

**Golder Associates Ltd.**

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**SPECIFICATIONS**  
**MINISTRY OF TRANSPORTATION ONTARIO**  
**PUMPING/RECHARGE WELL SYSTEM**  
**HIGHWAY 416**  
**NEPEAN, ONTARIO**  
  
**CONTRACT 94-62**  
**KNOXDALE ROAD TO BASELINE ROAD**

May 1997

951-1120

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DRAWING 1      -      Site Plan and Details

## 1.0 PURPOSE AND SCOPE OF WORK

The purpose of this specification is to define the design details of the pumping/recharge well system proposed to stabilize groundwater levels in the sandy deposits that underlie the east part of the Lynwood subdivision and including the zone towards the Bruce Pit pond area.

The objective of the pumping/recharge well system is to maintain groundwater levels in the sandy deposit within the Lynwood subdivision (i.e., on the exterior of the west cut-off wall) at about elevation 86.5 metres (geodetic datum). In general, the elevation of the groundwater table in the area is controlled by water levels in the Bruce Pit pond. It is envisaged at this time that the total flow requirements of the pumping/recharge well system will be about 225 to 260 litres per minute (50 to 60 Imperial gallons per minute).

There are currently one pumping and two recharge wells that will be incorporated into the final system design. The existing pumping well, Well No. 3, which will be on the side slope, is completed with a 3 metre length stainless steel screen with 1.0 millimetre slot sizes (40 slot) and is considered satisfactory for the permanent recharge system. Existing recharge wells RW-1 and RW-4 will comprise two of the recharge wells in the overall recharge well system. Well RW-1 is approximately 9 metres deep and is completed with a 3 metre length screen with 0.5 millimetre slot sizes (20 slot). Well RW-4 is approximately 12 metres deep and is completed with a 3 metre length screen with 1.0 millimetre slot sizes (40 slot).

This specification covers the requirements for materials, workmanship, and equipment required to supply and install the one additional pumping well and the two additional recharge wells with all required accessories for the complete system design. The system design includes two pumping and four recharge wells with associated pipes, valves and controls as shown on the Site Plan and Details (Drawing 1).

## 2.0 SUBMISSION REQUIREMENTS

The Contractor shall submit to the Ministry, two weeks in advance, his method of installation and the operation details for carrying out the work, including the following:

- (i) site preparation
- (ii) proposed sequence of work and time schedule

### 3.0 SITE CONDITIONS

The boreholes locations and soil strata are shown on sheets 211 to 219 of the Highway 416 Contract Drawings. This borehole information is intended for general guidance. This information is not intended to determine the construction costs, techniques and equipment choices, scheduling, safety and sequence of operation. Contractor bidding on this project may use the factual data subject to his own interpretation as to how subsurface conditions may affect his work, including construction technique, safety, schedule and equipment requirements.

### 4.0 SITE DESCRIPTION

The site is located along the west side of Highway 416 adjacent to the diaphragm and cement-bentonite cut-off walls between approximately stations 27+840 and 27+920 (see Drawing 1). All work will be conducted on Ministry of Transportation Ontario (MTO) lands.

### 5.0 CONTRACTOR REQUIREMENTS

The Contractor shall provide all labour, materials and equipment required to provide access to the site. The Contractor shall ensure that all unloading and loading of equipment and materials shall be appropriately co-ordinated with other ongoing site activities. The Contractor is responsible for utility clearances at the site prior to commencement of any work and must repair any damages to existing structures and other utilities as a result of the installation of the pumping/recharge system.

A total of one pumping well and two recharge wells with associated pipes, valves and controls are to be installed. The Contractor is responsible for the installation of all new pumping and recharge wells and required connections to previously installed pumping and recharge wells.

A benchmark and reference line shall be provided by the Engineer.

Materials and equipment shall be stored and handled by the Contractor in such a manner to prevent any damage to existing structures and utilities or interfere with ongoing site work.

## 6.0 QUALIFICATIONS

All work shall be performed by a Contractor having experience in works of a similar nature and complexity in the preceding five years. The work shall be carried out under the direction and supervision of a Geotechnical Consultant designated by the Ministry.

## 7.0 GENERAL SYSTEM DESIGN AND OPERATION

The pumping recharge well system shall include 2 pumping wells and 4 recharge wells to ensure adequate back-up capacity. Each pumping and recharge well shall have an isolation valve to facilitate repairs or maintenance on any individual well component. Each well shall include a stainless steel screen and steel casing. Each pumping/recharge well shall include a pitless adapter to facilitate practical removal of pumping systems and recharge down pipe for repair or maintenance.

Interconnecting piping shall be high density polyethylene with slip on, stainless steel clamped (Bandit clamps) joints as operating pressures are low. All piping shall be below frost level. A flow meter shall be included with a read-out box in the control panel to allow flow rates to be monitored and adjusted if required.

The system shall operate continuously with the pumps alternating on a daily basis as a method of extending pump life. The pump sequencing shall be an automatic feature built into the control panel. Water shall flow to all 4 recharge wells with flow rates to each well a function mainly of individual well capacities. If a pumping well stops, the second pump will continue at full time, continuous operation. A pump malfunction will trigger an electric alarm which in turn will activate a cellular modem and call-out to the appropriate emergency number. The cellular modem requires no outside connections with exception to electrical power from the panel. The modem shall be connected to an appropriate emergency responder such as Honeywell or similar agency. The responding company would contact MTO personnel or their agent for such work as defined. Power requirements shall be 1500 watts (2 horsepower) required from the high mast lighting source on a continuous basis. A low level water alarm shall be included with each pumping well to note drawdown more than approximately 2 metres below the level of the drainage system. A high level water alarm shall be installed in one of the higher capacity wells (RW-4) to ensure recharge well malfunctions are addressed before overflow conditions occur.

The electrical requirements have been discussed with Black and McDonald, the electrical contractor for the HML, and there are no apparent difficulties with utilizing power from this source. Black and McDonald would be able to furnish an electrical specification as required.

## **8.0 EQUIPMENT SPECIFICATION AND INSTALLATION**

The details and locations for the pumping/recharge well system are shown on Drawing 1. The Contractor's proposed system components and the method of installation of the system components must be approved by the Ministry.

Pumping and recharge well construction shall include no drilling muds and shall be installed by cable tool or large diameter hollow stem auger techniques. The well screens shall be telescoping or solid pipe installation. The well screens shall not include gravel packs and shall be naturally developed using conventional well development techniques.

The electrical panel (supplied by Mannion Pumps or equivalent supplier), must be weather proof and of sufficient size to include the following electrical components:

1. Panel NEMA-3R (weatherproof)
2. Two pump starters (Furnas or equivalent)
3. Two low and one high level cut-offs (Warrick Level II or equivalent)
4. Cellular Alarm Transmitter (HSI Cell-Pac by Cellular Alarm Products or equivalent) supplied by Honeywell
5. Neptune Pulsar RM Flowmeter readout panel (or equivalent)
6. Resistance Heater (maintain temperature above 15°Celsius)

## **9.0 SYSTEM COMMISSIONING**

The Contractor shall be responsible for the final testing and commissioning of the overall system to the satisfaction of the Ministry. The Contractor shall operate the complete system for a period of 7 days during which time the Ministry can monitor the performance of the individual pumping and recharge wells and the effectiveness of the system. The total pumping/recharge system shall be completed with all testing and commissioning by July 15, 1997.

The remote alarm system shall be commissioned and tested to confirm the operational ability.

The new pumping and recharge wells shall be step tested for four steps to assist in determining the maximum capacity of the wells. The pumping rates for each step will be determined by the Ministry but are not expected to exceed 450 Litres per minute (100 Imperial gallons per minute).

Following analysis of the step test results, each new pumping and recharge well shall be pump or recharge tested for a period of 12 hours at a rate to be determined by the Ministry but not to exceed 450 Litres per minute (100 Imperial gallons per minute).

The maintenance strategy will include bi-monthly monitoring of the overall system (flowrates, water levels) for two years with the requirements for subsequent years to be developed based on the results for the initial 2-year period.

## **10.0 RESTORATION**

Upon completion of all the work, the Contractor shall restore the site to the satisfaction of the Ministry. Work within the cut-off wall area shall be subject to the restoration requirements of the main contract. Following completion of the water line crossing of the cement bentonite wall and the unreinforced concrete wall, these walls should be reinstated to their original height using concrete backfill. Any ground modifications or excavations carried out for the installation of the recharge wells shall be properly graded and backfilled to the satisfaction of the Ministry. The entire site shall be restored to the original condition.

## **11.0 PAYMENT**

### **11.1 Measure of Payment**

Measurement is by Plan Quantity, as may be revised by Adjusted Plan Quantity, for each completed component of the overall pumping/recharge well system. Measurement by Plan Quantity, as may be revised by Adjusted Plan Quantity, for each complete component of the overall pumping/recharge well system.

### **11.2 Basis of Payment**

Payment at the contract price for the above tender items shall be of full compensation for the supply of all labour, equipment and materials required for the supply, installation and testing of pumping/recharge system including pipes, valves, electrical and controls. No additional compensation will be provided for the site preparation and restoration.

### **11.3 Extra Work**

Where the Ministry directs or otherwise authorizes the Contractor in writing to undertake in addition to that provided in the contract, the Contractor shall proceed with the work and such work shall be considered extra work. Payment for such work shall be made in addition to the work outlined.

### **11.4 Materials**

All material for this contract shall be supplied by the Contractor in new conditions and is subject to the inspection and approval of the Ministry.

RDS:cr  
spec-001.doc



**SPECIFICATIONS**

**MINISTRY OF TRANSPORTATION ONTARIO**

**PUMPING / RECHARGE WELL SYSTEM**

**HIGHWAY 416**

**NEPEAN, ONTARIO**

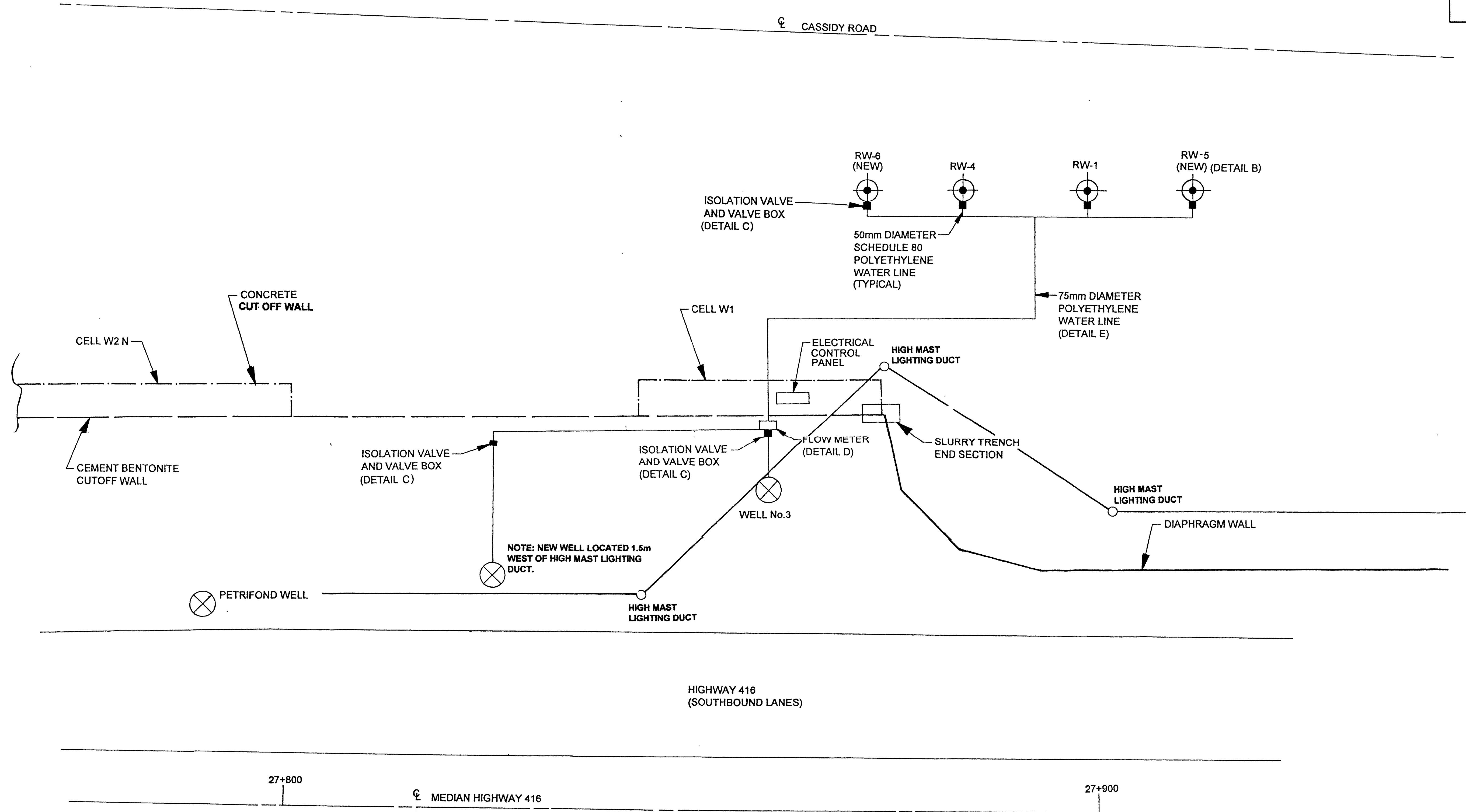
**CONTRACT 94-62**

**KNOXDALE ROAD TO BASELINE ROAD**

Submitted To:

Ministry of Transportation Ontario  
1201 Wilson Avenue  
Central Building  
Room 315  
Downsview, Ontario  
M3M 1J8



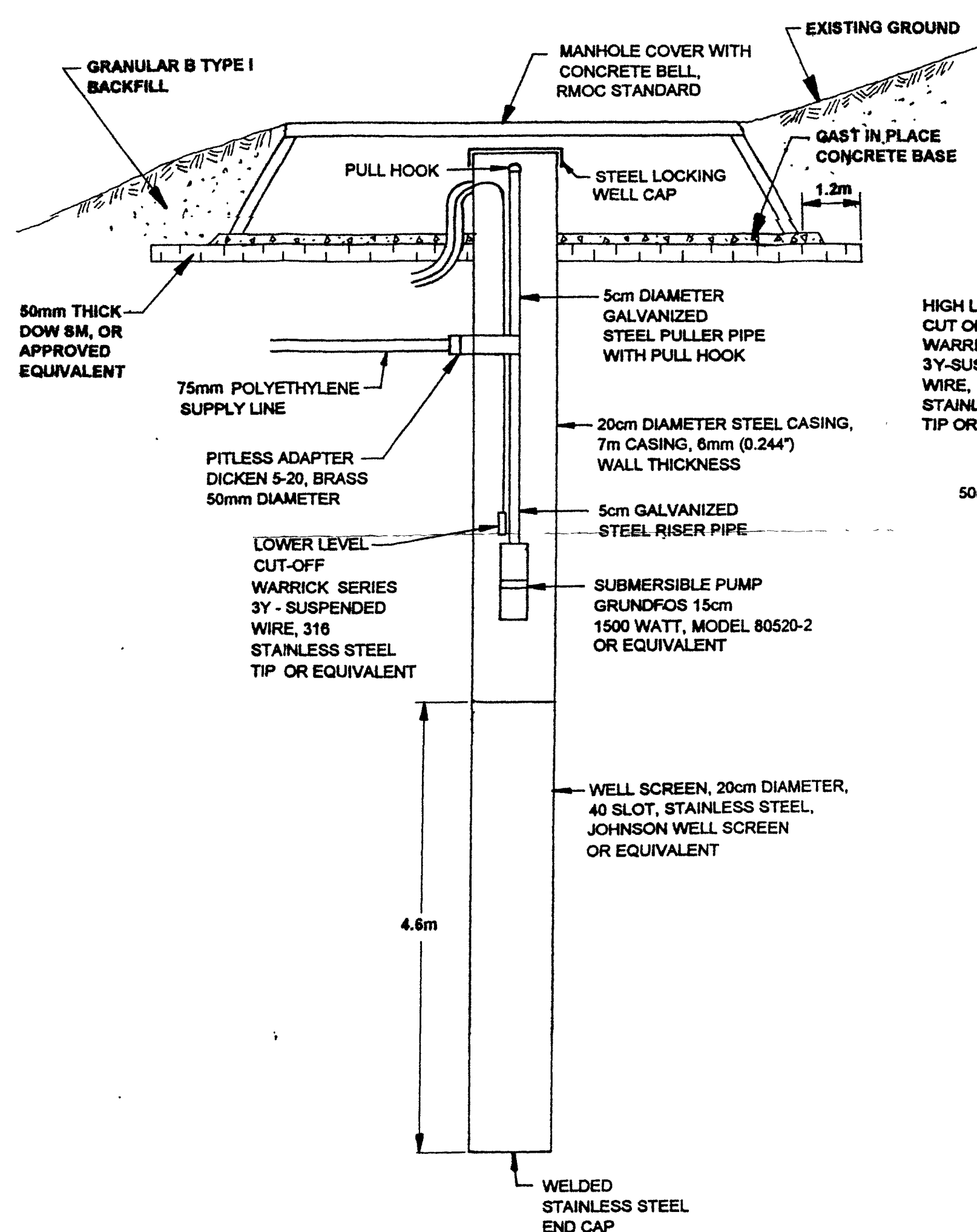


**SITE PLAN**

SCALE 1 : 250

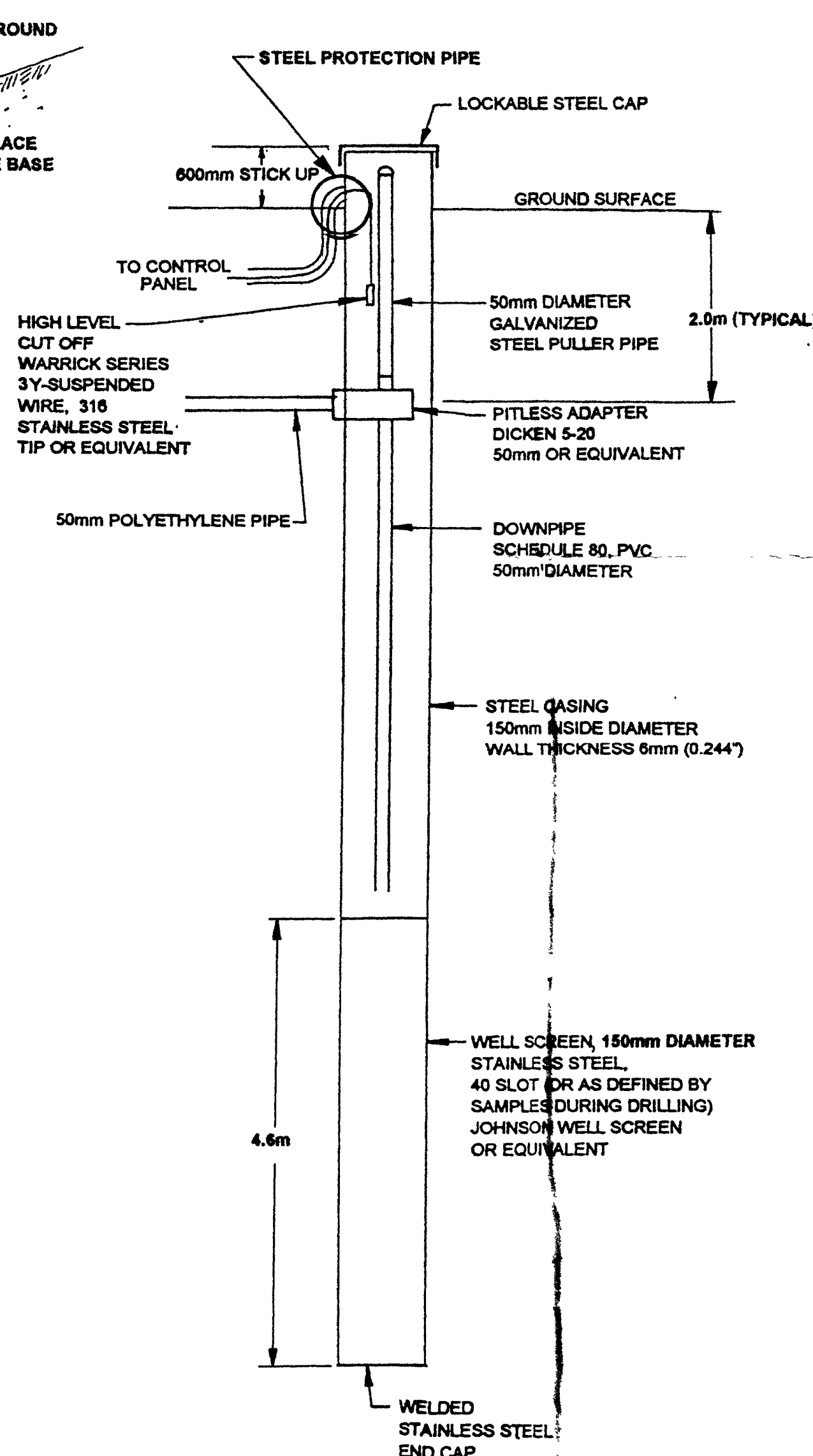
**DETAIL A - PUMPING WELL**

SCALE 1 : 50 VERTICAL

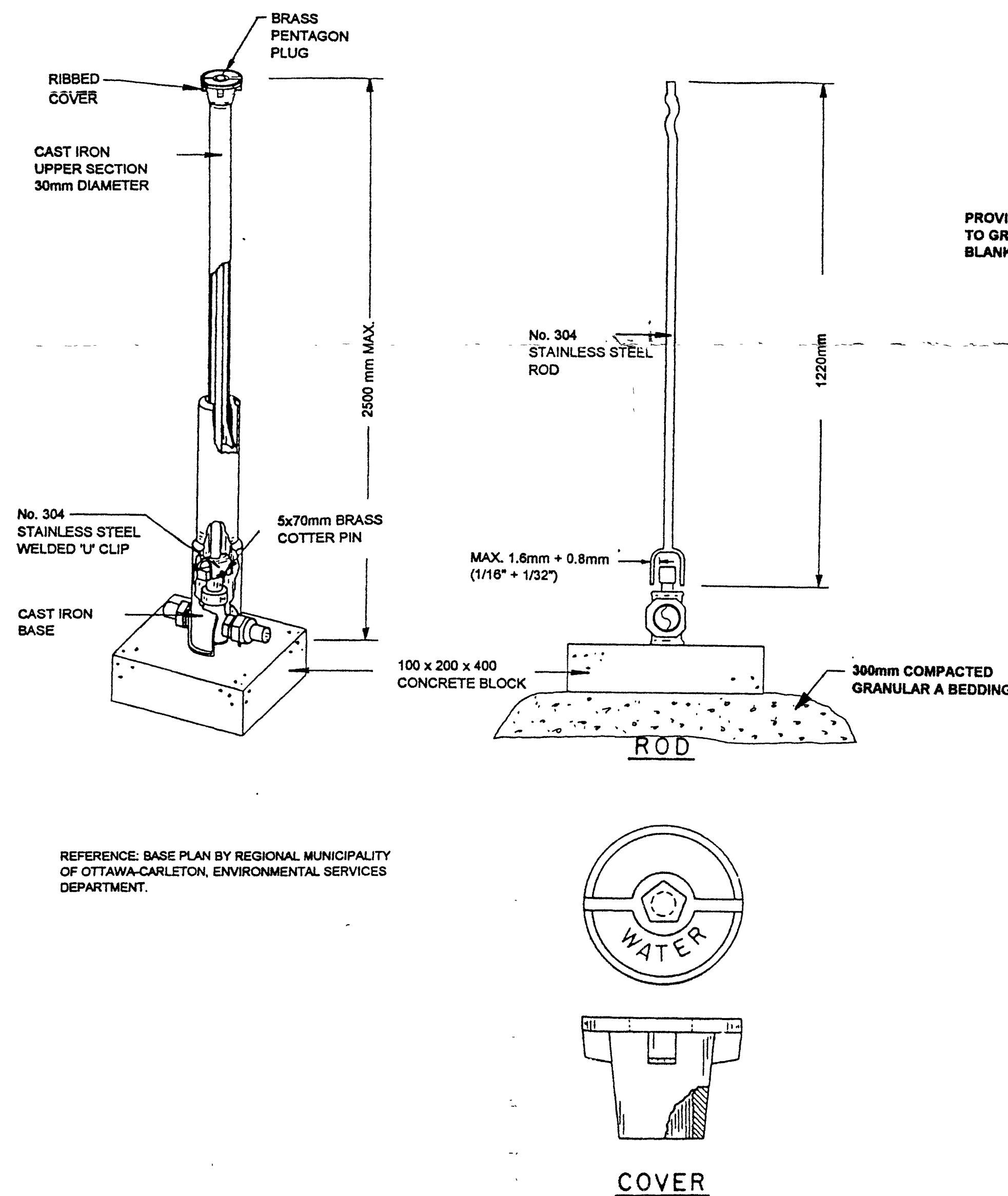


**DETAIL B - RECHARGE WELL**

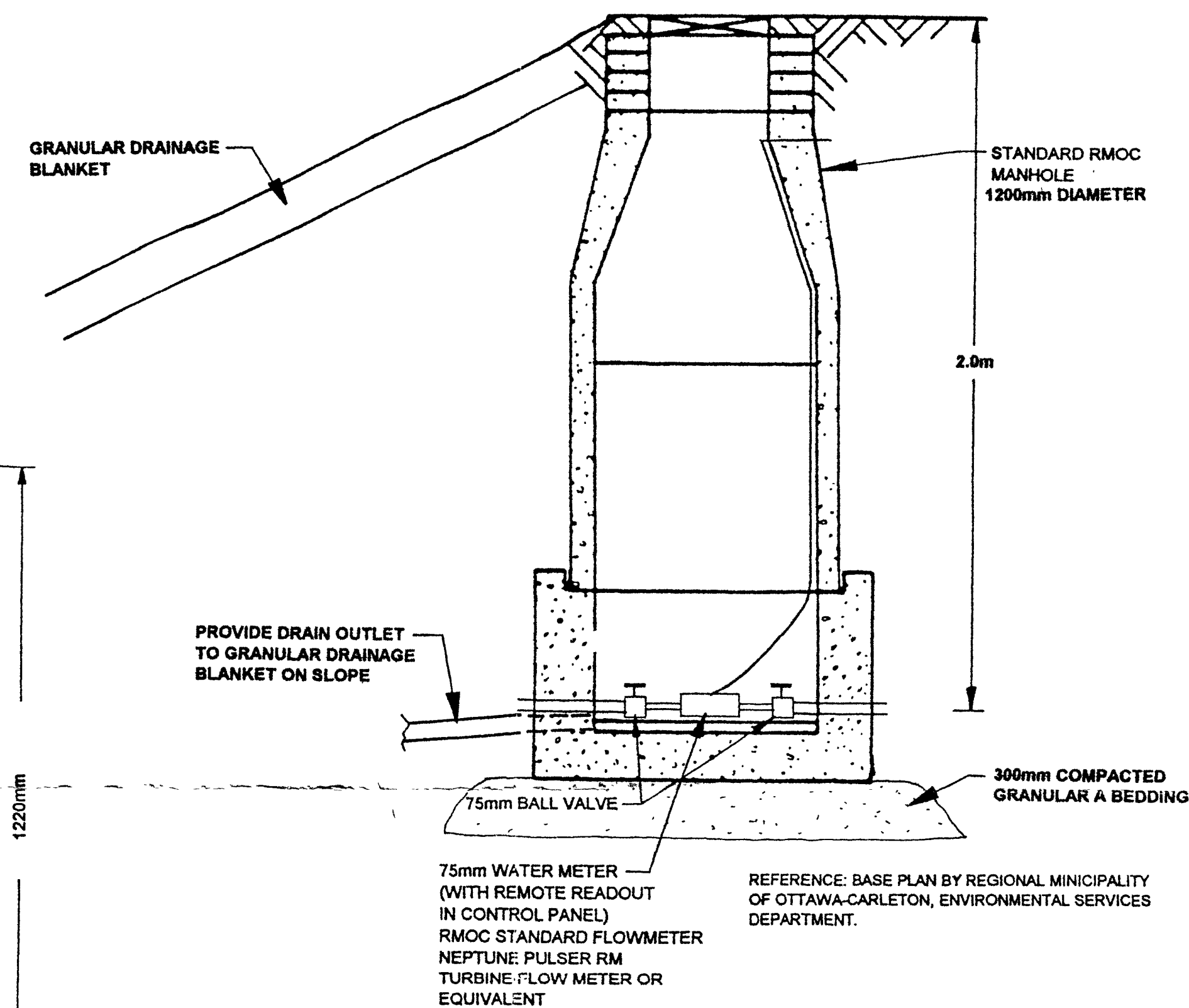
SCALE 1 : 50 VERTICAL



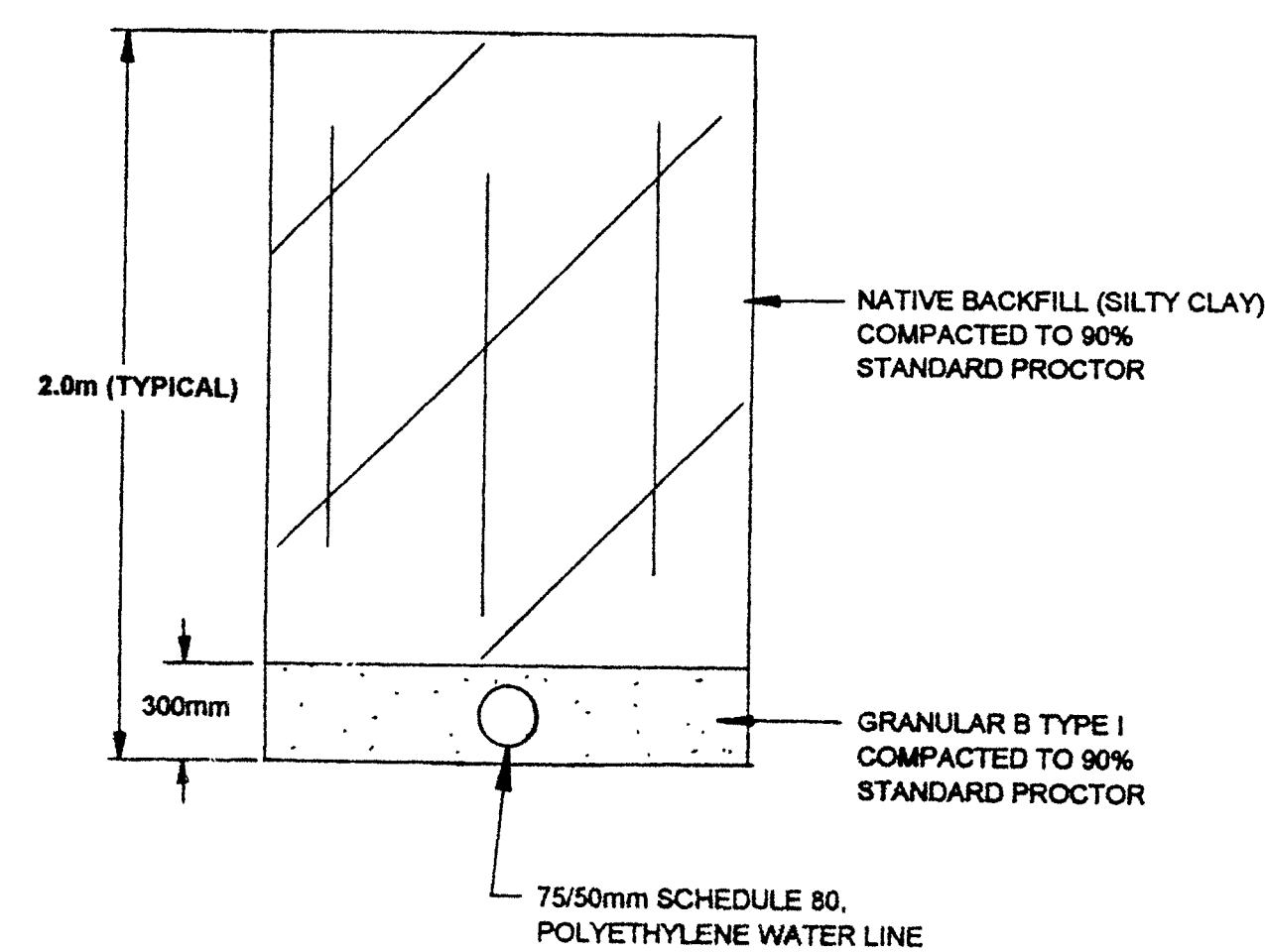
**DETAIL C - SHUT-OFF VALVE (50 AND 75 mm DIAMETER) (RMOC STANDARD WSD-35)**



**DETAIL D - FLOW METER**  
NOT TO SCALE



**DETAIL E - TRENCH BACKFILL**  
SCALE 1 : 25 VERTICAL



METRIC

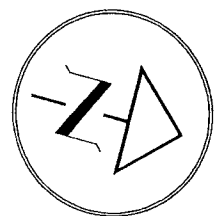
DIMENSIONS ARE IN METRES  
AND/OR MILLIMETRES  
UNLESS OTHERWISE SHOWN

DIST. 9 HWY. 416

CONT No.

WP No.

HIGHWAY 416

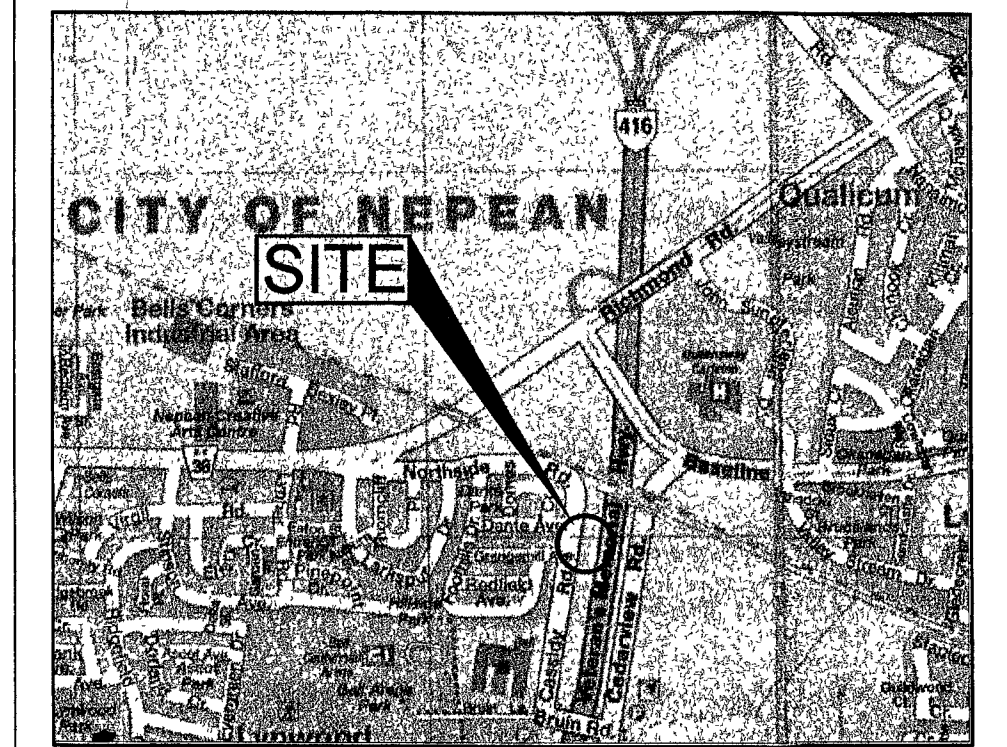


SHEET

BOREHOLE LOCATIONS AND SOIL STRATA



Golder Associates Ltd.  
MISSISSAUGA, ONTARIO, CANADA



KEY PLAN

LEGEND

- Borehole
- Recharge Well
- Seal
- Well Screen
- WL in well screen (June 1, 2001)

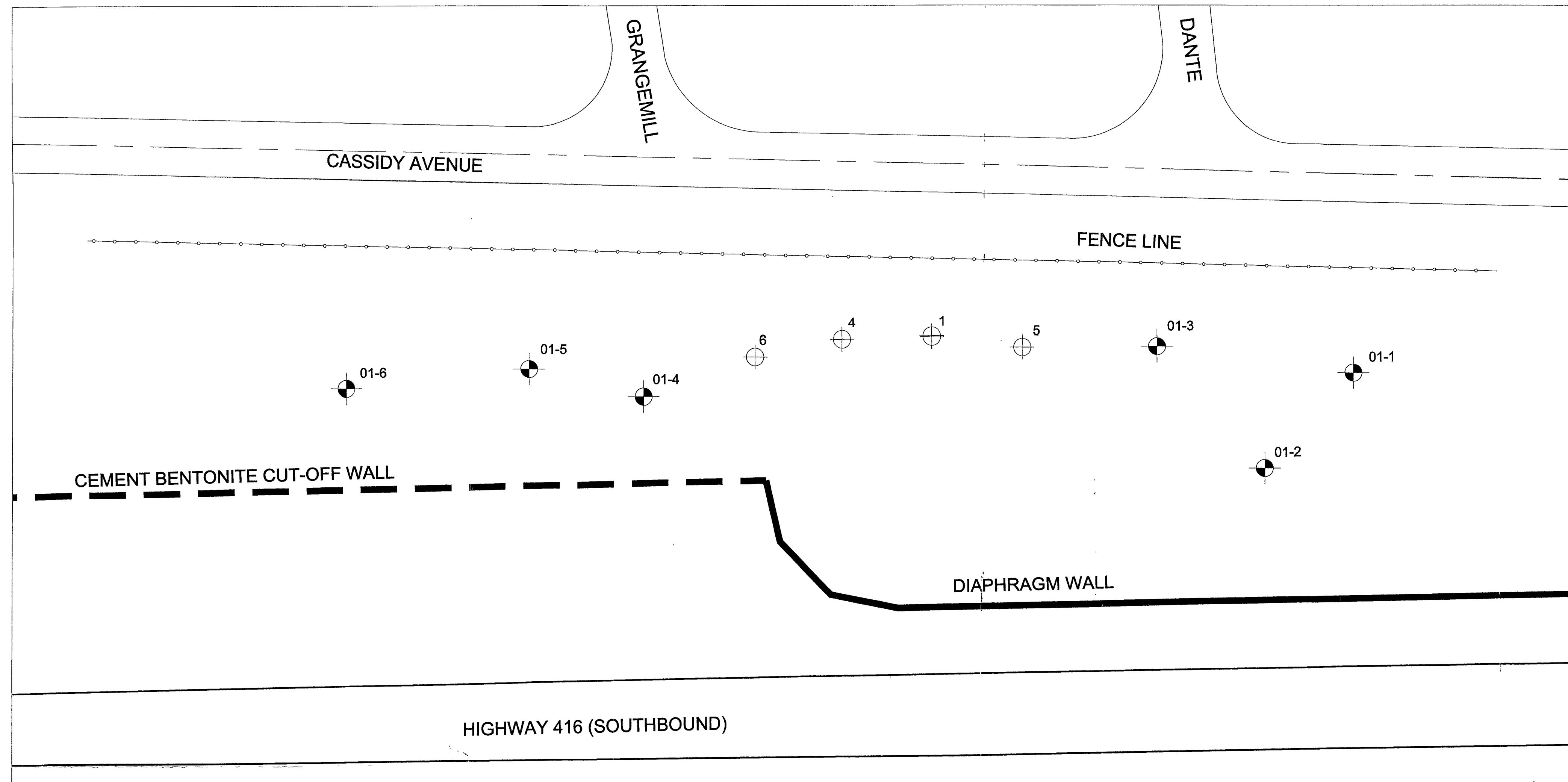
GR SA SI CL Grain Size Distribution (%)  
30 59 10 1

No.	ELEVATION	LOCATION	
		NORTHING	EASTING
01-1	87.32		
01-2	87.41		
01-3	87.61		
01-4	87.70		
01-5	87.89		
01-6	88.09		
1	87.70		
4			
5			
6			

NOTES

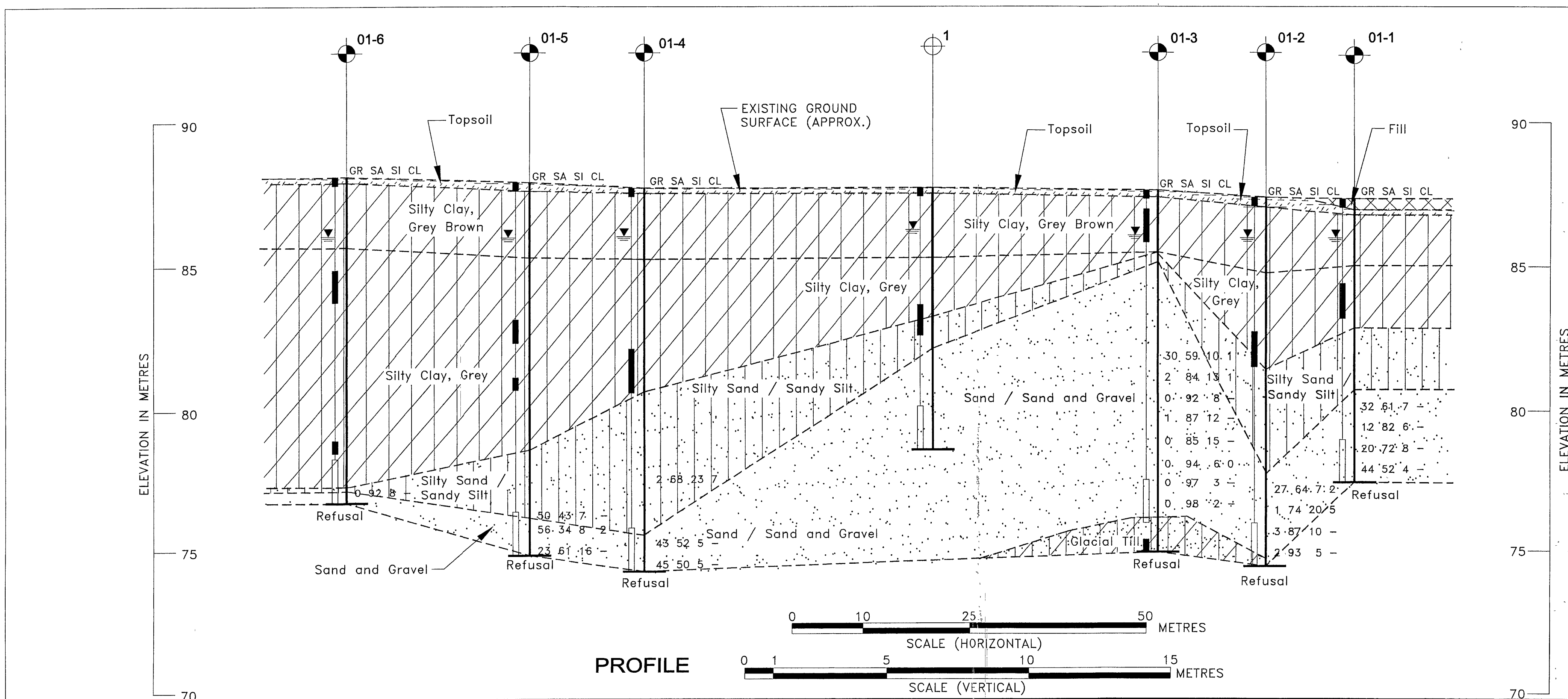
The boundaries between soil strata have been established only at borehole locations. Between boreholes the boundaries are assumed from geological evidence.

Geocres No.			
NO.	DATE	BY	REVISION
HWY. 416		PROJECT NO. 011-2079	DIST. 9
SUBM'D.	CHKD. M.I.C.	DATE: JUNE 2001	SITE:
DRAWN: S.L.	CHKD. F.H.	APPD.	DWG. A



PLAN

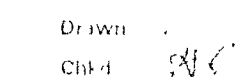
0 10 25 50 METRES  
SCALE



PROFILE

0 10 25 50 METRES  
SCALE (HORIZONTAL)  
0 1 5 10 15 METRES  
SCALE (VERTICAL)





PROJECT: 971-2015

LOCATION: SEE FIGURE 2

SAMPLER HAMMER, 63.5kg; DROP, 760mm

## RECORD OF BOREHOLE 97-13

BORING DATE: April 24-25/97

SHEET 1 OF 3

DATUM: GEODETIC

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT	
								Cu, kPa	nat. V - + rem. V - ⊕ U - ○			Wp	W
0		GROUND SURFACE		87.92									
		TOPSOIL		87.77									
		Very stiff grey-brown SILTY CLAY (weathered crust)		0.15									
1													
2													
3													
4		Grey SILTY CLAY, some sandy layers with depth		84.57 3.35									
5	POWER AUGER 200 mm Dia. Hollow Stem Augers												
6													
7													
8													
9													
10		Compact grey SANDY SILT, some gravel, some fine sand layers/bands		78.53 8.38	1	50 DO	13						
		CONTINUED ON NEXT PAGE			2	50 DO	27						

DATA INPUT: A:\2015-9713.BH

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: PH

CHECKED: mlc

PROJECT: 971-2015

## RECORD OF BOREHOLE 97-13

SHEET 2 OF 3

LOCATION: SEE FIGURE 2

BORING DATE: April 24-25/97

DATUM: GEODETIC

SAMPLER HAMMER, 63.5kg; DROP, 760mm

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, k, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION		
		DESCRIPTION	STRATA PLOT	ELEV. DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH				WATER CONTENT, PERCENT	
								nat.V. - + Cu, kPa	rem.V. - ⊕ 21 41 61 81			Q - ● U - ○	Wp   — W —   W
10	POWER AUGER 200 mm Dia. Hollow Stem Augers	CONTINUED FROM PREVIOUS PAGE			2	50 DO	27						
11				3	50 DO	24							
		Borehole continued by rock coring. Refer to Record of Drillhole 97-13		78.91 11.01									
12													
13													
14													
15													
16													
17													
18													
19													
20		CONTINUED ON NEXT PAGE											

DATA INPUT: A12015-9713.BH

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: PH

CHECKED: MLC

PROJECT: 971-2015

## RECORD OF DRILLHOLE: 97-13

SHEET 2 OF 3

LOCATION: SEE FIGURE 2

DRILLING DATE: April 24-25, 1997

DATUM: GEODETIC

INCLINATION: AZIMUTH:

DRILL RIG:

DRILLING CONTRACTOR:



DEPTH SCALE METRES	DRILLING RECORD	DESCRIPTION	SYMBOLIC LOG	ELEV. DEPTH (m)	RUN NO.	PENETRATION RATE (m/min)	FLUSH % RETURN	FR-FRACTURE CL-CLEAVAGE SH-SHEAR VN-VEIN	F-FAULT J-JOINT P-POLISHED S-SUCKENSIDED	SM-SMOOTH R-ROUGH ST-STEPPED PL-PLANAR	FL-FLEXURED UE-UNEVEN W-WAVY C-CURVED	DIAMETRAL POINT LOAD INDEX (MPa)	NOTES WATER LEVELS INSTRUMENTATION
10		CONTINUED FROM PREVIOUS PAGE											
11		CONTINUED FROM BOREHOLE 97-13											
11		BEDROCK SURFACE		78.91									
11		Dolomitic limestone BEDROCK, thinly to thickly bedded, some shale partings and sandstone seams		11.01	4								Bentonite Seal
12													
13					5								Silica Sand
14					6								
15		END OF DRILLHOLE		72.98 14.94									Top of Pipe at El. 87.82
16													
17													
18													
19													
20		CONTINUED ON NEXT PAGE											

DEPTH SCALE:

1 to 50

Golder Associates

LOGGED: PH

DATE:

CHECKED: MLC

DATA INPUT: A:\2015-9713.CH

PROJECT: 971-2038

LOCATION: SEE FIGURE 2

SAMPLER HAMMER, 63.5kg; DROP, 760mm

## RECORD OF BOREHOLE New 89-8

BORING DATE: April 17, 1997

SHEET 1 OF 2

DATUM: GEODETIC

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, K, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT ELEV. DEPTH (m)	NUMBER TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa nat.V. + Q - ● rem.V. ⊗ U - ○	WATER CONTENT, PERCENT Wp ——— W ——— W				
0	POWER AUGER 200 mm Dia. Hollow Stem Augers	GROUND SURFACE	88.98								Flush Mount Casing  Silica Sand          Native Backfill          Bentonite Seal
		TOPSOIL	0.00								
		Grey-brown SILTY CLAY (weathered crust)	0.30								
1											
2											
3											
4		Grey SILTY CLAY	3.35								
5											
6											
7		Grey SANDY SILT, some gravel (GLACIAL TILL)	7.01								
8											
9											
10											

CONTINUED ON NEXT PAGE

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: PH

CHECKED: MIC

DATA INPUT: A:\2038-988.BH



PROJECT: 971-2036

LOCATION: SEE FIGURE 2

SAMPLER HAMMER, 63.5kg; DROP, 760mm

## RECORD OF BOREHOLE New 89-8

BORING DATE: April 17, 1997

SHEET 2 OF 2

DATUM: GEODETIC

PENETRATION TEST HAMMER, 63.5kg; DROP, 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE		SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m		HYDRAULIC CONDUCTIVITY, K, cm/s		ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION
		DESCRIPTION	STRATA PLOT DEPTH (m)	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH Cu, kPa	WATER CONTENT, PERCENT Wp			
10	POWER AUGER 200 mm Dia. Hollow Stem Augers	CONTINUED FROM PREVIOUS PAGE									
11		Grey banded, SANDY SILT, and medium sand (transition)	78.29 10.67	1	50 DO	12					
12		Compact medium-course SANDS, trace silt	77.37 11.59	2	50 DO	18					
13		END OF BOREHOLE	78.00 12.98								
14											
15											
16											
17											
18											
19											
20											

DATA INPUT: A:\2036-998.BH

Silica  
SandTop of Pipe  
at El. 88.91m

DEPTH SCALE

1 to 50

Golder Associates

LOGGED: PH

CHECKED: M.C.

## METRIC

W P 146-74-00-3

LOCATION Co-ords N 5 021 090; E 358 915

ORIGINATED BY D.J.S.

DIST 9 HWY 416 BOREHOLE TYPE Hollow Stem Auger

COMPILED BY AC

DATUM Geodetic DATE May 10, 1990

CHECKED BY A.C.

[illegible]

# PROFILE REPORT ON SOIL EXPLORATION

PROJECT: 821-2158

## RECORD OF BOREHOLE P4

SHEET 1 OF 1

LOCATION: See Plan

BORING DATE: Nov. 12, 1984

DATUM: Geodetic

SAMPLER HAMMER, 63.6kg; DROP: 760mm

PENETRATION TEST HAMMER, 63.6kg; DROP: 760mm



DEPTH SCALE METRES	BORING METHOD	SOIL PROFILE			SAMPLES		DYNAMIC PENETRATION RESISTANCE, BLOWS/0.3m	HYDRAULIC CONDUCTIVITY, k, cm/s	ADDITIONAL LAB. TESTING	PIEZOMETER OR STANDPIPE INSTALLATION	
		DESCRIPTION	STRATA PLOT	ELEV.	NUMBER	TYPE	BLOWS/0.3m	SHEAR STRENGTH C <sub>u</sub> , kPa			WATER CONTENT, PERCENT W <sub>p</sub>   W   W <sub>L</sub>
				DEPTH (m)							
0	Power Auger 200mm Diam (Hollow Stem)	Ground Surface		88.23							
		Brown sand and gravel (FILL)		0.00							
1				87.47							
				0.78							
2		Very stiff to stiff grey brown SILTY CLAY (Weathered Crust)			1	SS	7				
3				84.88							
				3.35	2	SS	1				
4		Stiff grey SILTY CLAY			3	SS	1				
				83.88							
				4.57	4	SS	1				
5					5	SS	10				
6		Loose to compact grey sandy silt, some gravel and clay (GLACIAL TILL)			6	SS	5				
7					7	SS	27				
8				80.15							
				8.08	8	SS	35				
9					9	SS	36				
10			Dense to very dense grey stratified fine SAND		10	SS	42				
11					11	SS	48				
				78.71							
				11.32							
12		Dense to very dense grey sandy silt, some gravel and clay (GLACIAL TILL)		12	SS	> 100					
			76.22								
			12.01								
		End of Hole Auger Refusal									
13											
14											
15											

DATA INPUT: C:\82P4-158.DRF

DEPTH SCALE

1 to 75

Golder Associates

LOGGED: A.F.C.

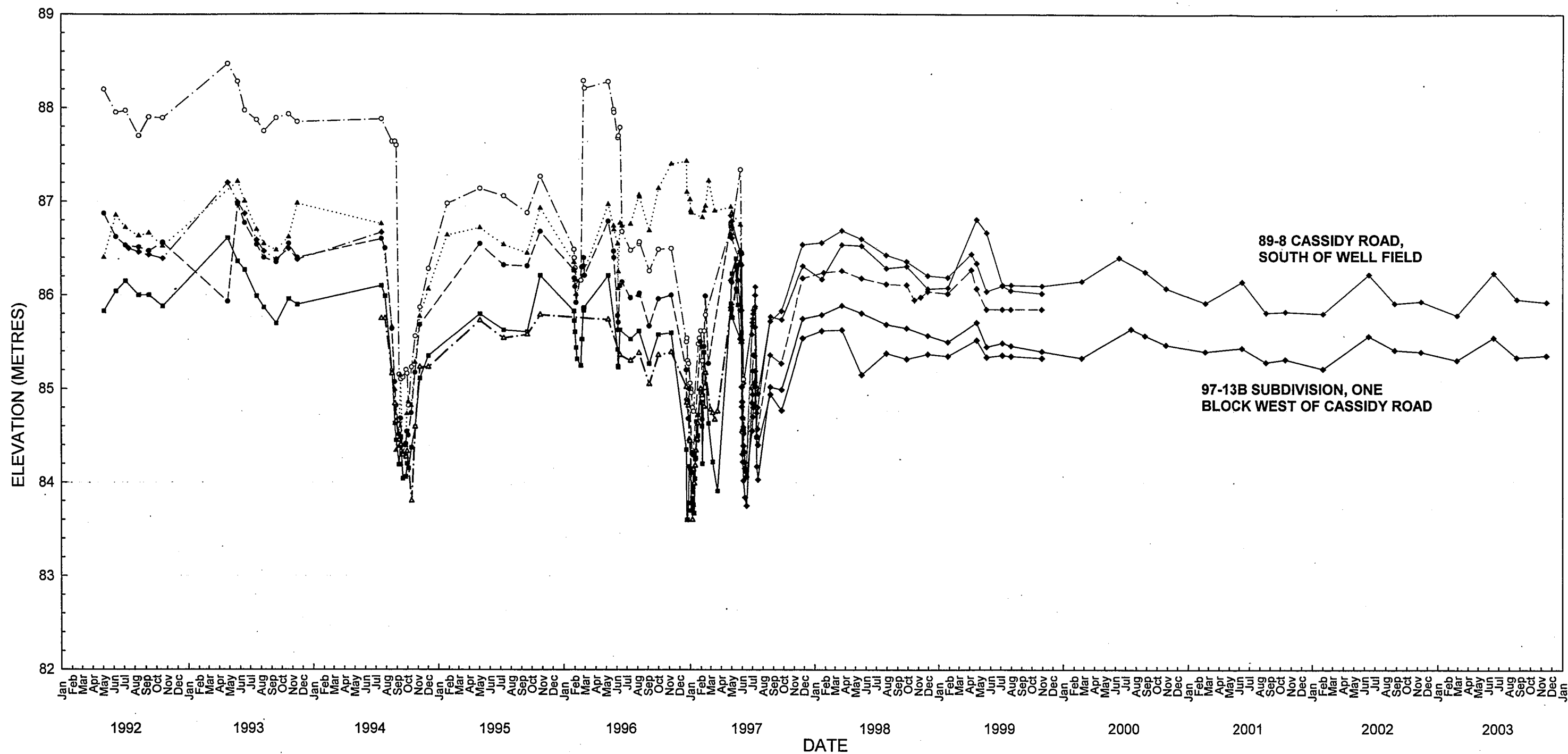
CHECKED: AC

## EXHIBIT 2

### Groundwater Levels Monitoring

Figure 1

Figure 2



- BH 89-6B (Destroyed June 2, 1997)
- BH 89-8
- BH 90-W29A (Destroyed after July 18, 1994)
- BH 89-7 (Destroyed June 13, 1997)
- BH 89-9 (Destroyed June 13, 1997)
- BH 89-2A
- 97-13B (89-6B Replacement)
- New 89-8
- New 89-7
- New 89-9
- New 89-2A

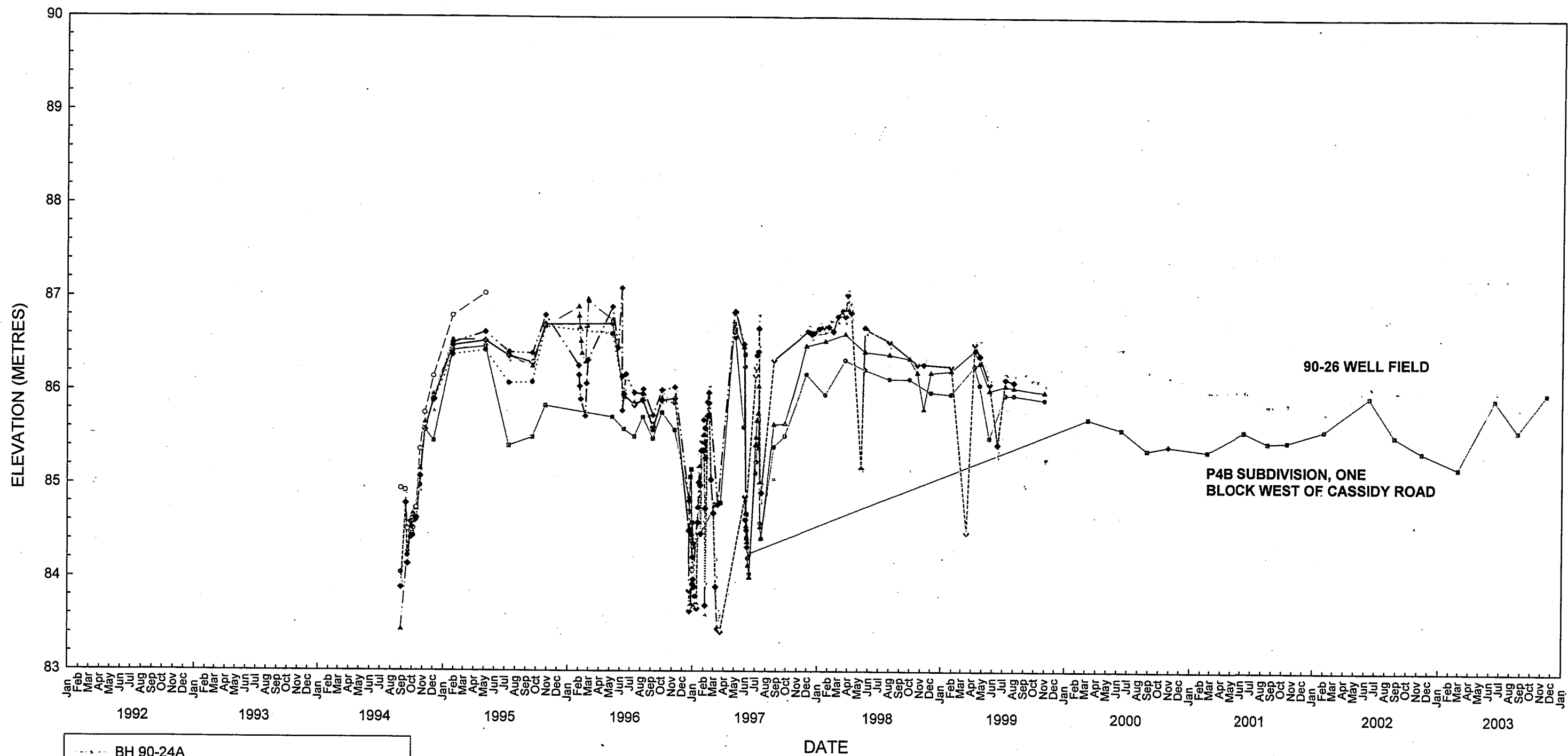


Date: July 2003  
Project: 001-2029

Drawn: MIC  
Chkd:

**GROUNDWATER LEVELS**

**FIGURE 1**



- BH 90-24A
- BH 90-25
- ... BH 90-26
- ▲— OLYMPIC WELL
- BH 89-4
- ... BH 88-4B
- BH P4B
- ◆— BH P5 (Destroyed June 13, 1997)
- New P4B
- ▲— New P5



Date: July 2003  
Project: 001-2029

Drawn: MIC  
Chkd: *WLC*

GROUNDWATER LEVELS

FIGURE 2