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**Groundwater Development
for
SIDNEY WATERWORKS DISTRICT
Well No. 12
Sidney, British Columbia**

**R.B. Erdman
W.L. Brown, P.Eng.**

November, 1968

INTRODUCTION

This report describes the construction and testing of a new 6 $\frac{1}{2}$ -inch diameter well which is now known as Sidney Waterworks District Well No. 12. The well is located near the intersection of McTavish Road and Canora Road on Lot 7, owned by the District.

The well was drilled to test the water-bearing capacity of the "Eastern Fracture Zone" as described in our report dated November, 1967.

OPERATIONS

The well was drilled by the air-rotary method in three shifts to a total depth of 300 feet. Two casings were used in an attempt to shut out the water flow from the overlying sands and gravels. An outside string of 10-inch diameter casing was set to a depth of 45 feet. Unfortunately, the surface of bedrock was sloping so that the seal could not be effected. A second string of 6-inch diameter casing was then set to 46 feet. For a time the seal was effective but was broken by further drilling and development.

Drilling proceeded in open hole and the first bedrock water was encountered in a fracture zone between depths of 73 and 88 feet. The first significant flow was obtained between depths of 119 and 124 feet. When the well had reached a depth of 242 feet the total flow of water blown from the well was 130 U.S. gpm. Drilling continued to 300 feet with no significant increase in production. The major fracture zone was therefore encountered between depths of 119 and 242 feet. The penetrated vertical thickness of the zone is 123 feet. Since the dip or inclination of the zone is unknown the true thickness is unknown. However, if it has an 80° dip as indicated by the straightness of the zone as it crosses hills and by Well No. 11, the fracture zone will be approximately 30 feet thick. However, numerous 25-30 foot thick fracture zones probably form an overall zone several hundreds of feet wide. Each fracture zone would be sub-parallel to its neighbour. The thickness of the intervening non-fractured zones are presently unknown but cross interconnecting fractures must exist.

The well was cased, sealed, cleaned and grouted by a cable tool rig. The surface casing was cemented in place in the following manner.

1. Sand between the 10- and 6-inch casings was removed by jetting with water under pressure.
2. 8-inch casing was threaded over the 6-inch so as to not loose the hole.
3. The 6-inch casing was removed.
4. The 6-inch hole at the top of bedrock was reamed using an 8-inch rock bit and the 8-inch casing was driven to a depth of 47 feet at which point it was tight into the rock.
5. The well was then cleaned of rock debris and cuttings to a depth of 297 feet. This was very necessary because large bridges of debris closed off the hole at depths of 145, 172 and 205 feet. (We may have been pushing the same bridge down the hole).
6. The annular space between the 8-inch and 10-inch casings was sealed with four sacks of cement slurry under a pressure of 200 psi.
7. A grout pipe was placed outside the 10-inch casing and the broken ground was grouted with five sacks of cement slurry. After the grouting all water flows between and outside of the casings were shut off.
8. Six sacks of regular concrete were used to fill the rest of the voids outside of the 10-inch.
9. During grouting the well was pumped for four hours at a rate of 43 U.S. gpm from a pumping level of seven feet below ground surface.
10. The well now flows at approximately 6 U.S. gpm through a $\frac{1}{2}$ -inch nipple.

RESULTS

The enclosed log of Well No. 12 shows the salient features of the well. The sizes and amounts of casing, the top of bedrock at 46 feet and the location of the various fractures.

The results of the four hours of pumping during grouting operation indicate a specific capacity of 5 U.S. gpm per foot of drawdown. This would indicate a transmissibility of 5,000 U.S. gpd/foot which is markedly different from the 250 U.S. gpd/foot of Well No. 11. The four-hour specific capacity of 5 U.S. gpm indicates that the pumping level in the well should be above 40 feet when the well is pumped at 100 U.S. gpm during low water next fall.

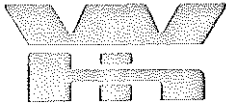
CONCLUSIONS and RECOMMENDATIONS

1. Sidney Waterworks District Well No. 12 located on our eastern fracture zone (our November 1967 report) has produced approximately 130 U.S. gpm of potable water when pumped by air while cleaning the well after it reached a depth of 300 feet. During grouting it was pumped at 43 U.S. gpm with a pumping water level of only seven feet below ground surface.
2. The specific capacity of the well is indicated to be five U.S. gpm per foot of drawdown. ??
short term
only
P.D.
3. The well is free flowing at an estimated six U.S. gpm at ground surface.
4. The actual behaviour of the well can only be illucidated after several months of pumping at a known rate.
5. A new pump should be purchased with the following characteristics.

Type	- submersible
Outside Diameter	- maximum 5-7/8 inches
Suction setting	- 47 feet to start perhaps 250 feet later
Discharge	- 100 U.S. gpm
Total Dynamic Head	- 350 feet

6. The well should be pumped at a uniform rate for several months and water level measurements should be taken weekly. It is hoped that a discharge of 100 gpm could be maintained.

7. Both bedrock wells No. 11 and 12 should be pumped continuously and the other wells rested if demand is too low. The water level measurements should be continued on No. 11.



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COAST ELDRIDGE
PROFESSIONAL SERVICES DIVISION

125 East 4th Ave., Vancouver 10, B. C. Phone 876-4111 — Telex 14-50353

REPORT OF: Chemical Analysis
AT Vancouver Laboratory
PROJECT: Water Sample
REPORTED TO: Robinson Roberts & Brown
4421 Patterdale Street
North Vancouver, B.C.

FILE NO C-3-1-2-69-295-A
DATE November 18, 1968
REPORT NO
ORDER NO:

We have analyzed the water samples submitted to us on November 4, 1968 and report as hereunder:

SAMPLE IDENTIFICATION

Sample No. 1 - "Sydney W.W. District Pw # 12"

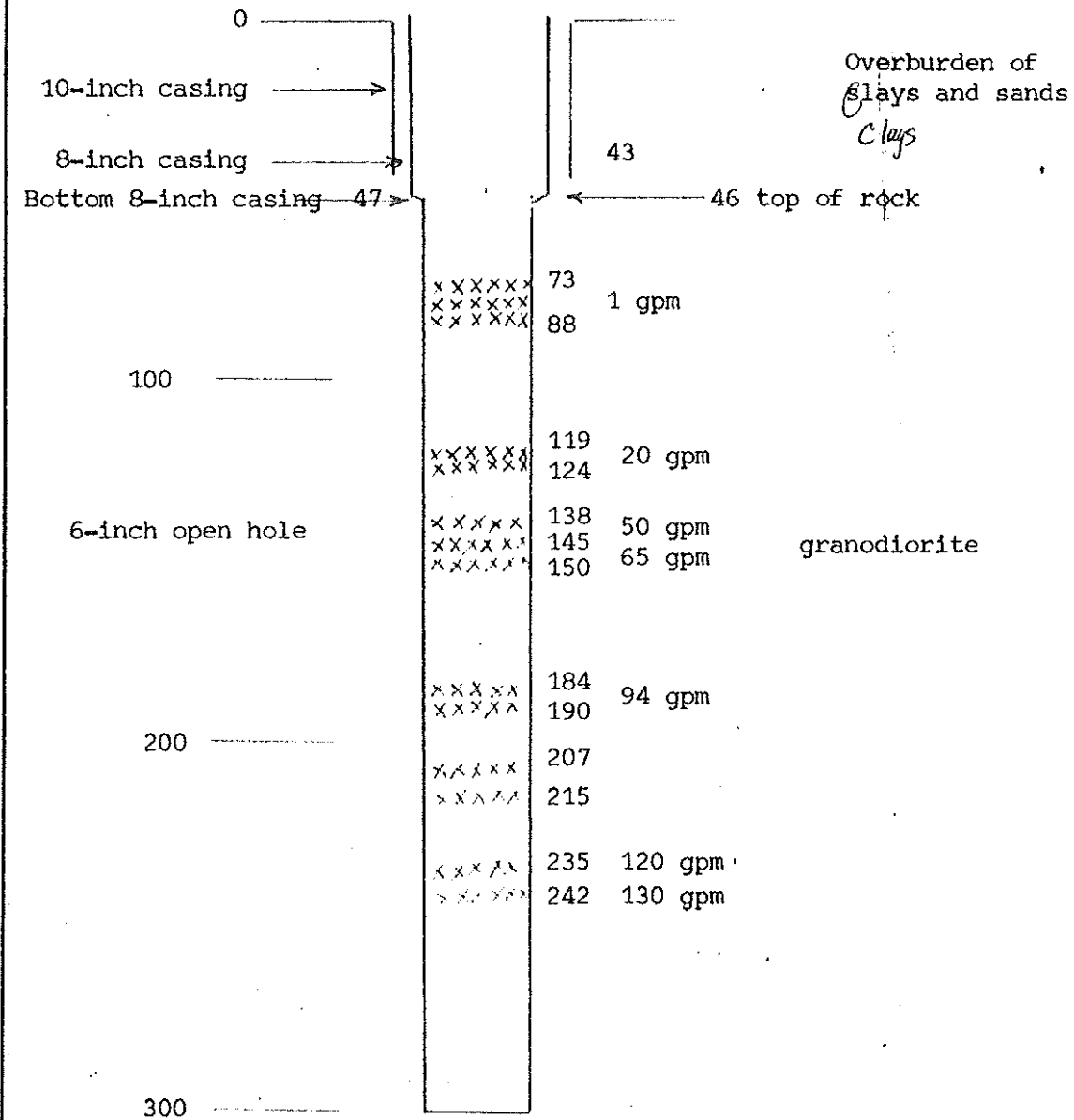
TEST RESULTS

PH	-	7.90
Colour (Pt-Co Scale)	-	Trace
Colour with Charcoal	-	Trace
Turbidity (SiO ₂ Scale)	-	0.5 ppm
Suspended Matter	-	10.0 ppm
Alkalinity: Carbonate	-	Not detected
Bicarbonate	-	210.5 ppm
Total Hardness (Soap Method)	-	76.4 ppm
Chlorides	-	24.5 ppm ←
Sulphates	-	Trace
Nitrates	-	2.0 ppm
Total Dissolved Solids	-	340.0 ppm
Volatile Solids	-	112.0 ppm
Fixed Solids	-	228.0 ppm
Calcium	-	29.0 ppm
Magnesium	-	6.6 ppm
Sodium	-	94.5 ppm ←
Potassium	-	2.0 ppm
Manganese	-	Trace
Total Iron	-	0.06 ppm
Dissolved Iron	-	0.04 ppm
Total Aluminum	-	0.32 ppm
Dissolved Aluminum	-	0.30 ppm
Dissolved Silicon	-	1.3 ppm
Spectrographic analysis	-	as per attached.

COAST ELDRIDGE

W. Wong
W. Wong,
CHIEF CHEMIST

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Note: Flows measured on water blown out of hole by air

SIDNEY WATERWORKS DISTRICT	Lithologic Log	ROBINSON, ROBERTS & BROWN LTD. CONSULTING GROUNDWATER GEOLOGISTS NORTH VANCOUVER, CANADA
Sidney British Columbia	Well No.12	September 1968