

***C2 GRAND FALLS DAM SITE
GEOLOGY***

***C2.1 Drilling Logs of Grand Falls Dam
Site***



DRILLING LOG
Hole inclination: Vertical
Azimuth:

Project: Mutonga Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 100.20m

Hole FL: 495.66m
Northing: 9,968,810.45
Easting: 392,179.63

Hole No: 94-1
(174)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugaoon (m)	Lu	Depth(m)
	1	1.00	494.6	Sandy silt	50	0						0-1.00m: Reddish brown, silty sand, with some quartz and gneiss gravels. 1.00-2.50m: Gray, fine and medium sand (disintegrated mafic gneiss)				1
	2	2.50	493.1	Mafic gneiss	60	0	2.3									2
	3				80	31	2.95 3.1 3.5	B C B	3 5 2	c d e	CM D CM	2.50-4.30m Moderately weathered and foliated, grey, with light brown laminations/streaks. Medium and coarse grained mafic, feldspar-biotite-hornblende with white feldspar-quartz. Pegmatite bottom 30cm.				3
	4	4.30	491.3		100	62	4	C	3	d	D					4
	5	5.40	490.2	Mafic gneiss	40	0	5.5	D	6	e	D	4.30-5.40m Gray, fine and medium sand (disintegrated gneiss)		6.2		5
	6				70	34										6
	7				100	67	7.15	B	3	c	CM	5.40-20.35m Slightly weathered, foliated grey, with light brown laminations/streaks.				7
	8				100	40	7.65	B	2	c	CM	Medium and coarse grained mafic, feldspar-biotite-hornblende with white feldspar-quartz. With occasional augen structure, and discordant quartz-feldspathic bands few mm upto 4cm thick.		6.30 11.20m		8
	9				100	63	8.55	B	3	c	CM			19		9
	10				100	86	9.7	B	2	b	CH	7.50-8.50m, 50cm core loss.				10
	11				100	73	10.45	B	3	c	CM	Joints; 10-30°, along foliation		10.7		11
	12				100	82	11.35 11.5	B C	1 5	b d	CH D			11.2		12
	13				100	91	13	B	1	b	CH			10.70- 15.20m		13
	14			Mafic gneiss	100	60	9.7	B	2	b	CH	At 20.05m: 10cm thick amphibolite. 6.60-7.00m: greenish gray, unfoliated amphibolite. Pegmatite bottom 30cm.		18.7		14
	15				100	71							14.55			15
	16				100	84	15.85 15.05	B D	2 5	b c	CH CL	9.95-10.30m, 1-3mm thick reddish brown clay in vertical joint.		15.7		16
	17				100	85	17.15 17.3	B C	2 5	b c	CH D	10.00-10.30m Closely spaced fractures light brown granite gneiss quartz feldspar minerals little biotite.		14.55- 19.55m		17
	18				100	77	18.4 18.6 19.05 19.4	B B B B	3 5 3 1	b c h h	CH CL CH CH	11.50-12.90m: With more felsic minerals. Joints mainly along foliation, also 0°, 90° rough/planar with brown clayey silt veneer/clean.		16.8		18
	19				100	68							19.55			19
	20	20.35	475.3		100	75	20.35	B	3	b	CH					20
	21			Mafic gneiss	65	22						20.35-22.2m: Gray, fine and medium biotite, hornblende feldspar grains (Machine disintegrated mafic gneiss)				21
	22	22.20	473.4		58	0	22.2									22
	23				95	37	22.8 23.25	B B	5 3	c b	CL CH	22.20-30.00m Slightly weathered, medium and widely spaced joints, foliated grey with light brown laminae/streaks, medium and coarse grained mafic, feldspar-biotite-hornblende with little quartz.		6.7		23
	24				100	53	23.85 24.35	E B	6 3	e b	D CH					24
	25				100	65							25.2			25
	26				54	70						24.20m: rare white quartzo-feldspathic band, 5cm. Top few 10cm: dark gray with green tinge amphibolite				26
	27				95	72						Foliation dip 40°.		25.20- 31.25m		27
	28				100	75	28.25	B	2	b	CH	Joints, 30-40° and vertical, rough/planar clean, rarely with green earthy chloritic material, sandy silt lining		3.4		28
	29				100	83	28.9	B	1	b	CH			29.25- 34.25m		29
	30				100	80	29.65 30	B B	2 4	b b	CH CM			30	0.4	30

DRILLING LOG

Hole inclination: Vertical
Azimuth

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
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Hole EL: 495.66m
Northing: 9,968,810.45
Easting: 392,179.63

Hole No: 94-1
(2/4)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)		RQD (%)		Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon		Depth(m)
																(m)	to	
	31			Mafic gneiss	100		65	31	B	2	b	CII	30.00-34.30m: Slightly weathered, medium and widely spaced joints, foliated grey with light brown laminae/streaks, medium and coarse grained mafic, feldspar-biotite-hornblende with little quartz. Foliation dip 40°. Joints, 30-40° and vertical, rough/planar clean, rarely with green earthy chloritic material, sandy silt lining			25.20	31	
	32				100		68	31.25	C	5	b	CII		31.25	34	29.25	32	
	33				100		76	31.75	B	1	b	CII				34.25m	33	
	34	34.30	461.3	Semi-felsic gneiss	100		95	34.25	B	2	b	CII	34.30-60.00m: Faintly weathered, foliated gray coarse grained, mafic biotite hornblende with quartz, feldspar. With occasional quartzose bands few mm upto 15cm. Joints mainly on foliation planes occasionally, 20° and 50-90°, rough/planar with green earthy lining/white calcareous coating/limonite staining			0.4	34	
	35				100		79							34.25	35		35	
	36	36.00	459.6	Mafic gneiss	100		61	36.2	A	2	b	CII	36.00-37.10m: With occasional quartzose bands few mm upto 15cm.				36	
	37	37.10	458.5		100		62	36.75	A	3	b	CII					37	
	38			Semi-felsic gneiss	100		70	37.85	A	2	b	CII	37.10-60.00m: With occasional quartzose bands few mm upto 15cm.				37	
	39				100		70	38.35	A	1	b	CII					38	
	40				100		76	39.25	A	3	b	CII				0.5	39	
	41				100		80										40	
	42				100		83	41.35	A	1	b	CII					41	
	43				100		85	41.8	A	3	b	CII					42	
	44				100		85										43	
	45				100		92									41.35-47.35m	44	
	46				100		96									7.9	45	
	47				100		96										46	
	48			100		99								47	47			
	49			100		100								47.35	48			
	50			100		100									49			
	51			100		100								47.00-52.00m	50			
	52			100		100								0.9	51			
	53			100		100									52			
	54			100		100									53			
	55			100		100									54			
	56			100		95								52.00-57.85m	55			
	57			100		90								1.2	56			
	58			100		71								57.55	57			
	59			100		93								57.85	58			
	60			100		91	60.00	A	1	a	B			57.55-62.55m	59			
														0.8	60			

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
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Easting: 392,179.63

Hole No 94-1
(3/4)

Date	Depth(m)	EL (m)	Leg	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W Level	Lugoon		Depth(m)
														(m)	lu	
	61			Semi-felsic gneiss	100	88						60.00-67.80m Faintly weathered, foliated gray coarse grained, mafic biotite hornblende with quartz, feldspar. With occasional quartzose bands few mm upto 15cm. Joints mainly on foliation planes occasionally, 20° and 50°-90°, rough/planer with green earthy lining/white calcareous coating/ironite staining.		57.55-62.55m	61	
	62				100	86							0.8		62	
	63				100	88							62.25-67.55		63	
	64				100	90							62.25-67.25m		64	
	65				100	90							0.6		65	
	66				100	95									66	
	67				100	100							67.05-67.25		67	
	68	67.90	427.8	Granitic gneiss	100	99	68.45	A	1	a	B	67.80-85.40m: Generally slightly weathered faintly foliated light brown with pink tinge coarse grained granitic; with little biotite. Partly mafic gneiss.		67.05-72.05m	68	
	69				100	75									69	
	70				100	56	70.05	A	2	a	CH		0		70	
	71				100	78	71	A	1	a	B				71	
							71.35	A	3	a	CH				71	
	72				100	66	71.85	A	1	a	B	Foliation 40°. Joints subhorizontal to steep, rough with white kaolin veneer/with siliceous crust occasionally smooth, clean.	72.05		72	
							71.95	B	5	b	CL				72	
	73				100	72	73.1	A	1	a	B				73	
							73.45	B	5	b	CL				73	
	74				100	72	74.25	A	2	a	CH	74.75-75.05m: Highly weathered, non intact partially kaolinized.		72.05-77.45m	74	
	75				100	57	74.85	B	3	b	CH	74.75-77.10m, looks fractured zone, with some slickenside (60° joints).		0	75	
							75.2	B	5	b	CL				75	
	76				100	42	75.8	A	3	a	CH				76	
	77			100	10							77.2-77.45		77		
						77.55	A	4	b	CM				77		
	78			100	50	77.95	A	2	a	CH				78		
	79			100	82	78.8	A	1	a	B				79		
						79.1	A	5	b	CL				79		
	80			100	73	80	A	1	a	B			77.20-82.20m	80		
						80.9	A	2	a	CH		4.5		80		
	81			100	72	81.65	A	1	a	B				81		
	82			100	79	82.0	A	2	a	CH			82.2	82		
	83			100	52	83.65	A	1	a	B				83		
	84			100	88									84		
	85	85.40	410.2	Granitic gneiss	100	88						85.40-90.00m: Fresh, foliated and banded grey with pinkish brown patches, coarse grained granitic feldspar quartz with little biotite. Foliation 40°. Joints 40°, 60°, 90°, rough clean/kaolin lined.		3.1	85	
	86				100	46									86	
	87				100	80							87.4		87	
	88				100	58	88	A	2	a	CH				88	
	89				100	51							87.40-92.40m		89	
	90			100	56	90.00	A	3	a	CH	85.40-85.90m & 87.20-87.70m, semi-felsic	8		90		

DRILLING LOG

Hole inclination: Vertical
Azimuth:

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Easting: 392,179.63

Hole No: 94-1
(1/4)

Date	Depth(m)	El. (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W. Level	Lugeon		Depth(m)		
														(m)	Lu			
	91			Granitic gneiss	100	88	90.7	A	2	a	CII	90.00-92.80m: Fresh, foliated and banded grey with pinkish brown patches, coarse grained granitic feldspar quartz with little biotite. Foliation 40°. Joints 40°, 60°, 90°, rough clean & satin lined.						
	92				100	80	91.5	A	1	a	B							
	93	92.80	402.8		100	64	93.15	A	3	a	CII							
	94			Mafic gneiss	100	51	94.4	A	2	a	CII	92.80-100.20m: Fresh, foliated grey, mafic hornblende biotite. Foliation 20-40°. Joints concordant and discordant to foliation rough clean, 0-40°.						
	95				100	50												
	96				100	50	96.4	A	1	a	B							
	97				100	76												
	98				100	86	97.6	A	3	a	CII							
	99				100	93	98.2	A	1	a	B							
	100	100.2	395.4		100	82	100.2	A	3	a	CII							
	101											Date commenced: 18.8.94 Date completed: 29.8.94						
	102																	
	103																	
	104																	
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	119																	
	120																	

DRILLING LOG
Hole inclination Vertical
Azimuth

Project Mutonga Grand Falls Hydropower Project
Site Grand Falls
Total Length: 75.00m

Hole EL: 474.36m
Northing: 9,969,585.43
Easting: 392,526.14

Hole No 91-2
(1/3)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W Level	Lugeon (m)	Lu	Depth(m)
	1	473.3		Sandy silt	50	0						0-1.00m: Brown, angular gravel of quartz-feldspathic gneiss				1
	2			Mafic gneiss	35	0						1.00-3.15m: Light brown, fine-medium; grains of quartz, feldspar, black ferruginous particles.				2
	3	471.2			46	0	3.15									3
	4	470.1		Semi-felsic gneiss	65	0						3.15-4.20m: Highly weathered, non intact foliated light brown coarse grained quartz-feldspar with little biotite				4
	5				95	6										5
	6				76	9						4.20-12.50m: Moderately weathered, foliated whitish, with black biotite streaks, specks coarse grained quartz-feldspathic with little biotite.				6
	7				67	11	6.75	C	4	c	CL	7.15-8.35m: With black biotite clusters upto 5mm discordant quartz-feldspar. Pegmatite bands few mm upto 15cm thick.	7.15			7
	8				100	8	8.25	C	3	b	CM					8
	9				100	9	8.65	B	2	b	CH	Foliation variable 40°-60° dip. Joints mainly on foliation planes occasionally discordant, 20°-80°, rough/planar limonite coated/clayey silt lined				9
	10				100	14	9.85	B	3	b	CH			2.5		10
	11				100	44	11.2	B	3	b	CH					11
	12	462.2			100	39	12.15	B	3	b	CH		12.15			12
	13				100	24	12.9	B	3	b	CH	12.15-21.15m: Slightly weathered, foliated, with occasional massive zones whitish with rare black biotite streaks, specks coarse grained quartz-feldspar.	13.5			13
	14				100	26	13.5	B	3	b	CH					14
	15				100	37	13.85	B	4	b	CM	With numerous quartzose zones few cm upto 1.20m thick, as 13.65-14.75m. Foliation 40°-50°.				15
	16			Semi-felsic gneiss	100	47	14.3	B	3	b	CH	Joints 10°-90°, rough limonite coated with sandy silt veneer.	1.3			16
	17				100	52	14.55	B	4	b	CM					17
	18				100	71	16.75	B	3	b	CH					18
	19				100	47	18.5	B	2	b	CH		18.5			19
	20				100	22										20
	21	453.2			100	43	21	B	3	b	CH					21
	22	451.9		Granitic gneiss	100	22	21.65	B	4	b	CM	21.15-22.45m: Taintly weathered, with closely spaced joints, light brown with pink tinge medium grained granitic, quartz, feldspar. Joints 10° and 80°, rough limonite coated	3.4			22
	23				100	26	22	B	3	b	CH					23
	24				100	68	22.5	B	4	b	CM		23.5			24
	25			Semi-felsic gneiss	100	91	23.7	B	3	b	CH	22.45-30.00m: Fresh, faintly foliated light grey with occasional white bands coarse grained, quartz-feldspar biotite				25
	26				100	93						With occasional very coarse quartzose pegmatitic bodies few cm upto 20cm.	3.7			26
	27				100	82						Faint foliation, 40°-70°, contact with lower formation.				27
	28				100	82						Joints subhorizontal to steep, rough/planar with green chloritic earthy veneer/clean/limonite coating				28
	29				100	67										29
	30				100	73	30.00	A	1	b	CH		29.5		2.9	30

DRILLING LOG

Hole inclination: Vertical
Azimuth:

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 75.00m

Hole EL: 4743.6m
Northing: 9,969,586.43
Easting: 392,526.14

Hole No: 91-2
(2/3)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W. Level	Lugosem (m)	Lu	Depth(m)	
	31			Semi-felsic gneiss	100	93						30.00-36.40m Fresh, faintly foliated light grey with occasional white bands coarse grained, quartz-feldspar biotite.				31	
	32				100	91							With occasional very coarse quartzose pegmatitic bodies few cm upto 20cm.				32
	33				100	84							Faint foliation; 40°-70°, contact with lower formation.		2.9		33
	34				100	76	33.5 33.8	A A	1 3	b b		CH CI	Joints subhorizontal to steep, rough/planar with green chloritic earthy veneer/clean/limonite coating				34
	35				100	60	34.5	A	1	b		CH					35
	36	36.40	437.9		100	50	35.15 35.8	A A	3 1	b b		CH CH		35.15			36
	37			Granitic gneiss	100	48	37.2	A	4	b		CM	36.40-46.35m: Fresh, faintly foliated light brown with pink tinge medium and coarse grained, granitic, with biotite specks contact plane with lower formation 30° with white siliceous crust.				37
	38				100	69	38.3	A	1	b		CH					38
	39				100	43	39.35	A	3	b		CH	44.65-45.25m dark grey mafic gneiss as below. Foliation 40°.		35.15- 42.45m		39
	40				100	66							Joints mainly 30°-40°, also 50°-70° rough/planar, brown stain/smooth with black/green veneer.		0.4		40
	41				100	79											41
	42				100	79	41.85	A	1	b		CH					42
	43				100	63	43.3 43.55	A A	2 4	b b		CH CM		42.4 42.45			43
	44				100	70											44
	45				100	91								42.40- 47.40m			45
	46	46.35	428.0		100	76	45.75	A	2	b		CI		0			46
	47			Mafic gneiss	100	56	46.5	A	3	b		CI	46.35-60.00m: Fresh, faintly foliated speckled dark grey coarse grained, mafic, biotite hornblende, with feldspar, little quartz.				47
	48				100	41	47.6	A	2	b		CI			47.1 47.4		48
	49				100	45	48.7	A	1	b		CH	Faint foliation, 70°.				49
	50				100	45							With rare quartzose pegmatitic bands few mm upto 20cm.		47.10- 52.10m		50
	51				100	79	50.55	A	3	b		CH	47.40-47.55m: Pink, granitic.		0.4		51
	52				100	86							Joints subhorizontal to steep, rough/planar occasionally smooth, limonite coated, with white siliceous/calcareous crust.				52
	53				100	52	52.4	A	1	b		CH		52.1 52.65			53
	54				100	29	53.8 54.05	A A	3 4	b a		CH CM			52.05- 57.05m		54
	55				100	32	54.8 55.2	A A	3 2	a a		CH CI		0.2			55
	56				100	49	56.15 56.55	A A	3 1	a a		CH B					56
	57			100	49	57.2	A	3	a		CH		56.95 57.05			57	
	58			100	62	57.2	A	1	a		B			56.95- 61.95m		58	
	59			100	63								0			59	
	60			100	69	60.00	A	2	a		CI					60	

DRILLING LOG

Hole inclination: Vertical
Azimuth

Project Matonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 75.00m

Hole EL: 474.36m
Northing: 9,969,586.43
Easting: 392,526.14

Hole No 94.2
(3/3)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W Level	Lugboon		Depth(m)	
														(m)	Lu		
	61			Mafic gneiss	100	86						60.00-65.15m: Fresh, faintly foliated speckled dark grey coarse grained, mafic, biotite hornblende, with feldspar, little quartz. Faint foliation, 70°.		56.95-61.95m		61	
	62				100	87							With rare quartzose pegmatitic bands few mm upto 20cm		61.85-61.95		62
	63				100	84	63.2	A	2	a	CH						63
	64				100	84	63.7	A	1	a	B						64
	65	65.15	499.2		100	84							Joints subhorizontal to steep, rough/planar occasionally smooth, limonite coated, with white siliceous/calcareous crust		61.85-66.85m		65
	66			Granitic gneiss	100	60	65.5	A	2	a	CH	65.15-70.00m: Fresh, pinkish brown medium grained, granitic. Joint horizontal to steep, rough with green chloritic coating/siliceous crust.		0		66	
	67				100	37	67.1	A	3	a	CH			66.85	65.00-70.00m		67
	68				100	40	67.5	A	3	a	CH			0			68
	69				100	33											69
	70				100	43								70			70
	71				100	50	71	A	2	a	CH	70.00-75.00m: Fresh, pinkish brown becoming grey with pink patches at 71.15m medium grained, granitic					71
	72				100	80	72.25	A	1	a	B	Joints subhorizontal to steep, rough clean/with green earthy veneer.			0		72
	73				100	60	73.1	A	2	a	CH						73
	74				100	72	73.8	A	3	a	CH						74
	75	75.00	399.3		100	64	75.00	A	1	a	B			75			75
	76											Date commenced: 14/8/94 Date completed: 31/8/94				76	
	77															77	
	78															78	
	79															79	
	80															80	
	81															81	
	82															82	
	83															83	
	84															84	
	85															85	
	86															86	
	87															87	
	88															88	
	89															89	
	90															90	

DRILLING LOG

Hole inclination: 60deg from horizontal
Azimuth: 205deg from N

Project: Mutonga Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 100.25m

Hole EL: 444.20m
Northing: 9,969,832.02
Easting: 392,633.23

Hole No: 94-3
(14)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level (m)	Lugeon (m)	Lu	Depth(m)
	0.30	441.9														
	1.65	442.7		Mafic gneiss	49	0						0-0.30m: White coarse grained, broken boulder.				1
	2.30	442.2			31	0	2.3					0.30-1.65m: Light grey medium and coarse sand (disintegrated quartz rich biotite hornblende gneiss)				2
					70	7		3.3	B	5	c	CL				3
				Semi-felsic gneiss	100	15		3.85	B	3	b	CH				4
					85	14						1.65-2.30m: No core recovery.				5
	5.65	439.3			20	9	5.95	B	5	c	CL	2.30-5.65m: Slightly weathered, foliated 45deg, light grey with dark greenish grey. Hornblende-biotite spots, patches, streaks coarse grained quartzo-feldspathic gneiss. Joints 10-70deg, rough with brown silt veneer/limonite.				6
				Mafic gneiss	100	33	7.15	B	2	b	b	CH				7
	7.45	431.7			73	24						5.65-7.45m: Slightly weathered, faintly foliated 60deg, grey with whitish felsic spots/streaks coarse grained mafic, biotite hornblende gneiss. Joints 30, 60, 90deg, rough/planar with orange limonite veneer.				8
				Granitic gneiss	51	0										9
					77	0	10.3	B	5	c	c	CL				10
	10.3	435.2			100	58	11.35	A	3	a	a	CH		10.05		11
					100	66	12.2	A	1	a	a	B				12
					100	62	13	A	3	a	a	CH				13
					100	95	13.9	A	1	a	a	B				14
				Mafic gneiss	100	74						10.30-26.40m: Faintly weathered, faintly foliated 45deg, dark grey with whitish streaks/spots coarse grained mafic, biotite hornblende gneiss. With rare quartzose bands few mm upto 35cm. Joints 0-90deg, rough with greyish green earthy materials foling/purple veneer.				15
					100	68										16
					100	67										17
					100	64										18
					100	76										19
					100	79	19.6	A	2	a	a	CH				20
					100	79	20.2	A	1	a	a	B				21
					100	79	20.8	A	2	a	a	CH				22
					100	63	21.1	B	5	b	b	CL				23
					100	63	21.65	A	3	b	b	CH				24
					100	63	21.85	A	4	b	b	CM				25
					100	63	22.2	A	3	b	b	CH				26
					100	63	22.4	A	5	b	b	CL				27
					100	63	22.7	A	3	b	b	CH				28
					100	83										29
					100	83										30
	26.4	421.3			100	51	25.6	A	1	a	a	B				31
				Granitic gneiss	100	49						26.40-27.20m: Fresh, brownish grey medium and coarse grained granite gneiss. Joints 10-30deg, rough planar with orange veneer.				32
	27.3	420.5			100	81	27.5	A	3	a	a	CH		26.45		33
					100	81										34
				Mafic gneiss	100	83	28.75	A	1	a	a	B				35
					100	83	28.95	A	3	a	a	CH				36
					100	85	29.9	A	1	a	a	B				37
					100	85	29.99	A	3	a	a	CH				38
					100	85						27.20-30.00m: Fresh, faintly foliated, dark grey speckled white coarse grained mafic, biotite hornblende gneiss. Joints 30-60deg, planar with light green purple earthy veneer/crust.				39

DRILLING LOG

Hole inclination: 60deg from horizontal
Azimuth:

Project Mutonga Grand Falls Hydropower Project
Site Grand Falls
Total Length: 100.25m

Hole FL: 444.20m
Northing: 9,969,832.02
Easting: 392,653.23

Hole No: 94-3
(2/4)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W Level	Lugosec (m)	Lu	Depth(m)	
							30.3	A	3	a	CH						
	31			Mafic gneiss	100	74						30.00-35.00m: Fresh, faintly foliated, dark grey speckled white coarse grained mafic, biotite hornblende gneiss Joints 30-60deg, planar with light green purple earthy veneer/crust.		0		31	
	32				100	74								31.6			32
	33				100	80											33
	34				100	80		33.65	A	1	a	B					34
	35				100	46		34.8	A	2	b	CH			0		35
	36			Granitic gneiss	100	27	36	A	1	a	B	35.00-39.70m: Fresh, faintly foliated grey speckled white coarse grained mafic biotite hornblende gneiss Joints 50-70deg, with green earthy lining		36.6		36	
	37				100	45	37.65	A	2	a	CH						37
	38				100	84	37.6	A	1	a	B						38
	39				100	63	38.1	A	3	a	CH						39
	40	39.7	409.8		100	63	39.2	A	1	a	B	39.70-40.40m: Faintly weathered, faintly foliated 50deg, greyish brown medium and coarse grained granite gneiss Joints 40-50deg, rough with purple mineral coating		0			40
	41	40.4	409.2	Mafic gneiss	100	68	40.2	B	5	b	CL						41
	42				100	69	40.8	A	3	a	CH	40.40-60.00m: Fresh, faintly foliated 40-50deg, grey speckled white coarse grained mafic biotite hornblende gneiss.		41.85			42
	43				100	75	41.55	A	2	a	CH	With occasional quartz bands/zones few cm upto 60cm. 53.15-53.80m 58.50-59.30m					43
	44				100	83	42.6	A	3	a	CH	Joints 20-70deg, rough/planar with greenish earthy filling/purple staining		0			44
	45				100	83	44.75	A	2	a	CH						45
	46			Mafic gneiss	100	80	45.15	A	3	a	CH						46
	47				100	74	46.85	A	2	a	CH			46.85			47
	48				100	72											48
	49				100	88									0		49
	50				100	88											50
	51			Mafic gneiss	100	80											51
	52				100	80								52			52
	53				100	70	52.8	A	1	a	B						53
	54				100	73	53.7	A	3	a	CH						54
	55				100	73									52.00-57.50m 0		55
	56			Mafic gneiss	100	73	56.2	A	1	a	B						56
	57				100	67	56.5	A	1	a	CH			57.4 57.5			57
	58				100	73											58
	59				100	64	58.5	A	1	a	B				57.40-62.40m 0		59
	60				100	67	59.99	A	1	a	B			60			60

DRILLING LOG

Hole inclination: 60deg from horizontal
Azimuth:

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 100.25m

Hole EL: 444.20m
Northing: 9,969,832.02
Easting: 392,653.23

Hole No: 94-3
(3/4)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	GW Level	Logoon (m)	Lu	Depth(m)	
	61			Mafic gneiss	100	67						60.00-70.00m: Fresh, faintly foliated 40-50deg, grey speckled white coarse grained mafic biotite hornblende gneiss.		57.40-62.40m		61	
	62				100	66	61.9	A	1	a	B	With occasional quartz bands/zones few cm upto 60cm, 62.50-62.70m		0			62
	63				100	71	62.75	A	3	a	CH	With 3cm thick gypsum at base, 63.40-63.80m		62.4			63
	64				100	79						Joints 20-70deg, rough/planar with greenish earthy filling/purple staining					64
	65				100	79								4.3			65
	66				100	86											66
	67				100	91											67
	68				100	86								67.6			68
	69				100	74											69
	70				100	71								67.60-72.25m			70
	71				100	71	70.85 71.15	A	1 3	a a	B CH	70.00-87.80m: Fresh, faintly foliated 40-50deg, dark grey speckled white coarse grained mafic biotite hornblende gneiss		0			71
	72				100	90								72.05			72
	73				100	88	73.05	A	1	a	B	With occasional white quartz bands/zones few cm upto 60cm 70.65-70.80m 72.80-73.25m		72.75			73
	74				100	73											74
	75				100	81	74.85	A	2	a	CH	With 3cm thick gypsum at base, 70.65-70.85m		72.05-77.05m			75
	76				100	81								0			76
	77				100	81								77.05			77
	78				100	96											78
	79				100	97											79
	80				100	97								2.9			80
	81			100	47											81	
	82			100	44											82	
	83			100	83								82.3			83	
	84			100	86											84	
	85			100	84										3.7	85	
	86			100	84	85.6 86	A	1 2	a a	B CH						86	
	87			100	78	86.65 86.95	A	1 3	a a	B CH						87	
	88	87.80	368.1		100	68	88.1	A	1	a	B	87.80-90.00m: Faintly weathered, faintly foliated pinkish brown coarse grained granite gneiss.	87.8			88	
	89			Granitic gneiss	100	30	88.75	A	3	a	CH	Joints 10-90deg, rough/planar/clean, with green earthy veneer.		87.80-92.65m		89	
	90				100	44	89.6 89.99	A	2 3	a a	CH CH		0			90	

DRILLING LOG

Hole inclination: 60deg from horizontal
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 100.25m

Hole FL: 444.20m
Northing 9,969,832.02
Easting 392,633.23

Hole No 94-3
(44)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C/W Level	Lugeon (m)	Iu	Depth(m)	
	91			Granitic gneiss	100	80						90.00-96.00m: Faintly weathered, faintly foliated pinkish brown coarse grained granite gneiss. Joints 10-90deg, rough planar/clean, with green earthy veneer.					
	92				100	46	91.9	A	3	a	CH			87.85-92.65m			91
	93				100	67	92.8	A	2	a	CH			0			92
	94				100	83	93.3	A	1	a	B			92.25-92.65			93
	95				100	59	94.2	A	2	a	CH			92.25-97.25m			94
	96	96.00	361.0		100	39	95.3	A	3	a	CH			95.25	0		95
	97			Mafic gneiss	100	28	96.1	A	4	a	CM	96.00-99.45m: Faintly weathered, faintly foliated 60deg, dark grey coarse grained mafic biotite hornblende gneiss. With occasional thin pegmatites with biotite books Joint 40-90deg, rough with green earthy lining					
	98				100	58	96.5	A	3	a	CH			97.25	95.25-100.25m		96
	99				100	69	96.9	A	4	a	CM			0			97
	100	100.2	357.3	Granitic gneiss	100	73	99.95	A	2	a	CH	99.45-100.25m: Fresh, greyish brown medium and coarse grained granite gneiss.				98	
	100.2						100.2	A	3	a	CH		100.2			99	
	101															100	
	102															101	
	103															102	
	104															103	
	105															104	
	106															105	
	107															106	
	108															107	
	109															108	
	110															109	
	111															110	
	112															111	
	113															112	
	114															113	
	115															114	
	116															115	
	117															116	
	118															117	
	119															118	
	120															119	

NOTE:
The attitude of the foliation/joints is measured from the perpendicular to the core axis.

Date commenced 10/9/94
Date completed 26/9/94

DRILLING LOG
Hole inclination: Vertical
Azimuth

Project: Mutonga Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 123.35m

Hole EL: 536.62m
Northing: 9,970,218.55
Easting: 393,155.71

Hole No: 94-4
(1/5)

Date	Depth(m)	EL. (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Cone shape	Weathering	Rock class	Description	C.W. Level	Lugoon (m)	Lu	Depth(m)
	0.60	536.0		Sandy silt	100	0						0-0.60m: Brown, fine and medium gravel, in situ, in sandy				1
	1.80	534.8		Mafic gneiss	60	14	1.8					0.60-1.80m: Highly weathered, non intact, light brown very coarse grained quartzo-feldspathic gneiss, pegmatitic				2
					100	72	3.4	C	3	c	CL	1.80-4.30m: Slightly weathered, foliated 40°, whitish brown with tiny pink spots medium and coarse grained quartzo-feldspathic gneiss.				3
	4.30	532.3			100	62	3.95	C	1	b	CM	Very coarse grained zone, 3.40-4.30m				4
					28	8						4.30-6.50m: Highly weathered, foliated brown, with pink grains medium and coarse grained quartzo-feldspathic gneiss.				5
				Mafic gneiss	28	8	6.5	D	6	e	D					6
	6.50	530.1			47	22						6.50-10.45m: Generally slightly weathered, foliated dark gray coarse grained mafic biotite hornblende gneiss. With occasional whitish concordant and discordant pegmatite veins/lenses few mm upto 5cm.	7.05			7
					76	45	7.7	C	4	c	CL	7.00-7.20m: Brown, highly weathered. Lower zone shot with quartz. Joints horizontal, rough brown clayey silt lined			99.1	8
					100	53	8.8	C	1	b	CM					9
							9.35	C	5	b	CL					10
					100	33										10
	10.45	526.1					10.45	B	4	b	CM					10
					100	66	11.05	A	2	a	CH	10.45-30.00m: Fresh, foliated 40°, dark grey with whitish spots, patches coarse grained mafic, biotite hornblende gneiss. Shot with much felsic minerals, quartz, occasionally feldspar bodies, patches few mm upto 30cm.	11.05			11
					100	93	12.15	A	3	a	CH	10.45-10.75m: 13.15-13.45m: 23.30-23.65m, aplite	12.05			12
					100	99										13
					100	100										14
					100	100										15
				Mafic gneiss	100	100										16
					100	100										17
					100	95										18
					100	98										19
					100	98										20
					100	100										21
					100	100										22
					100	100										23
					100	100										24
					100	100										25
					100	100										26
					100	100										27
					100	100										28
					100	100										29
					100	100	30.00	A	1	a	B					30

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 125.35m

Hole EL: 536.62m
Northing: 9,970,218.55
Easting: 393,155.71

Hole No 94-4
(2/5)

Date	Depth(m)	EL.(m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon (m)	Lu	Depth(m)	
	31			Mafic gneiss	100	100						30.00-35.00m Fresh, foliated 40deg., dark grey with whitish spots, patches coarse grained mafic, biotite hornblende gneiss. Shot with much felsic minerals, quartz, occasionally feldspar bodies, patches few mm upto 30cm. 31.25-31.55m, pink pegmatite 32.50-33.33m, pink pegmatite		0		31	
	32				100	100								31.25			32
	33				100	100											33
	34				100	100								31.25-36.35m			34
	35				100	100								0			35
	36				100	100								36.15-36.35			36
	37				100	100											37
	38	39.20	498.3		100	100								36.15-41.15m			38
	39				100	100								0			39
	40				Granitic gneiss	100	77						38.30-56.00m: Fresh, light brown with pink tinge, faintly foliated very coarse grained granite gneiss. With occasional dark grey streaks, spots of ferromagnesian minerals.				40
	41			100		64								41.15			41
	42			100		78											42
	43			100		86											43
	44			100		100								0			44
	45			100		100											45
	46			100		100								46.35			46
	47			100		100											47
	48			100		100								46.35-51.35m			48
	49			100		100								0			49
	50			100	100											50	
	51			100	100								51			51	
	52			100	100								51.35			52	
	53			100	100											53	
	54			100	100								51.00-56.00m			54	
	55			100	100								86.2			55	
	56	56.00	489.6	100	100								56			56	
	57			Granitic gneiss	100	100						56.00-60.25m Fresh, faintly foliated at 40°, light grey with pink tinge medium and coarse grained micro-granite gneiss.				57	
	58				100	100											58
	59				100	100								0			59
	60				100	100							56.00-60.25m, Fine grained granitic				60

DRILLING LOG

Hole inclination: Vertical
Azimuth:

Project: Mutonga Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 125.35m

Hole EL: 536.62m
Northing: 9,970,218.55
Easting: 393,155.71

Hole No: 94.4
(3/5)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugoon (m)	Lu	Depth(m)	
	60.25	476.3		Granitic gneiss	100	100						60.25-70.80m: Fresh, faintly foliated 30-50°, light brown with pink tinge very coarse grained granitic gneiss. With occasional dark grey ferro-magnesian mineral specks, streaks.	60.85	0		61	
	62				100	100											62
	63				100	100											63
	64				100	100											64
	65				100	100											65
	66				100	100								66			66
	67				100	100											67
	68				100	100											68
	69				100	100									0		69
	70				100	100											70
	70.80	465.8		Mafic gneiss	100	100						70.80-85.20m: Fresh, foliated 50°, dark grey speckled whitish coarse grained mafic, biotite-hornblende gneiss. Shot with white quartz lenses, clusters mm upto 5cm. With micro-folds on vertical plane, with horizontal strike Rare upto 6cm thick dark greenish grey amphibolite bands. Joints very rare, generally 20-40°, at 70.80m, 40°, rough with mica sheen.	71.4	0		71	
	72				100	100											72
	73				100	100											73
	74				100	100									0		74
	75				100	100											75
	76				100	100											76
	77				100	100								76.5			77
	78				100	100											78
	79				100	100									0		79
	80				100	100											80
	81			100	100								53.4			81	
	82			100	100											82	
	83			100	100											83	
	84			100	100									0		84	
	85	85.20	451.4	Quartzite	100	100										85	
	86				100	100	86.4	A	I		B			86.4			86
	87				100	94											87
	88				100	90											88
	89	89.10	447.5	Mafic gneiss	100	90										89	
	90				100	96	89.5	A	3		CH						90
						90.00	A	I		B						90	

DRILLING LOG

Hole inclination: Vertical
Azimuth:

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 125.35m

Hole EL: 536.62m
Northing: 9,970,218.55
Easting: 393,153.71

Hole No: 94-4
(4-5)

Date	Depth(m)	EL (m)	Leg	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W Level	Lugoo (m)	Lu	Depth(m)		
	91			Mafic gneiss	100	100						89.10-105.00m: Fresh, foliated 40-50°, dark grey with white patches mafic, biotite-hornblende gneiss. Shot with quartz in small concentrations, clusters, upto 6cm, rare thin quartz veinlets. 102.10-102.35m: light brown aplite gneiss.			0	91		
	92				100	100	91.6	A	1	a	B			91.4				92
	93				100	100	92.1	A	2	a	CH							93
	94				100	100	92.4	A	3	a	CH							94
	95				100	100									0			95
	96				100	100												96
	97				100	100									96.4			97
	98				100	100												98
	99				100	80									0			99
	100				100	81												100
	101			100	81											101		
	102			100	92								101.4			102		
	103			100	100											103		
	104			100	100											104		
	105			100	100											105		
	106			100	100											106		
	107			100	100											107		
	108			100	100											108		
	109			100	100											109		
	110			100	100											110		
	111			100	100											111		
	112	424.5		100	100											112		
	113			Granitic gneiss	100	100						105.00-112.10m: Fresh, foliated 50°, dark grey with white patches mafic, biotite-hornblende gneiss shot with quartz.				113		
	114				100	100												114
	115				100	100												115
	116				100	100												116
	117				100	100												117
	118	419.0		Mafic gneiss	100	100						112.10-117.60m: Fresh, foliated 50°, dark grey with white patches mafic, biotite-hornblende gneiss shot with quartz.			0	118		
	119				100	100												119
	120				100	100												120
	121				100	100												121
	122			Mafic gneiss	100	100						117.60-120.00m: Fresh, faintly foliated dark grey with white patches mafic, biotite-hornblende gneiss, shot with quartz in clusters, lenses, veins few mm upto 4cm. Contact with bottom formation with 50°, dip.				122		
	123				100	100												123
	124				100	100												124
	125			100	100		120.6	A	1	a	B					125		

DRILLING LOG

Hole inclination: Vertical
Azimuth:

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 125.35m

Hole EL.: 536.62m
Northing: 9,970,218.55
Easting: 393,155.71

Hole No: 93-4
(5/3)

Date	Depth(m)	EL. (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon		Depth(m)	
														(m)	Lu		
	118			Mafic gneiss	100	100						120.00-122.75m: Fresh, faintly foliated dark grey with white patches mafic, biotite-hornblende gneiss, shot with quartz in clusters, lenses, veins few mm upto 4cm. Contact with bottom formation with 500 dip		116.4	121.4	118	
	122				100	100									0		122
	123	122.7	413.8		100	100									120.35-125.35m		123
	124			Granitic gneiss	100	100						122.75-125.35m: Fresh, light brown with pink finge coarse grained granite gneiss, with tiny biotite specks. With faint foliation of 400 dip			0		124
	125	125.3	411.2		100	100	125.3	A	1	a	B						125
	126												Date commenced: 8/9/94 Date completed: 23/9/94				126
	127																127
	128																128
	129																129
	130																130
	131																131
	132																132
	133																133
	134																134
	135																135
	136																136
	137																137
	138																138
	139																139
	140																140
	141																141
	142																142
	143																143
	144																144
	145																145
	146																146
	147																147
	148																148
	149																149
	150																150

DRILLING LOG
Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 50.50m

Hole EL.: 520.37m
Northing: 9,970,390.11
Easting: 392,886.02

Hole No G95-1
(1/2)

Date	Depth(m)	Fl. (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon (m)	Lu	Depth(m)	
	1			Sandy silt	0	0						0-2.20m: Reddish brown sandy silt. 1.00-2.50m: Gray, fine and medium sand (disintegrated mafic gneiss)				1	
	2	2.2	519.1		0	0										2	
	3	2.95	517.4	Semi-felsic gneiss	0	0	2.6	D	5	d	D	2.20-2.95m: Brown silty sand, occasional gneiss cobbles.				3	
	4	3.3	517.0		80	29	3.3	C	2	c	CM	2.95-3.30m: Moderately weathered, foliated at 40° light brown, coarse grained.				4	
	5	4.3	516.0	Mafic gneiss	50	65	4.3	D	5	d	D	3.30-4.30m: Completely weathered, non intact, brown coarse grained quartzo-feldspathic.				5	
	6				100	100							4.30-15.05m: Slightly weathered to fresh, foliated generally at 60°, grey with whitish lamination streaks, coarse grained mafic hornblende - feldspar - quartz with little mica.	6.05		6	
	7				100	100							With occasional very coarse grained discordant and concordant quartzo-feldspathic veins few cm upto 5cm or thicker in zone 6.30-7.90m (pegmatitic).		0.9	7	
	8				100	100							Joints: 20-40°, rarely 60-70°.			8	
	9				100	100										9	
	10				100	100										10	
	11				100	100								11.05		11	
	12				100	100										12	
	13				100	100								11.05-15.80m		13	
	14				100	100								0		14	
	15	15.05	505.3		Granitic gneiss	100	100						15.05-30.00m: Fresh, with very widely spaced joints, very faintly gneissose, light grey with tiny biotite specks, coarse grained, granitic.	15.8		15	
	16					100	100							With occasional pink garnetiferous spots	16		16
	17					100	100							With occasional pink garnetiferous spots			17
	18			100		100							Joints: 20-40°, rarely 60-70°, clean with white veneer.	16.00-21.00m		18	
	19			100		100								0		19	
	20			100		100										20	
	21			100		100								21		21	
	22			100		100										22	
	23			100		100										23	
	24			100		100								0		24	
	25			100		100										25	
	26			100		100								26		26	
	27			100		100										27	
	28			100		90									0	28	
	29			100		85										29	
	30			100	100		30.00	A	1	a	B				30		

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 50.50m

Hole EL: 520.37m
Northing: 9,970,390.11
Easting: 392,886.02

Hole No G93-1
(22)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W Level	Logoon (m)	Lu	Depth(m)					
	31			Granitic gneiss	100	100						30.00-35.40m Fresh, with very widely spaced joints, very faintly gneissose, light grey with tiny biotite specks, coarse grained, granitic With occasional pink garnetiferous spots Joints; very rare, 20-40°, rarely 60-70°, clean/with white veneer.	31	0		31					
	32				100	100															32
	33				100	100															33
	34				100	89	33.7 34	A A	1 3	a a	B CH								0.6		34
	35	35.4	484.9		100	94	35.40	A	1	a	B										35
	36			Mafic gneiss	100	99	36	A	2	a	CH	35.40-47.10m Fresh, faintly foliated at 60°, dark grey streaked whitish coarse grained mafic, hornblende, little feldspar, biotite, quartz. 35.40-35.95m, with etched striations at 80°, with occasional concordant and discordant very coarse grained quartz - feldspar pegmatitic veins/bands lenses few cm upto 40cm. Occasional red garnet spots in the bands. Joints; very rare, 20-40°, rarely 60-70°, clean/with white veneer.	36			36					
	37				100	100	36.65	A	1	a	B										37
	38				100	100	38.3	A	3	a	CH										38
	39				100	100															39
	40				100	100															40
	41				100	100													41.05		41
	42				100	100															42
	43				100	100	42.75 43.15	A A	1 3	a a	B CH										43
	44				100	100	43.95	A	1	a	B										44
	45				100	100	44.5	A	3	a	CH										45
	46			100	100											46					
	47	47.1	473.2	100	100	47.2 47.5	A A	1 3	a a	B CH	47.10-50.50m: Fresh, generally foliated at 60°, light grey, with dark grey streaks, coarse grained feldspar - quartz with hornblende Joints; very rare, 20-40°, rarely 60-70°, clean/with white veneer.	47	0		47						
	48			100	100	48	A	1	a	B										48	
	49			100	100															49	
	50	50.50	469.8	100	100	50.50	A	3	a	CH						50					
	51											Date commenced: 31/7/95 Date completed: 4/8/95				51					
	52															52					
	53															53					
	54															54					
	55															55					
	56															56					
	57															57					
	58															58					
	59															59					
	60															60					

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 30 00m

Hole EL.: 493.42m
Northing: 9,970,147.87
Easting: 392,227.42

Hole No G95-2
(1/1)

Date	Depth(m)	EL. (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W. Level	Lugeon (m)	Lu	Depth(m)
	0.50	492.9		Sandy silt								0-0.50m: Reddish brown sandy silt				1
					100	0						0.50-5.70m Highly to completely weathered rock, core sample is slime (silty sand), with occasional quartz, feldspar fragments upto 5cm.				2
					100	0										3
					100	0										4
					100	0										5
	5.7	487.7		Semi-felsic gneiss	100	0	5.7	C	4	c	CL	5.70-7.80m Moderately weathered, machine broken, foliated at 60°, tiny laminated, light grey with thin mafic lamination, coarse grained, quartzo-feldspathic with mica.				6
					100	5	6.4 6.7 6.9	C	3 5 3	c c c	D CL D	6.00-6.40m, slime (sand and fragments)				7
	7.8	485.6			100	13	7.5 7.80	C	5 4	c c	D CL		7.5			8
					100	20	8.3 8.4 8.5 8.6 8.7 8.8	C	3 3 3 3 3 3	c c c c c c	D CL D CL D CL	7.80-14.00m Moderately to slightly weathered, foliated finely, laminated light grey coarse grained quartzo-feldspathic with biotite				9
				Semi-felsic gneiss	100	60	10.95	B	2	b	CH	Foliation variable generally 60°, 100 at zone B 50-9.00m.				10
					100	36	12	C	4	c	CL	With occasional quartz and black biotite bands few cm upto 4cm.		12.15		11
					100	86	13.45	B	2	b	CH					12
	14	479.4			100	56	13.9 14	B	3 5	b b	CH CL					13
				Mafic gneiss	100	26	15.50	B	3	b	CH	14.00-15.50m Highly weathered dark grey coarse grained mafic biotite - hornblende, low core recovery.				14
	15.5	477.9			50	0	16.25	B	4	b	CM	15.50-30.00m Faintly weathered, foliated and thinly laminated, generally light grey, with thin dark biotite lamination coarse grained.				15
					100	72	17	A	3	a	CH	With occasional dark mafic bands in the zones below;				16
					100	93	17.4 18.1	A	1 3	a a	B CH	17.50-17.70m 18.05-18.45m 19.25-20.40m		17.35		17
				Semi-felsic gneiss	100	93										18
					100	91						With occasional white felsic bands few cm upto 20cm in the zones below;				19
					100	88						17.75-18.00m 20.40-21.00m 23.75-24.00m				20
					100	100						24.20-24.70m (granitic) 25.30-25.80m (granitic) 26.25-26.45m (granitic)		3.3		21
					100	99						Joints, generally 10-30° from rock surface to bottom, concordant and discordant subhorizontal to medium steep, rough limonite coated.				22
					100	99						19.70m, 10° joint, brown stained		22.00-27.00m		23
					100	100								0		24
					100	95										25
					100	90										26
					100	100										27
					100	100								25.00-30.00m		28
					100	100								0		29
	30.00	463.4			100	100	30.00	A	1	a	B	Date commenced 27/7/95 Date completed 30/7/95				30

DRILLING LOG
Hole inclination Verbal
Azimuth

Project: Matonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 35.50m

Hole EL: 478.76m
Northing: 9,969,954.38
Easting: 392,690.60

Hole No: G95-3
(1/2)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Logbook (m)	Lu	Depth(m)		
	1	477.2		Sandy Silt	0	0						0-1.50m. Reddish brown sandy silt and fragments				1		
	2	476.2		Granitic gneiss	100	66	1.7	D	5	d	D	1.50-2.50m Moderately weathered, closely spaced joints, partly machine broken, foliated at 70°, pinkish brown, coarse grained granitic Joints, 40°, 90°, rough limonite coated				2		
	3				100	0	3	B	4	b	CM						3	
	4			Granitic gneiss	100	64						2.50-30.00m Slightly weathered, foliated at 70°, pinkish brown with dark biotite lamination/streaks, coarse grained (pegmatitic), granitic. With rare quartz veins upto 4cm thick. Joints horizontal to steep rough/planar orange/green limonite coated, occasionally white kaolin lined	4.15			4		
	5				100	84	5.1	B	3	b	CH						5	
	6				100	61												6
	7				100	100	7.15	B	1	b	CH				201.3			7
	8				100	100												8
	9				100	100									8.75			9
	10				100	81												10
	11				100	99												11
	12				100	100										2.8		12
	13				100	99												13
	14			100	96								14.1			14		
	15			100	69											15		
	16			100	94											16		
	17			100	97										239.1	17		
	18			100	82											18		
	19			100	85								19.05			19		
	20			100	99											20		
	21			100	97											21		
	22			100	84										1.2	22		
	23			100	100											23		
	24			100	93								24.25			24		
	25			100	76		25.35	A	1	b	CH					25		
	26			100	62		25.8	B	4	b	CM					26		
	27			100	25		26.7	A	3	b	CH					27		
	28			100	92								24.25-30.20m			28		
	29			100	72		28.65	A	1	b	CH		25.3			29		
	30			100	37		30.00	A	3	a	CH					30		

DRILLING LOG
 Hole inclination: Vertical
 Azimuth:

Project Mutonga/Grand Falls Hydropower Project
 Site Grand Falls
 Total Length: 35.50m

Hole EL: 478.76m
 Northing: 9,969,954.38
 Easting: 392,690.60

Hole No G95-3
 (2/2)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W Level	Eugeneon (m)	Lu	Depth(m)	
							30.2	A	3	a	CU			30.2	25.3		
	31			Granitic gneiss	100	54	30.9	A	2	a	CU	30.00-33.80m Slightly weathered, foliated at 70°, pinkish brown with dark biotite lamination/streaks, coarse grained, granitic. With rare quartz veins upto 4cm thick.				31	
	32				100	76	32.45	A	1	a	B						32
	33				100	76	33.8	A	3	a	CU		Joints, rare, 50-70°, rarely 80-90°, rough, planar orange/green limonite coated, occasionally white kaolin lined.			1.6	33
	34	33.8	444.9	100	80	33.7	A	1	a	B						34	
	35			Semi-felsic gneiss	100	99	34.05	A	3	a	CU	33.80-35.50m. Fresh, dark gray, foliated and thinly laminated at 50°, light grey coarse grained hornblende quartz, little feldspar.					
	35	35.50	443.2		100	100	35.50	A	1	a	B				35.50		35
	36											Date commenced: 24/7/95 Date completed: 29/7/95				36	
	37															37	
	38															38	
	39															39	
	40															40	
	41															41	
	42															42	
	43															43	
	44															44	
	45															45	
	46															46	
	47															47	
	48															48	
	49															49	
	50															50	
	51															51	
	52															52	
	53															53	
	54															54	
	55															55	
	56															56	
	57															57	
	58															58	
	59															59	
	60															60	

DRILLING LOG
Hole inclination: Vertical
Azimuth:

Project: Mutonga Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 50.25m

Hole EL: 505.59m
Northing: 9,969,299.91
Easting: 392,397.06

Hole No: G95-4
(1/2)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	GW Level	Logace (m)	Lu	Depth(m)
	0.5	505.0		Sandy silt								0-0.50m: Reddish brown sandy silt				
	1				57	6						0.50-1.50m: Slime (sand)				1
	1.5	504.0		Semi-felsic gneiss			1.5					1.50-4.50m: Highly to moderately weathered, steeply foliated, light grey with greenish tinge, coarse grained hornblende, feldspar.				2
	2				29	5	2.1	D	5	d	D	With occasional quartz veins upto 10cm at 40°.				3
	3				100	10	2.8	D	3	d	CL	Top 40cm, broken quartz.				4
	4				83	17	4	C	4	c	CL	Joints, 0-60°, rough reddish brown silty clay lined.				4
	4.5	501.0					4.5	C	3	c	CL	4.50-6.00m: Slime (sand)				5
	5			Semi-felsic gneiss	62	9						6.00-8.30m: Generally highly, partly slightly weathered, steeply foliated, grey with green tinge as above				6
	6	499.5			40	0	6					7.20-7.75m: pinkish light grey granitic gneiss.				7
	7				84	64	2.3	D	2	d	CL	8.30-9.00m: No core.				8
	8			Semi-felsic gneiss	76	45	7.7	B	3	b	CH	9.00-11.20m: Moderately weathered, steeply foliated, grey-greenish grey, coarse grained.				9
	8.3	497.2					8.1	D	2	d	CL	9.80-10.50m: 10.7				10
	9	496.5			82	10	9	D	4	d	D	9.80-10.50m & 10.70-11.20m, no core recovery.				11
	10				50	18	9.8	C	4	c	CL	11.20-12.65m: Slightly weathered, light grey with green tinge, medium grained hornblende, feldspar.				12
	11	494.3		Semi-felsic gneiss	37	0	11.20	C	4	c	CL	Joints, 0.30-40°, rough with brown silty clay veneer.				13
	12				83	65	12.65	B	3	b	CH	12.65-25.85m: Slightly weathered, medium and widely spaced joints, faintly foliated at 70°, light grey with tiny black biotite speckling, medium grained quartzo-feldspar-biotite, semipelitic.				14
	12.65	492.9			100	77						Joints, 40-50°, rarely 70-90° with slickenside, with light brown clayey veneer black, greenish mineral coating				15
	14				100	83										16
	15				100	85	15	A	1	b	CH					17
	16			Semi-felsic gneiss	100	88										18
	17				100	100										19
	18				100	90										20
	19				100	80										21
	20				100	70										22
	21				100	78	20.5	A	1	a	B	25.85-27.60m: Fresh, faintly foliated, light pinkish grey with occasional black mineral specks/spots, coarse grained, granitic.				23
	22				100	96	21.8	A	2	a	CH	With occasional black ferromagnesian minerals.				24
	23				100	99						27.60-30.00m: Fresh, faintly steeply foliated at 60-80°, dark grey with white speckling, coarse grained.				25
	24				100	95						With occasional quartz bands 5mm upto 4cm, with 10-40° dip.				26
	25				100	100						Joints, 30-50°, rough with orange green mineral veneer.				27
	25.85	479.7		Granitic gneiss	100	100	26.8	A	1	a	B					28
	27				100	100	27.55	A	2	a	CH					29
	27.6	477.9		Mafic gneiss	100	100										30
	29				100	98	30.00	A	1	a	B					30

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga Grand Falls Hydropower Project
Site Grand Falls
Total Length: 50.25m

Hole FL: 505.59m
Northing 9,959,299.91
Easting 392,392.06

Hole No. G95-4
(2/2)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon (m)	Lu	Depth(m)		
	31			Mafic gneiss	100	100						30.00-44.50m Fresh, faintly steeply foliated at 60-80°, dark grey with white speckling, coarse grained With occasional quartz bands 5mm upto 4cm, with 10-40° dip. Joints: 30-50°, rough with orange green mineral veneer. At 37.20m; joint (vertical) has slickenside				31		
	32				100	100												32
	33				100	100												33
	34				100	100												34
	35				100	55									34.5			35
	36				100	89												36
	37				100	100												37
	38				100	100										0		38
	39				100	100												39
	40				100	100									39.5			40
	41				100	100												41
	42				100	100										0		42
	43				100	100												43
	44	44.5	461.0		100	100												44
	45			Granitic gneiss	100	100							44.5			45		
	46	46.2	459.3		100	100											46	
	47			Mafic gneiss	100	100											47	
	48				100	100									0		48	
	49				100	91											49	
	50	50.25	455.3		100	96		50.25	A	1	a	B					50	
	51				100	100							50.25				51	
	52																52	
	53																53	
	54																54	
	55																55	
	56																56	
	57																57	
	58																58	
	59																59	
	60																60	

Date commenced: 27/6/95
Date completed: 5/7/95

DRILLING LOG

Hole inclination: Vertical
Azimuth

Project: Matonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 50.00m

Hole EL: 530.37m
Northing: 9,968,518.63
Easting: 392,051.75

Hole No: G95-5
(1/2)

Date	Depth (m)	EL. (m)	Log	Rock type	Core (%)	RQD (%)	Depth (m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon (m)	Lu	Depth (m)	
	1			Sandy silt	100	0	1.5					0-1.50m: Reddish brown sandy silt, with some quartz and gneiss gravels.				1	
	2	529.8		Granitic gneiss	100	30	2.4	C	4	c	CU	1.40-2.40m: Moderately weathered, faintly foliated at 40°, whitish brown with pink tinge, coarse grained, granitic				2	
	3	527.9			100	56	3.5	B	3	b	CH					3	
	4				100	68	4.8	B	1	b	CH	2.40-6.80m: Slightly weathered, faintly foliated at 40°, light brown with pink tinge, coarse grained, granitic.					4
	5				100	80	5	C	2	c	CU	Joints, 40°, rough brown stained, sandy silt lined					5
	6				90	90	5.5	B	1	b	CH						6
	7	523.5		Granitic gneiss	53	53	6.8	B	2	b	CH	6.80-12.60m: Slightly weathered, faintly foliated, light brown with black tiny biotite specks, coarse grained, granitic. Joints, 30°, rough brown stained.					7
	8				53	50	8.2										8
	9				53	46	9	B	1	b	CH	6.80-8.20m: no core recovery.					9
	10				67	62	9.3	B	2	b	CU	9.50-10.50m: no core recovery.					10
	11				33	28	10.5										11
	12				100	46	12	B	3	b	CH						12
	13	517.7			100	66	12.6	B	1	b	CH	12.60-21.20m: Fresh, light grey with tiny black biotite specks, coarse grained, granitic.					13
	14				100	98	13.5	B	3	b	CH	With occasional very coarse grained quartzose bands upto 5cm at 20°, 90°.					14
	15				100	100										0.7	15
	16				100	100											16
	17			100	100											17	
	18			100	100											18	
	19			100	100											19	
	20			100	100										0	20	
	21	509.1		Granitic gneiss	100	100	21.2					21.20-26.40m: Fresh, faintly foliated at 40°, brown with pink tinge, coarse grained, granitic with biotite streaks at 40°. Joints, 20°, rough with biotite sheer.				21	
	22				100	100	22						21.50-26.50m: pegmatitic.				22
	23				100	100											23
	24				100	100											24
	25				100	100										0	25
	26	503.9		Granitic gneiss	100	94	26.4					26.40-30.00m: Fresh, light grey with black biotite specks, medium and coarse grained, granitic. Joints brown stained, at 26.85m and 27.20m, 40° at 29.00m, 70°				26	
	27				100	88	27										27
	28				100	88											28
	29				100	90										1.4	29
	30				100	92	30.00	A	1	a	B						30

DRILLING LOG
Hole inclination: Vertical
Azimuth:

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 50.00m

Hole EL: 530.37m
Northing: 9,968,518.63
Easting: 392,651.75

Hole No. G95-5
(2/2)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	CW Level	Lugoon (m)	Eu	Depth(m)	
	31			Granitic gneiss	100	100						30.00-50.00m Fresh, light grey with black biotite specks, medium and coarse grained, granitic Joints brown stained, at 33.70m, 60° at 33.90m, horizontal				31	
	32				100	92							Joints: very rare, generally 40°, sometimes with white kaolinic veneer.		14		32
	33				100	83							41.00-42.00m, pegmatitic	33			33
	34				100	93											34
	35				100	97								33.00-38.00m			35
	36				100	100								0			36
	37				100	100											37
	38				100	100								37.7-38			38
	39				100	100											39
	40				100	100								40-37.70-42.70m			40
	41				100	100								0			41
	42				100	100											42
	43				100	100								42.7-40.00-45.00m			43
	44				100	99								0			44
	45				100	90								45			45
	46				100	100											46
	47				100	100									0		47
	48				100	100											48
	49				100	100											49
	50	50.00	489.3			100	100	50.00	A	I	a	II	Date commenced: 12/7/95 Date completed: 21/7/95	50.00			50
	51															51	
	52															52	
	53															53	
	54															54	
	55															55	
	56															56	
	57															57	
	58															58	
	59															59	
	60															60	

DRILLING LOG

Hole inclination: Vertical
Azimuth

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 80.15m

Hole E.L.: 522.82m
Northing: 9,969,956.60
Easting: 393,066.82

Hole No: G95-6
(1/3)

Date	Depth(m)	EL(m)	Leg	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W Level	Lugosec (m)	Lu	Depth(m)	
	1	521.3		Sandy silt	0	0	1.5					0-1.50m: Reddish brown sandy silt, with some quartz and gneiss gravels				1	
	2				50	45	2.2	A	2	b	CII	1.50-10.15m	2.3		2		
	3			Granitic gneiss	100	81	3.4	A	1	b	CII	Slightly weathered, faintly foliated at 60°, of aligned specks/streaks of biotite, pinkish brown, coarse grained, granitic				3	
	4	100	57		4.35	A	3	b	CII	Joints, subhorizontal and medium steep, rarely vertical, rough/planar, orange brown/reddish mineral stained				4			
	5	100	86		5.6	A	1	b	CII		1.7		5				
	6	100	86		6.6	B	2	b	CII				6				
	7	100	56		8.3	B	5	b	CI				7				
	8	100	0		9.1	B	3	b	CII		8		8				
	9	100	45		9.9	B	3	b	CII				9				
	10	522.6			10.15	100	77	9.9 10.15	A B	2 5	b b	CII CI				10	
	11				Granitic gneiss	100	82						10.15-31.00m				11
	12					100	100							Fresh, whitish grey, occasionally with pink tinge, coarse grained, granitic.			
	13			90		90							With black biotite specks and occasional hornblende spots.				13
	14			100		100							With rare dark grey mafic bands upto 3cm at 40-60°.				14
	15			100		100							Joints, very rare, 49°, rough brown limonite coated.				15
	16			100		100											16
	17			100		95											17
	18			100		97											18
	19			100		86											19
	20			100		92		19.5	A	1	b	CII					20
	21			100	100									0.3		21	
	22			100	100											22	
	23			100	100											23	
	24			100	100											24	
	25			100	100											25	
	26			100	100									0		26	
	27			100	100											27	
	28			100	100											28	
	29			100	100											29	
	30			100	100		30.00	A	1	b	B				0	30	

DRILLING LOG

Hole inclination: Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 60.15m

Hole EL.: 522.82m
Northing: 9,969,956.60
Easting: 393,066.82

Hole No G05-6
(2/3)

Date	Depth(m)	El. (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	GW Level	Lugeon (m)	Lu	Depth(m)
	31	491.8		Granitic gneiss	100	100						30.00-31.00m as above.				31
	32				100	100						31.00-37.00m Fresh, foliated and banded at 60°, generally dark grey with light grey bands/zones, coarse grained mafic biotite - hornblende with whitish felsic zones 20cm upto 1.20m Banding at 0-40°.	33	0		32
	33				100	100										33
	34			Mafic gneiss	100	100										34
	35				100	100								0		35
	36				100	100										36
	37	485.8			100	100										37
	38				100	100						37.00-60.00m Fresh, faintly foliated at 40-60°, with occasional dark grey mafic and whitish felsic bands, light grey zonally with pink tinge, coarse grained, granitic Rare dark grey mafic bands few cm upto 20cm thick at 30-40° dip. (47.00-47.50m & 53.50-53.90m, mafic) Joints, very rare, 40° with white siliceous crust.	38			38
	39				100	75										39
	40				100	93										40
	41				100	100								0		41
	42				100	100										42
	43				100	96							43			43
	44				100	99										44
	45				100	86								0		45
	46				100	96										46
	47			Granitic gneiss	100	100										47
	48				100	100										48
	49				100	100										49
	50				100	100								0		50
	51				100	100										51
	52				100	100										52
	53				100	100							53			53
	54				100	100										54
	55				100	100								0		55
	56				100	100										56
	57				100	100										57
	58				100	100							58			58
	59				100	100										59
	60				100	100	60.00	A	1	1	B			0		60

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 80.15m

Hole EL: 522.82m
Northing: 9,969,956.60
Easting: 393,066.82

Hole No 95-6
(3/3)

Date	Depth(m)	EL. (m)	Log	Rock type	Core		Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W. Level	Lugeon		Depth(m)	
					(%)	(%)								(m)	Lu		
	61			Granitic gneiss	100	100						60.00-74.60m Fresh, faintly foliated at 40-60°, with occasional dark grey mafic and whitish felsic bands, light grey zonally with pink tinge, coarse grained, granitic				61	
	62				100	100								0			62
	63				100	100							Rare dark grey mafic bands few cm upto 20cm thick at 30-40° dip.	62.7			63
	64				100	100							Joints, very rare, 40° with white siliceous crust				64
	65				100	84							73.20-74.60m, well foliated and banded at 60°, light grey with pink bands.		62.70-67.20m		65
	66				100	92							73.20-73.60m, light grey, with biotite lamination, 1cm thick concordant black fine grained band at bottom.	0			66
	67				100	98											67
	68				100	100								67.7			68
	69				100	100											69
	70				100	100									68.00-73.60m		70
	71				100	100								0			71
	72				100	100											72
	73				100	100											73
	74				100	100								73.6			74
	75	74.6	443.2		100	100								0		75	
	76			Mafic gneiss	100	100						74.60-80.15m Fresh, foliated at 50°, dark grey coarse grained mafic biotite - hornblende with little quartz and feldspar.				76	
	77				100	100							With occasional whitish quartzose pockets few mm upto 30cm.	76.6			77
	78				100	100							Contact with granitic gneiss, concordant.				78
	79				100	100									1.1		79
	80	80.15	442.6		100	100	80.15	A	1	a	B			80.15			80
	81											Date commenced 28/7/95 Date completed 6/8/95				81	
	82															82	
	83															83	
	84															84	
	85															85	
	86															86	
	87															87	
	88															88	
	89															89	
	90															90	

DRILLING LOG
Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 30.05m

Hole EL: 492.71m
Northing: 9,969,880.85
Easting: 392,989.38

Hole No G95-7
(1/1)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W Level	Lu	Depth(m)
	1			Sandy silt	100	0						0-1.00m: Reddish brown sandy silt, with some quartz and gneiss gravels			1
	2	491.2		Granitic gneiss	100	15	1.50	D	5	d	D	1.50-7.30m Highly to moderately weathered, partly machine broken, brown coarse grained, granitic			2
	3				100	30	3.3	C	3	c	CU	With occasional black hornblende - biotite spots/cluster few mm upto 1 cm.			3
	4				100	21	4.5	C	2	c	CM	Zonally faintly foliated at 40°.			4
	5				84	44	4.8	D	5	d	D	Joints, subhorizontal to steep, rough limonite stained			5
	6				20	0	6					4.80-6.00m, no core recovery.			6
	7	485.4			53	0	6.3	D	5	d	D	6.30-6.65m, no core recovery.			7
	8			Granitic gneiss	74	0	7.30	D	4	d	D	7.30-10.10m Slightly weathered, light brown with pink tinge, coarse grained, as above			8
	9				100	78	8.4	B	3	b	CH	Joints, rare, 40°, brown stained	9.4		9
	10	482.6			100	81	10.1	B	3	b	CH	10-10-12.75m Slightly weathered, light grey coarse grained, as above			10
	11			Granitic gneiss	100	98						Joints, subhorizontal, rough brown stained			11
	12				100	100							8.1		12
	13	479.9			100	76	12.6	A	1	b	CH	12.75-13.40m Slightly weathered, light pinkish grey, coarse grained, as above			13
	14	479.3			100	60	12.9	B	5	b	CL	With faint lamination at 20°.	13.9		14
	15				100	100	13.4	B	3	b	CH	Joints, 20°, 40°, rough/planer, brown stained.			15
	16				100	95									16
	17			Granitic gneiss	100	100						13.40-30.05m Fresh, light grey with pink patches, coarse grained, as above		0	17
	18				100	100						Joints, very rare, 30°, brown stained			18
	19				100	100						Pegmatitic from top to bottom.			19
	20				100	100							20.2		20
	21				100	100									21
	22				100	87							0		22
	23				100	93									23
	24				100	100									24
	25				100	99							24.9		25
	26				100	94									26
	27				100	99								3.9	27
	28				100	100									28
	29				100	100									29
	30	462.6		100	100	30.05	A	1	a	B			30.05	30	

Date commenced 17/7/95
Date completed 23/7/95

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 50.20m

Hole EL: 442.97m
Northing: 9,969,745.24
Easting: 392,853.92

Hole No G95-8
(1/2)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon (m)	Lu	Depth(m)
	0.5	442.4		Sand								0-1.00m Reddish brown silty - clayey sand				
	1.6	441.3		Sand	0	0						0.50-1.60m Grey, with green tinge, silty sand				1
	2	440.9		Gravel	50	0	2					1.60-2.00m Gravels, grey, angular, gneiss				2
	3			Mafic gneiss	100	12	2.75	B	2	b	CH	2.00-4.20m Slightly weathered, foliated (40-70°) greenish grey, coarse grained hornblende - biotite - quartz - feldspar. Joints; 40-60°, rough, limonite, earth green mineral lined				3
	4.2	438.7		Mafic gneiss	100	0										4
	5			Granitic gneiss	100	20	5.3	B	3	b	CH	4.20-5.90m Slightly weathered, pink with occasional dark grey biotite - hornblende lamination, coarse grained Joints; steep, rough with orange earthy veneer/crust.	5.5			5
	5.9	437.0		Mafic gneiss	100	62	6.2	B	2	b	CH					6
	7.1	435.8		Mafic gneiss	100	28	6.85	B	4	b	CM	5.90-7.10m Slightly weathered, faintly foliated, coarse grained mafic, hornblende - biotite. Joints; steep, with greenish chloritic veneer.				7
	8			Granitic gneiss	100	31	7.25	B	3	b	CH					8
	9			Granitic gneiss	100	44	7.65	B	1	b	CH	7.10-9.45m Slightly weathered, with faint foliation at 30°, pink coarse grained granitic, with occasional pegmatite bodies upto 30cm. Joints, 0-70°, rough orange/green earthy mineral lined.				9
	9.45	434.5		Mafic gneiss	100	60	8.2	B	3	b	CH					10
	10			Mafic gneiss	100	38	10.1	B	3	b	CH					11
	11			Mafic gneiss	100	39	11.1	B	2	b	CH	9.45-13.50m Slightly weathered, faintly foliated, dark grey with occasional white quartz bands few mm upto 8cm, coarse grained mafic hornblende - biotite. Joints; 0-90°, rough with white siliceous crust.				12
	12			Mafic gneiss	100	62	11.3	B	3	b	CH					13
	13.5	429.4		Semi-felsic gneiss	100	65	12.95	B	2	b	CH					14
	14			Semi-felsic gneiss	100	13	13.7	B	3	b	CH	13.50-16.60m Slightly weathered, light grey, medium and coarse grained quartz - feldspar - biotite - hornblende. Joints, 20-60°, rough limonite coated	15			15
	15			Semi-felsic gneiss	100	39	14.05	B	4	b	CM					16
	16			Semi-felsic gneiss	100	39	14.4	B	3	b	CH					17
	16.6	426.3		Mafic gneiss	100	75	14.65	B	5	b	CH					18
	17			Mafic gneiss	100	80	15.5	B	3	b	CH	16.60-30.15m Slightly weathered, foliated and thinly laminated at 40-60°, grey with greenish tinge, medium to coarse grained mafic, hornblende - biotite.				19
	18			Mafic gneiss	100	65	15.75	B	4	b	CM					20
	19			Mafic gneiss	100	71	17.85	A	1	b	CH	With occasional pink/white pegmatite, quartz and granitic bands few cm upto 60cm.				21
	20			Mafic gneiss	100	71	18.4	A	4	b	CM					22
	21			Mafic gneiss	100	73	19.1	A	1	b	CH	17.80-18.40m, white very coarse granitic pegmatite				23
	22			Mafic gneiss	100	69	19.3	B	5	b	CH	19.70-20.40m, pink/white pegmatite				24
	23			Mafic gneiss	100	46	19.95	A	3	b	CH	20.70-20.95m, pink granitic.				25
	24			Mafic gneiss	100	80	21	A	2	b	CH	Joints; generally 40-60°, rough orange stained with white encrustation.				26
	25			Mafic gneiss	100	71	21.85	A	1	b	CH					27
	26			Mafic gneiss	100	64	22.75	B	4	b	CM					28
	27			Mafic gneiss	100	62	23.15	A	1	b	CH					29
	28			Mafic gneiss	100	83	23.35	B	5	b	CH					30
	29			Mafic gneiss	100	79	23.65	A	2	b	CH					31
	30			Mafic gneiss	100	75	23.75	C	5	c	D					32
				Mafic gneiss	100	75	25.55	A	1	b	CH					33
				Mafic gneiss	100	75	26.6	A	3	b	CH					34
				Mafic gneiss	100	75	28.3	A	1	b	CH					35
				Mafic gneiss	100	75	28.5	A	5	b	CH					36
				Mafic gneiss	100	75	29.55	A	1	b	CH					37
				Mafic gneiss	100	75	30.00	A	3	b	CH					38

DRILLING LOG
Hole inclination: Vertical
Azimuth:

Project: Mutonga/Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 50.20m

Hole EL: 412.92m
Northing: 9,969,745.24
Easting: 392,853.92

Hole No: G95-8
(2/2)

Date	Depth (m)	EL (m)	Leg	Rock type	Core (%)	RQD (%)	Depth (m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Elevation (m)	1 u	Depth (m)	
	30.15	412.8					30.05	A	1	a	CH						
							30.4	A	1	b	CH						
	31				100	47	30.55	A	3	b	CH	30.15-36.00m		30.5	0		31
							31.15	A	5	b	CL	Slightly weathered, pink coarse grained, granitic					
	32				100	25	31.9	A	3	b	CH	Joints, subhorizontal and steep, rough with brown/orange stained					32
	33				100	11											33
							33.35	A	4	b	CM				19.9		33
	34			Granitic gneiss	100	41	34.1	A	2	b	CH						34
							34.6	A	4	b	CM						34
	35				100	42											35
							35.45	A	3	b	CH			35.1			35
	36	36	406.9		100	3	36										36
	37				100	0	36.9	A	3	b	CH	36.00-40.50m					37
												Slightly weathered, light grey with pink tinge, coarse grained, granitic					37
	38				100	5	38	A	4	b	CM	Joints: 0-90°, rough limonite coated.			0		38
	39				100	16	39.15	A	3	b	CH						39
							39.5	A	4	b	CM						39
	40				100	17								40.15			40
	41	40.5	402.4		90	13	40.9	A	2	b	CH	40.50-50.20m					41
							41.2	A	4	b	CM	Slightly weathered to fresh, faintly foliated at 40-70°, light grey, round dark grey spots and light grey spots, medium and coarse grained quartz - hornblende - biotite - feldspar.					41
	42				90	46	42	A	2	a	CH						42
							42.5	A	5	a	CL				40.15-45.40m		42
	43			Mafic gneiss	100	66	43.1	A	2	a	CH	43.20-44.50m, pink, slightly granitic.			0		43
							43.8	A	4	a	CM	45.60-46.20m, with pink impregnation.					43
	44				100	69						49.50-50.20m, with pink subhorizontal bands few cm thick, semi-felsic.					44
							44.55	A	1	a	B						44
	45				100	67	44.9	A	2	a	CH	Joints, 40-70°, rough with green chloritic veneer					45
							45.6	A	1	a	B			45			45
	46				15%	68								45.4			46
							46.4	A	2	a	CH						46
	47				100	85											47
																	47
	48				100	98	48.15	A	1	a	B						48
																	48
	49				100	80	48.9	A	2	a	CH						49
																	49
	50	50.20	392.7		100	29	50.20	A	1	a	B						50
																	50
	51											Date commenced: 1/7/95 Date completed: 11/7/95					51
	52																52
	53																53
	54																54
	55																55
	56																56
	57																57
	58																58
	59																59
	60																60

DRILLING LOG

Hole inclination: Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 30.15m

Hole EL: 464.46m
Northing: 9,969,657.03
Easting: 392,760.12

Hole No G95-9
(H/I)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugosem (m)	I u	Depth(m)
	0.5	463.9		Sandy silt								0-0.50m Reddish brown sandy silt				1
	2	462.4		Mafic gneiss	100	0	2.00					0.50-2.00m Slime (sand)				2
	3				100	0	2.75	C	5	e	D	2.00-5.10m Moderately weathered, foliated at 40°, dark grey with green tinge, medium and coarse grained mafic; hornblende - biotite, with angular structure. Joints, subhorizontal and steep and along foliation planes, rough with brown calcareous lining.				3
	4				100	0	3.65 4.05	C C	3 5	e e	CU D					4
	5.1	459.3			100	0	5.3	C	2	e	CM					5
	6				100	0	5.7 6	C C	5 5	e e	D D	5.10-14.30m Moderately to highly weathered, occasionally zonally non intact, foliated at 40°, with angular structure, grey with green tinge, mafic hornblende - biotite, altered.				6
	7				100	49	7.6	D	3	d	CL	Joints, medium steep and steep, rough brown silty clay lined	7.1			7
	8			Mafic gneiss	100	27	8 8.3	D D	2 5	d d	CL D					8
	9				100	4	8.75					No core recovery: 5.70-6.00m (slime) 8.30-8.75m (slime) 9.80-10.50m (slime) 11.30-11.50m 12.00-12.50m 13.00-13.50m				9
	10				100	20	9.4 9.8	D D	5 3	d d	D CL			8.8		10
	11				100	0	10.5 10.8 11.3 11.5	D C	5 5	d e	D D					11
	12				80	0	12	D	5	d	D		12			12
	13				50	15	12.5 13	D	3	d	CL		13			13
	14				63	0	13.5									14
	14.3	450.1		Mafic gneiss			14.3	D	3	d	CL					14
	15	449.2			93	33	14.8 15.20	B D	2 3	b b	CH CH	14.30-15.20m Slightly weathered, foliated and with angular structures at 40°, dark grey with green tinge and whitish patches, coarse grained mafic hornblende - biotite. Joints, rare, 40°, rough brown stained.		67.8		15
	16				100	29	15.5	B	5	e	CL					16
	17				100	0	15.9	B	3	c	CM					17
	18				100	0	17.8 18.2	B B	5 3	e e	CL CM	15.20-30.15m Moderately to slightly weathered, pink, medium and coarse grained, granitic.				18
	19				100	0	18.9	B	5	e	CL					19
	20				100	0	20.15	B	3	e	CM	With dark grey mafic gneiss band in zone 28.55-29.85m.				20
	21				100	0	21	B	4	e	CL	With greenish mafic hornblende spots below mafic gneiss bands	21.4			21
	22			Granitic gneiss	100	0	21.45	B	4	b	CM	Joints, 30-40°, rough with green staining/ altered orange brown.				22
	23				100	20										23
	24				100	20								16		24
	25				100	15	24.5	B	3	b	CH					25
	26				100	31	25.25	B	4	b	CM					26
	27				100	74	26	A	2	b	CH			26		27
	28				100	50	26.7 27.5	A A	3 2	b b	CH CH					28
	29				100	67	28.05 28.5	A A	3 2	b b	CH CH					29
	30	30.15	434.3		100	57	29.7 30.15	A A	1 3	b b	CH CH	Date commenced: 30/6/95 Date completed: 6/7/95				30

DRILLING LOG
Hole inclination: Vertical
Azimuth

Project: Motonga Grand Falls Hydropower Project
Site: Grand Falls
Total Length: 30.20m

Hole EL: 473.62m
Northing: 9,969,522.46
Easting: 392,627.47

Hole No: G95-10
(1/1)

Date	Depth (m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth (m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon (m)	Lu	Depth (m)
	1	472.3		Sandy-clayey silt	100	0						0-1.50m: Reddish brown sandy to clayey silt, with some quartz and gneiss gravels. Sand in bottom.				1
	1.5	472.1					1.5									1.5
	2	471.1		Mafic gneiss	30	10	1.8	D	5	c	D	1.50-2.50m: Highly weathered, faintly foliated at 60°, light grey, with dark grey and occasional whitish bands, coarse grained.				2
	2.5						2.5	D	4	c	D					2.5
	3						3									3
	3.9	469.7		Mafic gneiss	40	0	3.90					2.50-3.90m: Slime (sand)				4
	4						4									4
	5						4.5	D	4	c	D	3.90-6.65m: Highly weathered, foliated dark grey, with light grey specks, medium grained mafic; hornblende - biotite and felsic mineral.				5
	6	467.6					6	D	3	d	CL	4.50-5.00m, slime (sand, disintegrated gneiss)				6
	6.65	466.9		Mafic gneiss	80	21	6.65					6.00-6.65m, slime (sand).	6			6
	7						7.2	D	4	e	D	6.65-9.00m: Highly to moderately weathered, faintly foliated at 70°, dark grey, coarse grained, mafic, hornblende - biotite, with felsic minerals.				7
	8						7.85	D	3	d	CL	8.00-9.00m, semi-felsic				8
	9	464.6		Mafic gneiss	100	9	9.00	C	4	c	CL					9
	9.7	463.9					9.7					9.00-9.70m: Slime (sand).				9.7
	10						10.6	B	4	c	CL	9.70-10.60m: Moderately weathered, faintly foliated, pinkish brown, coarse grained granitic.				10
	11	463.0		Granitic gneiss	29	0						With occasional pegmatite bands upto 10cm thick.				11
	12						12.7	B	3	b	CH	Joints; subhorizontal and steep, rough/planar brown stained				12
	13						13.1	B	1	b	CH					13
	13.7	459.9					13.5	B	3	b	CH	10.60-13.70m: Slightly weathered, faintly foliated at 50°, pinkish brown, coarse grained, as above.				13.5
	14						15.25	A	3	b	CH	Joints; 30-60°, rare 90°, rough orange/green coated.				14
	15			Granitic gneiss	100	45						13.70-18.00m: Slightly weathered, faintly foliated at 40°, grey with black tiny biotite specks, medium and coarse grained, granitic.				15
	16						16.3	A	2	b	CH	With occasional pinkish brown patches.				16
	17						17.1	A	3	b	CH	17.50-17.70m, dark grey mafic hornblende - biotite gneiss band				17
	18	455.6					17.45	A	1	b	CH	Joints; 20-60°, rare 70-90°, rough/planar, brown stained				17
	19						18	A	3	b	CH					18
	20						22.3	A	1	a	B	18.00-30.20m: Fresh in general, foliated dark grey with light grey thin laminae, coarse grained mafic hornblende - biotite, with quartz and feldspar.				19
	21			Mafic gneiss	100	100						Foliation, 40-50°.				20
	22						22.5	A	4	b	CM	With occasional pegmatite bands/veins as below.				21
	23						22.5	A	4	b	CM	29.00-29.30m, whitish granitic pegmatite.				22
	24						27					29.45-29.75m, - ditto -.				23
	25						88					25.50-30.20m, with black mineral speckling, foliation very faint.				24
	26											Joints; rare, 40°, with orange sheen				25
	27															26
	28															27
	29						29	A	1	a	B					28
	30	443.4					29.35	A	3	a	CH	Date commenced: 27/6/95 Date completed: 3/7/95				29
	30.20						30.20	A	1	a	B					30

DRILLING LOG
Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 30.25m

Hole EL: 455.66m
Northing: 9,969,570.23
Easting: 393,038.41

Hole No G95-11
(1/1)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugeon (m)	Lu	Depth(m)
	1			Sandy silt	0	0						0-1.50m: Brown with pinkish red tinge, with occasional subround and angular gneiss fragments upto 3cm.				1
	2	463.5		Clayey silt	0	0						1.50-3.00m: Brown with orange green tinge, sandy (disintegrated gneiss).				2
	3	462.0		Sand	0	0						3.00-3.60m: Brown, angular, medium and coarse sand				3
	4	461.4			60	25	3.60									4
	5			Semi-felsic gneiss	67	23	5	D	3	d	CL	3.60-6.00m: Highly weathered, faintly foliated, light brown, coarse grained quartzo-feldspathic, with occasional greenish laminae and discordant pegmatite veins bands upto 3cm.	5			5
	6	459.0			73	26	6	D	6	e	D	5.50-6.00m: pinkish brown coarse sand, with fragments.				6
	7				100	17	7.2	C	3	c	CL					7
	8				100	19	8	C	4	c	CL	6.00-11.20m: Moderately weathered, steeply (80°) foliated and banded, whitish coarse grained quartzose, with occasional mafic hornblende - biotite upto 85cm.				8
	9				100	56	8.4	C	5	c	D	With occasional white siliceous subvertical stringers upto 4mm.				9
	10				100	87						Joints, subhorizontal, rarely steep, rough brown stained.				10
	11	453.8			100	87	11.2	C	2	c	CM	8.00-8.25m: no core recovery (slime)				11
	12			Pegmatite	50	17						11.20-14.10m: Highly weathered, machine broken, light brown with pink tinge, very coarse grained granitic.	9.5			12
	13	452.0			78	0						Joints, irregular, brown stained.				13
	14	450.9		Mafic gneiss	28	0	13.5	D	5	d	D	13.05-14.10m: Slime, Greenish brown, fine and medium sand (machined disintegrated mica hornblende with little feldspar gneiss).	14			14
	15				90	17	14.8	C	4	c	CL	14.10-17.20m: Moderately to slightly weathered, faintly gneissose, gray with whitish, coarse grained, mafic, hornblende, with quartzo-feldspathic lenses.				15
	16				82	17	16	D	3	d	CL	16.50-16.70m: pink granite band.				16
	17	447.8			73	16	16.3	B	2	b	CH	15.50-16.00m: no core recovery.	8.5			17
	18			Granite	100	14	17.2	B	3	b	CH	17.20-18.70m: Moderately to slightly weathered, pinkish grey coarse grained. Joints, 60-90°, rough brown stained.				18
	19	446.3			100	55	17.7	C	4	c	CL		19			19
	20	445.5		Mafic gneiss	100	60						18.70-19.50m: Slightly weathered, faintly foliated at 45°, grey with whitish patches mafic.				20
	21	444.6		Pegmatite	100	44	20.35	A	2	b	CH	19.50-20.45m: Slightly weathered, whitish, very coarse grained, granitic, upper contact concordant.				21
	22				100	27						Joints, 60-90°, rough brown stained.	0.9			22
	23				100	10	23.05	B	4	b	CM	20.45-23.15m: Slightly to moderately weathered, faintly foliated at 40°, grey with occasional pinkish red spots, coarse grained mafic biotite - hornblende.				23
	24				100	0	24	B	5	c	CL	Joints, 60-90°, rough limonite coated, with siliceous crust.	23.75			24
	25	439.9		Mafic gneiss	100	0	24.2	B	4	b	CM					25
	26				100	66	24.5	B	5	c	CL					26
	27				100	71	24.9	B	4	b	CM					27
	28				100	74	25.15	B	5	c	CL					28
	29				100	45	25.35	B	4	b	CM					29
	30	434.8			100	0	25.8	A	3	b	CH	25.15-30.25m: Slightly weathered, faintly foliated at 40°-50°, grey, coarse grained, as above.				30
							28.85	A	3	b	CH	Joints, 60-90°, rough brown stained.				30
							28.85	A	3	b	CH	Date commenced: 5/7/95 Date completed: 10/7/95				30

DRILLING LOG

Hole inclination: Vertical
Azimuth:

Project: **Muronga/Grand Falls Hydropower Project**
Site: **Grand Falls**
Total Length: **30.10m**

Hole EL: **491.83m**
Northing: **9,969,160.65**
Easting: **393,610.72**

Hole No: **G95-12**
(1/1)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W.Level	Lugeon (m)	Lu	Depth(m)
	1	12		Sandy silt	100	6	1.20					0-1.50m: Reddish brown sandy silt, with some quartz and gneiss gravels.				1
		15														
	2			Mafic gneiss	100	6	1.85	C	5	c	D	1.50-2.70m: Mainly quartz, with hornblende gneiss fragments				2
		2.7	489.1													
	3			Mafic gneiss	26	9	2.7	B	4	c	CL	2.70-3.90m: Generally highly weathered, partly non intact, brown, coarse grained				3
		3.9	487.9													
	4				54	7	3.35	D	3	a	CL	With white/pink pegmatite veins 2cm upto 8cm.				4
		4.5	487.3									Bottom part, moderately weathered, greenish grey, hornblende Joints; 50-60°, calcite lined				5
	5				34	0	3.7	C	4	c	CL	2.70-3.35m, no core recovery.				5
		5.5	486.3	Mafic gneiss												
	6				67	0						3.90-4.50m: No core recovery.				6
							6.8	C	5	c	D	4.50-5.50m: Slime (sand)				7
	7				38	0	7.1									
												5.50-11.70m: Generally highly weathered, mainly non intact, greenish grey, coarse grained, earthy stained.				8
	8				70	21	7.85	B	3	b	CH	With rare concordant quartz upto 2cm.				8
							8.2	B	5	b	CL	5.50-6.80m, no core recovery.				9
	9				23	6						6.80-7.10m, broken quartz.				9
												8.20-9.95m, no core recovery.				10
	10				47	26	9.95					10.85-11.05m, no core recovery.				10
												11.05-11.70m, slime (sand)				11
	11				64	33	10.85	B	2	b	CH	Joints, 20, 50-60°, rough calcite lined.				11
		11.7	489.1													
	12			Quartz	87	13	11.70					11.70-12.90m: Slightly weathered, white, coarse grained, little feldspar, faint foliation, 50°.				12
		12.9	478.9													
	13				95	51	12.55	B	3	b	CH					13
												12.90-17.00m: Slightly weathered, faintly foliated at 40°, greenish grey coarse grained biotite - hornblende.				14
	14				100	71	13.5	B	4	b	CM	Joints, 40-60°, rough, with brown/greenish earthy lining				14
	15			Semi-felsic gneiss	100	59	14.5	B	3	b	CH					15
					100	59	14.8	B	4	b	CM					16
	16				100	60										16
	17	17	474.8		100	59										17
		17.4	474.4	Pegmatite	100	55	17.4	B	3	b	CH	17.00-17.40m: Slightly weathered, white coarse grained, granitic.				18
	18				100	55	18.3	C	3	c	CL					18
		18.5	473.3	Mafic gneiss	100	83						17.40-18.50m: Generally moderately weathered, foliated at 30-40°, light grey with green tinge, medium grained biotite - hornblende - feldspar. Joints; 40-60°, rough, brown stained				19
	19				100	83										19
	20				100	96										20
												18.50-30.10m: Fresh, faintly foliated at 40°, greenish grey, hornblende - feldspar.				21
	21				100	100										21
												With occasional felsic quartzo - feldspathic bands upto 4cm, occasionally as large bodies			0.7	22
	22				100	100										22
												23.45-25.50m, white, very coarse grained pegmatite.				23
	23				100	100										23
												Joints, very rare, 50-60°, with white crust				24
	24				100	100										24
	25				100	100										25
	26				100	100										26
	27				100	100										27
	28				100	100										28
	29				100	100										29
	30	30.10	461.7		100	100	30.10	A	1	a	B	Date commenced: 9/7/95 Date completed: 13/7/95				30

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 30.10m

Hole EL: 484.45m
Northing: 9,958,950.26
Easting: 392,922.39

Hole No G95-13
(1/1)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	CW Level	Lugooon (m)	Lu	Depth(m)
	1	483.4		Sandy silt	100	0						0-1.00m: Reddish brown sandy silt, with some quartz and gneiss gravels.				1
	2	482.4			100	0						1.00-2.00m: Slime (sand)				2
	2.5	481.9										2.00-2.50m: Quartz fragments				3
	3				90	0	3					2.50-7.00m				3
	4			Mafic gneiss	80	15	3.7	D	4	d	D	Moderately to highly weathered, faintly foliated at 80°, dark grey, coarse grained, mafic; hornblende - biotite				4
	5				83	51	3.9					3.70-4.50m: light greenish grey.				4
	6				91	28	4.5	D	3	d	CL	Joints: 30-70°, rough, orange limonite coated clay veneer				5
	7	477.4			80	9	4.9	C	2	c	CM	No core recovery:				5
	8				96	46	5.2	D	4	d	D	3.70-3.90m and 5.70-6.00m				6
	9				93	53	5.5	D	3	d	CL					7
	10				77	47	6.8	C	3	c	CL	7.00-11.35m	7.2			7
	11	473.1		Mafic gneiss	79	42	7.7	D	4	d	D	Highly weathered, foliated at 80°, altered brown with occasional orange calcareous spots upto 2cm, coarse grained.				8
	12				86	29	8.7	D	3	d	CL	No core recovery;				9
	13	471.6			100	4	9.05					8.70-9.05m and 10.20-10.50m				10
	14				100	42	9.95	D	3	d	CL					11
	15	469.7		Semi-felsic gneiss	100	37	10.2	D	5	d	D	11.35-12.80m				11
	16				100	32	10.5					Highly weathered, machine broken, grey, coarse grained, mafic.	12.2			12
	17				100	4	11.6	D	3	d	CL					13
	18	465.7		Semi-felsic gneiss	100	20	12.9	D	5	d	D	12.80-15.00m				13
	19				100	37	13.1					Highly weathered, altered brown, coarse grained. With occasional brown calcareous zones upto 5cm and occasional dark grey hornblende patches.				14
	20				79	0	14.5	D	3	d	CL	12.90-13.10m, no core recovery (slime)				15
	21	463.1		Semi-felsic gneiss	100	22	15	C	3	c	CL	15.00-18.50m				16
	22	462.2			100	7	16.6	B	3	b	CH	Generally slightly, partly moderately weathered, faintly foliated at 70°, light greenish grey, coarse grained hornblende - feldspar, quartz.				16
	23	461.2		Pyroxenite	100	12	16.9	B	1	b	CH	Joints: 30-50°, with some fractured zones, rough calcite lined				17
	24				100	44	17.3	C	5	c	D					18
	25				100	37	18.2	B	1	b	CH	18.50-19.20m: No core recovery (slime)				18
	26			Mafic gneiss	100	2	18.5	C	5	c	D					19
	27				100	40	19.2					19.20-21.30m				20
	28				100	35	20.7	B	4	b	CM	Moderately to slightly weathered, machine broken, light greenish grey, coarse grained hornblende - feldspar - biotite, calc-silicate.				20
	29				100	45	20.7					Joints: 30°, rough, orange stained				21
	30	454.3			100	40	22.2	B	3	b	CH	21.30-22.20m				22
					100	12	22.95	B	5	b	CL	Slightly weathered, faint close lamination at 60°, grey/whitish, coarse grained				23
					100	44						With thin white contorted lamination.				23
					100	37						22.20-23.20m				24
					100	37						Slightly weathered, machine broken, pinkish brown, very coarse grained, granitic.				24
					100	2						Joints, subhorizontal to steep, rough, orange stained	24.7			25
					100	24						23.20-30.10m				26
					100	24						Slightly weathered, faintly foliated at 50°, dark greenish grey with light grey auger structures striations, medium and coarse grained graphite bearing mafic.				26
					100	35										27
					100	45						27.20-27.55m, green-black fault clay (70°), with pyrite.				27
					100	40						Joints: 20, 60-80° (with slickenside and clay), rough with greenish veneer/graphite sheen occasional pyrite.				28
					100	40										29
	30.10	454.3			100	40	30.10	B	3	b	CH	Date commenced: 15/7/95				30
												Date completed: 20/7/95	30.1			30

DRILLING LOG

Hole inclination Vertical
Azimuth

Project Matonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 50.20m

Hole EL: 521.78m
Northing: 9,968,403.07
Easting: 392,695.85

Hole No G95-14
(1/2)

Date	Depth(m)	EL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	C.W Level	Eucor		Depth(m)	
														(m)	Lu		
	1			Sandy silt	0	0	1.5					0-1.50m Reddish brown sandy silt, with many quartz and gneiss gravels. Bottom 30cm, clayey				1	
	2	520.2		Semi-felsic gneiss	50	23	1.8	D	5	d	D	1.50-4.50m Moderately to slightly weathered, very faintly foliated at 50°, light grey with greenish sprinkling, coarse grained hornblende - feldspar Joints: 20-50°, rough, with brown sandy silt.				2	
	3		100		76	2.65	A	2	b	CH					3		
	4		100		79	3.1	C	3	c	CL					4		
	5	517.2			100	79	3.75	A	1	b	CH					5	
	6	515.4		Mafic gneiss	100	43	4.5	B	3	b	CH	4.50-6.30m Moderately weathered, foliated and finely banded at 50°, dark grey, coarse grained mafic, hornblende - biotite with felsic mineral bands Joints: mainly along foliation with silt veneer.	5.7			6	
	7		100		15	6.1	C	5	c	D					7		
	8	513.5		Pegmatite	100	12	6.55	C	3	c	CL	6.30-8.20m Moderately, partly slightly weathered, coarse grained quartz - feldspar. Joint, 50°, white kaolin lined. From 8.00m, CH class good rock condition.				8	
	9		100		12	6.85	C	5	e	D					9		
	10			Semi-felsic gneiss	100	27	7.7	B	4	b	CM	8.20-12.00m Slightly weathered, faintly foliated at 50°, light greenish grey, coarse grained, hornblende - biotite - quartz - feldspar 10.70-11.30m; mafic with hornblende and biotite. Joints: 20-40°, rough, green chlorite lined.				10	
	11		100		44	11.05	B	3	b	CH					11		
	12	509.7			100	51	11.4	B	5	b	CL			11.2			12
	13		100		86	12	B	4	b	CM						13	
	14	507.4		Mafic gneiss	100	40	14.1	A	1	b	CH	12.00-14.30m Slightly weathered, faintly foliated at 50°, light grey with dark greenish hornblende, coarse grained Joints, at 14.20m 50°, rough, limonite coated				14	
	15	506.7			100	37	15	B	4	b	CM					15	
	16			Semi-felsic gneiss	100	79						14.30-15.00m. Slightly weathered, foliated at 60°, dark grey mafic hornblende, biotite 15.00-20.00m Slightly, partly moderately weathered, foliated at 60°, light grey, coarse grained feldspar - quartz with little mafic minerals With occasional zones vesicular, filled with orange/green minerals Joints: 20-40°, rough, with green mineral coating				16	
	17		100		93	17.3	A	1	b	CH					17		
	18		100		84	17.6	C	3	c	CL					18		
	19		100		77	18.5	A	1	b	CH					19		
	20	501.7		Mafic gneiss	100	59	19	C	3	c	CL	20.00-22.50m Slightly weathered, dark grey, coarse grained mafic biotite - hornblende. Joints: 20-40°, rough, with greenish chloritic lining				20	
	21		100		41	19.75	B	2	b	CH					21		
	22		100		0	19.95	B	5	b	CL					22		
	23	499.2			100	60	20.6	B	3	b	CH					23	
	24			Semi-felsic gneiss	100	50	22.25	B	3	b	CH	22.50-29.85m Slightly, partly moderately weathered, foliation at 50-60°, light grey, coarse grained quartz - feldspar with little mafic minerals With occasional quartzose bands upto 8cm at 70°. Joints: 20-40°, rough with greenish mineral lining				24	
	25		100		95	22.7	C	5	c	D					25		
	26		100		95	22.7	C	5	c	D					26		
	27		100		86	23.05	A	2	b	CH					27		
	28		100		93	27.4	A	1	b	CH					28		
	29		100		100	27.85	A	3	b	CH					29		
	30	491.9		100	71	29.6	A	1	b	CH				30			
							29.85	C	5	c	D				29		
							30.00	A	1	b	CH				30		

DRILLING LOG
Hole inclination Vertical
Azimuth.

Project Mutooga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 50.20m

Hole EL: 521.28m
Northing: 9,668,403.07
Easting: 392,693.85

Hole No C95-14
(2/2)

Date	Depth(m)	El. (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W. Level	Lugoon		Depth(m)	
														(m)	Lu		
							30.4	A	1	b	CH	29.85-35.00m Fresh in general, foliated at 50-70°, light grey with dark green minerals, coarse grained biotite - hornblende - feldspar - quartz. Occasional quartz veins discordant and along foliation, also, quartz lenses few mm upto 5cm. Joints, very rare.		27.00- 32.30m		31	
	31			Semi-felsic gneiss	100	92								87.7		32	
	32				100	100									32.3		32
	33				100	94											33
	34				100	94									32.00- 36.75m		34
	35				100	100									0		35
	36				100	100											36
	37				100	100									36.75		37
	38				100	100											38
	39				100	100										4.3	39
	40				100	100											40
	41				100	100											41
	42				100	100											42
	43				100	95											43
	44				100	100									0		44
	45				100	100											45
	46				100	100									45.75		46
	47				100	100											47
	48				100	100									0		48
	49				100	100											49
	50	50.20	471.5			100	100	50.20	A	1	a	B	Date commenced: 13/7/95 Date completed: 21/7/95				50
	51													50.20		51	
	52															52	
	53															53	
	54															54	
	55															55	
	56															56	
	57															57	
	58															58	
	59															59	
	60															60	

DRILLING LOG
Hole inclination: Vertical
Azimuth

Project Mutonga/Grand Falls Hydropower Project
Site Grand Falls
Total Length: 30.25m

Hole FL: 572.15m
Northing: 9,967,854.36
Easting: 392,079.64

Hole No. GQ95-1
(1/1)

Date	Depth(m)	FL (m)	Log	Rock type	Core (%)	RQD (%)	Depth(m)	Hardness	Core shape	Weathering	Rock class	Description	G.W Level (m)	Elevation (m)	Depth(m)	
	1			Silty sand	100	0						0-2.65m Reddish brown silty sand Slightly silty in upper zone			1	
	2				100	0										2
	3	2.65 3.05	569.5 569.1	Granitic gneiss	100	0	2.65 3.05	C C	4 1	e c	CE CM	2.65-3.05m Moderately weathered, machine broken, light brown, coarse grained quartz - feldspathic, with little biotite streaks.			3	
	4				100	93	4.5	B	1	b	CH					4
	5				100	80	5.2	B	3	b	CH					5
	6			Semi-felsic gneiss	100	67	6.4 6.7	B B	1 4	b b	CH CM	3.05-6.60m Moderately to slightly weathered, faintly foliated at 40°, light grey/whitish, coarse grained quartzo - feldspathic, granitic with little biotite specks. 6.40-6.50m, moderately weathered Joints, very rare, 10-30°, rough, with orange veneer.			6	
	7	6.6	565.5		100	80										7
	8				100	90							6.60-15.50m Fresh, faintly foliated, light grey, coarse grained quartzo - feldspathic, sprinkled tiny mm size biotite specks With light colored spots/blebs upto 1cm. Rare white quartzose bands upto 1cm at 30°. Joints, very rare.			8
	9			Granitic gneiss	100	100									9	
	10				100	100									10	
	11				100	100									11	
	12				100	100									12	
	13				100	100									13	
	14				100	100									14	
	15				100	100									15	
	16	15.5	556.6		100	100									16	
	17				100	100							15.50-30.25m Fresh, faintly foliated at 70°, light grey/whitish with occasional black mafic blebs/spots xenoclasts upto 2cm, coarse grained, granitic quartzo - feldspathic Joints, very rare, subhorizontal.			17
	18				100	100									18	
	19			100	100									19		
	20			100	100									20		
	21			100	100									21		
	22			100	100									22		
	23			100	100									23		
	24			100	100									24		
	25			100	100									25		
	26			100	100									26		
	27			100	100									27		
	28			100	100									28		
	29			100	100							Date commenced 7/7/95 Date completed 10/7/95			29	
	30	30.25	541.9	100	100		30.25	A	1	b	B				30	