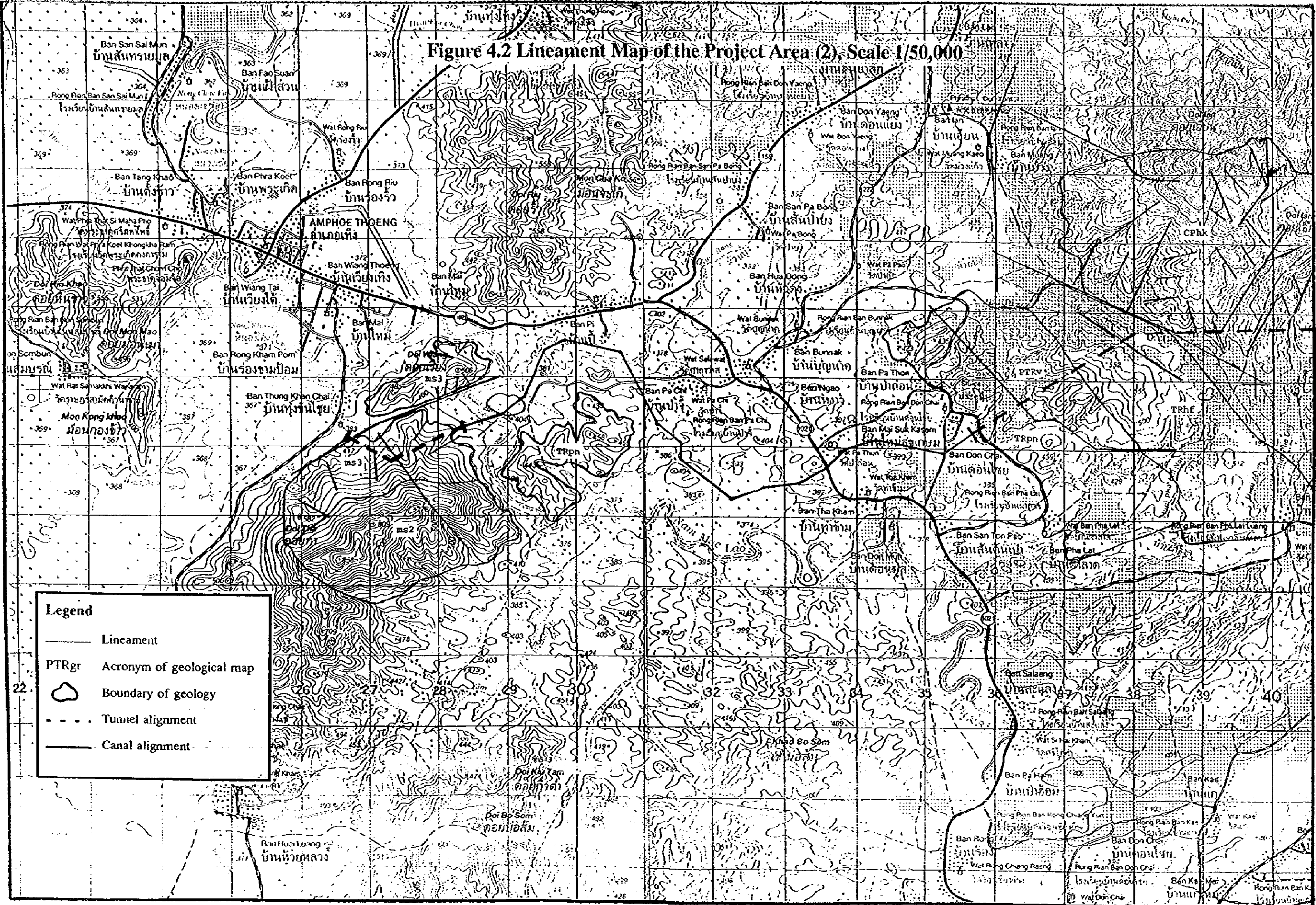


Figure 4.2 Lineament Map of the Project Area (2), Scale 1/50,000



Legend






-  Lineament
-  PTRgr Acronym of geological map
-  Boundary of geology
-  Tunnel alignment
-  Canal alignment

Figure 4.3 Lineament Map of the Project Area (3), Scale 1/50,000

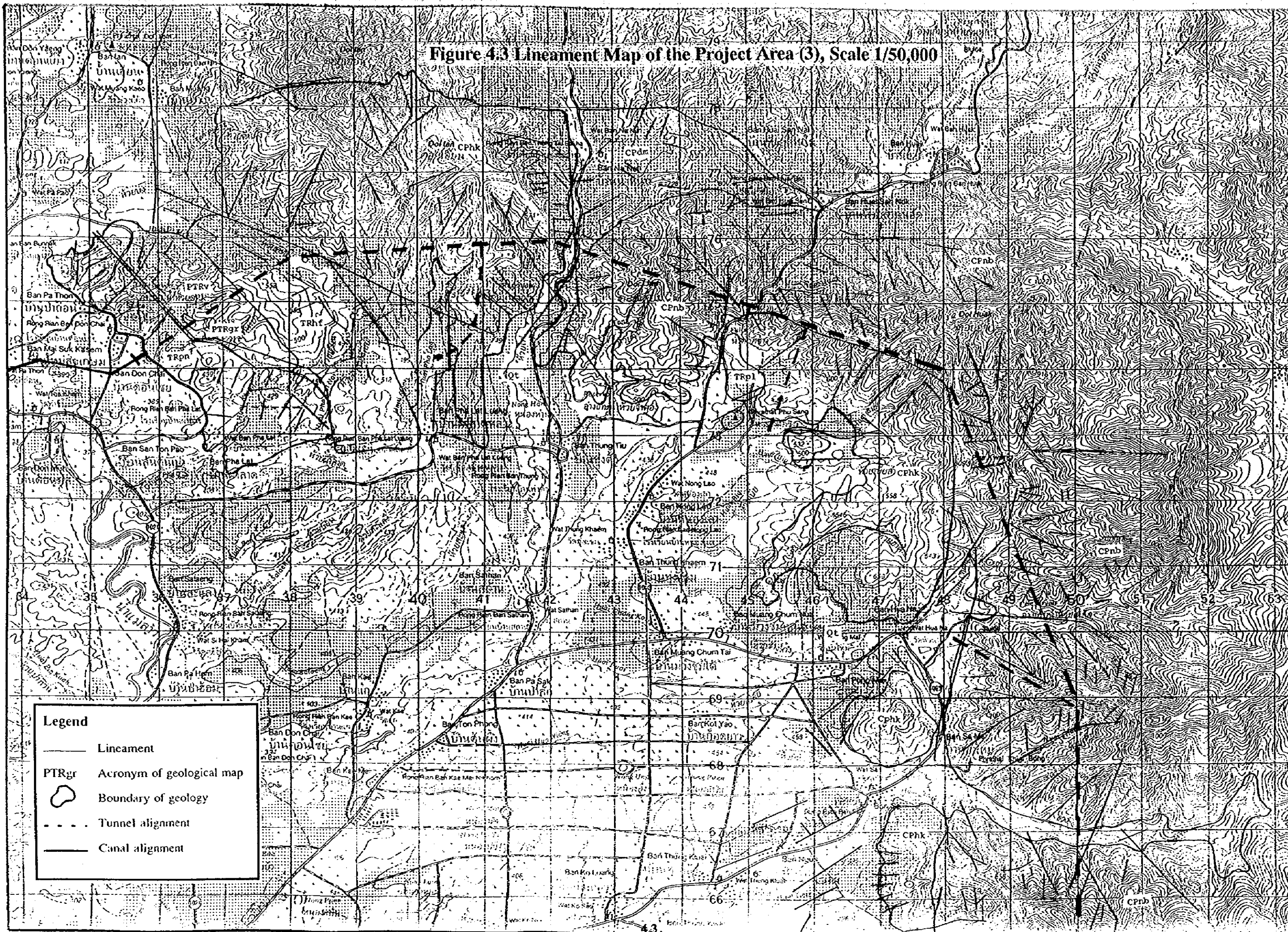
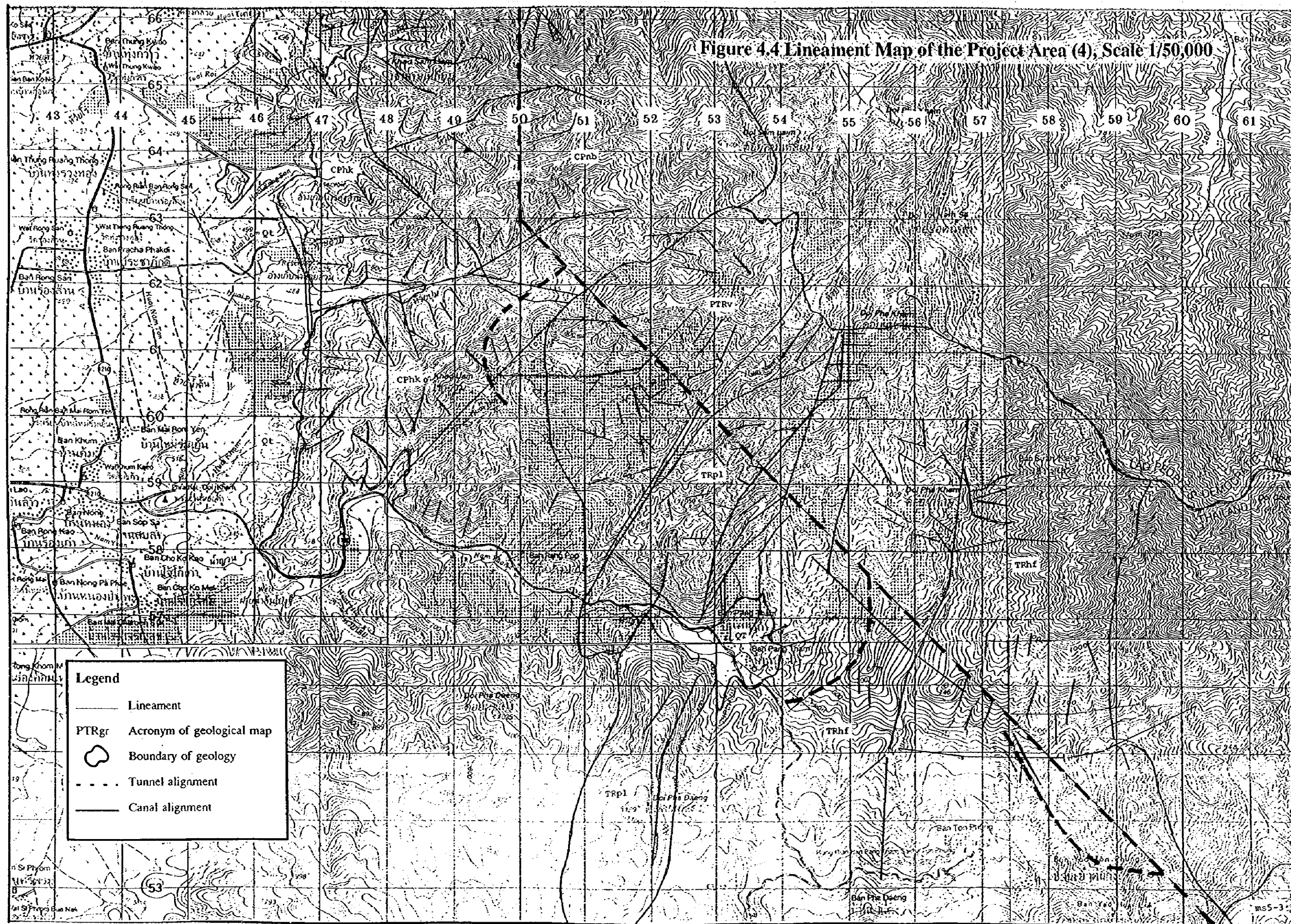


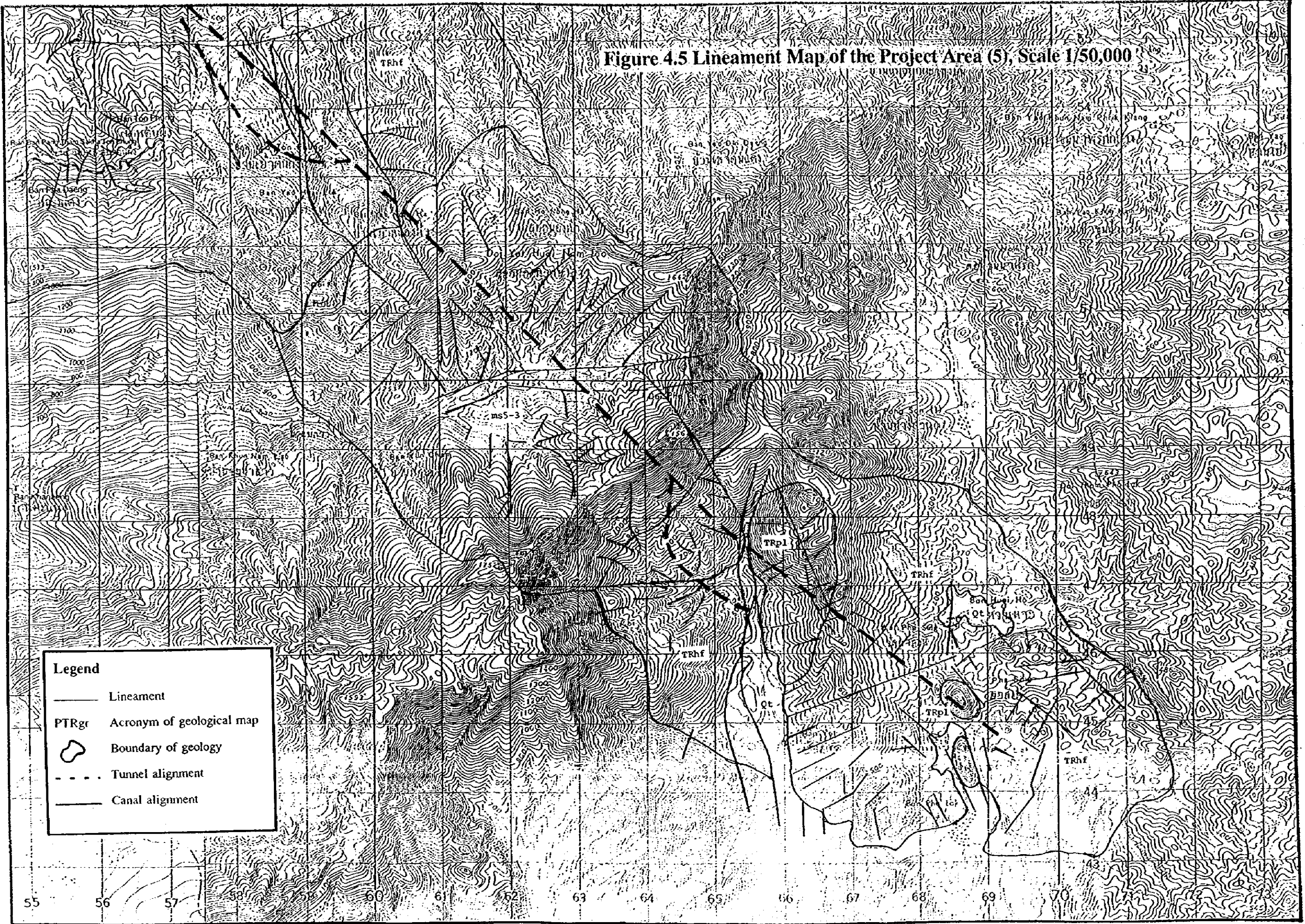
Figure 4.4 Lineament Map of the Project Area (4), Scale 1/50,000



Legend

- Lineament
- PTRgr Acronym of geological map
- Boundary of geology
- - - Tunnel alignment
- Canal alignment

Figure 4.5 Lineament Map of the Project Area (5), Scale 1/50,000



5. Boring Log

Figure 5.1 Boring Log (1), Kok Intake

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 16 Jul, 1997			Hole No : DHK1-A1			
Changwat : CHIANGRAI - PHAYAO - NAN			Drilling Finished : 27 Jul, 1997			Total Depth : 30.00 m.			
Site : Kok Intake			Logged Date : 11 Aug, 1997			Angle From Vertical : 0 Degree			
Location : 968053			Logged By : P. Sarayut			Bearing of Angle Hole : -			
Approx. Ground Height : +389.000 m.			Drilling Method : Rotary Oil Feed			Depth of Water Level : 1.95 m.			
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
									LEAN CLAY (CL) : medium plasticity fines, trace of fine sand.
5									SILTY SAND (SM) : fine to coarse sand, nonplastic fines.
									LEAN CLAY WITH SAND (CL) : medium plasticity fines, fine to coarse sand.
									CLAYEY SAND (SC) : fine to coarse sand, medium plasticity fines.
10									POORLY GRADED SAND (SP) : fine to coarse sand.
									POORLY GRADED SAND (SP) :
15									
20									
25									
									LEAN CLAY (CL) : medium plasticity fines, fine gravel.
30									SILTY SAND (SM) : fine to coarse sand, nonplastic fines.
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec			
50-75 % = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90 % = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100 % = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller :									
Geologist : P. Sarayut									

Figure 5.2 Boring Log (2), Kok Intake and Kok-Ing Diversion Canal

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI - PHAYAO - NAN Site : Kok Intake Location : 917029 Approx. Ground Height : +389.000 m.			Drilling Started : 29 Jul, 1997 Drilling Finished : 5 Aug, 1997 Logged Date : 11 Aug, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DHKI-B1 Total Depth : 30.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 2.10 m.			Page 1 of 1
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
5								LEAN CLAY (CL) : medium plasticity fines, fine to medium sand.	
								POORLY GRADED SAND (SP) : fine to coarse sand, trace of fines.	
10								POORLY GRADED SAND (SP) : fine to coarse sand, few fine to medium gravel and nonplastic fines, some core loss.	
15									
20									
25									
30									Bottom of hole
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock 25-50% = Poor Rock 50-75% = Fair Rock 75-90% = Good Rock 90-100% = Very Good Rock		1 = Very Soft Rock 2 = Soft Rock 3 = Medium Hard Rock 4 = Hard Rock 5 = Very Hard rock		1 = Fresh Rock 2 = Slightly Weathered Rock 3 = Moderately Weathered Rock 4 = Highly Weathered Rock 5 = Completely Weathered Rock		1 = < 1 Lugeon or < 10 ⁻⁶ cm/sec 2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁶ cm/sec 3 = 5-10 Lugeon or 5x10 ⁻⁶ - 10 ⁻⁴ cm/sec 4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec 5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : P. Sarayut									

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI - PHAYAO - NAN Site : Kok-Ing Canal Location : 937003 Approx. Ground Height : +391.000 m.			Drilling Started : 28 Aug, 1997 Drilling Finished : 3 Sep, 1997 Logged Date : 15 Sep, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DHKI-B2 Total Depth : 30.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 2.00 m.			Page 1 of 1
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
5								SANDY SILT (ML) : low plasticity fines, very fine to fine sand.	
								LEAN CLAY (CL) : medium plasticity fines, few very fine sand.	
10								FAT CLAY (CH) : high plasticity fines, fine to medium gravel, trace of sand.	
15									
20									
25								CLAYEY SAND (SC) : fine to coarse sand, medium plasticity fines, trace of gravel.	
30									Bottom of hole
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock 25-60% = Poor Rock 50-75% = Fair Rock 75-90% = Good Rock 90-100% = Very Good Rock		1 = Very Soft Rock 2 = Soft Rock 3 = Medium Hard Rock 4 = Hard Rock 5 = Very Hard rock		1 = Fresh Rock 2 = Slightly Weathered Rock 3 = Moderately Weathered Rock 4 = Highly Weathered Rock 5 = Completely Weathered Rock		1 = < 1 Lugeon or < 10 ⁻⁶ cm/sec 2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁶ cm/sec 3 = 5-10 Lugeon or 5x10 ⁻⁶ - 10 ⁻⁴ cm/sec 4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec 5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : P. Sarayut									

Figure 5.3 Boring Log (3), Kok-Ing Diversion Canal

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 14 Aug, 1997			Hole No : DHKI-B7 Page 1 of 1			
Changwat : CHIANGRAI - PHAYAO - NAN			Drilling Finished : 22 Aug, 1997			Total Depth : 30.00 m.			
Site : Kok-Ing Canal			Logged Date : 15 Sep, 1997			Angle From Vertical : 0 Degree			
Location : 064907			Logged By : S. Worapot			Bearing of Angle Hole : -			
Approx. Ground Helght : +397.000 m.			Drilling Method : Rotary Oil Feed			Depth of Water Level : 0.00 m.			
Depth (m)	Cone Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description	
0								LEAN CLAY (CL) : medium plasticity fines, roots.	
5								LEAN CLAY (CL) : medium plasticity fines, trace of sand and gravel.	
10								LEAN CLAY WITH GRAVEL (CL) : medium plasticity fines, fine to coarse sand.	
15								LEAN CLAY (CL) : medium plasticity fines, trace of sand and gravel.	
20								GRAVELLY LEAN CLAY (CL) : medium plasticity fines, fine to coarse gravel with fine to coarse sand.	
25								SILTY SAND (SM) : washing sample.	
30								LIMESTONE : massive, slightly weathered, hard, moderately to intensely fractured. (dip 45, 60 and 80 degrees)	
								Bottom of hole	

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁶ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : _____ Geologist : P. Sarayut

Figure 5.4 Boring Log (4), Kok-Ing Diversion Canal

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI - PHAYAO - NAN Site : Kok-Ing Canal Location : 183822 Approx. Ground Height : +367.000 m.			Drilling Started : 31 Aug, 1997 Drilling Finished : 7 Sep, 1997 Logged Date : 15 Sep, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DHKI-B8 Total Depth : 20.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 0.00 m.			Page 1 of 1
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
5									LEAN CLAY (CL) : low plasticity fines.
									LEAN CLAY WITH GRAVEL (CL) : low plasticity fines, fine gravel.
10									
15									GRAVELLY LEAN CLAY (CL) : low plasticity fines, fine to medium gravel.
20									Bottom of hole
25									
30									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec			
50-75 % = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90 % = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 6x10 ⁻⁴ cm/sec			
90-100 % = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 6x10 ⁻⁴ cm/sec			
Driller :		Geologist : P. Sarayut							

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI - PHAYAO - NAN Site : Kok-Ing Canal Location : 171753 Approx. Ground Height : +372.000 m.			Drilling Started : 25 Sep, 1997 Drilling Finished : 28 Sep, 1997 Logged Date : 10 Oct, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DHKI-B9 Total Depth : 20.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 0.08 m.			Page 1 of 1
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
5									LEAN CLAY (CL) : medium plasticity fines, fine to medium gravel.
10									LEAN CLAY WITH GRAVEL (CL) : medium plasticity fines, fine to coarse gravel.
15									SANDY LEAN CLAY (CL) : medium plasticity fines, fine to coarse sand.
20									LEAN CLAY (CL) : medium plasticity fines, fine to coarse gravel.
25									Bottom of hole
30									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec			
50-75 % = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90 % = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 6x10 ⁻⁴ cm/sec			
90-100 % = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 6x10 ⁻⁴ cm/sec			
Driller :		Geologist : P. Sarayut							

Figure 5.5 Boring Log (5), Kok-Ing Diversion Canal

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 21 Oct, 1997			Hole No : DK1-2			Page 1 of 1
Changwat : CHIANGRAI - PHAYAO - NAN			Drilling Finished : 23 Oct, 1997			Total Depth : 30.00 m.			
Site : Kok-Ing Canal			Logged Date : 24 Oct, 1997			Angle From Vertical : 0 Degree			
Location : 591,740 E 2,201,950 N			Logged By : S. Worapot			Bearing of Angle Hole : -			
Approx. Ground Height : + m.			Drilling Method : Rotary Oil Feed			Depth of Water Level : 3.00 m.			
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
0									LEAN CLAY (CL) : medium plasticity fines, fine to coarse sand.
5									SILTY SAND (SM) : fine to coarse sand, nonplastic fines.
10									SILTY SAND (SM) : fine to coarse sand and fine to medium gravel, nonplastic fines.
15									
20									
25									
30									Bottom of hole
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : S. Worapot									

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 29 Oct, 1997			Hole No : DK1-4			Page 1 of 1
Changwat : CHIANGRAI - PHAYAO - NAN			Drilling Finished : 2 Nov, 1997			Total Depth : 30.00 m.			
Site : Kok-Ing Canal			Logged Date : 3 Nov, 1997			Angle From Vertical : 0 Degree			
Location : 598,800 E, 2,199,080 N			Logged By : S. Worapot			Bearing of Angle Hole : -			
Approx. Ground Height : + m.			Drilling Method : Rotary Oil Feed			Depth of Water Level : 0.50 m.			
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
0									FAT CLAY (CH) : high plasticity fines, fine to medium gravel.
5									SILTY SAND (SM) : fine sand, nonplastic fines.
10									FAT CLAY (CH) : high plasticity fines.
15									LEAN CLAY (CL) : medium plasticity fines, trace of sand.
20									
25									
30									SANDSTONE : fine grained, highly weathered, very intensely fractured, framework of rock fragment and clay matrix.
Bottom of hole									
% R.Q.D.		Degree of Hardness		Degree of Weathering		Degree of Permeability			
<25% = Very Poor Rock		1 = Very Soft Rock		1 = Fresh Rock		1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec			
25-50% = Poor Rock		2 = Soft Rock		2 = Slightly Weathered Rock		2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec			
50-75% = Fair Rock		3 = Medium Hard Rock		3 = Moderately Weathered Rock		3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec			
75-90% = Good Rock		4 = Hard Rock		4 = Highly Weathered Rock		4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec			
90-100% = Very Good Rock		5 = Very Hard rock		5 = Completely Weathered Rock		5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec			
Driller : Geologist : S. Worapot									

Figure 5.6 Boring Log (6), Kok-Ing Diversion Canal

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 29 Oct, 1997			Hole No : DKI-5			Page 1 of 1
Changwat : CHIANGRAI - PHAYAO - NAN			Drilling Finished : 2 Nov, 1997			Total Depth : 20.00 m.			
Site : Kok-Ing Canal			Logged Date : 3 Nov, 1997			Angle From Vertical : 0 Degree			
Location : 601,000 E , 2,198,400 N			Logged By : S. Worapot			Bearing of Angle Hole : -			
Approx. Ground Height : + m.			Drilling Method : Rotary Oil Feed			Depth of Water Level : 0.50 m.			
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
0-5								SILTY SAND (SM) : very fine to fine sand, low plasticity fines.	
5-10								FAT CLAY (CH) : high plasticity fines, fine to coarse gravel, reddish gray.	
10-15								FAT CLAY (CH) : high plasticity fines, dark gray.	
15-20						D	VVV VV VVV	TUFF : dark gray, sheared and stressed, very intensely fractured.	
20-25							VV VVV VV VVV	TUFF : greenish gray, highly weathered, sheared and stressed, very intensely fractured.	
20-20							VVV	Bottom of hole	
25-30									

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<-25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁵ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller :
Geologist : S. Worapot

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN			Drilling Started : 18 Oct, 1997			Hole No : DKI-5			Page 1 of 1
Changwat : CHIANGRAI - PHAYAO - NAN			Drilling Finished : 19 Oct, 1997			Total Depth : 20.00 m.			
Site : Kok-Ing-Nan			Logged Date : 20 Oct, 1997			Angle From Vertical : 0 Degree			
Location : 606,480 E , 2,192,420 N			Logged By : S. Worapot			Bearing of Angle Hole : -			
Approx. Ground Height : + m.			Drilling Method : Rotary Oil Feed			Depth of Water Level : 2.50 m.			
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
0-5								FAT CLAY (CH) : high plasticity fines, yellowish brown.	
5-10								LEAN CLAY (CL) : medium plasticity fines, very fine sand.	
10-15								FAT CLAY (CH) : high plasticity fines, trace of sand, dull black.	
15-20								SILTY SAND (SM) : fine to coarse sand, nonplastic fines.	
20-25								FAT CLAY WITH SAND (CH) : fine to coarse sand, nonplastic fines.	
25-30								FAT CLAY (CH) : high plasticity fines.	
20-20								Bottom of hole	

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<-25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁵ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller :
Geologist : S. Worapot

Figure 5.7 Boring Log (7), Kok-Ing Diversion Canal

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI - PHAYAO - NAN Site : Kok-Ing Canal Location : 606,740 E , 2,191,000 N Approx. Ground Height : + m.			Drilling Started : 28 Oct, 1997 Drilling Finished : 29 Oct, 1997 Logged Date : 30 Oct, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DK1-7 Total Depth : 20.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 1.00 m.			
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
0									TOP SOIL (OL) : low plasticity fines, trace of sand, and gravel, high organic matter, roots.
5									LEAN CLAY (CL) : medium plasticity fines, few fine to coarse sand and gravel, reddish yellow.
10									
15									SANDY LEAN CLAY (CL) : medium plasticity fines, fine to coarse sand and gravel.
20									FAT CLAY (CH) : high plasticity fines, trace of fine to coarse sand.
25									Bottom of hole
30									

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : _____ Geologist : S. Worapot

KENBER GEOTECHNIC (THAILAND) CO., LTD.									
GEOLOGIC LOG OF DRILL HOLE									
Project : KOK - ING - NAN Changwat : CHIANGRAI - PHAYAO - NAN Site : Kok-Ing Canal Location : 617,600 E , 2,183,720 N Approx. Ground Height : + m.			Drilling Started : 13 Oct, 1997 Drilling Finished : 14 Oct, 1997 Logged Date : 15 Oct, 1997 Logged By : S. Worapot Drilling Method : Rotary Oil Feed			Hole No : DK1-8 Total Depth : 20.00 m. Angle From Vertical : 0 Degree Bearing of Angle Hole : - Depth of Water Level : 0.70 m.			
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness	Degree of Weathering	Degree of Permeability	Rock Class	Log Symbol	Description	
	0 to 100 %	0 to 100 %	1 2 3 4 5	1 2 3 4 5	1 2 3 4 5				
0									FAT CLAY (CH) : high plasticity fines, trace of sand and gravel, gray.
5									FAT CLAY (CH) : high plasticity fines, yellow.
10									FAT CLAY (CH) : high plasticity fines with fine to medium gravel, yellow to gray.
15									CLAYEY SAND (SC) : fine to coarse sand, medium plasticity fines.
20									SILTY SAND (SM) : fine to coarse sand, nonplastic fines.
25									FAT CLAY (CH) : high plasticity fines, trace of sand.
30									Bottom of hole

% R.Q.D.	Degree of Hardness	Degree of Weathering	Degree of Permeability
<25% = Very Poor Rock	1 = Very Soft Rock	1 = Fresh Rock	1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec
25-50% = Poor Rock	2 = Soft Rock	2 = Slightly Weathered Rock	2 = 1-5 Lugeon or 10 ⁻⁵ - 5x10 ⁻⁵ cm/sec
50-75% = Fair Rock	3 = Medium Hard Rock	3 = Moderately Weathered Rock	3 = 5-10 Lugeon or 5x10 ⁻⁵ - 10 ⁻⁴ cm/sec
75-90% = Good Rock	4 = Hard Rock	4 = Highly Weathered Rock	4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec
90-100% = Very Good Rock	5 = Very Hard rock	5 = Completely Weathered Rock	5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec

Driller : _____ Geologist : S. Worapot

Figure 5.8 Boring Log (8), Kok-Ing Diversion Canal (South Route)

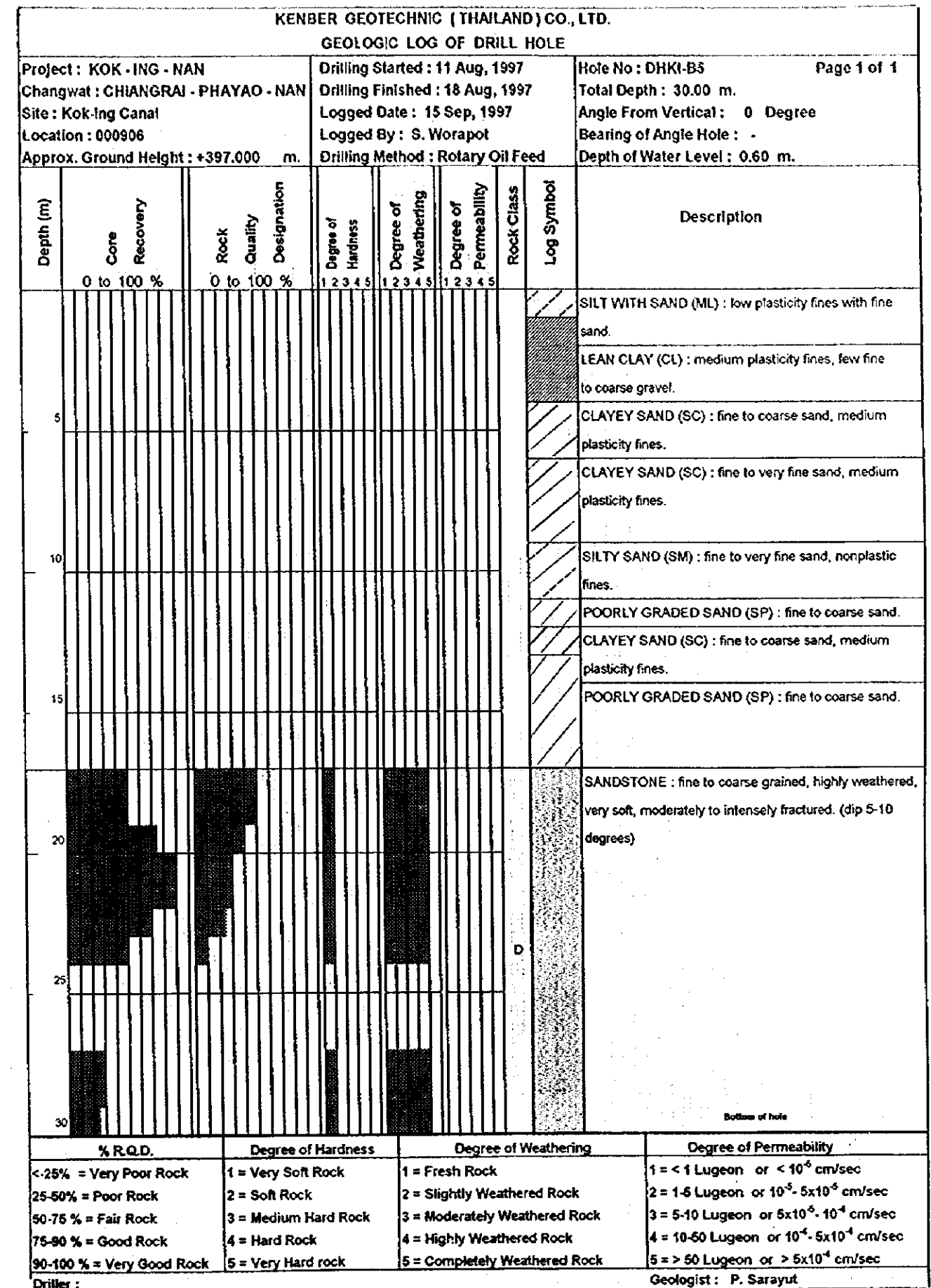
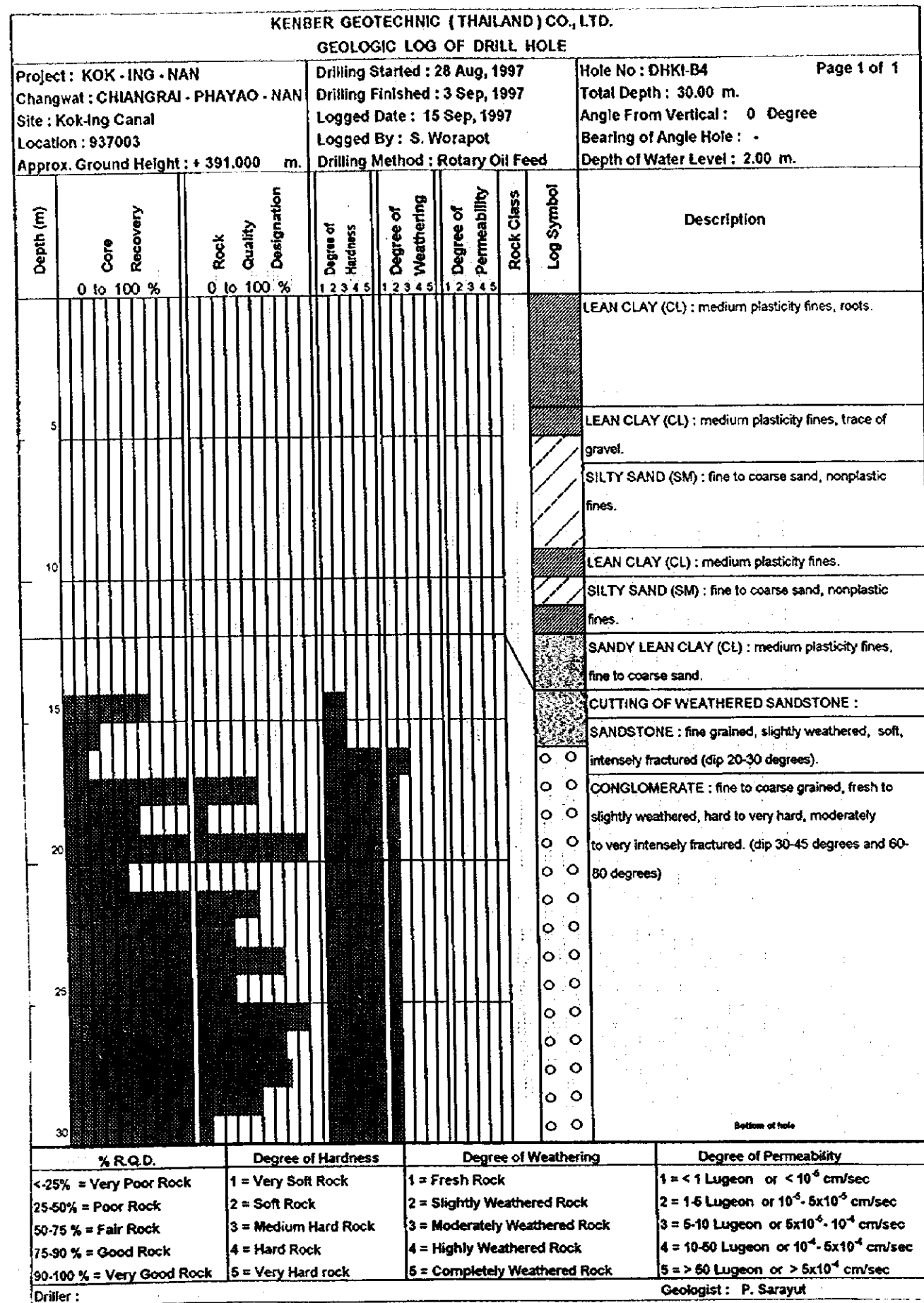


Figure 5.9 Boring Log (9), Kok-Ing Diversion Canal (South Route)

KENBER GEOTECHNIC (THAILAND) CO., LTD.																						
GEOLOGIC LOG OF DRILL HOLE																						
Project : KOK - ING - NAN			Drilling Started : 21 Aug, 1997			Hole No : DHKI-B6SP																
Changwat : CHIANGRAI - PHAYAO - NAN			Drilling Finished : 8 Sep, 1997			Total Depth : 30.00 m.																
Site : Kok-Ing Canal			Logged Date : 15 Sep, 1997			Angle From Vertical : 0 Degree																
Location : 026921			Logged By : S. Worapot			Bearing of Angle Hole : -																
Approx. Ground Height : +397.000 m.			Drilling Method : Rotary Oil Feed			Depth of Water Level : 0.63 m.																
Depth (m)	Core Recovery	Rock Quality Designation	Degree of Hardness					Degree of Weathering					Rock Class	Log Symbol	Description							
			0 to 100 %					0 to 100 %														
			1	2	3	4	5	1	2	3	4	5										
0															LEAN CLAY (CL) : medium plasticity fines.							
5															FAT CLAY WITH GRAVEL (CH) : high plasticity fines, fine to medium gravel.							
10															FAT CLAY (CH) : high plasticity fines, few fine to coarse sand.							
15															GRAVELLY LEAN CLAY (CL) : medium plasticity fines, fine to medium gravel with fine to coarse sand.							
20													D		SHALE : core loss.							
25													D		SHALE : moderately to highly weathered, very soft to soft, very intensely fractured.							
30															Bottom of hole							
			% R.Q.D.					Degree of Hardness					Degree of Weathering					Degree of Permeability				
			<25% = Very Poor Rock					1 = Very Soft Rock					1 = Fresh Rock					1 = < 1 Lugeon or < 10 ⁻⁵ cm/sec				
			25-50% = Poor Rock					2 = Soft Rock					2 = Slightly Weathered Rock					2 = 1-5 Lugeon or 10 ⁻⁶ - 5x10 ⁻⁵ cm/sec				
			50-75 % = Fair Rock					3 = Medium Hard Rock					3 = Moderately Weathered Rock					3 = 5-10 Lugeon or 6x10 ⁻⁶ - 10 ⁻⁴ cm/sec				
			75-90 % = Good Rock					4 = Hard Rock					4 = Highly Weathered Rock					4 = 10-50 Lugeon or 10 ⁻⁴ - 5x10 ⁻⁴ cm/sec				
			90-100 % = Very Good Rock					5 = Very Hard rock					5 = Completely Weathered Rock					5 = > 50 Lugeon or > 5x10 ⁻⁴ cm/sec				
Driller :										Geologist : P. Sarayut												

Figure 5.11 Boring Log (11), Kok-Ing No.2 Tunnel

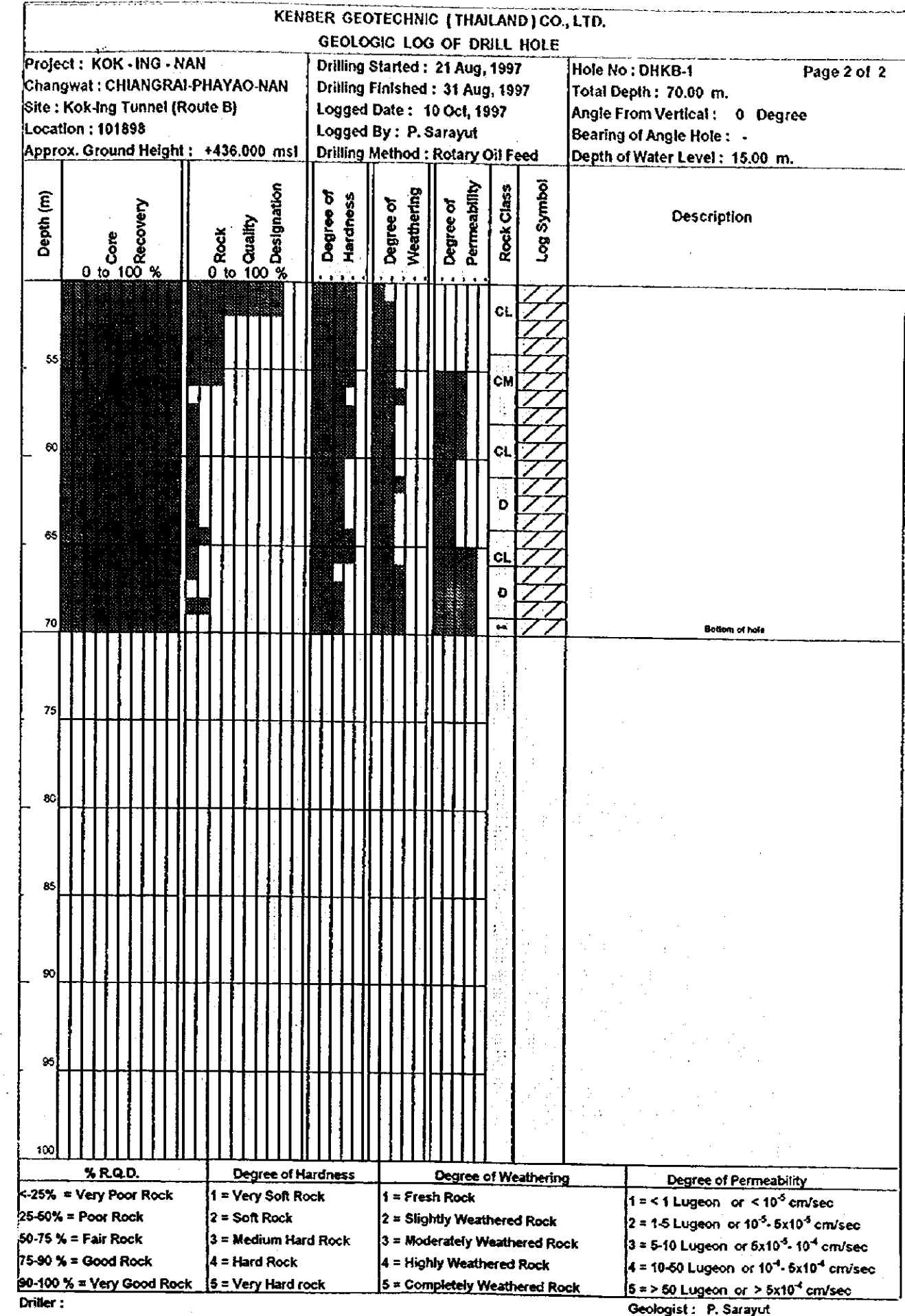
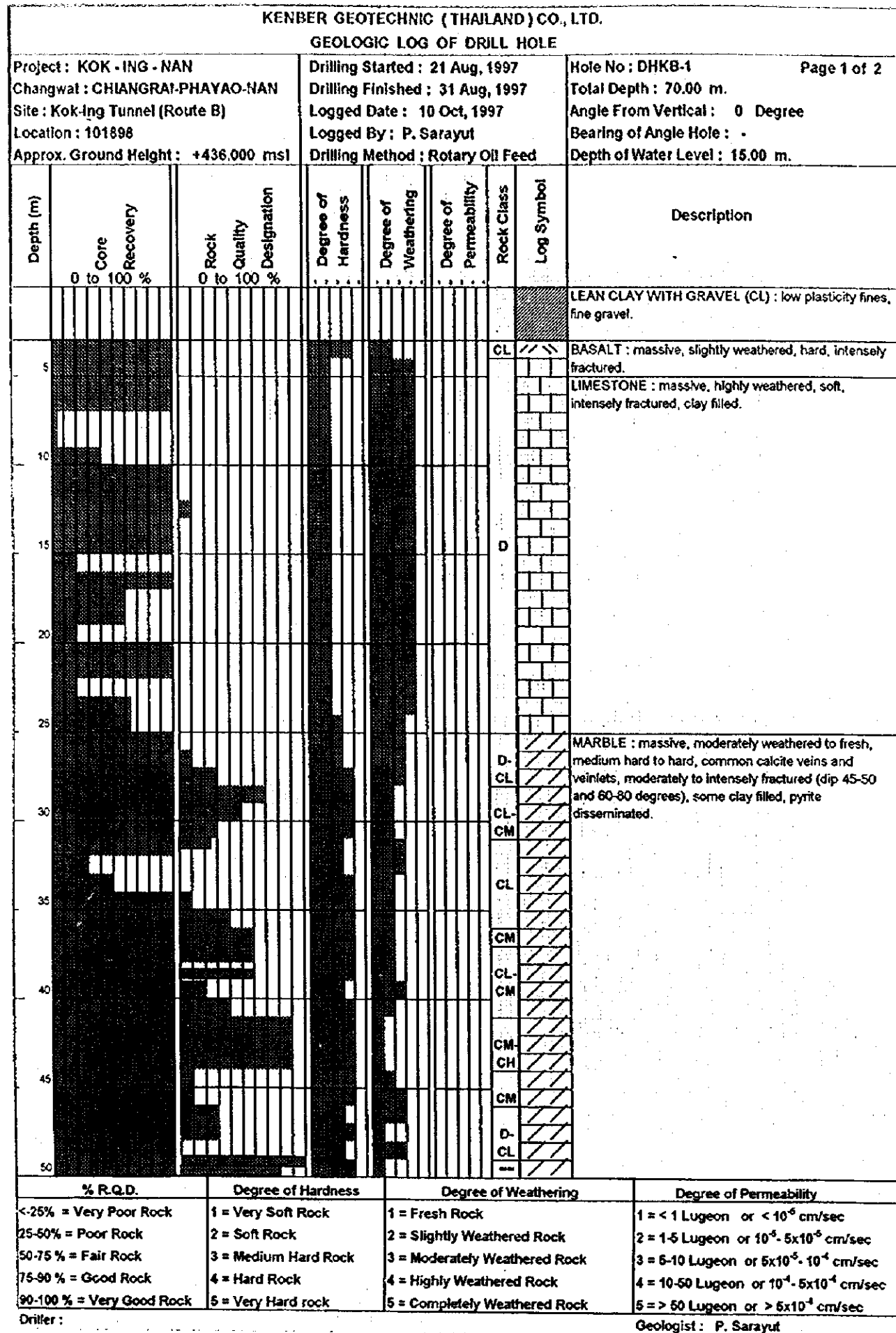


Figure 5.12 Boring Log (12), Kok-Ing No.2 Tunnel

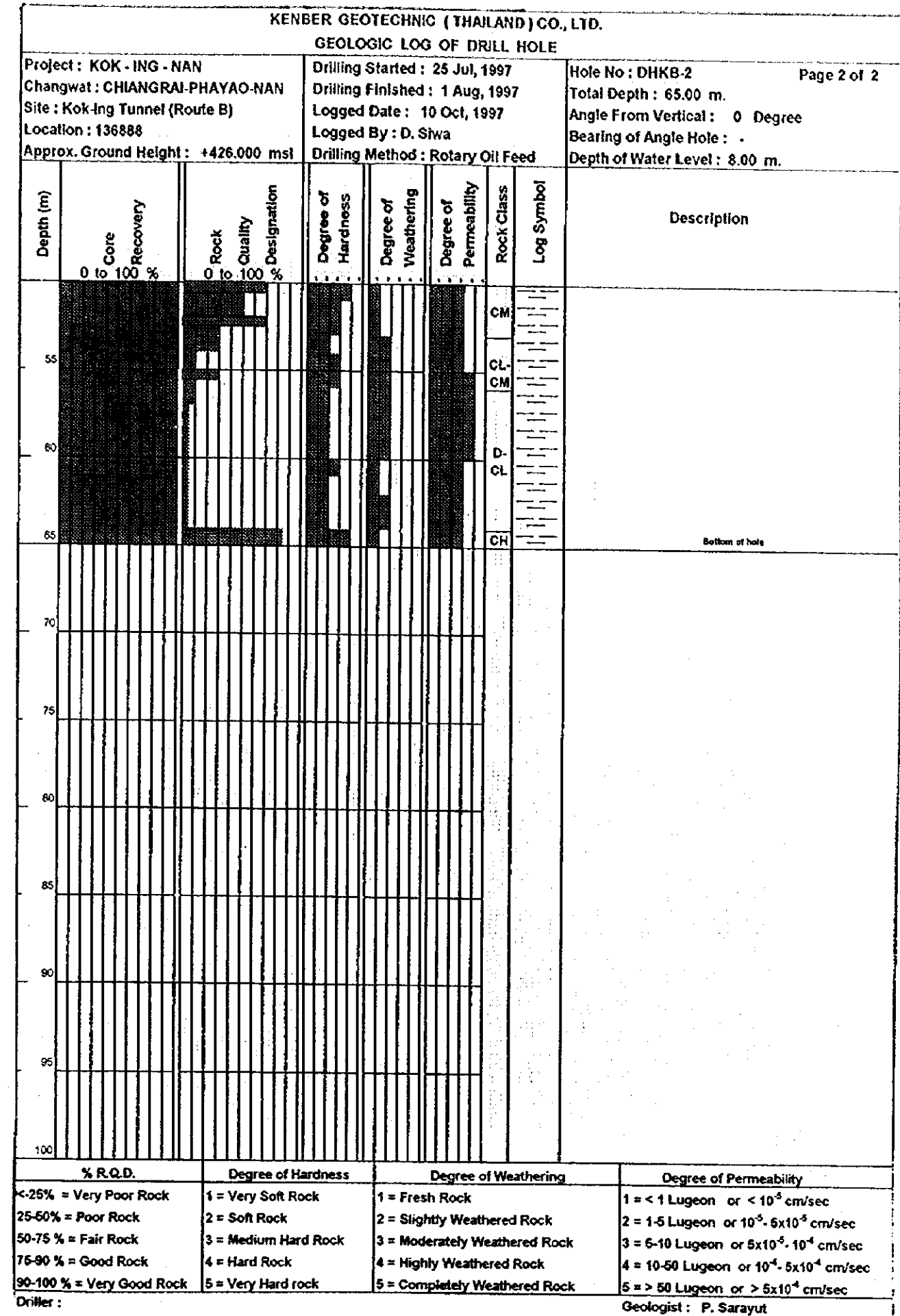
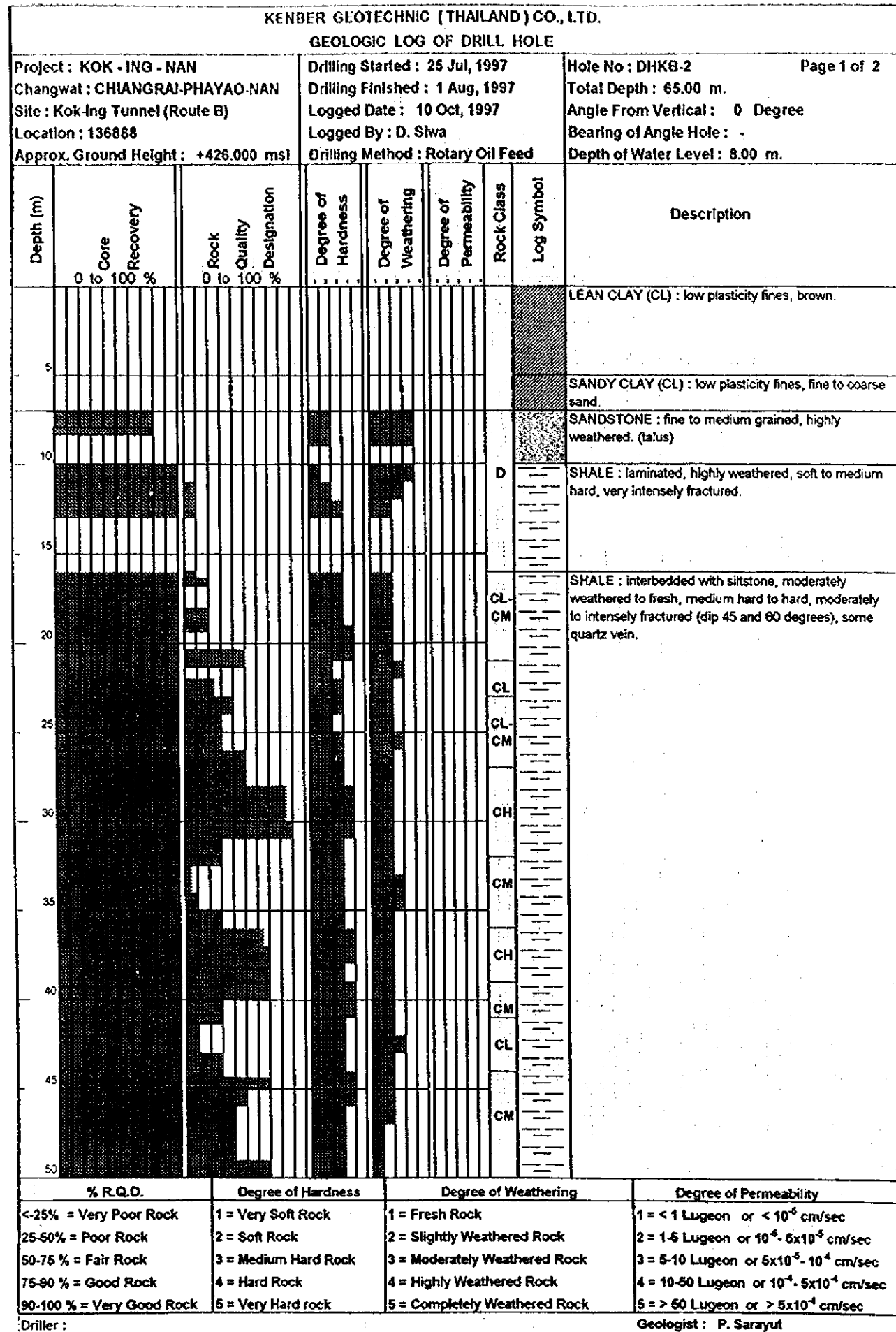


Figure 5.13 Boring Log (13), Kok-Ing No.2 Tunnel

Geologic log of drill hole
Hole No. DHB - EXTRA7

Depth (m)	Core Recovery 0 to 100 %	Rock Quality Designation 0 to 100 %	Degree of Hardness 1 2 3 4 5	Degree of Weathering 1 2 3 4 5	Degree of Permeability 1 2 3 4 5	Rock Class	Log Symbol	Description
0								LEAN CLAY : residual soil.
5							◀◀	BOULDER BASALT : hard. LEAN CLAY : clay with some gravel.
10								
15								
20							●●●	SILT WITH GRAVEL : silt and rock fragments.
25							●●●	SILT WITH GRAVEL : silt, sand and rock fragments
30								LEAN CLAY : clay with some gravel.
35								
40							●●●	SILT WITH GRAVEL : silt and rock fragments.
45							●●●	LEAN CLAY WITH SAND : clay, sand and some gravel. LEAN CLAY WITH GRAVEL : clay, sand and rock fragments
50						CM	●●●	LEAN CLAY WITH SAND : clay, sand and some gravel. SANDSTONE : calcareous, slightly to very intensely fractured, some calcite veins and pyrite. Bottom of hole.