926-2-148

BROWN, ERDMAN & ASSOCIATES LTD.
1401 BEWICKE AVENUE, NORTH VANCOUVER, BRITISH COLUMBIA V7M 3C7
TELEPHONE 986-1557

78-082

December 4th, 1978

Macleod Geotechnical Ltd.
1451 Marine Drive
West Vancouver, B. C.
V7T 1B8

Attention: Mr. Graeme Macleod, P. Eng.

Subject: New Westminster Courthouse
B.C.B.C. Project No. 0309
Permanent Relief Wells

Dear Sirs:

The 12 permanent relief wells and two permanent piezometers have been installed. Attached please find the driller's logs of these holes.

Analysis of the temporary dewatering system allows us to compare the criteria used for design with the actual criteria. After 123 days (to November 21st, 1978) or 177,120 minutes of operation the drawdown water level in the central areas of the excavation should have been at an elevation of 60 feet. The actual elevation varied (on November 21st, 1978) between 60.9 and 59.8 feet. The design discharge rate was 54 USgpm while the average discharge rate over the 123 day period was 67 USgpm (11,885,000 gallons divided by 177,120 minutes).

The closeness (to a geologist) of the design and actual figures indicates that the aquifer coefficients used to design the temporary dewatering system are essentially representative of the water-bearing zones within and adjacent to the subject site.

The comparisons made above leads to confidence in the permanent relief well system because the aquifer coefficients used to design the temporary dewatering system were used to design the permanent relief well system. Pertinent measurements taken on November 21st, 1978 by H. W. Reed of this office are plotted on the attached semi-logarithmic graph. This graph plots the water level curves between dewatering wells D5 and D6 and piezometer 8

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through relief well R3. These are actual field curves which are then rotated about the point of zero drawdown (assumed to be at elevation 100 feet) to the elevation of the bleeder pipes for the permanent relief wells at elevation 64 feet. This rotated curve indicates that the greatest elevation of piezometric (water pressure) head on the lowest floor slab (elevation 70 feet) should range from elevation 77 to 73 feet with the most probable elevation at 76 feet. These figures are for the pressure head at a point between the most widely spaced relief wells R4 to R6.

The above assumes no drainage into the trenches containing the perforated pipes that connect the relief wells to the sewer. Since trenches observed to date cut into the sands at the top of the water-bearing zone (dry under dewatered conditions) the trenches will aid in the keeping of the water pressure on the lowest floor slab below the elevations indicated by the attached curves.

These curves also make no allowance for well loss in the plotted water levels for D5 and D6. A few feet of well loss can be expected so that, for example, the curve through D6 and R3 will be flatter, the rotating point at elevation 100 feet will shift to the right and the expected water level at 30 feet distance between wells will be below those shown.

These two features should keep the maximum water pressure head on the lowest floor slab to the design elevation of 74 feet. The 74 foot elevation level is most probably conservative. Observed field conditions in those trenches dug to date show that the top of the water-bearing zone lies at a maximum elevation of 65 feet. This suggests that the lowest floor slab should be able to withstand a water pressure head to a maximum elevation of 80 feet.

Unfortunately, the writer cannot devise a test for the relief wells until the floor slab is poured and the walls are built (at least part way) around the northern parts of the site. It would be foolhardy to turn off the temporary dewatering system before these structures are in place because the sediments along the sides of the excavation could become water saturated and loss of ground could occur.

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In conclusion, based upon data presently available to us, we conclude that the relief well system as designed will keep the water pressure on the lowest floor slab at or below elevation 74 feet. This conclusion is based upon:

1. The successful operation of the dewatering system which has lowered the water level in the water-bearing zone beneath the excavation to within a foot of the design level.

2. The trenches cut into the top of the water-bearing zone so that water will seep into the trenches between wells wherever the water levels tend to exceed elevation 65 feet.

3. The curves used to analyse the future behaviour of the relief wells are conservative in that well loss is ignored.

The premanent relief well system should be tested as soon as it is safe and feasible to do so.

If any of the above needs amplification or clarification please do not hesitate to call.

Yours truly

BROWN, ERDMAN & ASSOCIATES LTD.

W. L. BROWN, P. Eng.

WLB/sa
cc: Poole Construction Ltd.
Attention: Messrs. Fraser & Langevin
Encls:

LOGS OF RELIEF WELLS

	Depth (feet)	Description (Driller's Logs)	Elevation (feet)
R1	0 - 18	Silt and sand.	69 - 51
	18 - 24	Silt and sand, some gravel.	51 - 45
	24 - 25	Large rock.	45 - 44
	25 - 42.5	Silt and sand, some gravel, open hole from 36'.	44 - 33 44 - 26.5
R2	0 - 16	Sandy till.	60 - 53
	16 - 28	Sand and gravel.	53 - 41
	28 - 37	Sandy till, some WB.	41 - 32
	37 - 42	Sand and gravel, WB.	32 - 27
R3	0 - 18	Sand, silt, clay.	69 - 51
	18 - 35	Sand and gravel.	51 - 34
	35 - 42	Gravelly till.	34 - 27
R4	0 - 25	Silt and sand.	69 - 44
	25 - 27	Sand, some silt, some WB.	44 - 42
	27 - 29	Sandy silt.	42 - 40
	29 - 41	Hard packed gravel and sand.	40 - 28
	41 - 42.5	Fine to medium sand, heaving.	28 - 26.5
R5	0 - 17	Silt and sand.	69 - 52
	17 - 19	Boulder.	52 - 50
	19 - 26	Silt and sand.	50 - 43
	26 - 42.5	Silt, sand, some gravel.	43 - 26.5
R6	0 - 30	Silt and sand.	69 - 39
	30 - 36	Till.	39 - 33
	36 - 42.5	Coarse gravel.	33 - 26.5

LOGS OF RELIEF WELLS

	Depth (feet)	Description (Driller's Logs)	Elevation (feet)
R1	0 - 18	Silt and sand.	69 - 51
	18 - 24	Silt and sand, some gravel.	51 - 45
	24 - 25	Large rock.	45 - 44
	25 - 42.5	Silt and sand, some gravel, open hole from 36'.	44 - 33 44 - 26.5
R2	0 - 16	Sandy till.	60 - 53
	16 - 28	Sand and gravel.	53 - 41
	28 - 37	Sandy till, some WB.	41 - 32
	37 - 42	Sand and gravel, WB.	32 - 27
R3	0 - 18	Sand, silt, clay.	69 - 51
	18 - 35	Sand and gravel.	51 - 34
	35 - 42	Gravelly till.	34 - 27
R4	0 - 25	Silt and sand.	69 - 44
	25 - 27	Sand, some silt, some WB.	44 - 42
	27 - 29	Sandy silt.	42 - 40
	29 - 41	Hard packed gravel and sand.	40 - 28
	41 - 42.5	Fine to medium sand, heaving.	28 - 26.5
R5	0 - 17	Silt and sand.	69 - 52
	17 - 19	Boulder.	52 - 50
	19 - 26	Silt and sand.	50 - 43
	26 - 42.5	Silt, sand, some gravel.	43 - 26.5
R6	0 - 30	Silt and sand.	69 - 39
	30 - 36	Till.	39 - 33
	36 - 42.5	Coarse gravel.	33 - 26.5

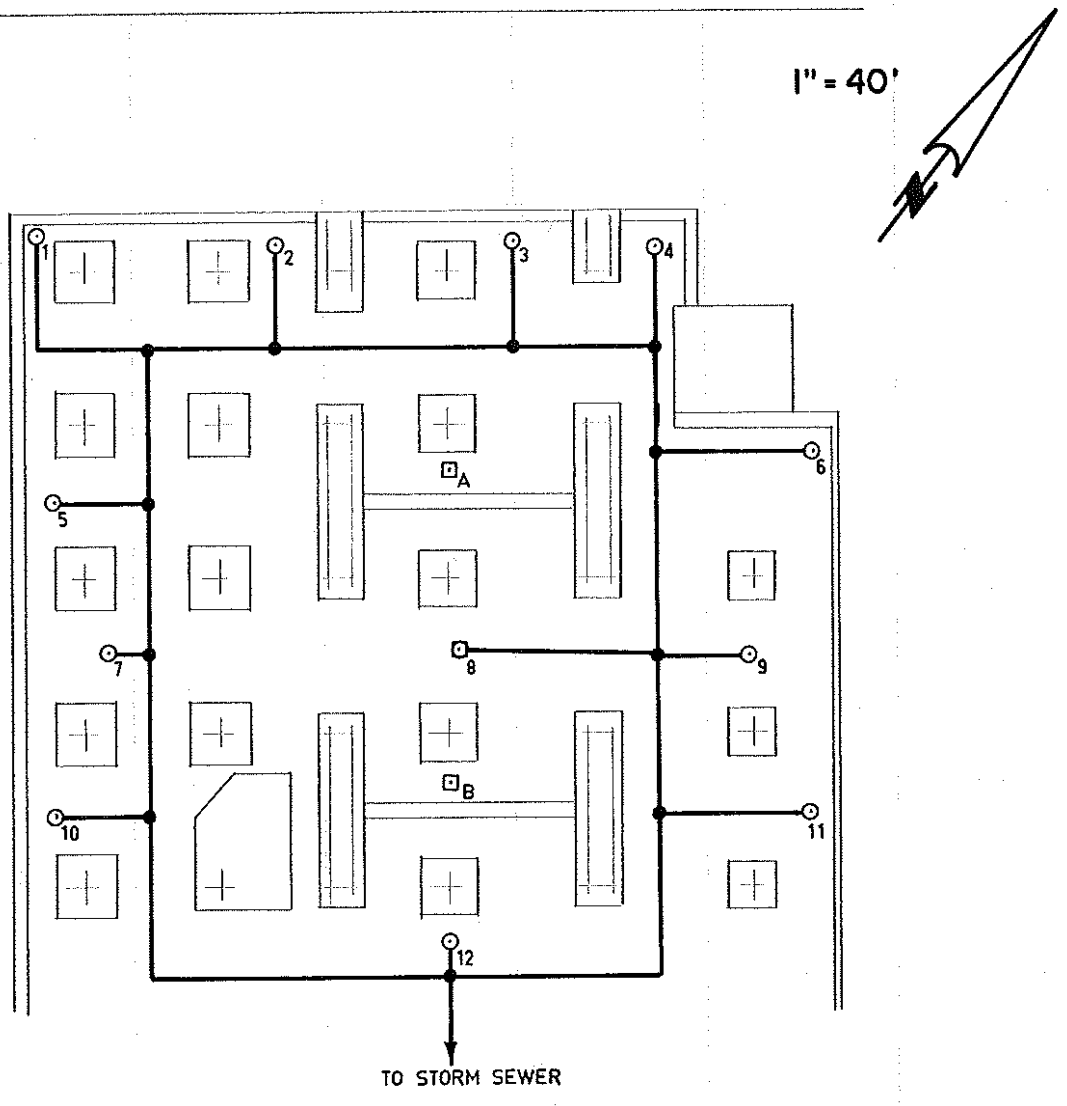
	Depth (feet)	Description (Driller's Logs)	Elevation (feet)
R7	0 - 18	Silt and sand.	69 - 51
	18 - 24	Silt and sand, some WB.	51 - 45
	24 - 35	Silt and sand.	45 - 34
	35 - 38	Silty sand and gravel, some WB.	34 - 31
	38 - 42.5	Dry sand and gravel.	31 - 26.5
R8	0 - 14	Silty sand and clay.	69 - 55
	14 - 22	Gravelly till.	55 - 47
	22 - 35	Till.	47 - 34
	35 - 42	Sand and gravelly till.	34 - 27
R9	0 - 30	Sand and silt.	69 - 39
	30 - 42	Gravel.	39 - 27
R10	0 - 23	Silt and sand.	69 - 46
	23 - 26	Silt and sand, some WB.	46 - 43
	26 - 36	Silt, sand, some gravel.	43 - 33
	36 - 42.5	Hard silt and sand.	33 - 26.5
R11	0 - 10	Sand, silt, clay.	69 - 59
	10 - 20	Till, some gravel.	59 - 49
	20 - 23	Silty sand and gravel, some WB.	49 - 46
	23 - 33	Gravelly till, hard.	46 - 36
	33 - 42.5	Gravelly till, looser, some WB.	36 - 26.5
R12	0 - 20	Silty sand, clay.	69 - 49
	20 - 34	Till, some WB.	49 - 33
	34 - 43	Gravel, WB.	33 - 26

LOGS OF RELIEF WELLS

	Depth (feet)	Description (Driller's Logs)	Elevation (feet)
PA	0 - 18	Silt and fine sand.	69 - 51
	18 - 40	Sandy till.	51 - 29
	40 - 42	Compact sand and gravel, some WB.	29 - 27
PB	0 - 11	Sand and silt.	69 - 58
	11 - 18	Gravel and cobbles.	58 - 51
	18 - 34	Hard coarse gravel.	51 - 33
	34 - 42.5	Hard coarse angular gravel.	33 - 26.5
Elevator Shaft - NE Corner			
	0 - 32	Sand and silt.	69 - 37
	32 - 36	Sand and gravel.	37 - 33

Note: WB = water-bearing.

Underlined elevation = water-bearing sand and gravel.



REFERENCE

- ⊙1 RELIEF WELL CONSTRUCTED IN EXCAVATION FROM ELEV. 66 FT.
- ⊡A PERMANENT PIEZOMETER LOCATION (DESIGN AS IN RELIEF WELLS)
- FOOTING
- WALL FOOTING
- BLEEDER PIPE WITH CLEANOUT PORT AT NODE TO ELEV. 68 FT.

NOTES

ALL RELIEF WELLS TO FREE FLOW AT APPROX. 3 USGPM INTO RELIEF BLEEDER PIPE WITH INVERT AT ELEV. 62 FT. TWELVE RELIEF WELLS ARE DESIGNED TO MAINTAIN MAXIMUM PRESSURE HEAD BELOW ELEV. 70 FT. PATTERN MAY BE ALTERED AT THE DISCRETION OF THE ENGINEER. RELIEF WELL DETAILS SHOWN ON DWG. 2.

BRITISH COLUMBIA BUILDING CORPORATION
NEW WESTMINSTER COURTHOUSE

FOUNDATION PLAN AT ELEVATION 66 FEET SHOWING RELIEF WELL LOCATIONS

APRIL 1978
78 082
HWR

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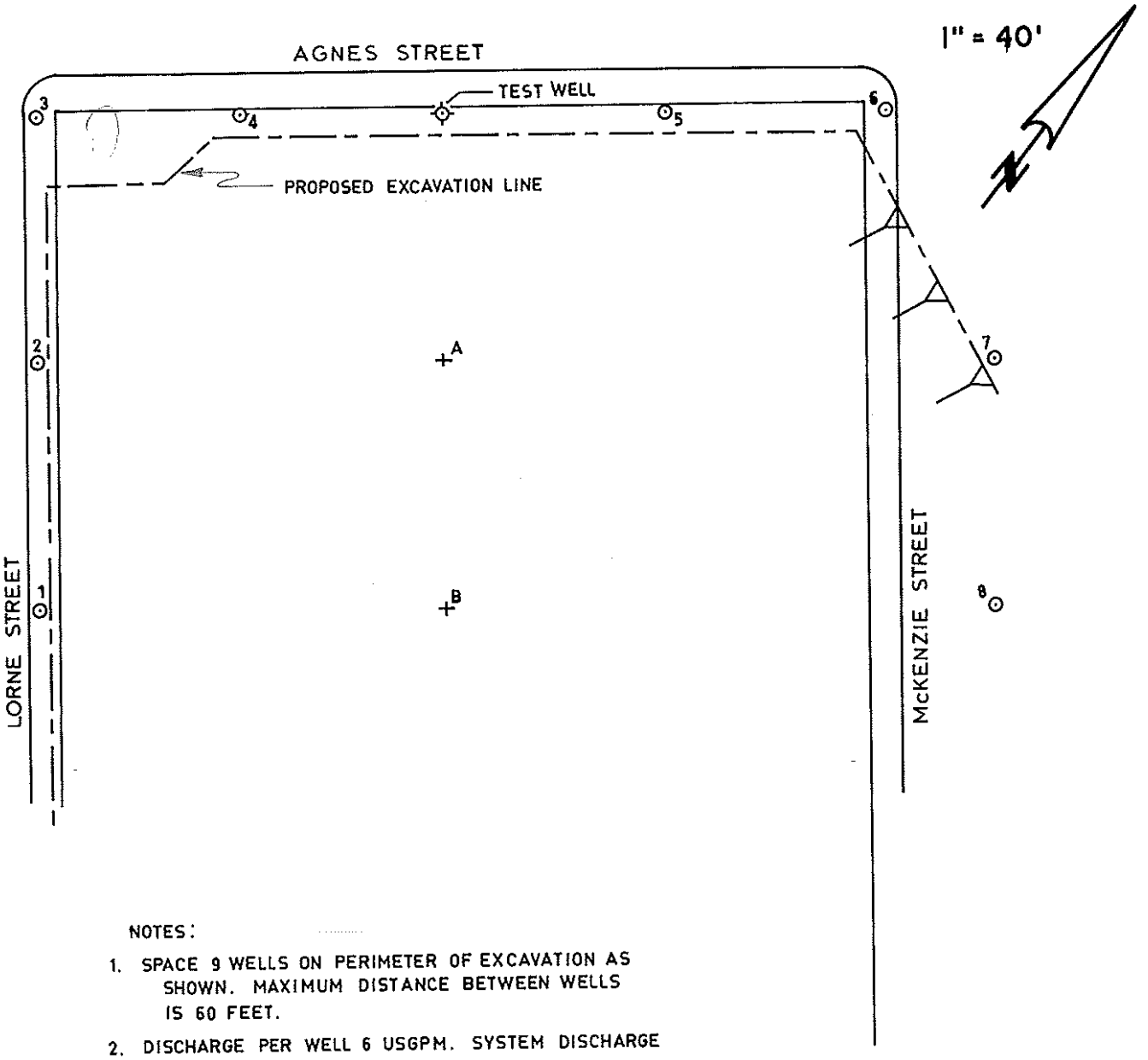
1
DWG.



NOTES:

1. SPACE 9 WELLS ON PERIMETER OF EXCAVATION AS SHOWN. MAXIMUM DISTANCE BETWEEN WELLS IS 60 FEET.
2. DISCHARGE PER WELL 6 USGPM. SYSTEM DISCHARGE 54 USGPM
3. DRAWDOWN REQUIRED - SITE A 46 FT.
   SITE B 35 FT.

BRITISH COLUMBIA BUILDING CORPORATION

DEWATERING WELL LAYOUT
NEW WESTMINSTER COURTHOUSE

APRIL 1978
78-082 HWR

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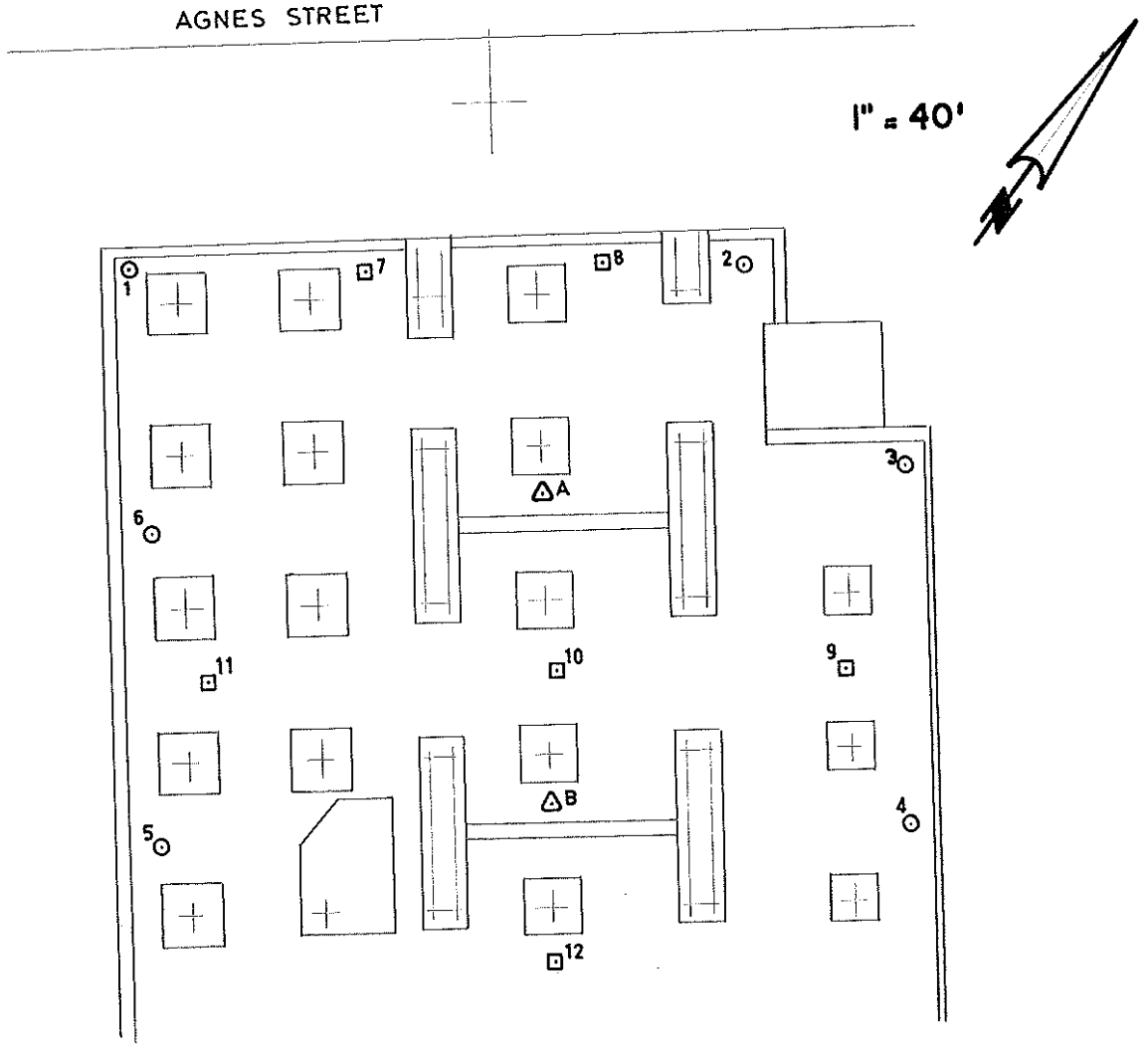
1
Dwg.



REFERENCE

2⊙ DEWATERING WELL CONVERTED TO RELIEF WELL

9⊡ RELIEF WELL CONSTRUCTED IN EXCAVATION

△A PERMANENT PIEZOMETER LOCATION

NOTES

ALL RELIEF WELLS TO FREE FLOW AT APPROXIMATELY 3 USGPM INTO RELIEF BLEEDER AT ELEVATION 62 FEET. TWELVE RELIEF WELLS ARE DESIGNED TO MAINTAIN MAXIMUM PRESSURE HEAD BELOW ELEVATION 70 FEET.

BRITISH COLUMBIA BUILDING CORPORATION

FOUNDATION PLAN ELEVATION 66 FEET WITH RELIEF WELL LOCATIONS

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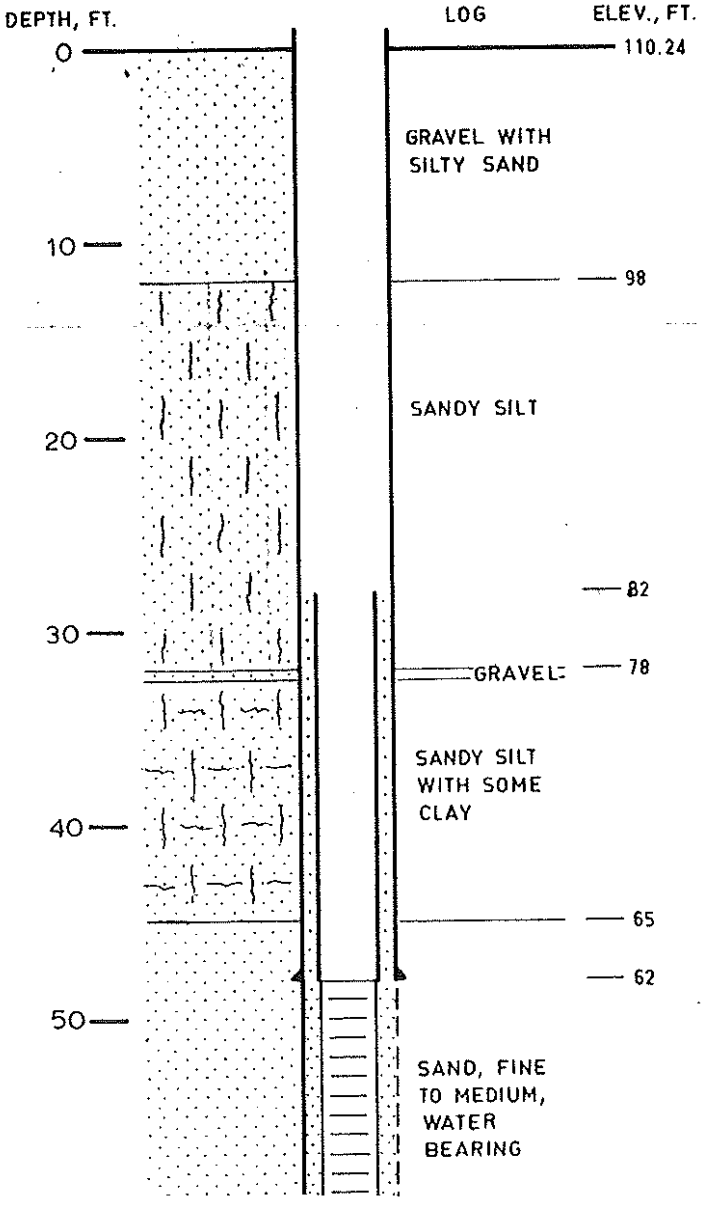
4
Dwg.



CONSTRUCTION

- HOLE 8 IN. DIAMETER DRILLED AND CASED TO 105 FT. DEPTH.
- STAINLESS STEEL WELL SCREEN SET BETWEEN DEPTHS OF 48 FT. AND 70 FT. NOMINAL DIAMETER 6 IN., SLOT SIZE 0.020 IN. RISER ON TOP OF SCREEN 20 FEET LONG.
- ANNULAR SPACE BETWEEN SCREEN AND CASING PACKED WITH F-16 FILTER SAND.
- CASING WITHDRAWN TO 48 FT. DEPTH TO EXPOSE SCREEN