrical conductivity tests indicate all the aquifers tested contain brackish water. More detailed analysis of water samples by the Pakistan Council for Scientific and Industrial Research, Fuel Research Centre (PCSIR-FRC), Karachi verifies the water is brackish. The results of the water analysis performed by PCSIR-FRC are shown on Table 3.3, following this text.

Following this text are:

Figure 3.1: Generalized Stratigraphic Section

Tables

3.1: Estimated In-place Lignite Resources
3.2: Water Pump Test Data
3.3: Water Quality Analysis



GENERALIZED STRATIGRAPHIC SECTION
THAR COAL DEPOSIT
Thar Parkar District - Sind Province, Pakistan
Prepared For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00

Scale, 1 : 100

May 1994

John T. Boyd Company
Mining and Geological Engineers

FIGURE 3.1

TABLE 3.1

ESTIMATED IN-PLACE LIGNITE RESOURCES
THAR COAL DEPOSIT STUDY AREA
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
POWER SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
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John T. Boyd Company
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May 1994

Seam Zone Designation	Seam Height Range (m)	Hectares	Thickness (m)			In-Place (Tonnes-millions)			Waste Volume (BCM-millions)			In-Place Strip Ratio*
			Coal	Parting	Seam	Coal	Parting	Seam	Over-burden	Inter-burden	Total	
A	1 - 2	6,045.2	1.5	-	1.5	118.7	-	118.7	8,896	-	8,896	74.9
	2 - 3	7,798.2	2.5	-	2.5	255.8	-	255.8	11,220	-	11,220	43.9
	3 - 4	7,545.1	3.5	-	3.5	339.2	7.2	346.4	11,092	-	11,092	32.0
	4 - 5	9,087.0	4.5	-	4.5	530.4	8.5	538.9	13,462	-	13,462	25.0
	5 - 6	7,972.4	5.3	0.3	5.6	544.9	51.7	596.6	11,734	-	11,734	19.7
	6 - 7	4,610.3	6.2	0.3	6.5	372.6	27.1	399.7	6,580	-	6,580	16.5
	7 - 8	4,955.1	7.4	0.1	7.5	477.2	8.5	485.7	7,067	-	7,067	14.6
	8 - 9	5,676.3	8.4	0.1	8.5	616.8	15.3	632.1	8,423	-	8,423	13.3
	9 - 10	1,561.1	9.5	-	9.5	191.8	0.2	192.0	2,277	-	2,277	11.9
	10 - 11	832.1	10.5	-	10.5	113.5	-	113.5	1,198	-	1,198	10.6
	11 - 12	133.8	11.0	-	11.3	19.1	0.8	19.9	194	-	194	9.7
		56,216.6	4.9	0.3	5.0	3,580.0	119.3	3,699.3	82,143	-	82,143	22.2
B	4 - 5	1,053.0	4.8	-	4.8	65.7	-	65.7	-	32	32	0.5
	5 - 6	3,239.7	5.4	0.2	5.6	229.3	8.5	237.8	1,222	217	1,439	6.1
	6 - 7	2,897.5	6.5	-	6.5	243.9	5.8	249.7	2,336	137	2,473	9.9
	7 - 8	4,202.4	7.4	0.1	7.5	405.9	9.3	415.2	2,493	273	2,766	6.7
	8 - 9	4,000.9	8.3	0.2	8.5	429.8	17.3	447.1	2,260	304	2,564	5.7
	9 - 10	2,852.6	9.3	0.2	9.5	346.3	11.2	357.5	1,261	234	1,495	4.2
	10 - 11	3,099.4	10.3	0.2	10.5	414.7	13.9	428.6	1,047	316	1,363	3.2
	11 - 12	3,734.7	11.3	0.2	11.5	546.6	20.2	566.8	1,019	417	1,436	2.5
	12 - 13	4,187.8	12.3	0.2	12.5	668.3	18.8	687.1	695	538	1,233	1.8
	13 - 14	4,802.1	13.3	0.2	13.5	828.0	25.1	853.1	103	772	875	1.0
	14 - 15	9,884.6	14.4	0.1	14.5	1,648.8	30.9	1,879.7	-	1,450	1,450	0.8
	15 - 16	9,307.2	15.4	0.1	15.5	1,858.9	23.9	1,882.8	-	1,285	1,285	0.7
	16 - 17	4,218.4	16.1	0.4	16.5	883.1	39.3	922.4	-	432	432	0.5
	17 - 18	3,345.9	16.9	0.6	17.5	735.6	40.2	775.8	-	325	325	0.4
	18 - 19	4,139.2	17.5	1.0	18.5	943.0	83.4	1,026.4	-	356	356	0.3
	19 - 20	43.5	17.5	1.6	19.1	9.9	1.4	11.3	-	4	4	0.4
		65,008.9	12.4	0.2	12.6	10,457.8	349.2	10,807.0	12,436	7,092	19,528	1.8
C	1 - 2	1,812.5	1.5	-	1.5	35.2	-	35.2	-	205	205	5.8
	2 - 3	5,116.5	2.5	-	2.5	165.1	-	165.1	-	701	701	4.2
	3 - 4	4,858.5	3.5	-	3.5	219.8	-	219.8	-	594	594	2.7
	4 - 5	10,590.7	4.2	0.3	4.5	576.7	73.1	649.8	-	1,665	1,665	2.6
	5 - 6	9,981.8	5.5	-	5.5	708.0	6.2	714.2	-	1,289	1,289	1.8
	6 - 7	9,988.2	6.4	0.1	6.5	836.4	13.7	850.1	-	1,021	1,021	1.2
	7 - 8	11,461.7	7.4	0.1	7.5	1,096.3	33.9	1,130.2	-	1,060	1,060	0.9
	8 - 9	6,066.3	8.3	0.2	8.5	652.9	23.9	676.8	-	736	736	1.1
	9 - 10	3,618.7	9.2	0.3	9.5	432.6	23.3	455.9	-	547	547	1.2
	10 - 11	1,718.8	10.1	0.4	10.5	224.2	14.9	239.1	-	289	289	1.2
	11 - 12	404.7	10.9	0.8	11.7	57.3	6.8	64.1	-	66	66	1.0
		65,618.4	5.9	0.1	6.0	5,004.5	195.8	5,200.3	-	8,173	8,173	1.6

TABLE 3.1 - Continued

Seam Zone Designation	Seam Height Range (m)	Hectares	Thickness (m)			In-Place (Tonnes-millions)			Waste Volume (BCM-millions)			In-Place Strip Ratio*
			Coal	Parting	Seam	Coal	Parting	Seam	Over-burden	Inter-burden	Total	
						Grand Total						
A, B & C	1 - 2	7,857.7	1.5	-	1.5	153.9	-	153.9	8,896	205	9,101	59.1
	2 - 3	12,914.7	2.5	-	2.5	420.9	-	420.9	11,220	701	11,921	28.3
	3 - 4	12,403.6	3.5	-	3.5	559.0	7.2	566.2	11,092	594	11,686	20.6
	4 - 5	20,730.7	4.4	0.1	4.5	1,172.8	81.6	1,254.4	13,462	1,697	15,159	12.1
	5 - 6	21,193.9	5.4	0.1	5.5	1,482.2	66.4	1,548.6	12,956	1,506	14,462	9.3
	6 - 7	17,496.0	6.4	0.1	6.5	1,452.9	46.6	1,499.5	8,916	1,158	10,074	6.7
	7 - 8	20,619.2	7.4	0.1	7.5	1,979.4	51.7	2,031.1	9,560	1,333	10,893	5.4
	8 - 9	15,743.5	8.3	0.2	8.5	1,699.5	56.5	1,756.0	10,683	1,040	11,723	6.7
	9 - 10	8,032.4	9.3	0.2	9.5	970.7	34.7	1,005.4	3,538	781	4,319	4.3
	10 - 11	5,650.3	10.3	0.2	10.5	752.4	28.8	781.2	2,245	605	2,850	3.6
	11 - 12	4,273.2	11.2	0.3	11.5	623.0	27.8	650.8	1,213	483	1,696	2.6
	12 - 13	4,187.8	12.3	0.2	12.5	668.3	18.8	687.1	695	538	1,233	1.8
	13 - 14	4,802.1	13.3	0.2	13.5	828.0	25.1	853.1	103	772	875	1.0
	14 - 15	9,884.6	14.4	0.1	14.5	1,848.8	30.9	1,879.7	-	1,450	1,450	0.8
	15 - 16	9,307.2	15.4	0.1	15.5	1,858.9	23.9	1,882.8	-	1,285	1,285	0.7
	16 - 17	4,218.4	16.1	0.4	16.5	883.1	39.3	922.4	-	432	432	0.5
	17 - 18	3,345.9	16.9	0.6	17.5	735.6	40.2	775.8	-	325	325	0.4
	18 - 19	4,139.2	17.5	1.0	18.5	943.0	83.4	1,026.4	-	356	356	0.3
	19 - 20	43.5	17.5	1.6	19.1	9.9	1.4	11.3	-	4	4	0.4
		186,843.9				19,042.3	664.3	19,706.6	94,579	15,265	109,844	5.6

*Bank cubic meters of waste: in-place seam tonnes.

TABLE 3.2

WATER PUMP TEST DATA
THAR COAL DEPOSIT STUDY AREA
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

Drill Hole No.	Meters			Average Water Volume (Liters/min)	Field Electrical Conductivity (μ mhos/cm)	Static Water Level (m)
	Thickness of Sand Tested	Depth to Top of Sand	Interval Tested			
STP-3	12.9	11.6	115.9 to 118.9	52.8	4,165	52.6
	20.9	185.2	191.6 to 194.6	78.2	4,500	43.2
STP-7	5.2	137.5	139.2 to 142.3	50.0	4,760	-
	12.3	210.7	213.4 to 216.4	90.0	4,270	-
STP-8	3.7	89.1	88.4 to 91.4	9.5	5,900	62.7
	4.5	149.9	149.4 to 152.4	0	-	-
	9.1	176.4	179.9 to 182.9	38.2	4,550	52.3

TABLE 3.3

WATER QUALITY ANALYSIS
THAR COAL DEPOSIT STUDY AREA
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

Drill Hole Number		STP-3	STP-3	STP-7	STP-7	STP-8	STP-8
Sample Number		1	2	1	2	1	2
Interval Tested (m)		191.6-194.6	115.9-118.9	213.4-216.4	139.2-142.3	179.9-182.9	88.4-91.4
pH		8.36	7.90	8.25	8.21	7.68	5.57
Conductivity (µS/cm at 25.4 C)		7.13	7.52	7.85	8.48	7.65	12.07
Salinity	(ppt)	4.4	4.7	4.9	5.3	4.8	6.8
Acid Consuming Capacity (to attain pH=4.1 meq/l)		4.34	3.70	4.12	3.70	3.60	2.86
Chloride	(mg/l)	2,480	2,610	2,750	2,950	2,680	4,020
Sulphate	(mg/l)	0.24	0.28	0.24	0.27	0.25	0.48
Sodium	(mg/l)	1,306	1,348	1,425	1,035	1,395	2,094
Potassium	(mg/l)	30	32	35	39	33	41
Calcium	(mg/l)	148	164	187	179	165	325
Magnesium	(mg/l)	-	100	109	99	100	370
Iron Soluble	(mg/l)	0.03	0.04	0.02	0.02	0.04	0.04
Manganese	(mg/l)	0.44	0.30	0.24	0.18	0.25	0.04
Fluoride	(mg/l)	1.90	1.53	1.95	1.99	1.49	1.29

4.0 COAL QUALITY

4.1 Exploration Core Sampling Procedure

Core samples of the three seam zones were obtained by on-site BOYD geologists during the drilling phase of this project. All seam zone cores were HQ size (63.5 mm).

Coal cores were pushed (pumped) out of the inner barrel using drilling fluid. Once in the push tray, cores were washed to remove drilling mud that adhered readily to the core. (Not all drilling mud could be removed from the cores and may have slightly affected the samples.) The coal seam was covered with wet jute and/or cotton waste to retain moisture in the dry environment during logging. Cores were then lithologically described and wrapped in plastic sheeting with identifying sample cards placed with the core. The wrapped cores were placed in precut 0.91 m (3 ft.) or 1.52 m (5 ft) length PVC tubes and sealed with PVC cemented end caps. Tubes were marked according to the drill hole and sampled zone and placed within a tent for storage. The approximate time a coal core was removed from the inner barrel and sealed in the PVC tube ranged from 15 to 30 minutes.

The stored cores were periodically transported from the field to Karachi and stored at the USAID warehouse facilities until transport to the United States. Core samples were obtained from mid-November 1993 to the end of the drilling project on January 3, 1994. Core tubes were packaged in two wooden crates and sealed

prior to BOYD personnel leaving the country. The samples arrived in the United States during February and were shipped to the geotechnical laboratory in Milwaukee, Wisconsin. Geotechnical testing was completed in mid-April, and cores were shipped to Standard Laboratories, Inc., in Charleston, West Virginia, for quality analysis.

4.2 Estimated In-Seam Coal Quality

Coal core samples were grouped according to seam correlation. In-seam partings less than 0.50 meters in thickness were included to represent the mining resource. Cores were prepared and split for testing of moisture, ash, sulfur, volatile matter, fixed carbon, and calorific value. Test reports were submitted on both an as-received and dry basis. Equilibrium moisture tests on selected core samples ranged from 60% to 80% and are considered inconclusive. Hardgrove Grindability Index (HGI) for selected coal cores also varied, but the coal is anticipated to be in the 90 to 100 HGI range with an assumed moisture content of 50%.

Table 4.1, following this text, shows the average in-seam coal quality (dry basis) by seam zone. Test results from each seam were weighted both on seam zone thickness and area of drill hole influence (polygon method) to arrive at an

average quality for each zone. The average in-seam coal quality for the study area is estimated below:

Parameter		Estimated In-Seam Coal Quality	
		As Received*	Dry Basis
Assumed Moisture	(%)	50.00	-
Ash	(%)	9.24	18.48
Volatile Matter	(%)	24.65	49.30
Fixed Carbon	(%)	16.11	32.22
Sulfur (%)		1.25	2.50
Calorific Value	(Btu/lb)	5,140	10,280
	(KCal/Kg)	2,855	5,710
SO_2 /MM Btu		4.86	

* Based on an assumed moisture of 50% because test results of later cores indicated various degrees of moisture loss and equilibrium moisture tests were inconclusive.

Following this text is:

Table 4.1: Average In-Seam Coal Quality by Seam Zone

TABLE 4.1

AVERAGE IN-SEAM COAL QUALITY BY SEAM ZONE
THAR COAL DEPOSIT STUDY AREA
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
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			In-Seam Coal Quality (Dry Basis)				
Drill Hole	Seam Thickness (m)	Area of Influence (hectares)	Ash (%)	Volatile Matter (%)	Fixed Carbon (%)	Sulfur (%)	Calorific Value (Btu/lb)
			Seam Zone A				
STP-1	10.41	8,022	12.35	50.46	37.19	1.64	11,388
STP-2	2.83	2,096	26.07	47.58	26.35	6.18	9,140
STP-3	3.63	7,520	25.04	48.25	26.71	3.37	9,321
STP-4	1.04	14,083	32.82	43.97	23.21	7.18	8,060
STP-5	5.11	9,867	20.29	46.76	32.95	4.79	9,926
STP-7	1.43	9,303	54.10	31.06	14.84	4.25	5,264
STP-9	9.70	6,586	25.69	47.62	26.69	3.19	9,153
	4.51	57,477	21.54	47.38	31.08	3.37	9,780
			Seam Zone B				
STP-1	9.81	8,006	14.09	50.60	35.31	1.06	11,120
STP-2	5.22	2,097	19.13	45.34	35.53	0.97	10,055
STP-3	14.08	7,530	18.97	50.23	30.80	2.53	10,264
STP-4	16.48	14,083	14.96	56.35	28.69	1.90	11,104
STP-5	15.65	9,816	15.28	49.66	35.06	2.79	10,849
STP-7	19.06	8,748	22.49	42.44	35.07	2.11	9,692
STP-8	9.16	7,990	18.30	50.16	31.54	4.13	9,583
STP-9	3.73	7,200	45.17	31.70	23.13	15.59	6,363
	12.95	65,470	18.22	49.65	32.13	2.72	10,382
			Seam Zone C				
STP-1	7.32	8,006	11.71	49.17	39.12	1.63	11,259
STP-2	7.92	2,097	18.14	52.74	29.12	1.03	8,750
STP-3	8.27	7,530	12.73	59.89	27.38	1.07	11,333
STP-4	0.99	14,083	21.86	45.30	32.84	0.69	9,870
STP-5	8.15	9,816	8.11	53.55	38.34	1.07	11,883
STP-7	5.23	8,748	16.63	46.17	37.20	0.86	10,118
STP-8	4.69	7,990	42.34	36.64	21.02	1.26	6,711
STP-9	13.79	7,200	19.06	48.20	32.74	2.26	10,066
	6.32	65,470	16.85	49.94	33.21	1.41	10,419

5.0 CONCEPTUAL MINES

5.1 Introduction

During the course of the Thar Coal Deposit (Thar) study, the capacity of a potential surface mine that would make the monetary investment feasible was questioned. Mining capacities were proposed from 1 million tonnes to as high as 25 million tonnes per year.

This section of the report indicates the order of magnitude for the required investment to develop a surface mine in the Thar and the approximate annual mining capacity. Three annual production levels are analyzed: 2.5 million, 3.5 million, and 7.0 million tonnes.

Individual mining companies and developers will have their own methods of approaching this project. The plan shown is based on our experience in Pakistan and the currently available geologic data for the deposit. This report is intended to provide the potential mining company, power developer, and/or investor the basic data needed to make an informed decision regarding development of this deposit for electrical power generation.

5.2 Conceptual Mine Design

The basic geological model of the study area is based on exploration data points shown on Exhibit 1. The parameters used for the conceptual mine plans follow:

	Average Thickness (m)
Overburden	150
Interburden	24
Seam zones	23.5

Data for the pit slope design was developed from testing data results of rock and coal samples obtained during the exploration phase of the study. Development of a preliminary mine design was completed based on circular failure using the Modified Bishop's Method.[1] The computer code used was PCSTABL5.[2] The minimum safety factor used for design was 1.2. This type of analysis is appropriate for deep failures and large slopes where wedges defined by discontinuities do not control the stability of the slope. The analysis was completed for not only deep failure but for overall sections of the slope considered critical. A bench within each zone and the bench at each zone boundary were examined.

Because of the manner in which bucket wheel excavators operate (i.e., the active bench slope fails to the bucket wheel), a safety zone was designed to protect the equipment and personnel operating on the upper benches. This safety zone is based on a safety factor of 1.2.

Still to be completed is a wedge analysis for benches in the rock type material. No wedge analysis has been completed because adequate discontinuity/joint studies of the strata have not been performed. To account for the lack of a wedge stability analysis, a safety factor of 1.8 for rock material bench slopes was used in the circular stability analysis. BOYD's preliminary design is shown on Figure 5.1, following this text.

There are three aquifers at the site: one at the top of the oxidized zone, one within the overburden, and one within the underburden. Of concern are the

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[1]Bishop, A.W., 1955, "The Use of the Slip Circle in the Stability Analysis of Slopes," Geotechnique, Vol. 5, No. 1.

[2]Purdue University and Indiana State Highway Commission, PCSTABL5, Purdue University, West Lafayette, Indiana.

two lower aquifers that are under pressure and have the potential to cause uplift of the pit bottom. Relief wells are needed at the benches shown to reduce the potential of uplift.

The characteristics of these aquifers are established by a limited number of basic pump tests, and further studies are required. Water tests show that the density of water in the two lower aquifers is 1.05 g/cc, a value used in both the uplift calculations and the stability analysis.

Based on the mechanical properties of the strata and deposit configuration, BOYD recommends using bucket wheel excavators to mine the dune sand and shovel/truck units to mine the remaining strata. Shovel/truck units are selected over additional bucket wheel excavators for maneuverability and work versatility (i.e., shovel/truck units could be used for both rock and coal). The following are the equipment units utilized for each production level:

	No. of Units		
Annual Production Level Tonnes (Millions)	Bucket Wheel Excavators	Shovel/Truck Rock	Shovel/Truck Coal
2.5	2	3	3
3.5	2	3	3
7.0	3	6	3

The mine requires two 30-meter height bucket wheel excavator benches, four 15-meter height shovel benches for the oxidized zone, and two 15-meter height shovel benches for the coal formation overburden to reach the first coal zone. The number of working benches required for mining the coal and

interburden ranges from five to seven according to configuration of the seam zones.

The estimated area for the mine and supporting facilities for a 30-year supply of lignite to a power generating plant is shown below:

Annual Production Level Tonnes (Millions)	Estimated Land Requirement (hectares)
2.5	1,000
3.5	1,400
7.0	2,800

5.3 Production Levels

A 15-year mining plan was constructed to show conceptual mine projections. Preproduction mine development is designated on the plans as Years D-5 to D-1. Coal production years are shown as D+1 through D+10.

Table 5.1, following this text, tabulates the projected mine production by year for the 15-year mining period by case. Productivity for the mining equipment units has been derated due to remote third world applications. Lead time for equipment erection is not shown in the plan.

5.4 Labor Requirement

Table 5.2 estimates labor requirements for the respective cases at full production. Expatriates are included for intense on-the-job training of Pakistani workers in all facets of the mining operation. It is assumed that the number of

expatriates declines as training is completed and productivity of the local work force reaches adequate levels. It is imperative for the mine to attract educated personnel to operate the required sophisticated equipment. The mining plan assumes expatriates manage operations until Pakistani nationals are trained for these managerial duties.

5.5 Capital Expenditures

Tables 5.3, 5.4, and 5.5 estimate the yearly initial and replacement capital requirements to develop and sustain the mine according to production level. Funds for freight and erection of equipment at the mine site are included in the unit capital costs. In accordance with the GOP and GOS incentives for coal-fired power development, as presented at the Thar Coal Conference (May 1994), all duties and taxes associated with mining equipment are excluded from the capital cost. A contingency of 20% has been applied to all capital expenditures.

The capital to extend utilities and highway access to the mine site are excluded from the estimate. It is assumed that these infrastructure costs and construction are the responsibility of the federal and/or provincial governments. Capital for housing local workers is also excluded from the estimate.

Replacement capital for rebuilds is based on the assigned life of the equipment units and the projected hours of operation. Rebuilds are estimated to cost 60% of the unit purchase price and are considered "strip to the frame", complete overhauls that extend the useful life of the unit.

5.6 Production Costs

Tables 5.6, 5.7 and 5.8 present the estimated total cost of production for the respective cases. All labor costs assume an average salary base rate. Expatriates are considered exempt from overtime. Overtime as a percentage of base salary is estimated at 5%, 10%, and 20% for the 2.5, 3.5, and 7.0 million tonne cases, respectively. Fringe benefits, i.e., paid holidays, vacation, training, clothing allowance, etc., is projected at 100% of the base salary.

Operating and supply costs are based on the estimated costs per unit operating-hour. Explosive costs are assumed to be $0.05 per BCM.

The projected work schedule for mining functions is as follows:

Mining Function	No. of 8-Hour Shifts Per Day
Overburden Removal	
- Bucket wheel excavators	3
- Shovel/Truck units	3
- Blasthole drilling	2
Interburden Removal	
- Shovel/Truck units	3
- Blasthole drilling	2
Coal Removal	2

Scheduled annual operating days are projected to be 240 for the 2.5 million tonne case, 260 for the 3.5 million tonne case, and 310 for the 7.0 million tonne case. The effective operating hours per shift are estimated at 6.5 hours.

Mine administration costs are estimated at $2.0 million per annum for office supplies, utilities, communication, operation of water and sewage treatment facilities, housing of expatriates at the site, and in-country travel expenses.

Depreciation is projected at a flat rate per tonne over the life of the mine for the capital expended. Interest cost of the initial capital and mine development is 10% per year, amortized over the projected mine development time after coal production commences.

Corporate G&A cost assumes a foreign mining company expenses corporate management, communication, business travel and lodging to the operation. The G&A cost is projected at $1.00 per tonne mined for the 2.5 and 3.5 million tonne cases, and $0.50 per tonne for the 7.0 million tonne case.

5.7 Mine Economics

The depth of the deposit necessitates a large capital investment in both mining equipment and movement of prestrip material; therefore, the annual coal production output should be sufficiently large to support the front-end investment in both capital and management before coal production commences. The following table shows the realization per tonne of coal mined to obtain a 10% return on investment (ROI):

Annual Coal Production Level Tonnes (Millions)	Mine Development			Required Gross Realization per Tonne @ 10% ROI
	Years	Prestripping Requirement (BCM-000)	Initial Capital* Requirement ($000)	
2.5	5	112,856	343,391	88.00
3.5	5	122,136	396,245	68.50
7.0	5	154,316	497,585	40.60

*Includes 20% contingency.

The federal and provincial governments are offering an incentive package to entice private sector development of electrical power generation; this includes

a payment of 6.5 cents per kilowatt-hour produced regardless of the fuel type. The estimated gross realization per tonne required to yield a 10% return on investment (ROI) as a percentage of the 6.5 cents per kilowatt-hour payment for electrical power is:

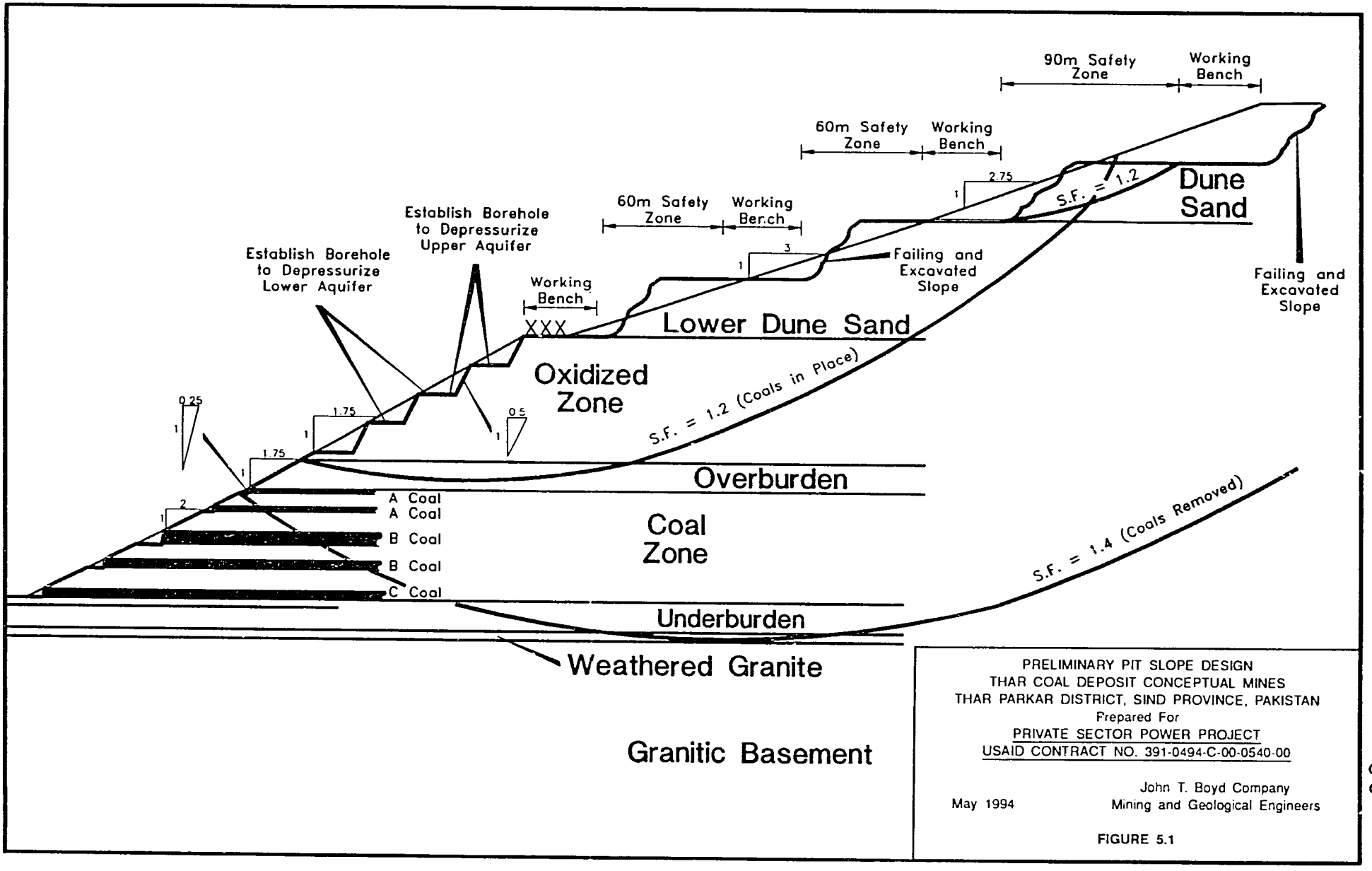
Annual Production Level Tonnes (Millions)	Estimated Gross Realization ($/tonne)	Coal Cost as a Percentage of 6.5 Cents per Kilowatt-Hour
2.5	88.00	117.7
3.5	68.50	91.5
7.0	40.60	54.3

Following this text are:

Figure 5.1: Preliminary Pit Slope Design

Tables

5.1: Projected Production Levels by Case
5.2: Estimated Labor Summary at Full Production by Case
5.3: Estimated Capital Expenditures - 2.5 Million Tonne Case
5.4: Estimated Capital Expenditures - 3.5 Million Tonne Case
5.5: Estimated Capital Expenditures - 7.0 Million Tonne Case
5.6: Projected Production Cost - 2.5 Million Tonne Case
5.7: Projected Production Cost - 3.5 Million Tonne Case
5.8: Projected Production Cost - 7.0 Million Tonne Case



PRELIMINARY PIT SLOPE DESIGN
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT, SIND PROVINCE, PAKISTAN
Prepared For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00

May 1994

John T. Boyd Company
Mining and Geological Engineers

FIGURE 5.1

TABLE 5.1

PROJECTED PRODUCTION LEVELS BY CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
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Mining Year:	D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
2.5 MILLION TONNE CASE																
Overburden (BCM-000)																
Bucket Wheel Excavators	5,000	11,000	16,000	16,000	16,000	16,000	16,000	16,000	8,000	8,000	16,000	16,000	16,000	16,000	16,000	208,000
Shovel/Truck Units	-	-	-	4,264	15,622	20,699	21,000	17,045	14,008	14,008	14,008	14,008	14,008	14,008	14,008	176,686
Interburden (BCM-000)																
Shovel/Truck Units	-	-	-	-	-	-	-	1,506	2,051	2,051	2,051	2,051	2,051	2,051	2,051	15,863
Total Waste Moved (BCM-000)	5,000	11,000	16,000	20,264	31,622	36,699	37,000	34,551	24,059	24,059	32,059	32,059	32,059	32,059	32,059	400,549
Coal Mined (Tonnes-000)	-	-	-	-	-	590	839	2,632	2,512	2,512	2,512	2,512	2,512	2,512	2,512	21,645
Estimated Ratio (BCM:Tonne)	-	-	-	-	-	62.2	44.1	13.1	9.6	9.6	12.8	12.8	12.8	12.8	12.8	18.5
Prestrip Requirement (BCM-000) to Coal Zone						112,856										
3.5 MILLION TONNE CASE																
Overburden (BCM-000)																
Bucket Wheel Excavators	5,000	11,000	16,000	16,000	16,000	16,000	16,000	16,000	9,000	10,000	18,000	18,000	18,000	19,000	19,000	223,000
Shovel/Truck Units	-	-	-	4,264	15,622	29,625	21,839	14,008	14,008	14,008	14,008	14,008	14,008	14,008	14,008	183,414
Interburden (BCM-000)																
Shovel/Truck Units	-	-	-	-	-	-	2,152	2,930	2,930	2,930	2,930	2,930	2,930	2,930	2,930	25,592
Total Waste Moved (BCM-000)	5,000	11,000	16,000	20,264	31,622	45,625	39,991	32,938	24,938	26,938	34,938	34,938	34,938	34,938	34,938	432,006
Coal Mined (Tonnes-000)	-	-	-	-	-	590	3,206	3,588	3,588	3,588	3,588	3,588	3,588	3,588	3,588	32,500
Estimated Ratio (BCM:Tonne)	-	-	-	-	-	77.3	12.5	9.2	7.0	7.5	9.7	9.7	9.7	9.7	9.7	13.3
Prestrip Requirement (BCM-000) to Coal Zone						122,136										

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TABLE 5.1
PROJECTED PRODUCTION LEVELS BY CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
Sheet 1 of 2

TABLE 5.1 - Continued

Mining Year:	D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
7.0 MILLION TONNE CASE																
Overburden (BCM-000)																
Bucket Wheel Excavators	5,000	15,000	19,000	22,000	24,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	26,000	345,000
Shovel/Truck Units	-	-	-	4,264	15,622	29,625	29,069	28,016	24,500	24,500	24,500	24,500	24,500	24,500	24,500	278,096
Interburden (BCM-000)																
Shovel/Truck Units	-	-	-	-	-	-	4,304	5,125	5,125	5,125	5,125	5,125	5,125	5,125	5,125	45,304
Total Waste Moved (BCM-000)	5,000	15,000	19,000	26,264	39,622	55,625	59,373	59,141	55,625	55,625	55,625	55,625	55,625	55,625	55,625	668,400
Coal Mined (Tonnes-000)	-	-	-	-	-	590	5,629	7,176	7,176	7,176	7,176	7,176	7,176	7,176	7,176	63,627
Estimated Ratio (BCM:Tonne)	-	-	-	-	-	94.3	10.5	8.2	7.8	7.8	7.8	7.8	7.8	7.8	7.8	10.5
Prestrip Requirement (BCM-000) to Coal Zone						154,316										

TABLE 5.2

ESTIMATED LABOR SUMMARY
AT FULL PRODUCTION - BY CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

		2.5 Million Tonne Case				3.5 Million Tonne Case				7.0 Million Tonne Case			
		Shift				Shift				Shift			
Item	Description	Day	Afternoon	Midnight	Total	Day	Afternoon	Midnight	Total	Day	Afternoon	Midnight	Total
I.	Administration												
	- Expatriates	10	-	-	10	10	-	-	10	10	-	-	10
	- Pakistani Nationals	35	18	13	66	35	16	13	66	35	18	13	66
	Total	45	18	13	76	45	18	13	76	45	18	13	76
II.	Stripping - Bucket Wheel Excavators												
	- Expatriates	9	9	6	24	9	9	6	24	9	9	6	24
	- Pakistani Nationals	12	12	14	38	12	12	14	38	12	12	14	38
	Total	21	21	20	62	21	21	20	62	21	21	20	62
III.	Stripping - Shovels												
	- Expatriates	12	6	3	21	12	6	3	21	12	6	3	21
	- Pakistani Nationals	36	36	33	105	57	53	46	156	57	53	46	156
	Total	48	42	36	126	69	59	49	177	69	59	49	177
IV.	Coal Loading and Hauling												
	- Expatriates	8	4	2	14	8	4	3	15	8	4	3	15
	- Pakistani Nationals	17	21	4	42	21	23	12	56	31	35	12	78
	Total	25	25	6	56	27	27	15	71	39	39	15	93
V.	Mine Support												
	- Expatriates	6	6	4	16	6	6	4	16	6	6	4	16
	- Pakistani Nationals	36	32	20	88	43	39	26	108	43	39	26	108
	Total	42	38	24	104	49	45	30	124	49	45	30	124
VI.	Mine Management												
	- Expatriates	6	5	5	16	6	5	5	16	6	5	5	16
	Totals												
	- Expatriates	51	30	20	101	51	30	21	102	51	30	21	102
	- Pakistani Nationals	136	119	84	339	168	145	111	424	178	157	111	446
	Total	187	149	104	440	219	175	132	526	229	187	132	548

TABLE 5.2
ESTIMATED LABOR SUMMARY
AT FULL PRODUCTION - BY CASE
THAR COAL DEPOSIT CONCEPTUAL MINE
THAR PARKAR DISTRICT

TABLE 5.3

ESTIMATED CAPITAL EXPENDITURES
2.5 MILLION TONNE CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

Item	Description		No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
I	Mine Facilities																				
	Portable Housing		40	40	LOM	400	400	400	400	-	-	-	-	-	-	-	-	-	-	-	1,600
	Water & Sewage Treatment Facility		1	350	LOM	350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350
	Water Wells		10	15	LOM	15	30	30	30	30	15	-	-	-	-	-	-	-	-	-	150
	Communication System		1	40	LOM	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	40
	Mine Office and Shop		1	13,000	LOM	-	-	5,000	5,000	3,000	-	-	-	-	-	-	-	-	-	-	13,000
	Total - Item I					765	470	5,430	5,430	3,030	15	-	-	-	-	-	-	-	-	-	15,140
II	Stripping Equipment																				
	Bucket Wheel Excavators	- Initial	2	14,000	20	14,000	14,000	-	-	-	-	-	-	-	-	-	-	-	-	-	28,000
		- Replacement		-	-	-	-	-	-	-	-	-	-	8,400	-	8,400	-	-	-	-	16,800
	Mobile Transfer Conveyor	- Initial	2	5,000	20	5,000	5,000	-	-	-	-	-	-	-	-	-	-	-	-	-	10,000
		- Replacement		-	-	-	-	-	-	-	-	-	-	3,000	-	3,000	-	-	-	-	6,000
	Hopper Car	- Initial	2	850	10	850	850	-	-	-	-	-	-	-	-	-	-	-	-	-	1,700
		- Replacement		-	-	-	-	-	-	510	510	-	-	850	-	850	-	-	510	510	3,740
	Shiftable Conveyor (1000 m)	- Initial	4	7,400	20	14,800	14,800	-	-	-	-	-	-	-	-	-	-	-	-	-	29,600
		- Replacement		-	-	-	-	-	-	-	-	-	-	3,700	-	3,700	-	-	-	-	7,400
	Conveyor Drive Unit	- Initial	7	1,000	10	3,000	4,000	-	-	-	-	-	-	-	-	-	-	-	-	-	7,000
		- Replacement		-	-	-	-	-	-	1,800	2,400	-	-	3,000	-	3,000	-	-	1,800	2,400	14,400
	Spoil Spreader System	- Initial	2	13,000	20	13,000	13,000	-	-	-	-	-	-	-	-	-	-	-	-	-	26,000
		- Replacement		-	-	-	-	-	-	-	-	-	-	3,250	-	3,250	-	-	-	-	6,500
	Spoil Conveyor (1000 m)	- Initial	2	7,400	20	7,400	7,400	-	-	-	-	-	-	-	-	-	-	-	-	-	14,800
		- Replacement		-	-	-	-	-	-	-	-	-	-	1,850	-	1,850	-	-	-	-	3,700
	Spoil Drive Units	- Initial	2	1,000	10	1,000	1,000	-	-	-	-	-	-	-	-	-	-	-	-	-	2,000
		- Replacement		-	-	-	-	-	-	-	-	-	-	600	-	600	-	-	1,000	1,000	3,200
	Power Shovels (44 cubic meter)	- Initial	3	14,000	20	-	-	14,000	14,000	14,000	-	-	-	-	-	-	-	-	-	-	42,000
		- Replacement		-	-	-	-	-	-	-	-	-	-	-	-	-	8,400	8,400	8,400	-	25,200
	Rock Trucks (240 ton)	- Initial	30	1,800	8	-	-	18,000	18,000	18,000	-	-	-	-	-	-	-	-	-	-	54,000
		- Replacement		-	-	-	-	-	-	-	-	-	5,400	10,800	10,800	5,400	9,000	18,000	18,000	9,000	86,400
	Blasthole Drills	- Initial	3	1,600	10	-	-	1,600	1,600	1,600	-	-	-	-	-	-	-	-	-	-	4,800
		- Replacement		-	-	-	-	-	-	-	-	960	960	960	-	-	1,600	1,600	1,600	-	7,680
	Cat D11N Dozer or Equiv.	- Initial	2	1,600	8	1,600	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200
		- Replacement		-	-	-	-	-	-	960	960	-	-	1,600	1,600	-	-	960	960	-	7,040
	Cat D10N Dozer or Equiv.	- Initial	2	1,000	8	-	1,000	1,000	-	-	-	-	-	-	-	-	-	-	-	-	2,000
		- Replacement		-	-	-	-	-	-	-	600	600	-	-	1,000	1,000	-	-	600	600	4,400
	Cat D8L Dozer or Equiv.	- Initial	4	800	8	-	-	800	1,600	800	-	-	-	-	-	-	-	-	-	-	3,200
		- Replacement		-	-	-	-	-	-	-	-	480	960	480	-	800	1,600	800	-	480	5,600
	Cat 824B RT Dozer or Equiv.	- Initial	3	1,400	8	1,400	-	1,400	1,400	-	-	-	-	-	-	-	-	-	-	-	4,200
		- Replacement		-	-	-	-	-	-	840	-	840	840	1,400	-	1,400	1,400	840	-	840	8,400
	Total - Item II	- Initial				62,050	62,650	36,800	36,600	34,400	-	-	-	-	-	-	-	-	-	-	232,500
		- Replacement				-	-	-	-	4,110	4,470	2,880	8,160	39,890	13,400	33,250	22,000	30,600	32,870	14,830	206,460

TABLE 5.3 - Continued

Item	Description		No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
III.	Coal Haulage and Crushing																				
	Power Shovels (20 cubic meter)	- Initial	3	6,600	20	-	-	-	-	6,600	6,600	-	-	-	-	-	-	-	-	-	13,200
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,960	3,960
	Bottom-dump Haulers (120-ton)	- Initial	7	700	8	-	-	-	-	-	2,800	2,100	-	-	-	-	-	-	-	-	4,900
		- Replacement				-	-	-	-	-	-	-	-	-	1,680	1,260	-	-	2,800	2,100	7,840
	Cat 992C FEL or Equiv	- Initial	2	1,600	8	-	-	-	-	-	-	1,600	1,600	-	-	960	960	-	-	1,500	3,200
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,520
	Cat 245 Backhoe or Equiv	- Initial	1	800	10	-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	800
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	480	-	-	-	480
	Truck Dump and Crushing Facility	- Initial	1	750	LOM	-	-	-	-	750	-	-	-	-	-	-	-	-	-	-	750
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	375	-	375
	Total - Item III	- Initial				-	-	-	-	7,350	9,400	4,500	1,600	-	-	-	-	-	-	-	22,850
		- Replacement				-	-	-	-	-	-	-	-	-	1,680	2,220	1,440	-	3,175	7,660	16,175
IV.	Mine Support Equipment																				
	Mechanics Trucks	- Initial	4	70	8	70	140	70	-	-	-	-	-	-	-	-	-	-	-	-	280
		- Replacement				-	-	-	-	-	-	-	-	70	140	70	-	-	-	-	280
	Fuel Truck	- Initial	1	125	10	-	125	-	-	-	-	-	-	-	-	-	-	-	-	-	125
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	125	-	-	-	125
	Lube Truck	- Initial	1	150	10	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	150
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	150	-	-	-	150
	Powder Truck	- Initial	2	120	6	-	-	-	120	-	-	-	-	-	-	-	-	-	-	-	120
		- Replacement				-	-	-	-	-	-	-	-	120	-	-	-	-	-	120	240
	Cat 16G Motorgrader or Equiv.	- Initial	2	485	10	485	485	-	-	-	-	-	-	-	-	-	-	-	-	-	970
		- Replacement				-	-	-	-	-	290	290	-	-	485	485	-	-	-	290	1,840
	Roller/Compactor	- Initial	2	900	10	900	900	-	-	-	-	-	-	-	-	-	-	-	-	-	1,800
		- Replacement				-	-	-	-	-	540	540	-	-	900	900	-	-	-	540	3,420
	Waterwagon	- Initial	2	1,600	10	1,600	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200
		- Replacement				-	-	-	-	-	960	960	-	-	1,600	1,600	-	-	-	960	6,080
	Portable Light Plants	- Initial	8	28	5	28	28	56	56	56	-	-	-	-	-	-	-	-	-	-	224
		- Replacement				-	-	-	-	-	28	28	56	56	56	28	28	56	56	56	448
	Pumps	- Initial	10	30	3	-	-	150	-	150	-	-	-	-	-	-	-	-	-	-	300
		- Replacement				-	-	-	-	-	150	-	150	150	-	150	150	-	150	150	1,050
	Mobile Crane (60-ton)	- Initial	2	1,300	15	1,300	-	1,300	-	-	-	-	-	-	-	-	-	-	-	-	2,600
		- Replacement				-	-	-	-	-	-	780	-	780	-	-	-	-	-	1,600	3,160
	Tire Handler Truck	- Initial	1	360	15	-	-	360	-	-	-	-	-	-	-	-	-	-	-	-	360
		- Replacement				-	-	-	-	-	-	-	-	216	-	-	-	-	-	-	216
	Belt Vulcanizer	- Initial	1	400	10	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400
		- Replacement				-	-	-	-	-	240	-	-	-	-	400	-	-	-	-	640
	Transport Crawler	- Initial	2	2,100	8	2,100	2,100	-	-	-	-	-	-	-	-	-	-	-	-	-	4,200
		- Replacement				-	-	-	-	1,260	1,260	-	-	2,100	2,100	-	-	1,260	1,260	-	9,240
	Cable Truck	- Initial	2	75	10	75	-	-	75	-	-	-	-	-	-	-	-	-	-	-	150
		- Replacement				-	-	-	-	-	45	-	-	45	-	75	-	-	75	-	240
	Cargo Truck	- Initial	2	65	8	-	-	65	65	-	-	-	-	-	-	-	-	-	-	-	130
		- Replacement				-	-	-	-	-	-	-	-	-	65	65	-	-	-	-	130
	Portal Buses	- Initial	4	75	6	75	75	75	75	-	-	-	-	-	-	-	-	-	-	-	300
		- Replacement				-	-	-	-	-	-	75	75	75	75	-	-	75	75	75	525
	Light Vehicles (4x4)	- Initial	12	30	3	60	60	120	120	-	-	-	-	-	-	-	-	-	-	-	360
		- Replacement				-	-	-	60	60	120	180	60	120	180	60	120	180	60	120	1,320
	Total - Item IV	- Initial				7,093	5,663	2,196	511	206	-	-	-	-	-	-	-	-	-	-	15,669
		- Replacement				-	-	-	60	1,320	3,633	2,853	341	3,732	5,601	3,833	573	1,571	1,676	3,911	29,104

TABLE 5.3 Continued

Item	Description	No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
Total	- Initial Capital				69,908	68,783	44,426	42,541	44,986	9,415	4,500	1,600	-	-	-	-	-	-	-	286,159
	- Replacement Capital				-	-	-	60	5,430	8,103	5,733	8,501	43,622	20,681	39,303	24,013	32,171	37,721	26,401	251,739
	Total Capital				69,908	68,783	44,426	42,601	50,416	17,518	10,233	10,101	43,622	20,681	39,303	24,013	32,171	37,721	26,401	537,898
	- Contingency (20%)				13,982	13,757	8,885	8,520	10,083	3,504	2,047	2,020	8,724	4,136	7,961	4,803	6,434	7,544	5,280	107,580
GRAND TOTAL					83,890	82,540	53,311	51,121	60,499	21,022	12,280	12,121	52,346	24,817	47,164	28,816	38,605	45,265	31,681	645,478

TABLE 5.3 - Continue

Sheet 3 of 3

JOHN T. BOYD COMPANY

TABLE 5.4

ESTIMATED CAPITAL EXPENDITURES
3.5 MILLION TONNE CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

Item	Description		No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
I.	Mine Facilities																				
	Portable Housing		40	40	LOM	400	400	400	400	-	-	-	-	-	-	-	-	-	-	-	1,600
	Water & Sewage Treatment Facility		1	350	LOM	350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350
	Water Wells		10	15	LOM	15	30	30	30	30	15	-	-	-	-	-	-	-	-	-	150
	Communicaton System		1	40	LOM	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	40
	Mine Office and Shop		1	13,000	LOM	-	-	5,000	5,000	3,000	-	-	-	-	-	-	-	-	-	-	13,000
	Total - Item I					765	470	5,430	5,430	3,030	15	-	-	-	-	-	-	-	-	-	15,140
II.	Stripping Equipment																				
	Bucket Wheel Excavators	- Initial	2	14,000	20	14,000	14,000	-	-	-	-	-	-	-	-	-	-	-	-	-	28,000
		- Replacement				-	-	-	-	-	-	-	-	8,400	-	8,400	-	-	-	-	16,800
	Mobile Transfer Conveyor	- Initial	2	5,000	20	5,000	5,000	-	-	-	-	-	-	-	-	-	-	-	-	-	10,000
		- Replacement				-	-	-	-	-	-	-	-	3,000	-	3,000	-	-	-	-	6,000
	Hopper Car	- Initial	2	850	10	850	850	-	-	-	-	-	-	-	-	-	-	-	-	-	1,700
		- Replacement				-	-	-	-	510	510	-	-	850	-	850	-	-	510	510	3,740
	Shiftable Conveyor (1000 m)	- Initial	4	7,400	20	14,800	14,800	-	-	-	-	-	-	-	-	-	-	-	-	-	29,600
		- Replacement				-	-	-	-	-	-	-	-	3,700	-	3,700	-	-	-	-	7,400
	Conveyor Drive Unit	- Initial	7	1,000	10	3,000	4,000	-	-	-	-	-	-	-	-	-	-	-	-	-	7,000
		- Replacement				-	-	-	-	1,800	2,400	-	-	3,000	-	3,000	-	-	1,800	2,400	14,400
	Spoil Spreader System	- Initial	2	13,000	20	13,000	13,000	-	-	-	-	-	-	-	-	-	-	-	-	-	26,000
		- Replacement				-	-	-	-	-	-	-	-	3,250	-	3,250	-	-	-	-	6,500
	Spoil Conveyor (1000 m)	- Initial	2	7,400	20	7,400	7,400	-	-	-	-	-	-	-	-	-	-	-	-	-	14,800
		- Replacement				-	-	-	-	-	-	-	-	1,850	-	1,850	-	-	-	-	3,700
	Spoil Drive Units	- Initial	2	1,000	10	1,000	1,000	-	-	-	-	-	-	-	-	-	-	-	-	-	2,000
		- Replacement				-	-	-	-	-	-	-	-	600	-	600	-	-	1,000	1,000	3,200
	Power Shovels (44 cubic meter)	- Initial	3	14,000	20	-	-	14,000	14,000	14,000	-	-	-	-	-	-	8,400	8,400	8,400	-	42,000
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25,200
	Rock Trucks (240-ton)	- Initial	45	1,800	8	-	-	18,000	27,000	27,000	9,000	-	-	-	-	-	-	-	-	-	81,000
		- Replacement				-	-	-	-	-	-	-	10,800	16,200	16,200	5,400	18,000	27,000	27,000	9,000	129,600
	Blasthole Drills	- Initial	5	1,600	10	-	-	1,600	1,600	1,600	1,600	1,600	-	-	-	-	-	-	-	-	8,000
		- Replacement				-	-	-	-	-	-	960	960	960	960	960	1,600	1,600	1,600	1,600	11,200
	Cat D11N Dozer or Equiv	- Initial	2	1,600	8	1,600	1,600	-	-	960	960	-	-	1,600	1,600	-	-	960	960	-	3,200
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,040
	Cat D10N Dozer or Equiv	- Initial	2	1,000	8	-	1,000	1,000	-	-	600	600	-	-	1,000	1,000	-	-	600	600	2,000
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,400
	Cat D8L Dozer or Equiv.	- Initial	4	800	8	-	-	800	1,600	800	-	480	960	480	-	800	1,600	800	-	480	3,200
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	5,600
	Cat 824B RT Dozer or Equiv	- Initial	5	1,400	8	1,400	1,400	1,400	1,400	1,400	-	-	-	-	-	-	-	-	-	-	7,000
		- Replacement				-	-	-	-	840	840	840	840	2,240	1,400	1,400	1,400	2,240	840	840	13,720
	Total - Item II	- Initial				62,050	64,050	36,800	45,600	44,800	10,600	1,600	-	-	-	-	-	-	-	-	265,500
		- Replacement				-	-	-	-	4,110	5,310	2,880	13,560	46,130	21,160	34,210	31,000	41,000	42,710	16,430	258,500

TABLE 5.4

ESTIMATED CAPITAL EXPEND
3.5 MILLION TONNE CA

TABLE 5.4 Continued

Item	Description		No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
III.	Coal Haulage and Crushing																				
	Power Shovels (20 cubic meter)	- Initial	3	6,600	20	-	-	6,600	6,600	6,600	-	-	-	-	-	-	-	-	-	-	19,800
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Bottom-dump Haulers (120-ton)	- Initial	10	700	8	-	-	-	-	3,500	3,500	-	-	-	-	-	3,960	3,960	3,960	-	11,880
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	7,000
	Cat 992C FEL or Equiv	- Initial	2	1,600	8	-	-	-	-	1,600	1,600	-	-	-	2,100	2,100	-	-	3,500	3,500	11,200
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200
	Cat 245 Backhoe or Equiv	- Initial	1	800	10	-	-	-	-	-	-	-	-	960	960	-	-	1,600	1,600	-	5,120
		- Replacement				-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	800
	Truck Dump and Crushing Facility	- Initial	1	750	LOM	-	-	-	-	-	-	-	-	-	-	-	480	-	-	-	480
		- Replacement				-	-	-	-	750	-	-	-	-	-	-	-	-	-	-	750
	Total - Item III	- Initial				-	-	6,600	6,600	12,450	5,100	800	-	-	-	-	-	375	-	-	375
		- Replacement				-	-	-	-	-	-	-	-	960	3,060	2,100	4,440	5,935	9,060	3,500	31,550
IV	Mine Support Equipment																				29,055
	Mechanics Trucks	- Initial	6	70	8	70	140	140	70	-	-	-	-	-	-	-	-	-	-	-	420
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
	Fuel Truck	- Initial	2	125	10	-	125	-	125	-	-	-	-	70	140	140	70	-	-	-	420
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	250
	Lube Truck	- Initial	2	150	10	-	150	-	150	-	-	-	-	-	-	-	125	-	125	-	250
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300
	Powder Truck	- Initial	2	120	6	-	-	-	120	-	-	-	-	-	-	-	150	-	150	-	300
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	120
	Cat 16G Motorgrader or Equiv	- Initial	2	485	10	485	485	-	-	-	-	-	-	120	-	-	-	-	-	120	240
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	970
	Roller Compactor	- Initial	2	900	10	900	900	-	-	-	290	290	-	-	485	485	-	-	-	290	1,840
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	1,800
	Waterwagon	- Initial	2	1,600	10	1,600	1,600	-	-	-	540	540	-	-	900	900	-	-	-	540	3,420
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200
	Portable Light Plants	- Initial	8	28	5	28	28	56	56	56	960	960	-	-	1,600	1,600	-	-	-	960	6,080
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	224
	Pumps	- Initial	10	30	3	-	-	150	-	150	28	28	56	56	56	28	28	56	56	56	448
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	300
	Mobile Crane (60-ton)	- Initial	3	1,300	15	1,300	-	1,300	-	1,300	150	-	150	150	-	150	150	-	150	150	1,050
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	3,900
	Tire Handler Truck	- Initial	2	360	15	-	-	360	-	360	-	780	-	780	-	780	-	-	-	1,600	3,940
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	720
	Belt Vulcanizer	- Initial	1	400	10	400	-	-	-	-	-	-	-	216	-	216	-	-	-	-	432
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400
	Transport Crawler	- Initial	2	2,100	8	2,100	2,100	-	-	-	240	-	-	-	-	400	-	-	-	-	640
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	4,200
	Cable Truck	- Initial	2	75	10	75	-	-	75	1,260	1,260	-	-	2,100	2,100	-	-	1,260	1,260	-	9,240
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	150
	Cargo Truck	- Initial	2	65	8	-	-	65	65	-	45	-	-	45	-	75	-	-	75	-	240
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	130
	Portal Buses	- Initial	6	75	6	75	75	75	75	150	-	-	-	-	65	65	-	-	-	-	130
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	450
	Light Vehicles (4x4)	- Initial	16	30	3	60	60	120	120	120	-	75	75	75	75	150	-	75	75	75	675
		- Replacement				-	-	-	60	60	120	-	-	-	300	180	120	300	180	120	480
	Total - Item IV	- Initial				7,093	5,663	2,266	856	2,136	-	-	-	-	-	-	-	-	-	-	2,040
		- Replacement				-	-	-	60	1,320	3,633	2,973	461	3,732	5,721	5,169	643	1,691	2,071	3,911	18,014
																					31,385

TABLE 5.4 - Continued

No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
			69,908	70,183	51,096	58,486	62,416	15,715	2,400	-	-	-	-	-	-	-	-	330,204
			-	-	-	60	5,430	8,943	5,853	14,021	50,822	29,941	41,479	36,083	48,626	53,841	23,841	318,940
			69,908	70,183	51,096	58,546	67,846	24,658	8,253	14,021	50,822	29,941	41,479	36,083	48,626	53,841	23,841	649,144
			13,982	14,037	10,219	11,709	13,569	4,932	1,651	2,804	10,164	5,988	8,296	7,217	9,725	10,768	4,768	129,829
			83,890	84,220	61,315	70,255	81,415	29,590	9,904	16,825	60,986	35,929	49,775	43,300	58,351	64,609	28,609	778,973

TABLE 5.5 - Continued

Item	Description		No of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
III	Coal Haulage and Crushing																				
	Power Shovels (20 cubic meter)	- Initial	6	6,600	20	-	-	13,200	13,200	13,200	-	-	-	-	-	-	-	-	-	-	39,600
		- Replacement				-	-	-	-	-	-	-	-	-	-	3,960	3,960	3,960	3,960	3,960	19,800
	Bottom-dump Haulers (120-ton)	- Initial	12	700	8	-	-	-	-	4,200	4,200	-	-	-	-	-	-	-	-	-	8,400
		- Replacement				-	-	-	-	-	-	-	-	-	2,520	2,520	-	-	4,200	4,200	13,440
	Cat 992C FEL or Equiv	- Initial	4	1,600	8	-	-	-	-	1,600	3,200	1,600	-	-	-	-	-	-	-	-	6,400
		- Replacement				-	-	-	-	-	-	-	-	960	1,920	960	-	1,600	3,200	1,600	10,240
	Cat 245 Backhoe or Equiv	- Initial	1	800	10	-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	800
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	480	-	-	-	480
	Truck Dump and Crushing Facility	- Initial	1	750	LOM	-	-	-	-	750	-	-	-	-	-	-	-	-	-	-	750
		- Replacement				-	-	-	-	-	-	-	-	250	-	-	-	375	-	-	625
	Total - Item III	- Initial				-	-	13,200	13,200	19,750	7,400	2,400	-	-	-	-	-	-	-	-	55,950
		- Replacement				-	-	-	-	-	-	-	-	1,210	4,440	7,440	4,440	5,935	11,360	9,760	44,585
IV	Mine Support Equipment																				
	Mechanics Trucks	- Initial	6	70	8	70	140	140	70	-	-	-	-	-	-	-	-	-	-	-	420
		- Replacement				-	-	-	-	-	-	-	-	70	140	140	70	-	-	-	420
	Fuel Truck	- Initial	2	125	10	-	125	-	125	-	-	-	-	-	-	-	-	-	-	-	250
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	125	-	125	-	250
	Lube Truck	- Initial	2	150	10	-	150	-	150	-	-	-	-	-	-	-	-	-	-	-	300
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	125	-	125	-	300
	Powder Truck	- Initial	2	120	6	-	-	-	120	-	-	-	-	-	-	-	-	-	-	-	120
		- Replacement				-	-	-	-	-	-	-	-	120	-	-	-	-	-	120	240
	Cat 16G Motorgrader or Equiv	- Initial	2	485	10	485	485	-	-	-	-	-	-	-	-	-	-	-	-	-	970
		- Replacement				-	-	-	-	-	290	290	-	-	485	485	-	-	-	290	1,840
	Roller/Compactor	- Initial	2	900	10	900	900	-	-	-	-	-	-	-	-	-	-	-	-	-	1,800
		- Replacement				-	-	-	-	-	540	540	-	-	900	900	-	-	-	540	3,420
	Waterwagon	- Initial	2	1,600	10	1,600	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200
		- Replacement				-	-	-	-	-	960	960	-	-	1,600	1,600	-	-	-	960	6,080
	Portable Light Plants	- Initial	8	28	5	28	28	56	56	56	-	-	-	-	-	-	-	-	-	-	224
		- Replacement				-	-	-	-	-	28	28	56	56	56	28	28	56	56	56	448
	Pumps	- Initial	10	30	3	-	-	150	-	150	-	-	-	-	-	-	-	-	-	-	450
		- Replacement				-	-	-	-	-	150	-	150	150	-	150	150	-	150	150	1,050
	Mobile Crane (60 ton)	- Initial	3	1,300	15	1,300	-	1,300	-	1,300	-	-	-	-	-	-	-	-	-	-	3,900
		- Replacement				-	-	-	-	-	-	780	-	780	-	780	-	-	-	1,560	3,120
	Tire Handler Truck	- Initial	2	360	15	-	-	360	-	360	-	-	-	-	-	-	-	-	-	-	720
		- Replacement				-	-	-	-	-	-	-	-	216	-	216	-	-	-	-	432
	Belt Vulcanizer	- Initial	1	400	10	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400
		- Replacement				-	-	-	-	-	240	-	-	-	-	400	-	-	-	-	640
	Transport Crawler	- Initial	2	2,100	8	2,100	2,100	-	-	-	-	-	-	-	-	-	-	-	-	-	4,200
		- Replacement				-	-	-	-	1,260	1,260	-	-	2,100	2,100	-	-	1,260	1,260	-	9,240
	Cable Truck	- Initial	2	75	10	75	-	-	75	-	-	-	-	-	-	-	-	-	-	-	150
		- Replacement				-	-	-	-	-	45	-	-	45	-	75	-	-	75	-	240
	Cargo Truck	- Initial	2	65	8	-	-	65	65	-	-	-	-	-	-	-	-	-	-	-	130
		- Replacement				-	-	-	-	-	-	-	-	-	65	65	-	-	-	-	130
	Portal Buses	- Initial	6	75	6	75	75	75	75	150	-	-	-	-	-	-	-	-	-	-	450
		- Replacement				-	-	-	-	-	-	75	75	75	75	150	-	75	75	75	675
	Light Vehicles (4x4)	- Initial	16	30	3	60	60	120	120	120	-	-	-	-	-	-	-	-	-	-	480
		- Replacement				-	-	-	60	60	120	300	180	120	300	180	120	300	180	120	2,040
	Total - Item IV	- Initial				7,093	5,663	2,266	856	2,136	-	-	-	-	-	-	-	-	-	-	18,014
		- Replacement				-	-	-	60	1,320	3,633	2,973	461	3,732	5,721	5,169	643	1,691	2,071	3,911	31,385

TABLE 5.5

ESTIMATED CAPITAL EXPENDITURES
7.0 MILLION TONNE CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

Item	Description		No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
I	Mine Facilities																				
	Portable Housing		40	40	LOM	400	400	400	400	-	-	-	-	-	-	-	-	-	-	-	1,600
	Water & Sewage Treatment Facility		1	350	LOM	350	-	-	-	-	-	-	-	-	-	-	-	-	-	-	350
	Water Wells		10	15	LOM	15	30	30	30	30	15	-	-	-	-	-	-	-	-	-	150
	Communication System		1	40	LOM	-	40	-	-	-	-	-	-	-	-	-	-	-	-	-	40
	Mine Office and Shop		1	13,000	LOM	-	-	5,000	5,000	3,000	-	-	-	-	-	-	-	-	-	-	13,000
	Total - Item I					765	470	5,430	5,430	3,030	15	-	-	-	-	-	-	-	-	-	15,140
II	Stripping Equipment																				
	Bucket Wheel Excavators	- Initial	3	14,000	20	14,000	14,000	-	-	-	-	14,000	-	-	-	-	-	-	-	-	42,000
		- Replacement				-	-	-	-	-	-	-	-	8,400	-	8,400	-	-	-	-	16,800
	Mobile Transfer Conveyor	- Initial	3	5,000	20	5,000	5,000	-	-	-	-	5,000	-	-	-	-	-	-	-	-	15,000
		- Replacement				-	-	-	-	-	-	-	-	3,000	-	3,000	-	-	-	-	6,000
	Hopper Car	- Initial	3	850	10	850	850	-	-	-	-	850	-	-	-	-	-	-	-	-	2,550
		- Replacement				-	-	-	-	510	510	-	-	850	-	850	-	-	510	510	3,740
	Shiftable Conveyor (1000 m)	- Initial	6	7,400	20	14,800	14,800	-	-	-	-	14,800	-	-	-	-	-	-	-	-	44,400
		- Replacement				-	-	-	-	-	-	-	-	3,700	-	3,700	-	-	-	-	7,400
	Conveyor Drive Unit	- Initial	10	1,000	10	3,000	4,000	-	-	-	-	4,000	-	-	-	-	-	-	-	-	11,000
		- Replacement				-	-	-	-	1,800	2,400	-	-	3,000	-	3,000	-	-	1,800	2,400	14,400
	Spoil Spreader System	- Initial	3	13,000	20	13,000	13,000	-	-	-	-	13,000	-	-	-	-	-	-	-	-	39,000
		- Replacement				-	-	-	-	-	-	-	-	3,250	-	3,250	-	-	-	-	6,500
	Spoil Conveyor (1000 m)	- Initial	3	7,400	20	7,400	7,400	-	-	-	-	7,400	-	-	-	-	-	-	-	-	22,200
		- Replacement				-	-	-	-	-	-	-	-	1,850	-	1,850	-	-	-	-	3,700
	Spoil Drive Units	- Initial	3	1,000	10	1,000	1,000	-	-	-	-	1,000	-	-	-	-	-	-	-	-	3,000
		- Replacement				-	-	-	-	-	-	-	-	600	-	600	-	-	1,000	1,000	3,200
	Power Shovels (44 cubic meter)	- Initial	3	14,000	20	-	-	14,000	14,000	14,000	-	-	-	-	-	-	-	-	-	-	42,000
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	8,400	8,400	8,400	-	25,200
	Rock Trucks (240-ton)	- Initial	45	1,800	8	-	-	18,000	27,000	27,000	9,000	-	-	-	-	-	-	-	-	-	81,000
		- Replacement				-	-	-	-	-	-	-	10,800	16,200	16,200	5,400	18,900	27,000	27,000	9,000	129,600
	Blasthole Drills	- Initial	5	1,600	10	-	-	1,600	1,600	1,600	1,600	1,600	-	-	-	-	-	-	-	-	8,000
		- Replacement				-	-	-	-	-	-	960	960	960	960	960	1,600	1,600	1,600	1,600	11,200
	Cat D11N Dozer or Equiv	- Initial	2	1,600	8	1,600	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200
		- Replacement				-	-	-	-	960	960	-	-	1,600	1,600	-	-	960	960	-	7,040
	Cat D10N Dozer or Equiv	- Initial	2	1,000	8	-	1,000	1,000	-	-	-	-	-	-	-	-	-	-	-	-	2,000
		- Replacement				-	-	-	-	-	600	600	-	-	1,000	1,000	-	-	600	600	4,400
	Cat D8L Dozer or Equiv.	- Initial	4	800	8	-	-	800	1,600	800	-	-	-	-	-	-	-	-	-	-	3,200
		- Replacement				-	-	-	-	-	-	480	960	480	-	800	1,600	800	-	480	5,600
	Cat 824B RT Dozer or Equiv	- Initial	5	1,400	8	1,400	1,400	1,400	1,400	1,400	-	-	-	-	-	-	-	-	-	-	7,000
		- Replacement				-	-	-	-	840	840	840	840	2,240	1,400	1,400	1,400	2,240	840	840	13,720
	Total - Item II	- Initial				62,050	64,050	36,800	45,600	44,800	10,600	61,650	-	-	-	-	-	-	-	-	325,550
		- Replacement				-	-	-	-	4,110	5,310	2,880	13,560	46,130	21,160	34,210	31,000	41,000	42,710	16,430	258,500

TABLE 5.5 Continued

Item	Description		No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
III	Coal Haulage and Crushing																				
	Power Shovels (20 cubic meter)	- Initial	6	6,600	20	-	-	13,200	13,200	13,200	-	-	-	-	-	-	-	-	-	-	39,600
		- Replacement				-	-	-	-	-	-	-	-	-	-	3,960	3,960	3,960	3,960	3,960	19,800
	Bottom-dump Haulers (120-ton)	- Initial	12	700	8	-	-	-	-	4,200	4,200	-	-	-	-	-	-	-	-	-	8,400
		- Replacement				-	-	-	-	-	-	-	-	-	2,520	2,520	-	-	4,200	4,200	13,440
	Cat 992C FEL or Equiv	- Initial	4	1,600	8	-	-	-	-	1,600	3,200	1,600	-	-	-	-	-	-	-	-	6,400
		- Replacement				-	-	-	-	-	-	-	-	960	1,920	960	-	1,600	3,200	1,600	10,240
	Cat 245 Backhoe or Equiv	- Initial	1	800	10	-	-	-	-	-	-	800	-	-	-	-	-	-	-	-	800
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	480	-	-	-	480
	Truck Dump and Crushing Facility	- Initial	1	750	LOM	-	-	-	-	750	-	-	-	-	-	-	-	-	-	-	750
		- Replacement				-	-	-	-	-	-	-	-	250	-	-	-	375	-	-	625
	Total - Item III	- Initial				-	-	13,200	13,200	19,750	7,400	2,400	-	-	-	-	-	-	-	-	55,950
		- Replacement				-	-	-	-	-	-	-	-	1,210	4,440	7,440	4,440	5,935	11,360	9,760	44,585
IV	Mine Support Equipment																				
	Mechanics Trucks	- Initial	6	70	8	70	140	140	70	-	-	-	-	-	-	-	-	-	-	-	420
		- Replacement				-	-	-	-	-	-	-	-	70	140	140	70	-	-	-	420
	Fuel Truck	- Initial	2	125	10	-	125	-	125	-	-	-	-	-	-	-	-	-	-	-	250
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	125	-	125	-	250
	Lube Truck	- Initial	2	150	10	-	150	-	150	-	-	-	-	-	-	-	-	-	-	-	300
		- Replacement				-	-	-	-	-	-	-	-	-	-	-	125	-	125	-	300
	Powder Truck	- Initial	2	120	6	-	-	-	120	-	-	-	-	-	-	-	-	-	-	-	120
		- Replacement				-	-	-	-	-	-	-	-	120	-	-	-	-	-	120	240
	Cat 16G Motorgrader or Equiv	- Initial	2	485	10	485	485	-	-	-	-	-	-	-	-	-	-	-	-	-	970
		- Replacement				-	-	-	-	-	290	290	-	-	485	485	-	-	-	290	1,840
	Roller/Compactor	- Initial	2	900	10	900	900	-	-	-	-	-	-	-	-	-	-	-	-	-	1,800
		- Replacement				-	-	-	-	-	540	540	-	-	900	900	-	-	-	540	3,420
	Waterwagon	- Initial	2	1,600	10	1,600	1,600	-	-	-	-	-	-	-	-	-	-	-	-	-	3,200
		- Replacement				-	-	-	-	-	960	960	-	-	1,600	1,600	-	-	-	960	6,080
	Portable Light Plants	- Initial	8	28	5	28	28	56	56	56	-	-	-	-	-	-	-	-	-	-	224
		- Replacement				-	-	-	-	-	28	28	56	56	56	28	28	56	56	56	448
	Pumps	- Initial	10	30	3	-	-	150	-	150	-	-	-	-	-	-	-	-	-	-	300
		- Replacement				-	-	-	-	-	150	-	150	150	-	150	150	-	150	150	1,050
	Mobile Crane (60-ton)	- Initial	3	1,300	15	1,300	-	1,300	-	1,300	-	-	-	-	-	-	-	-	-	-	3,900
		- Replacement				-	-	-	-	-	-	780	-	780	-	780	-	-	-	1,600	3,940
	Tire Handler Truck	- Initial	2	360	15	-	-	360	-	360	-	-	-	-	-	-	-	-	-	-	720
		- Replacement				-	-	-	-	-	-	-	-	216	-	216	-	-	-	-	432
	Belt Vulcanizer	- Initial	1	400	10	400	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400
		- Replacement				-	-	-	-	-	240	-	-	-	-	400	-	-	-	-	640
	Transport Crawler	- Initial	2	2,100	8	2,100	2,100	-	-	-	-	-	-	-	-	-	-	-	-	-	4,200
		- Replacement				-	-	-	-	1,260	1,260	-	-	2,100	2,100	-	-	1,260	1,260	-	9,240
	Cable Truck	- Initial	2	75	10	75	-	-	75	-	-	-	-	-	-	-	-	-	-	-	150
		- Replacement				-	-	-	-	-	45	-	-	45	-	75	-	-	75	-	240
	Cargo Truck	- Initial	2	65	8	-	-	65	65	-	-	-	-	-	-	-	-	-	-	-	130
		- Replacement				-	-	-	-	-	-	-	-	-	65	65	-	-	-	-	130
	Portal Buses	- Initial	6	75	6	75	75	75	75	150	-	-	-	-	-	-	-	-	-	-	450
		- Replacement				-	-	-	-	-	-	75	75	75	75	150	-	75	75	75	675
	Light Vehicles (4x4)	- Initial	16	30	3	60	60	120	120	120	-	-	-	-	-	-	-	-	-	-	480
		- Replacement				-	-	-	60	60	120	300	180	120	300	180	120	300	180	120	2,040
	Total - Item IV	- Initial				7,093	5,663	2,266	856	2,136	-	-	-	-	-	-	-	-	-	-	18,014
		- Replacement				-	-	-	60	1,320	3,633	2,973	461	3,732	5,721	5,169	643	1,691	2,071	3,911	31,385

TABLE 5.5 - Continued

Item	Description	No. of Units	Unit Price ($000)	Assigned Life (yrs)	Mining Year D-5	D-4	D-3	D-2	D-1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10	Total
Total	- Initial Capital				69,908	70,183	57,696	65,086	69,716	18,015	64,050	-	-	-	-	-	-	-	-	414,654
	- Replacement Capital				-	-	-	60	5,430	8,943	5,853	14,021	51,072	31,321	46,819	36,083	48,626	56,141	30,101	334,470
	- Total Capital				69,908	70,183	57,696	65,146	75,146	26,958	69,903	14,021	51,072	31,321	46,819	36,083	48,626	56,141	30,101	749,124
	- Contingency (20%)				13,982	14,037	11,539	13,029	15,029	5,392	13,981	2,804	10,214	6,264	9,364	7,217	9,725	11,228	6,020	149,825
GRAND TOTAL					83,890	84,220	69,235	78,175	90,175	32,350	83,884	16,825	61,286	37,585	56,183	43,300	58,351	67,369	36,121	898,949

TABLE 5 6

PROJECTED PRODUCTION COST
2 5 MILLION TONNE CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO 391 0494 C-00-0540 00
By
John T Boyd Company
Mining and Geological Engineers
May 1994

Year	D 5	D 4	D 3	D 2	D 1	D+1	D+2	D+3	D+4	D+5	D+6	D+7	D+8	D+9	D+10
Production BCM (000)	5 000	11 000	16 000	20 264	31 622	36 699	37 000	34 551	24 059	24 059	32 059	32 059	32 059	32 059	32 059
Coal Tonnes (000)						590	839	2 632	2 512	2 512	2 512	2 512	2 512	2 512	2 512
Operating In situ Ratio						62 2	44 1	13 1	9 6	9 6	12 8	12 8	12 8	12 8	12 8
(BCM Moved Coal Tonnes Mined)															

Item Description	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne
I Labor																												
Direct	2 285		2 606		3 127		4 163		7 517		9 581	15 90	9 402	11 60	10 423	3 96	10 423	4 15	10 423	4 15	10 423	4 15	10 423	4 15	10 423	4 15	10 423	4 15
Fringes and Benefits	2 057		2 572		3 086		4 115		7 715		9 256	15 63	9 773	11 65	10 287	3 91	10 287	4 10	10 287	4 10	10 287	4 10	10 287	4 10	10 287	4 10	10 287	4 10
Total - Item I	4 142		5 178		6 213		8 284		15 532		18 839	31 53	19 675	23 45	20 710	7 87	20 710	8 24	20 710	8 24	20 710	8 24	20 710	8 24	20 710	8 24	20 710	8 24
II Operating and Supply Cost																												
Stripping Operations	4 687		5 859		7 031		9 374		17 577		21 046	35 75	22 264	26 54	23 436	8 90	23 436	9 33	23 436	9 33	23 436	9 33	23 436	9 33	23 436	9 33	23 436	9 33
Explosives	0		0		0		426		1 562		2 070	3 51	2 100	2 50	1 855	0 70	1 606	0 64	1 606	0 64	1 606	0 64	1 606	0 64	1 606	0 64	1 606	0 64
Coal Removal and Haulage	0		0		0		0		0		3 541	6 00	3 541	4 22	3 541	1 35	3 541	1 41	3 541	1 41	3 541	1 41	3 541	1 41	3 541	1 41	3 541	1 41
Maintenance and Support	797		996		1 195		1 593		2 987		3 585	6 08	3 784	4 51	3 983	1 51	3 983	1 59	3 983	1 59	3 983	1 59	3 983	1 59	3 983	1 59	3 983	1 59
Total - Item II	5 484		6 855		8 226		11 393		22 126		31 242	51 34	31 689	37 77	33 815	12 47	33 566	13 96	33 566	13 96	33 566	13 96	33 566	13 96	33 566	13 96	33 566	13 96
III Mine Administration	450		500		600		600		1 500		1 800	3 05	1 900	2 26	2 000	0 76	2 000	0 80	2 000	0 80	2 000	0 80	2 000	0 80	2 000	0 80	2 000	0 80
Subtotal Mine Cash Cost	10 076		12 533		15 039		20 477		39 158		50 727	85 39	53 264	63 49	55 525	21 10	55 276	22 00	55 276	22 00	55 276	22 00	55 276	22 00	55 276	22 00	55 276	22 00
IV Depreciation and Amortization											13 413	22 73	19 073	22 73	59 836	22 73	57 108	22 73	57 108	22 73	57 102	22 73	45 040	17 93	45 040	17 93	45 040	17 93
V Interest											8 760	14 85	8 760	10 44	8 760	3 33	8 760	3 49	8 760	3 49	8 760	3 49	3 250	1 29	0	0 00	0	0 00
V Corporate G & A											590	1 00	839	1 00	2 632	1 00	2 512	1 00	2 512	1 00	2 512	1 00	2 512	1 00	2 512	1 00	2 512	1 00
Total Production Cost	10 026		12 533		15 039		20 477		39 158		73 490	124 56	81 936	97 66	126 753	48 16	123 656	49 23	123 656	49 23	123 650	49 22	106 078	42 23	102 828	40 93	102 828	40 93

TABLE 5.7

PROJECTED PRODUCTION COST
3.5 MILLION TONNE CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May, 1994

Year	D-5		D-4		D-3		D-2		D-1		D-1		D-2		D-3		D-4		D-5		D-6		D-7		D-8		D-9		D-10	
Production BCM (000)	5,000		11,000		16,000		20,264		31,622		45,625		39,391		32,938		24,938		26,938		34,938		34,938		34,938		34,938		34,938	
Coal Tonnes (000)											590		3,206		3,588		3,588		3,588		3,588		3,588		3,588		3,588		3,588	
Operating In-situ Ratio (BCM Moved/ Coal Tonnes Mined)											77.3		12.5		9.2		7.0		7.5		9.7		9.7		9.7		9.7		9.7	
Item Description	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne	$000	$/Tonne
I Labor																														
Direct	2,276		3,414		5,691		6,536		9,105		10,243	17.36	10,812	3.37	11,381	3.17	11,381	3.17	11,381	3.17	11,381	3.17	11,381	3.17	11,381	3.17	11,381	3.17	11,381	3.17
Fringes and Benefits	2,208		3,313		5,521		8,282		8,834		9,938	16.84	10,490	3.27	11,042	3.08	11,042	3.08	11,042	3.08	11,042	3.08	11,042	3.08	11,042	3.08	11,042	3.08	11,042	3.08
Total - Item I	4,484		6,727		11,212		16,818		17,939		20,181	34.21	21,302	6.64	22,423	6.25	22,423	6.25	22,423	6.25	22,423	6.25	22,423	6.25	22,423	6.25	22,423	6.25	22,423	6.25
II Operating and Supply Cost																														
Stripping Operations	5,484		8,226		13,710		20,566		21,937		24,679	41.83	26,050	8.13	27,421	7.64	27,421	7.64	27,421	7.64	27,421	7.64	27,421	7.64	27,421	7.64	27,421	7.64	27,421	7.64
Explosives	0		0		0		426		1,562		2,960	5.02	2,399	0.75	1,694	0.47	1,694	0.47	1,694	0.47	1,694	0.47	1,694	0.47	1,694	0.47	1,694	0.47	1,694	0.47
Coal Removal and Haulage	0		0		0		0		0		3,384	5.74	3,572	1.11	3,760	1.05	3,760	1.05	3,760	1.05	3,760	1.05	3,760	1.05	3,760	1.05	3,760	1.05	3,760	1.05
Maintenance and Support	911		1,367		2,279		3,418		3,646		4,101	6.95	4,329	1.35	4,557	1.27	4,557	1.27	4,557	1.27	4,557	1.27	4,557	1.27	4,557	1.27	4,557	1.27	4,557	1.27
Total - Item II	6,395		9,593		15,989		24,410		27,145		35,127	59.54	36,350	11.34	37,432	10.43	37,432	10.43	37,432	10.43	37,432	10.43	37,432	10.43	37,432	10.43	37,432	10.43	37,432	10.43
III Mine Administration	400		600		1,000		1,500		1,630		1,800	3.05	1,900	0.59	2,000	0.56	2,000	0.56	2,000	0.56	2,000	0.56	2,000	0.56	2,000	0.56	2,000	0.56	2,000	0.56
Subtotal - Mine Cash Cost	11,279		16,920		28,201		42,728		46,684		57,108	96.79	59,552	18.58	61,855	17.24	61,855	17.24	61,855	17.24	61,855	17.24	61,855	17.24	61,855	17.24	61,855	17.24	61,855	17.24
IV Depreciation and Amortization											13,494	22.87	73,403	22.90	82,058	22.87	82,058	22.87	82,058	22.87	82,140	22.89	66,557	18.55	66,557	18.55	66,557	18.55	66,557	18.55
V Interest											10,720	18.17	10,720	3.34	10,720	2.99	10,720	2.99	10,720	2.99	10,720	2.99	3,970	1.11	0	0.00	0	0.00	0	0.00
V Corporate G & A											590	1.00	3,206	1.00	3,588	1.00	3,588	1.00	3,588	1.00	3,588	1.00	3,588	1.00	3,588	1.00	3,588	1.00	3,588	1.00
Total - Production Cost	11,279		16,920		28,201		42,728		46,684		81,912	138.83	146,881	45.81	158,221	44.10	158,221	44.10	158,221	44.10	158,303	44.12	135,970	37.90	132,000	36.79	132,000	36.79	132,000	36.79

TABLE 5.8

PROJECTED PRODUCTION COST
7.0 MILLION TONNE CASE
THAR COAL DEPOSIT CONCEPTUAL MINES
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494 C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

Year	D-5		D-4		D-3		D-2		D-1		D+1		D+2		D+3		D+4		D+5		D+6		D+7		D+8		D+9		D+10	
Production: BCM (000)	5,000		15,000		19,000		26,264		39,622		55,625		59,373		59,141		55,625		55,625		55,625		55,625		55,625		55,625		55,625	
Coal Tonnes (000)											590		5,629		7,176		7,176		7,176		7,176		7,176		7,176		7,176		7,176	
Operating In situ Ratio (BCM Moved: Coal Tonnes Mined)											94.3		10.5		8.2		7.8		7.8		7.8		7.8		7.8		7.8		7.8	
Item Description	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne	$X00	$/Tonne
I Labor																														
Direct	2,386		3,580		5,966		8,949		9,546		10,739	19.20	11,335	2.01	11,932	1.66	11,932	1.66	11,932	1.66	11,932	1.66	11,932	1.66	11,932	1.66	11,932	1.66	11,932	1.66
Fringes and Benefits	2,244		3,365		5,609		8,413		8,974		10,096	17.11	10,667	1.89	11,218	1.56	11,218	1.56	11,218	1.56	11,218	1.56	11,218	1.56	11,218	1.56	11,218	1.56	11,218	1.56
Total - Item I	4,630		6,945		11,575		17,362		18,520		20,835	35.31	21,992	3.91	23,150	3.23	23,150	3.23	23,150	3.23	23,150	3.23	23,150	3.23	23,150	3.23	23,150	3.21	23,150	3.23
II Operating and Supply Cost																														
Stripping Operations	6,831		10,246		17,077		25,615		27,323		30,739	52.10	32,446	5.76	34,154	4.76	34,154	4.76	34,154	4.76	34,154	4.76	34,154	4.76	34,154	4.76	34,154	4.76	34,154	4.76
Explosives	0		0		0		426		1,562		2,963	5.02	3,337	0.59	3,388	0.47	3,388	0.47	3,388	0.47	3,388	0.47	3,388	0.47	3,388	0.47	3,388	0.47	3,388	0.47
Coal Removal and Haulage	0		0		0		0		0		4,325	7.33	4,565	0.81	4,805	0.67	4,805	0.67	4,805	0.67	4,805	0.67	4,805	0.67	4,805	0.67	4,805	0.67	4,805	0.67
Maintenance and Support	1,084		1,626		2,710		4,065		4,336		4,878	8.27	5,149	0.91	5,420	0.76	5,420	0.76	5,420	0.76	5,420	0.76	5,420	0.76	5,420	0.76	5,420	0.76	5,420	0.76
Total - Item II	7,915		11,872		19,787		30,106		33,221		42,905	72.72	45,497	8.08	47,767	6.66	47,767	6.66	47,767	6.66	47,767	6.66	47,767	6.66	47,767	6.66	47,767	6.66	47,767	6.66
III Mine Administration	400		600		1,000		1,500		1,600		1,800	3.05	1,900	0.34	2,000	0.28	2,000	0.28	2,000	0.28	2,000	0.28	2,000	0.28	2,000	0.28	2,000	0.28	2,000	0.28
Subtotal - Mine Cash Cost	12,945		19,417		32,362		48,968		53,341		65,540	111.08	69,389	12.33	72,917	10.16	72,917	10.16	72,917	10.16	72,917	10.16	72,917	10.16	72,917	10.16	72,917	10.16	72,917	10.16
IV Depreciation and Amortization											7,870	13.34	75,091	13.34	95,727	13.34	95,727	13.34	95,829	13.34	95,829	13.35	76,783	10.70	76,783	10.70	76,783	10.70	76,783	10.70
V Interest											11,460	19.42	11,460	2.04	11,460	1.62	11,460	1.62	11,460	1.62	11,460	1.62	4,250	0.59	0	0.00	0	0.00	0	0.00
V Corporate G & A											590	1.00	3,588	0.64	3,588	0.50	3,588	0.50	3,588	0.50	3,588	0.50	3,588	0.50	3,588	0.50	3,588	0.50	3,588	0.50
Total - Production Cost	12,945		19,417		32,362		48,968		53,341		85,460	144.85	159,528	28.34	183,692	25.60	183,692	25.60	183,794	25.61	157,578	21.95	153,288	21.36	153,288	21.36	153,288	21.36	153,288	21.36

APPENDIX A

DRILL HOLE SUMMARY
THAR COAL DEPOSIT STUDY AREA
THAR PARKAR DISTRICT
SIND PROVINCE, PAKISTAN
For
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
By
John T. Boyd Company
Mining and Geological Engineers
May 1994

Drill Hole No.	Coordinates (m) Northing	Coordinates (m) Easting	Estimated Surface Elevation* (m)	Strata Zone Designation	Top of Zone Elevation (m)	Overburden Thickness (m)	Seam Zone Thickness (m) Coal	Parting	Separable** Parting	Total	Interval to Seam Above (m)	Total Interburden Thickness (m)	Total Hole Depth (m)
STP-1	785,900	2,364,050	91	Dune Sand	-	78.00	-	-	-	-	-	-	
				Oxidized	13.00	37.62	-	-	-	-	-	-	
				Seam Zone A	-47.90	23.28	10.41	-	5.01	10.41	-	5.01	
				Seam Zone B	-78.77	-	9.33	0.34	2.33	9.67	15.45	17.78	
				Seam Zone C	-103.98	-	7.11	0.21	9.75	7.32	13.21	22.96	237.00
STP-2	789,800	2,375,340	92	Dune Sand	-	64.68	-	-	-	-	-	-	
				Oxidized	27.32	10.25	-	-	-	-	-	-	
				Seam Zone A	-33.27	10.34	3.29	-	17.41	3.29	-	17.41	
				Seam Zone B	-70.68	-	5.53	0.37	-	5.90	16.71	16.71	
				Seam Zone C	-86.24	-	6.48	0.95	-	7.43	9.66	9.66	
				Seam Zone C Split	-107.09	-	0.40	0.09	-	0.49	13.41	13.41	223.42
STP-3	784,460	2,371,900	70	Dune Sand	-	64.64	-	-	-	-	-	-	
				Oxidized	5.36	41.89	-	-	-	-	-	-	
				Seam Zone A	-57.85	21.32	4.48	0.48	12.91	4.96	-	12.91	
				Seam Zone B	-79.64	-	13.48	0.60	-	14.08	3.92	3.92	
				Seam Zone C	-94.27	-	6.98	-	0.58	6.98	0.55	1.13	
				Seam Zone C Split	-109.55	-	1.29	-	-	1.29	7.72	7.72	215.19
STP-4	774,95	2,366,950	76	Dune Sand	-	81.00	-	-	-	-	-	-	
				Oxidized	5.00	51.98	-	-	-	-	-	-	
				Seam Zone A	-70.50	13.52	1.04	-	1.56	1.04	-	1.56	
				Seam Zone B	-96.27	-	14.51	0.03	2.07	14.54	23.17	25.24	
				Seam Zone C	-121.82	-	0.99	-	-	0.99	8.94	8.94	233.96

APPENDIX A

DRILL HOLE SUMMARY
THAR COAL DEPOSIT STUDY ARE

Sheet 1 of 4

APPENDIX A - Continued

Drill Hole No.	Coordinates (m) Northing	Coordinates (m) Easting	Estimated Surface Elevation* (m)	Strata Zone Designation	Top of Zone Elevation (m)	Overburden Thickness (m)	Seam Zone Thickness (m) Coal	Parting	Separable** Parting	Total	Interval to Seam Above (m)	Total Interburden Thickness (m)	Total Hole Depth (m)
STP-5	773,600	2,375,600	53	Dune Sand	-	62.48	-	-	-	-	-	-	
				Oxidized	-9.48	62.81	-	-	-	-	-	-	
				Seam Zone A	-89.04	16.75	5.84	0.02	1.74	5.86	-	1.74	
				Seam Zone B	-104.50	-	16.04	0.35	6.83	16.39	7.86	14.69	
				Seam Zone C	-132.91	-	7.67	-	0.75	7.67	5.19	5.94	230.91
STP-6	770,650	2,388,850	46	Dune Sand	-	25.78							
				Oxidized	20.22	67.82							
				Seam Zone A	-	-	Below	Horizon					
				Seam Zone B	-	-	Below	Horizon					
				Seam Zone C	-	-	Below	Horizon					111.56
STP-7	775,410	2,382,630	92	Dune Sand	-	44.07	-	-	-	-	-	-	
				Oxidized	47.93	88.59	-	-	-	-	-	-	
				Seam Zone A	-52.78	12.12	2.44	-	6.52	2.44	-	6.52	
				Seam Zone B	-67.92	-	17.54	1.52	2.00	19.06	6.18	8.18	
				Seam Zone C	-98.73	-	5.20	-	1.40	5.20	9.75	11.15	224.20
STP-8	781,800	2,388,280	88	Dune Sand	-	51.31				-	-	-	
				Oxidized	36.69	99.87				-	-	-	
				Seam Zone A	-	-	Below	Horizon		-	-	-	
				Seam Zone B	-66.38	3.20	8.10		1.77	8.18	-	1.77	
				Seam Zone C	-97.42	-	3.82		-	4.69	21.09	21.09	212.12
STP-9	786,800	2,380,100	84	Dune Sand	-	53.34	-	-	-	-	-	-	
				Oxidized	30.66	73.56	-	-	-	-	-	-	
				Seam Zone A	-45.48	2.59	8.95	0.19	11.27	9.14	-	11.27	
				Seam Zone B	-71.52	-	5.55	0.04	-	5.59	5.63	5.63	
				Seam Zone C	-90.84	-	11.24	0.86	4.32	12.10	13.73	18.05	225.04
STP-10	787,700	2,936,200	91	Dune Sand	-	62.33							
				Oxidized	28.67	107.14							
				Seam Zone A	-	-	Below	Horizon					
				Seam Zone B	-	-	Below	Horizon					
				Seam Zone C	-	-	Below	Horizon					175.26
TP-1	802,100	2,365,860	78	Dune Sand	-	67.50	-	-	-	-	-	-	
				Oxidized	10.50	49.38	-	-	-	-	-	-	
				Seam Zone A	-68.52	29.64	3.12	-	0.72	3.12	-	0.72	
				Seam Zone B	-84.25	-	9.91	0.60	1.15	10.51	11.89	13.04	
				Seam Zone C	-99.43	-	7.30	-	8.81	7.30	3.52	12.33	252.92

APPENDIX A - Continued

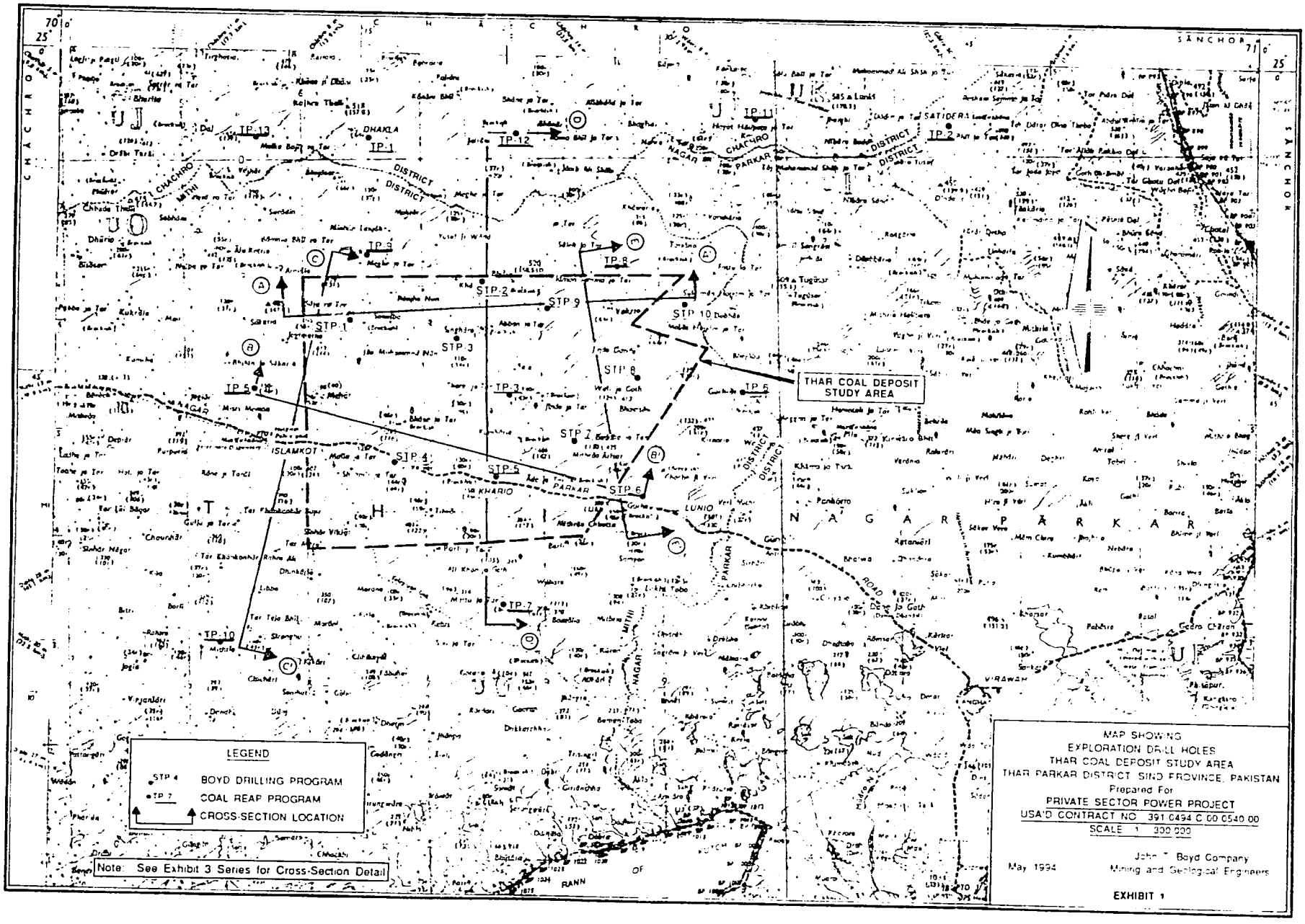
Drill Hole No.	Coordinates (m) Northing	Coordinates (m) Easting	Estimated Surface Elevation* (m)	Strata Zone Designation	Top of Zone Elevation (m)	Overburden Thickness (m)	Seam Zone Thickness (m) Coal	Parting	Separable** Parting	Total	Interval to Seam Above (m)	Total Interburden Thickness (m)	Total Hole Depth (m)
TP-3	781,000	2,376,350	74	Dune Sand	-	58.40	-	-	-	-	-	-	
				Oxidized	-15.60	59.60	-	-	-	-	-	-	
				Seam Zone A	-60.87	16.87	4.63	0.86	9.26	5.49	-	9.26	
				Seam Zone B/C	-76.67	-	23.21	-	0.90	-	1.05	1.95	209.57
TP-5	781,500	2,354,600	63	Dune Sand	-	42.75							
				Oxidized	20.75	91.75							
				Seam Zone A	-	-	Below	Horizon					
				Seam Zone B	-94.76	23.26	11.75	0.37	9.29	12.12		9.29	
				Seam Zone C	-129.98		3.60		15.78	3.60	13.81	29.59	273.58
TP-6	779,350	2,397,150	73	Dune Sand	-	16.50							
				Oxidized	56.50	121.50							
				Seam Zone A	-	-	Below	Horizon					
				Seam Zone B	-	-	Below	Horizon					
				Seam Zone C	-	-	Below	Horizon					146.97
TP-7	761,860	2,376,740	45	Dune Sand	-	69.36	-	-	-	-	-	-	
				Oxidized	-24.36	110.13	-	-	-	-	-	-	
				Seam Zone A	-141.97	7.48	1.16	-	1.69	1.16	-	1.69	
				Seam Zone B	-145.93	-	16.57	0.45	7.31	17.02	1.10	8.41	
				Seam Zone C	-176.16	-	10.61	-	4.83	10.61	5.90	10.73	245.74
TP-8	790,750	2,385,860	90	Dune Sand	-	40.68	-	-	-	-	-	-	
				Oxidized	49.32	106.82	-	-	-	-	-	-	
				Seam Zone A	-67.43	9.93	7.85	0.40	-	8.25	-	-	
				Seam Zone B	-88.28	-	4.85	-	-	4.85	12.60	12.60	
				Seam Zone C	-106.98	-	4.54	-	0.96	4.54	13.85	14.81	
				Seam Zone C Split	-132.73	-	0.85	-	-	0.85	13.34	13.34	268.31
TP-9	792,250	2,365,550	110	Dune Sand	-	77.01	-	-	-	-	-	-	
				Oxidized	32.99	37.99	-	-	-	-	-	-	
				Seam Zone A	-38.44	33.44	12.05	0.30	12.76	12.35	-	12.76	
				Seam Zone B	-72.68	-	5.22	-	1.27	5.22	9.13	10.40	
				Seam Zone C	-85.12	-	12.54	0.20	16.77	12.74	5.95	22.72	307.79
TP-10	758,520	2,352,390	26	Dune Sand	-	57.00	-	-	-	-	-	-	
				Oxidized	-31.00	108.60	-	-	-	-	-	-	
				Seam Zone A	-163.03	23.40	7.37	-	8.43	7.37	-	8.43	
				Seam Zone B/C	-188.88	-	22.47	0.72	6.18	23.19	10.05	16.23	267.05
TP-11	801,380	2,399,400	122	Dune Sand	-	55.70	-	-	-	-	-	-	
				Oxidized	66.30	160.14	-	-	-	-	-	-	
				Seam Zone A	-111.18	17.34	11.45	0.25	1.10	11.70	-	1.10	
				Seam Zone B	-	-	Not	Deep	Enough				249.02

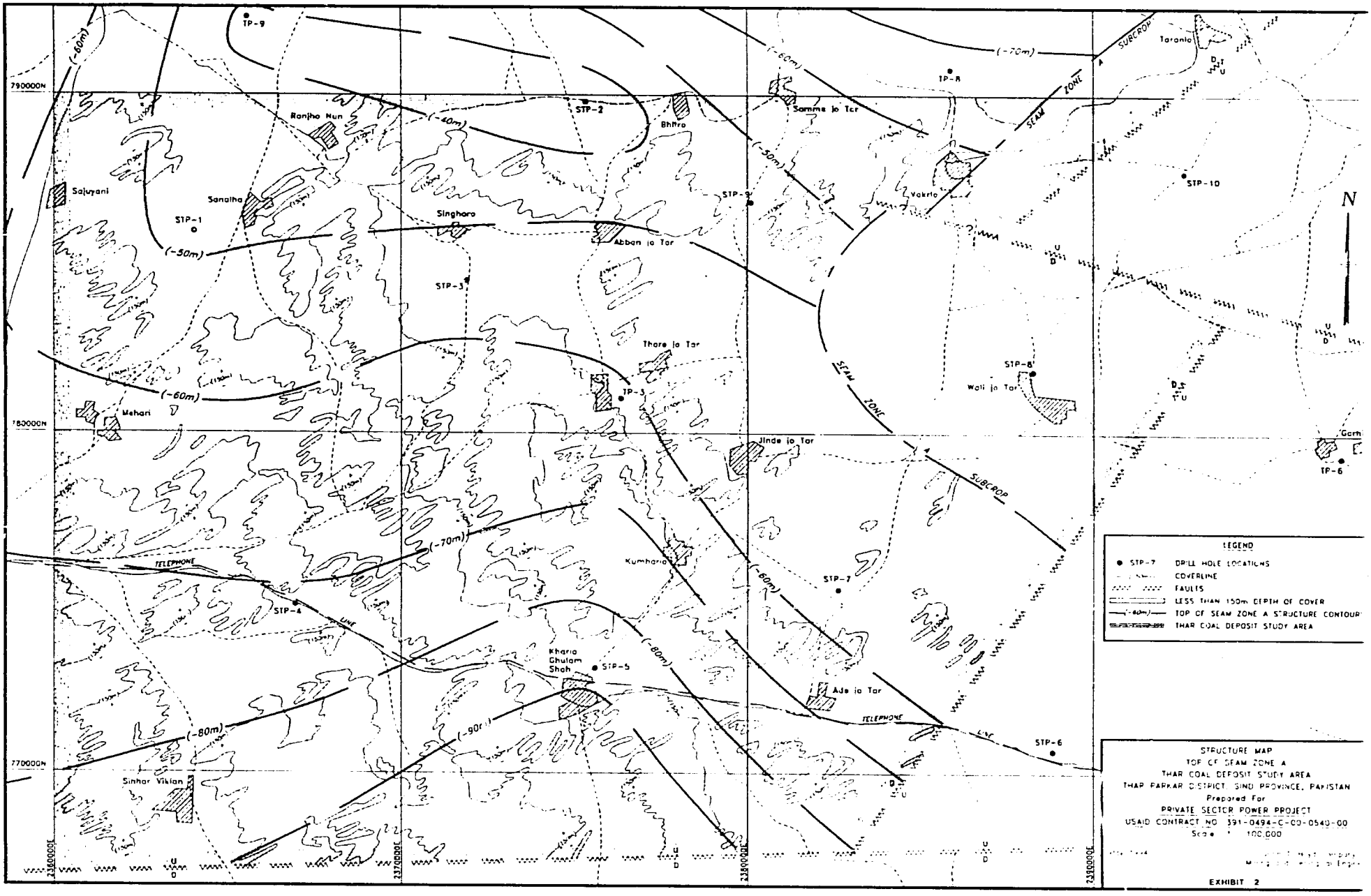
APPENDIX A - Continued

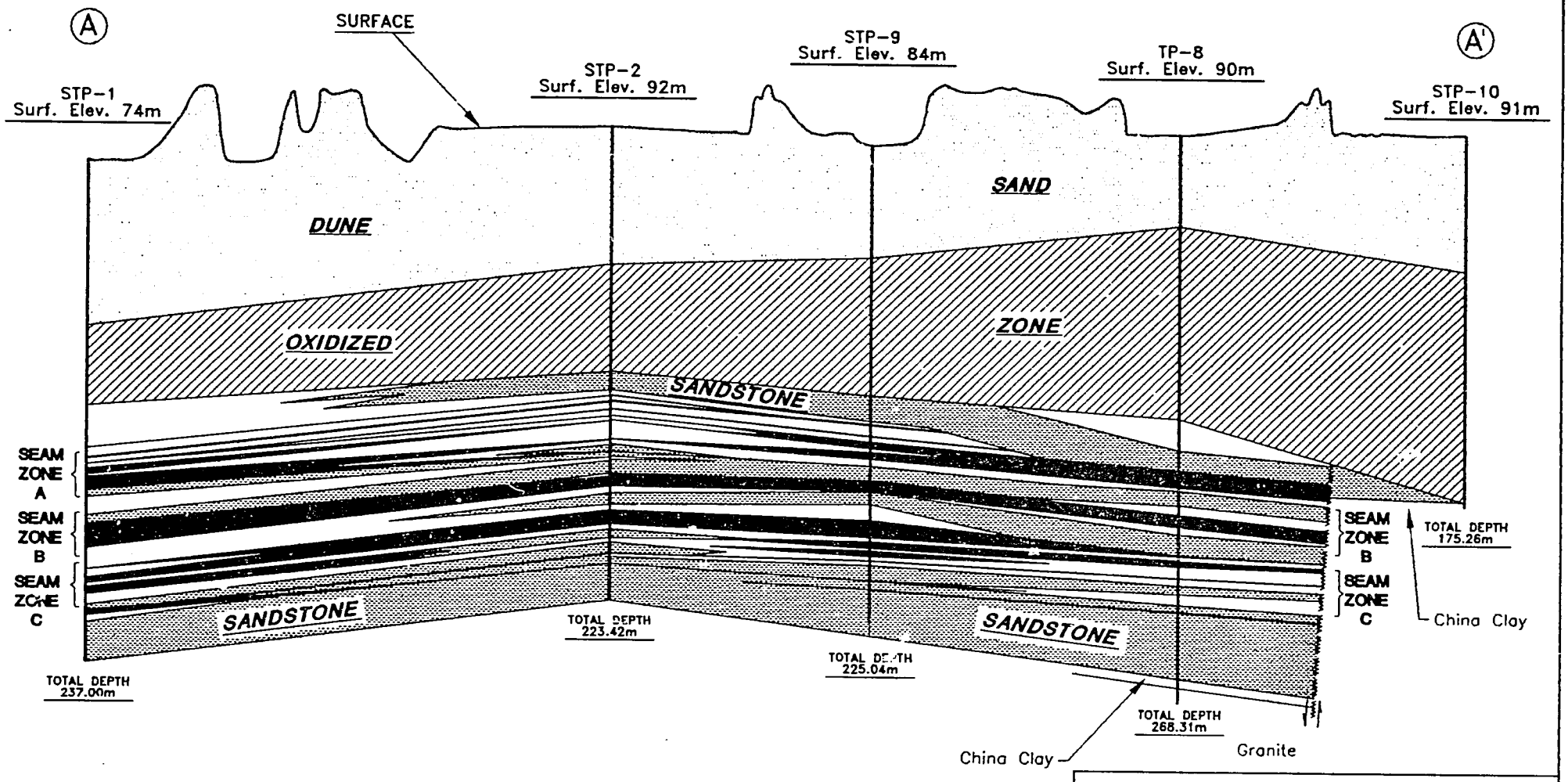
Drill Hole No.	Coordinates (m) Northing	Coordinates (m) Easting	Estimated Surface Elevation* (m)	Strata Zone Designation	Top of Zone Elevation (m)	Overburden Thickness (m)	Seam Zone Thickness (m) Coal	Parting	Separable** Parting	Total	Interval to Seam Above (m)	Total Interburden Thickness (m)	Total Hole Depth (m)
TP-12	802,510	2,377,300	91	Dune Sand	-	78.00	-	-	-	-	-	-	
				Oxidized	13.00	119.00	-	-	-	-	-	-	
				Seam Zone A	-110.12	23.20	0.52	0.73	12.22	1.25	-	12.22	
				Seam Zone B	-129.20	-	9.16	0.13	3.41	9.29	5.61	9.02	
				Seam Zone C	-144.51	-	12.87	0.19	-	13.06	2.61	2.61	
				Seam Zone C Split	-159.15	-	1.46	-	4.00	4.46	1.58	5.58	262.78
TP-13	802,440	2,356,700	73	Dune Sand	-	60.15	-	-	-	-	-	-	
				Oxidized	12.85	81.74	-	-	-	-	-	-	
				Seam Zone A	-103.91	34.92	2.94	0.20	-	3.14	-	-	
				Seam Zone B	-124.86	-	9.08	0.43	-	9.51	6.55	6.55	
				Seam Zone C	-151.71	-	3.33	-	17.21	3.33	17.34	34.55	300.91

*Surface elevations estimated from topographic maps.
**In-seam partings thicker than 0.50 m separated during loading and discarded as interburden.

TP - Designation for Coal Reap Program Drill Holes
STP - Designation for BCYD Program Drill Holes







BEST AVAILABLE DOCUMENT

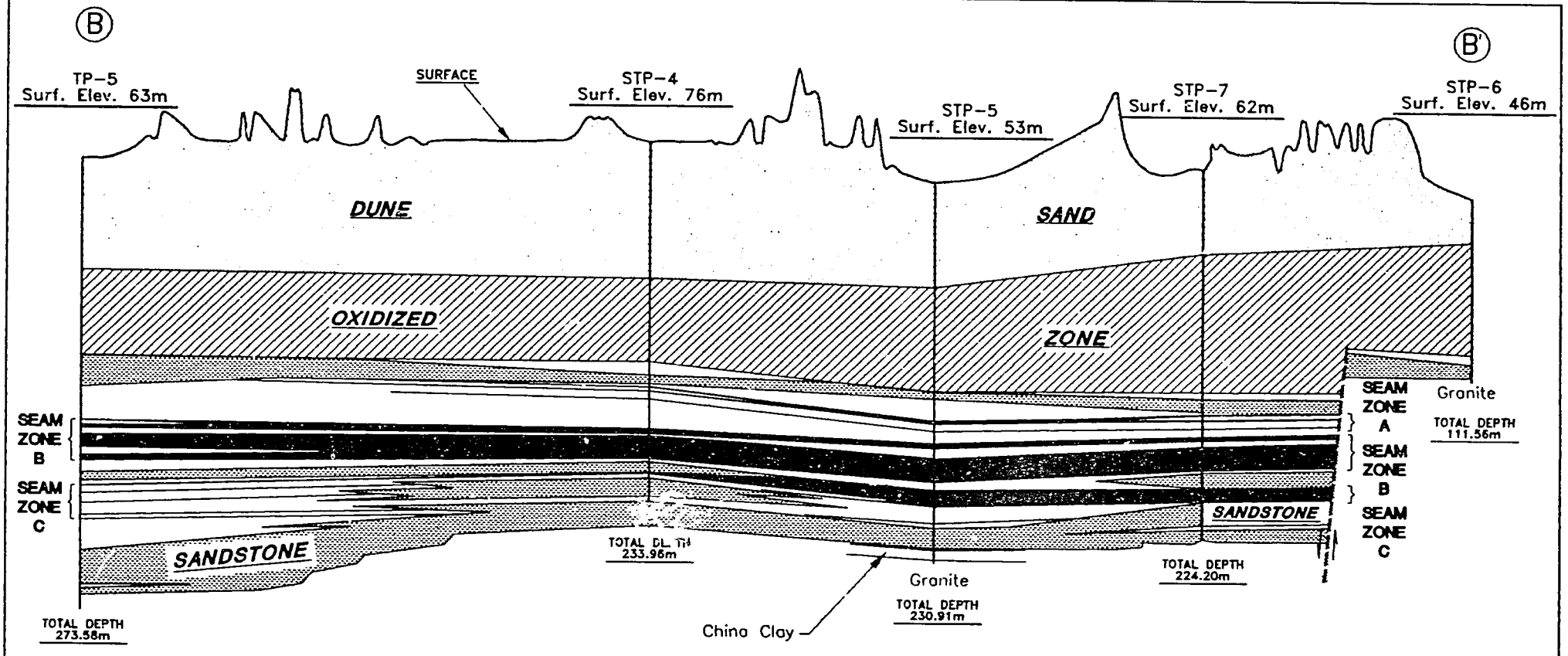
Note: See Exhibit 1 for Cross-Section Location.

GEOLOGICAL CROSS-SECTION A-A'
THAR COAL DEPOSIT STUDY AREA
Thar Parkar District, Sind Province, Pakistan
Prepared for
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
Scale – Horizontal 1:137,500
Vertical 1:275

May 1994

John T. Boyd Company
Mining and Geological Engineers

EXHIBIT 3A



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Note: See Exhibit 1 for Cross-Section Location.

GEOLOGICAL CROSS-SECTION B-B'
THAR COAL DEPOSIT STUDY AREA
Thar Parkar District, Sind Province, Pakistan
Prepared for
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
Scale - Horizontal 1:175,000
Vertical 1:350

May 1994

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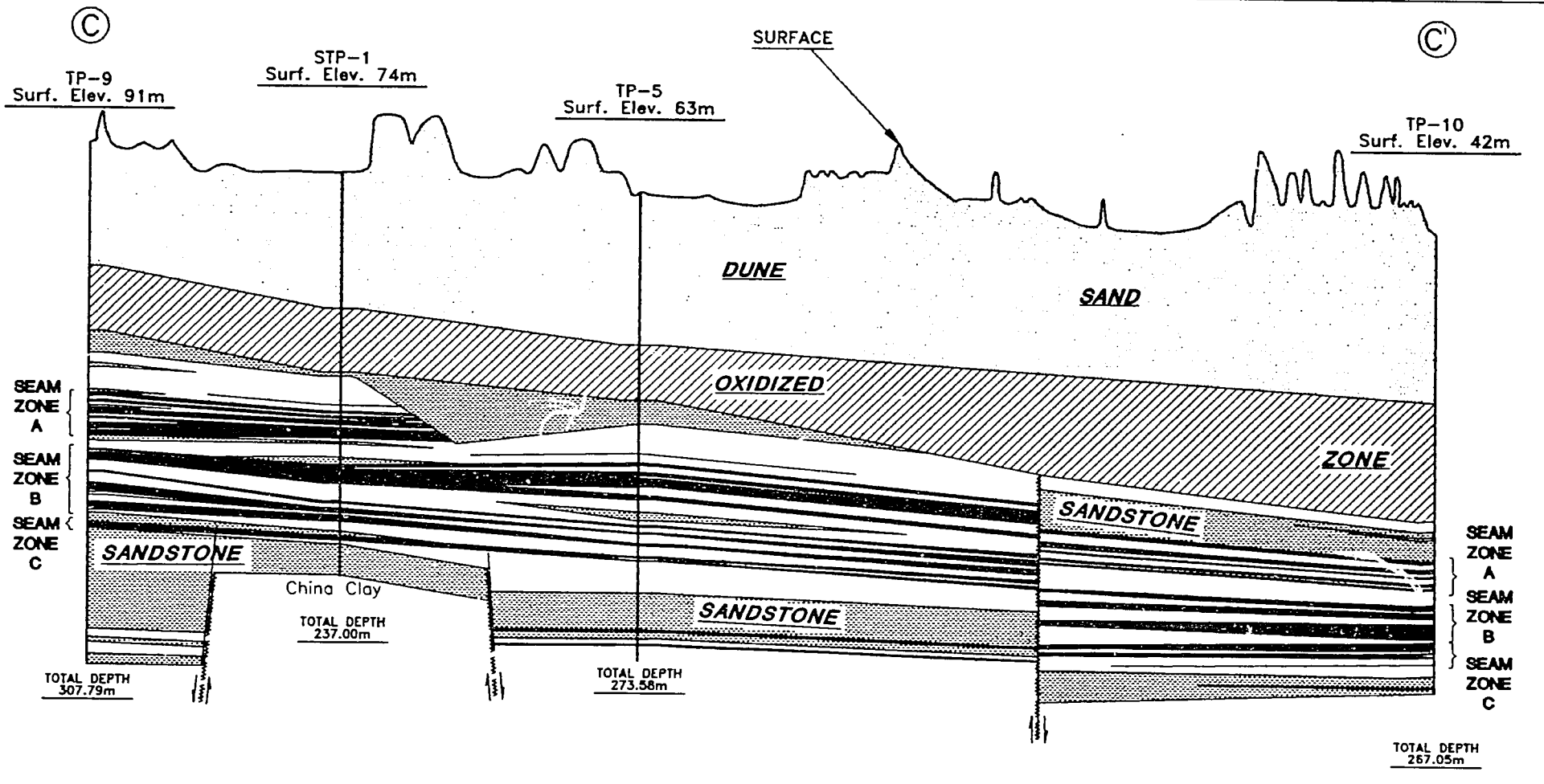
Mining and Geological Engineers

EXHIBIT 3B



BEST AVAILABLE DOCUMENT

Note: See Exhibit 1 for Cross-Section Location.

GEOLOGICAL CROSS-SECTION C-C'
THAR COAL DEPOSIT STUDY AREA
Thar Parkar District, Sind Province, Pakistan
Prepared for
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
Scale - Horizontal 1:175,000
Vertical 1:350

May 1994

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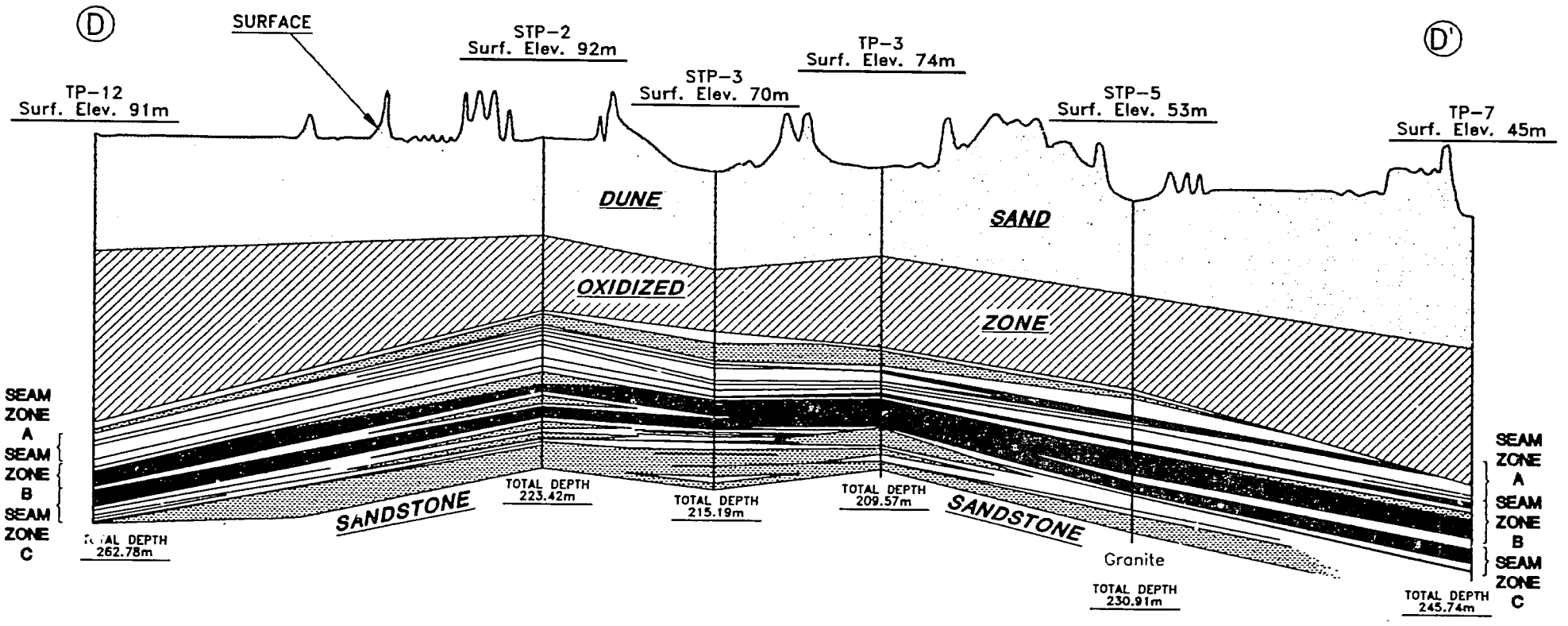
EXHIBIT 3C



BEST AVAILABLE DOCUMENT

Note: See Exhibit 1 for Cross-Section Location.

GEOLOGICAL CROSS-SECTION D-D'
THAR COAL DEPOSIT STUDY AREA
Thar Parkar District, Sind Province, Pakistan
Prepared for
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
Scale - Horizontal 1:200,000
Vertical 1:400

May 1994

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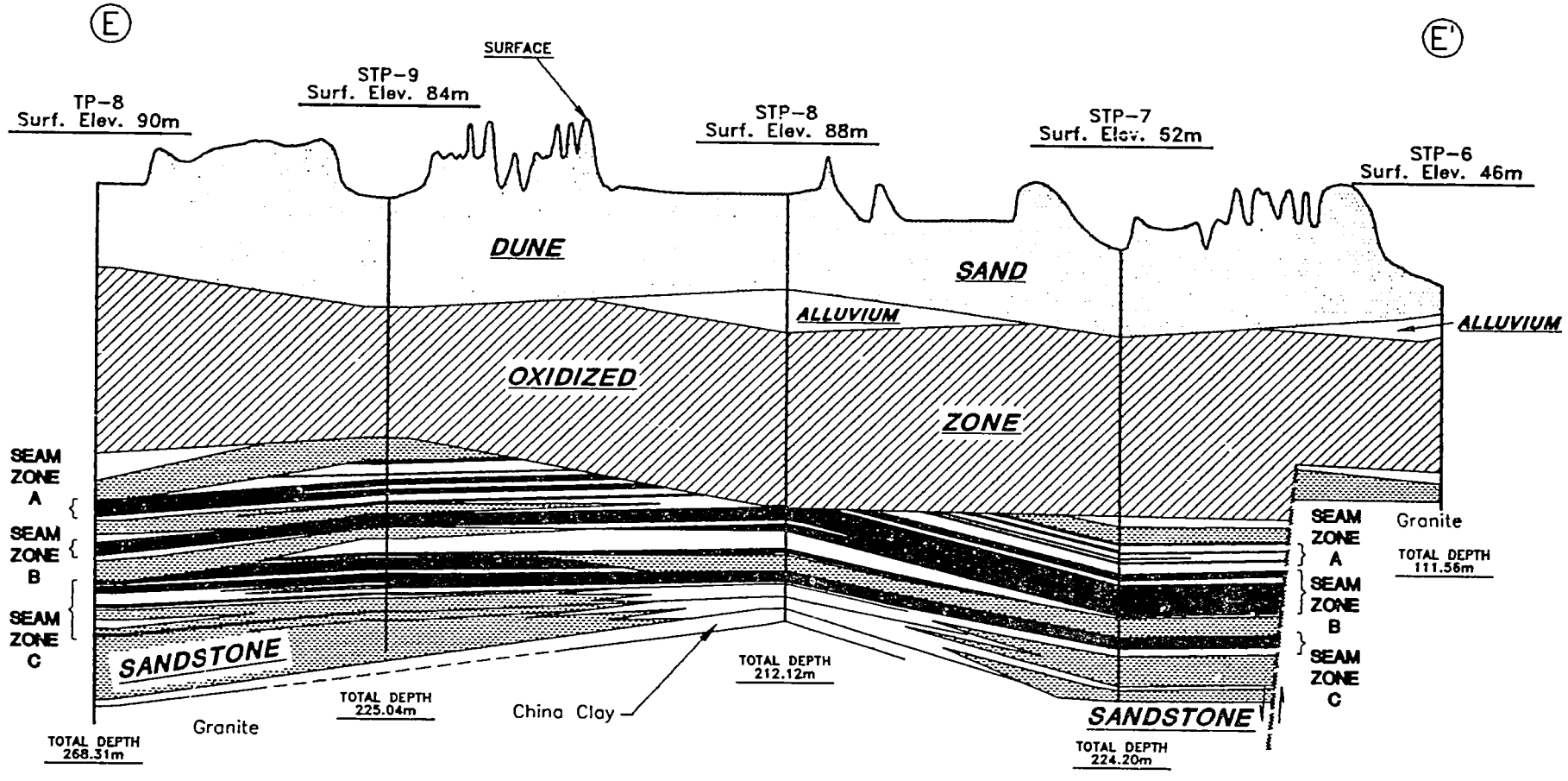
Mining and Geological Engineers

EXHIBIT 3D

69



BEST AVAILABLE DOCUMENT

Note: See Exhibit 1 for Cross-Section Location.

GEOLOGICAL CROSS-SECTION E-E'
THAR COAL DEPOSIT STUDY AREA
Thar Parkar District, Sind Province, Pakistan
Prepared for
PRIVATE SECTOR POWER PROJECT
USAID CONTRACT NO. 391-0494-C-00-0540-00
Scale - Horizontal 1:160,000
Vertical 1:320

May 1994

John T. Boyd Company
Mining and Geological Engineers

EXHIBIT 3E