MISCELLANEOUS

RESULTS OF CHEMICAL ANALYSIS AND NOTCH WEIR GAUGING OF THE RAIL BRIDGE SPRING IN CHILLAGOE CREEK, NORTH QUEENSLAND, AUSTRALIA.

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ABSTRACT

Over a period of six years from mid 1982 water samples have been taken on an irregular basis for chemical analysis, and notch weir gauge levels recorded at a spring in Chillagoe Creek close to the Railway Bridge.

Chemical analysis of samples has been performed by Anne Woolley, Cairns City Council Chemist, and values recorded. The levels of the various elements appear to be relatively stable and not greatly affected by the flow rates of the spring.

INTRODUCTION

In May 1982 I spent a week with Dr Joe Jennings accompanying him on his only trip to the Mitchell-Palmer area and taking water samples at every possible water source along the way. In discussion with Joe he suggested that it would be worthwhile to take samples from a spring at intervals over a long period to set a base line of data for use of scientists researching solution of limestone.

This has been done at a resurgence spring at the Chillagoe Rail Bridge on Chillagoe Creek. Here water issues up out of the last main limestone band crossing Chillagoe Creek and would appear to be draining the valley up towards Dome Rock and possibly across towards the town dump. This spring is a significant one and appears to normally contribute about half of the flow in the creek at the Rail Bridge. There are times however when the creek carries flood flows or when the creek dries up above the spring which alter this approximate balance of flows. The spring is limited in its maximum discharge by the head loss in the conduits through the limestone so that when the Chillagoe Creek is flooding the reservoir in the limestone supplying the conduit is being recharged.

Samples of the spring water has been collected from the pool in the area where the flow from the spring can be felt. This is the nearest practical source of water from the spring which issues through a crack several feet under the water surface. Care was taken to rinse the collection bottle in the spring water and cap under water surface to minimize entrapped air. Water temperature just below the water surface was also recorded on most occasions.

Flow measurements were taken with a simple notch weir to a specification obtained from the Queensland Water Resources Commission at Mareeba. Flow is measured as millimetres of water above the bottom of the notch and flow in litres per second is derived from tables from supplied by the Queensland Water Resources Department. These tables are derived from the formula as set out below.

Where Q = discharge in litres per hour
H = water depth in notch (upstream side of notch)

$$Q = 0.17556\ H^{2.48}$$

(The notch weir needs to be set well into the ground and care taken to avoid leaks around it. Also the downstream side needs to drop away so that the bottom of the notch on the downstream side is not flooded.)

All water tests made by Ann Wooley of Cairns City Council were as set out in Standard Methods for Examining Water and Waste Water, APHA 14th Edition. With several samples water showed abnormal sulphate levels and the water containers were considered to be probably responsible. The containers had previously been used for photographic chemicals and perhaps still had sufficient residues to affect results of sulphate content which is normally in the 5 to 10 ppm range.

RESULTS AND CONCLUSIONS

The results of all tests are tabulated in Table I.

From the results obtained I believe it can be said that there is a consistency in the results from chemical analysis of the water from the spring over a range of flows which vary from 2.51 to 10.24 litres per second.

Water temperature above the efflux was also consistently around 29 degrees Celcius regardless of the air or ground surface temperature.

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TABLE I - DETAILS OF WATER SAMPLES FROM RAIL BRIDGE SPRING, CHILLAGOE.

DATE	TEMP C	pH	ALKALINITY mg/l CaCO3	HARDNESS mg/l CaCO3	CONDUCTIVITY uSiemens/cm	CALCIUM mg/l	MAGNESIUM mg/l	SODIUM mg/l	POTASSIUM mg/l
11-07-1982	28.0	7.10	299	296	590	111	4.60	6.50	1.10
12-08-1982	28.5	7.00	295	293	590	111	3.80	6.90	1.00
03-10-1982	29.0	7.00	298	300	-	112	5.00	6.40	1.10
23-10-1982	29.5	6.90	294	299	-	113	3.80	7.00	1.10
31-12-1982	-	7.30	297	307	575	115	4.70	7.10	1.10
13-01-1983	26.0	7.00	297	294	590	110	4.80	8.40	1.00
18-03-1983	-	6.80	287	295	610	110	5.00	6.50	1.03
02-05-1983	-	7.00	290	299	590	110	6.00	6.50	1.03
15-05-1983	-	6.90	298	303	600	115	3.60	6.50	1.09
12-06-1983	-	7.20	307	316	560	112	8.80	6.80	1.00
16-07-1983	-	7.20	311	301	560	113	4.50	9.30	1.40
25-09-1983 #	-	7.20	249	338	550	126	5.70	7.00	1.24
19-10-1983	-	7.20	298	200	520	113	4.30	8.00	1.00
13-11-1983	-	7.10	292	298	560	113	3.80	7.00	1.00
01-01-1984 #	31.0	7.10	271	315	570	120	3.80	11.80	1.40
31-03-1984 #	28.0	6.90	270	315	590	120	3.60	10.50	1.10
04-06-1984 *	29.0	7.40	181	178	390	65	3.90	9.00	1.50
28-07-1984	29.0	7.10	302	316	570	120	3.90	8.00	1.20
23-09-1984	29.0	7.10	308	328	590	125	3.80	8.00	1.20
01-01-1985	31.0	7.00	280	314	550	120	3.40	8.00	1.50
06-05-1985	-	6.80	310	290	590	110	3.70	8.00	1.20
09-06-1985	29.0	6.80	311	290	590	110	3.70	7.00	1.30
15-09-1985	29.0	7.10	291	328	550	120	3.90	7.00	1.20
26-10-1985	30.0	7.30	295	304	550	115	4.10	7.00	1.30
05-01-1986	29.5	7.30	210	227	-	86	3.00	7.00	1.20
15-01-1986	30.0	7.20	255	249	-	93	4.00	7.50	1.30
05-05-1986	30.0	7.10	315	328	-	125	3.90	10.00	1.20
27-06-1986	29.0	7.10	305	289	-	110	3.50	8.00	1.20
29-06-1986	29.0	7.10	305	289	570	110	3.50	8.00	1.00
20-07-1986	29.0	7.10	305	302	-	115	3.50	7.00	1.30
31-08-1986	29.0	6.70	294	265	-	100	3.80	8.00	1.30
16-11-1986	29.5	7.10	300	273	-	103	3.90	8.00	1.30
14-03-1987	29.5	7.50	302	320	550	122	3.70	7.00	1.40
28-03-1987	30.0	7.50	306	327	550	125	3.60	7.00	1.30
02-05-1987	29.5	7.10	316	310	550	118	3.60	8.00	1.40
17-07-1987	29.0	7.50	310	316	570	120	3.90	7.00	1.20
07-09-1987	29.0	7.40	295	316	570	120	3.90	7.00	1.30
26-09-1987	29.5	7.30	300	316	566	120	3.90	7.00	1.20
10-10-1987	29.0	7.20	295	303	560	115	3.80	7.50	1.30
24-10-1987	29.0	7.00	300	315	560	120	3.80	7.50	1.30
03-12-1987	-	7.10	291	301	-	115	3.40	7.20	1.10
04-01-1988	31.0	7.30	291	302	550	115	3.60	7.00	1.10
04-04-1988	29.5	7.60	270	276	515	105	3.40	7.00	1.10
14-04-1988	-	7.10	300	303	570	115	3.90	7.00	1.10
14-06-1988	-	7.10	291	301	570	115	3.00	7.00	1.00
28-08-1988 *	29.0	7.00	215	215	410	80	3.70	6.00	1.20

Notes : * Sample showed signs of precipitation before analysis.

Abnormal sulphate - suspect containers previously used for photographic chemicals.

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TABLE I (CONT) - DETAILS OF WATER SAMPLES FROM RAIL BRIDGE SPRING, CHILLAGOE.

SILICON mg/l	CARBONATE mg/l	CHLORIDE mg/l	SULPHATE mg/l	IRON mg/l	MANGANESE mg/l	COPPER mg/l	ZINC mg/l	FLUORINE mg/l	FLOW l/s
-	365	8.9	16.00	0.01	0.01	0.01	0.05	-	-
27.00	360	8.9	6.60	-	-	-	-	-	-
29.00	364	9.2	6.50	-	-	-	-	-	3.91
30.00	359	9.2	6.00	-	-	-	-	-	3.81
30.00	363	9.6	7.10	-	-	-	-	-	4.23
28.00	361	7.4	6.70	0.01	0.01	-	-	0.12	6.30
28.00	350	9.6	-	-	-	-	-	-	-
16.00	361	9.9	8.00	-	-	-	-	-	-
26.00	364	12.1	7.20	-	-	-	-	-	-
26.00	375	10.3	7.20	-	-	-	-	-	-
25.00	379	10.0	8.00	-	-	-	-	-	-
25.00	304	8.9	78.00	-	-	-	-	-	3.9
25.00	364	12.4	6.60	-	-	-	-	-	3.90
25.00	356	10.6	5.40	-	-	-	-	-	3.90
32.00	331	11.7	51.00	-	-	-	-	0.17	5.7
32.00	329	9.2	55.00	-	-	-	-	0.18	5.4
36.00	221	8.5	6.50	-	-	-	-	0.11	6.3
33.00	368	7.0	6.50	-	-	-	-	0.11	4.50
33.00	376	8.5	7.00	-	-	-	-	-	5.00
32.00	342	12.0	7.00	-	-	-	-	-	5.00
31.00	378	6.0	10.00	-	-	-	-	0.20	10.24
31.00	379	6.0	9.00	-	-	-	-	0.28	4.44
31.00	355	6.0	7.00	-	-	-	-	0.23	4.81
30.00	360	6.0	8.00	-	-	-	-	0.29	2.71
29.00	256	8.0	7.00	-	-	-	-	0.20	8.52
25.00	311	8.0	6.00	-	-	-	-	0.20	6.70
29.00	384	10.0	8.00	-	-	-	-	0.20	8.52
30.00	372	7.0	7.00	-	-	-	-	0.16	7.43
30.00	372	7.0	7.00	-	-	-	-	-	7.43
29.00	372	7.0	7.00	-	-	-	-	-	8.99
29.00	358	8.0	6.50	-	-	-	-	-	9.70
33.00	366	8.0	7.00	-	-	-	-	-	4.12
22.00	369	12.00	7.00	<0.10	<0.10	-	-	<0.10	4.44
30.00	373	12.00	7.00	<0.10	<0.10	-	-	<0.10	5.50
32.00	386	8.00	7.00	0.07	<0.10	-	-	0.22	3.71
32.00	378	9.00	7.00	-	-	-	-	0.24	3.91
32.00	360	9.00	7.00	-	-	-	-	<0.10	3.18
32.00	366	11.00	8.00	-	-	-	-	<0.10	2.88
34.00	360	10.00	7.00	-	-	-	-	0.20	3.05
36.00	366	10.00	7.20	-	-	-	-	0.27	2.48
32.00	355	8.20	6.40	-	-	-	-	<0.10	2.51
29.00	355	9.20	7.20	-	-	-	-	0.07	3.23
29.00	329	7.00	8.00	-	-	-	-	0.28	6.15
32.00	366	7.00	7.00	-	-	-	-	0.18	2.84
32.00	355	8.00	7.00	-	-	-	-	<0.10	2.51
28.00	262	7.00	9.00	-	-	-	-	0.20	1.76

My belief is that the water from the spring is controlled and limited in flow by the friction in the conduits in the limestone and is in contact with the limestone over a sufficient length that relatively stability is reached in temperature and in minerals dissolved from the limestone and surrounding groundwater.

The results are so consistent that I believe there is no advantage in continuing collecting this data any longer.

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REFERENCES

A.P.H.A.-A.W.W.A.-W.P.C.F. 1980. **Standard Methods for Examination of Water and Waste Water** 15th edition.

JENNINGS, J.N. 1982. Karst of Northeastern Queensland reconsidered. **Tower Karst** 4. pp13-52.

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