ENVIRONMENT AGENCY

**WATER QUALITY SECTION**
**CORNWALL AREA**

**FINAL DRAFT REPORT**

# INVESTIGATION TO ASSESS THE COMPLIANCE OF TRELAVOUR KILNS DISCHARGE CP/7 (SW 9479 5722) WITH CONSENT CONDITIONS AND TO IDENTIFY ANY IMPACT UPON WATER QUALITY IN THE ST DENNIS STREAM

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**COR/97/006**
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## CONTENTS



**Appendices**

## 1. Introduction

In response to a request from Mary Youell (Water Quality Officer, Cornwall Area) a water quality investigation was undertaken to assess the compliance of the Trelavour Kilns discharge CP/7 with its consent conditions and to identify any adverse effects the effluent may be having upon the St Dennis Stream.

The trade effluent is derived from process waste water arising from the refining and dewatering of china clay. A water quality survey of the St Dennis Stream and the trade effluent was carried out on the 19th of November 1996. A repeat survey was also carried out on the 2nd of December, when the Trelavour kilns were not discharging effluent due to the desludging of the settlement lagoons. The water quality parameters recorded during both surveys enabled a comparison between the quality of the St. Dennis Stream when the kilns were discharging and when they were not.

## 2. Method

Please see Appendix I, figures (i) and (ii) for maps of the survey area and the location of monitoring sites.

The pH and Temperature of the St Dennis Stream were recorded using a hand-held meter. Readings were taken at 50 metre intervals downstream of the Trelavour kilns discharge until the routine monitoring site at Carsella (R19C018) was reached. These parameters were also recorded for any tributary joining the St Dennis Stream (Sites 1, 11 and 15). The pH and Temperature of the trade effluent were taken on the 19th of November only.

Water samples were taken according to the standard methodology at 6 sites for the purposes of comparing Biochemical Oxygen Demand (BOD (ATU), suspended solids (105°C) and ammonia levels. It was only possible to obtain a sample of the trade effluent on the 19th of November.

## 3. Results

The Storm Sewage Overflow at St Dennis Sewage Treatment Works ( 500m downstream of Trelavour Kilns) was discharging during both Surveys.

Please refer to Appendix II, tables A and B for the pH and Temperature readings and tables C and D for the sample analysis results.

## 4. Discussion

The Biochemical Oxygen Demand (ATU) recorded for the Trelavour Kilns trade effluent on the 19th of November was 46.2 mg/l. The reason for this high value requires further investigation. The BOD of the St Dennis Stream, 100 metres downstream (site 4), was 14.6 mg/l on the 19th of November and 1 mg/l on the 2nd of December when the effluent was not discharging. A tributary with a BOD of 1 mg/l joins the effluent just upstream of site 4 accounting for the improvement in BOD value on the 19th of November. The St Dennis Stream consists almost entirely of the Trelavour Kilns effluent prior to meeting this tributary some 100 metres downstream from the point of discharge. At 500 metres downstream of the discharge (20 metres downstream of the Storm Sewage Overflow) BOD values of 5 mg/l and 3.30 mg/l were recorded on the 19th of November and the 2nd of December respectively. The Storm Sewage overflow was in operation throughout both surveys.

The Bodella Brook joins the St Dennis Stream just upstream of the routine monitoring site at Carsella (R19C018). The BOD value recorded for the Bodella Brook (Site 15) was 1 mg/l on both occasions. The St Dennis Stream, 600 metres downstream of the discharge (Site 16/R19C018) showed a slight improvement in water quality with a BOD value of 3.80 mg/l on the 19th of November and 2.30 mg/l on the 2nd of December. The high suspended solids readings recorded on the 19th of November can be attributed to extremely high rainfall throughout the previous 24 hours. All ammonia readings for both surveys were found to be less than 0.5 mg/l reflecting good water quality (see Appendix II, Tables C and D). The GQA chemical grade for the Bodella Brook at Carsella (R19C018/Site 16) was F in 1995 indicating bad water quality.

The Trelavour Kilns discharge (R19C026) failed to comply with the EC Dangerous Substances Directive in 1994 and 1995. These failures were attributed to pH. The low hardness of waters downstream of china clay discharges makes compliance with stringent Environmental Quality Standards (EQSs) difficult to achieve. The source water used for china clay extraction within quarries is often poorly buffered and generally has been taken from riverine sources with elevated metal concentrations. As reported in the 1994 and 1995 'EC Directive Returns' most china clay consents are now being reviewed thus ensuring an improved control of these discharges. However, the control of pH within EQS upper and lower bounds by consenting may be limited.

The Trelavour Kilns discharge on the 19th of November complied with its consent conditions. The pH and Temperature readings were 6.09 and 22°C respectively. A copy of the consent to discharge can be seen in Appendix IV. The pH of the Trelavour Kilns effluent prior to treatment with caustic soda was 5.80.

Concern has been expressed that although the trade effluent might comply with its consent conditions at the point of discharge it may still be having an adverse effect upon the water quality of the receiving watercourse downstream.

The pH of the St Dennis Stream on the 19th of November was seen to fluctuate widely between 50 and 250 metres downstream of the Trelavour Kilns effluent. The pH then stabilised between 250 and 600 metres downstream. Please refer to Appendix III for graphical representations of the pH and Temperature readings recorded during both surveys. On the 19th of November, the pH of the St Dennis Steam rose significantly from 6.09 at the point of discharge to 6.76 at site 3 (50 metres downstream). pH values of 4.97 and 4.71 were then recorded at 100 metres and 200 metres downstream of the discharge respectively. In contrast, readings of 5.86 (100 metres downstream) and 5.97 (200 metres downstream) were recorded on the 2nd of December when the Kilns were not discharging. Please refer to Appendix III for graphs comparing pH and Temperature readings between surveys.

Site 7 (250 metres downstream of the discharge) appears to be the point where the Temperature and pH readings cease to fluctuate and then proceed to coincide approximately with readings taken on the 2nd of December. The pH of the St Dennis Stream on the 2nd of December ranged from 5.72 to 6.11.

The receiving watercourse by means of dilution and buffer action (a high bicarbonate alkalinity figure) can play an important role in the amelioration of low pH trade effluents. The low hardness of watercourses downstream of china clay discharges may be a contributing factor in the wide fluctuations in pH.

The Temperature of the St Dennis Stream fell dramatically from 22°C at the point of discharge to 13.4°C at site 3 (50 metres downstream). The Temperature then decreased gradually until it stabilised at site 7 (250 metres downstream of the discharge).

## 5. Conclusions

i) The Trelavour Kilns discharge complied with its consent conditions on the 19th of November 1996.

ii) A BOD value of 46.2 mg/l was recorded for the trade effluent. A BOD of 14.6 mg/l was recorded 100 metres downstream reflecting poor water quality.

iii) The Trelavour kilns discharge had had a detrimental effect upon the St Dennis with regard to pH on the 19th of November. The pH of the Stream had been affected between 50 and 250 metres downstream of the point of discharge. Readings of 4.97 and 4.71 were recorded at 100 and 200 metres downstream respectively. On the 2nd of December, when the kilns were not discharging, the pH of the Stream ranged from 5.71 to 6.11.

iv) 250 metres downstream of the discharge at site 7 was the point at which the pH and Temperature readings stabilised on the 19th of November. Readings taken downstream of site 7 approximately matched those taken on the 2nd of December.

6. **Recommendations**

i) The cause of the high BOD value recorded for the Trelavour Kilns discharge requires further investigation.

ii) The pH of the St Dennis Stream should continue to be monitored.

7. **References**

Eckenfelder; W Wesley, 1989, Industrial Water Pollution Control.

Oliver A (June 1995). Technical department: 1994 EC Directive returns. South Western Region.

Oliver, A (July 1996). Water Quality technical Series (QA96/01). 1995 EC Directive Returns.

Klein, Dr Louis, 1971, River Pollution 1 + 2.

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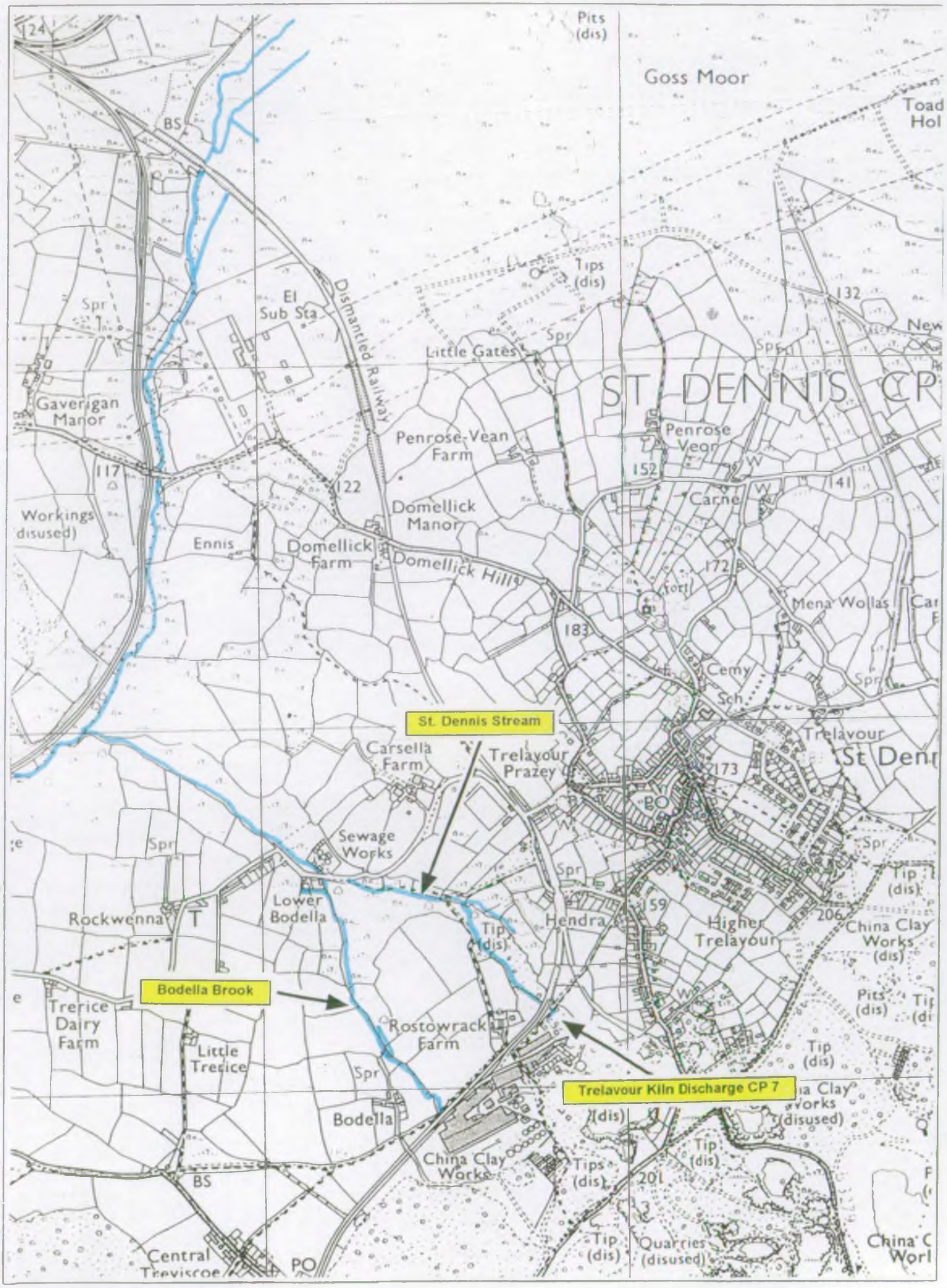
# APPENDIX I(FIGURE(i)) :- MAP TO SHOW SURVEY AREA



| SITE NO. | SITE | TEMP °C | pH | TIME | WATER SAMPLE ANALYSIS |
|---|---|---|---|---|---|
| 1 | UPSTREAM TRELAVOUR DISCHARGE | 8.60 | 7.10 | 09:55 AM | YES |
| 2 | TRELAVOUR KILN DISCHARGE | 22.00 | 6.09 | 09:30 AM | YES |
| 3 | St.Dennis Stream - 50m downstream discharge | 13.40 | 6.76 | 11:20 AM | NO |
| 4 | St.Dennis Stream - 100m downstream discharge | 13.60 | 4.97 | 10:00 AM | YES |
| 5 | St.Dennis Stream - 150m downstream discharge | 12.80 | 5.09 | 10:15 AM | NO |
| 6 | St.Dennis Stream - 200m downstream discharge | 12.60 | 4.71 | 10:20 AM | NO |
| 7 | St.Dennis Stream - 250m downstream discharge | 11.10 | 5.76 | 11:30 AM | NO |
| 8 | St.Dennis Stream - 300m downstream discharge | 11.00 | 5.77 | 11:40 AM | NO |
| 9 | St.Dennis Stream - 350m downstream discharge | 11.00 | 5.82 | 11:55 AM | NO |
| 10 | St.Dennis Stream - 400m downstream discharge (u/s confluence with Carsella Farm Tributary) | 10.90 | 5.82 | 12:00 PM | NO |
| 11 | Carsella Farm Tributary (20m u/s confluence with St.Dennis Stream) | 8.20 | 6.45 | 12:05 PM | YES |
| 12 | St.Dennis Stream - 450m downstream discharge (u/s Storm sewage overflow) | 11.00 | 5.92 | 12:25 PM | NO |
| 13 | St.Dennis Stream - 500m downstream discharge (20m d/s Storm sewage overflow) | 10.90 | 5.97 | 12:20 PM | YES |
| 14 | St.Dennis Stream - 550m downstream discharge | 10.90 | 5.84 | 12:30 PM | NO |
| 15 | Bodella Brook ( ~10m u/s confluence with St.Dennis Stream) | 9.30 | 5.90 | 01:25 PM | YES |
| 16 | St.Dennis Stream - 600m downstream discharge (~ 10m d/s confluence wuth Bodella Brook) - 19C018 | 10.50 | 6.01 | 01:30 PM | YES |

**SURVEY DATE:- 19 - November - 1996**
**TABLE ( A )**

| SITE NO. | SITE | TEMP °C | pH | TIME | WATER SAMPLE ANALYSIS |
|---|---|---|---|---|---|
| 1 | UPSTREAM TRELAVOUR DISCHARGE | 10.20 | 6.76 | 11:25 AM | YES |
| 2 | TRELAVOUR KILN DISCHARGE | | | | NO DISCHARGE |
| 3 | St.Dennis Stream - 50m downstream discharge | 10.80 | 5.72 | 01:35 PM | NO |
| 4 | St.Dennis Stream - 100m downstream discharge | 10.80 | 5.86 | 11:15 AM | YES |
| 5 | St.Dennis Stream - 150m downstream discharge | 10.70 | 5.98 | 11:40 AM | NO |
| 6 | St.Dennis Stream - 200m downstream discharge | 10.70 | 5.97 | 11:45 AM | NO |
| 7 | St.Dennis Stream - 250m downstream discharge | 10.50 | 6.05 | 11:48 AM | NO |
| 8 | St.Dennis Stream - 300m downstream discharge | 10.40 | 6.07 | 12:30 PM | NO |
| 9 | St.Dennis Stream - 350m downstream discharge | 10.40 | 6.09 | 12:35 PM | NO |
| 10 | St.Dennis Stream - 400m downstream discharge (u/s confluence with Carsella Farm Tributary) | 10.50 | 6.11 | 12:38 PM | NO |
| 11 | Carsella Farm Tributary (20m u/s confluence with St.Dennis Stream) | 9.20 | 6.56 | 12:45 PM | YES |
| 12 | St.Dennis Stream - 450m downstream discharge (u/s Storm sewage overflow) | 10.40 | 6.17 | 12:50 PM | NO |
| 13 | St.Dennis Stream - 500m downstream discharge (20m d/s Storm sewage overflow) | 10.40 | 6.05 | 12:48 PM | YES |
| 14 | St.Dennis Stream - 550m downstream discharge | 10.50 | 6.02 | 12:55 PM | NO |
| 15 | Bodella Brook ( ~10m u/s confluence with St.Dennis Stream) | 10.10 | 5.64 | 01:05 PM | YES |
| 16 | St.Dennis Stream - 600m downstream discharge (~ 10m d/s confluence wuth Bodella Brook) - 19C018 | 10.40 | 6.01 | 01:10 PM | YES |

**SURVEY DATE:- 02 - December - 1996**
**TABLE ( B )**

**APPENDIX II :- Result Tables showing pH and Temperature readings at each site.**

| SITE NO. | SITE | TIME | BOD ( ATU ) mg/l | AMMONIA ( N ) mg/l | S.S 105°C mg/l |
|---|---|---|---|---|---|
| 1 | Upstream Trelavour Discharge | 09:55 AM | 1.00 | < 0.5 | 8.50 |
| 2 | **Trelavour Discharge** | 09:30 AM | 46.20 | < 0.5 | 16.00 |
| 4 | St.Dennis Stream - 100m d/s discharge | 10:00 AM | 14.60 | < 0.5 | 39.00 |
| 11 | Carsella Farm Tributary - ( 20m u/s confluence with St.Dennis Stream ) | 12:05 PM | 3.10 | < 0.5 | 31.00 |
| 13 | St.Dennis Stream - 500m d/s discharge ( 20m d/s Storm Sewage Overflow ) | 12:20 PM | 5.00 | < 0.5 | 43.00 |
| 15 | Bodella Brook - ( ~ 10m u/s confluence with St.Dennis Stream ) | 01:25 PM | 1.00 | < 0.5 | 6.30 |
| 16 | St.Dennis Stream - 600m d/s discharge ( ~ 10m d/s confluence with Bodella Brook ) - 19C018 | 01:30 PM | 3.80 | < 0.5 | 120.00 |

**SURVEY DATE :- 19 - NOVEMBER - 1996**
**TABLE C**

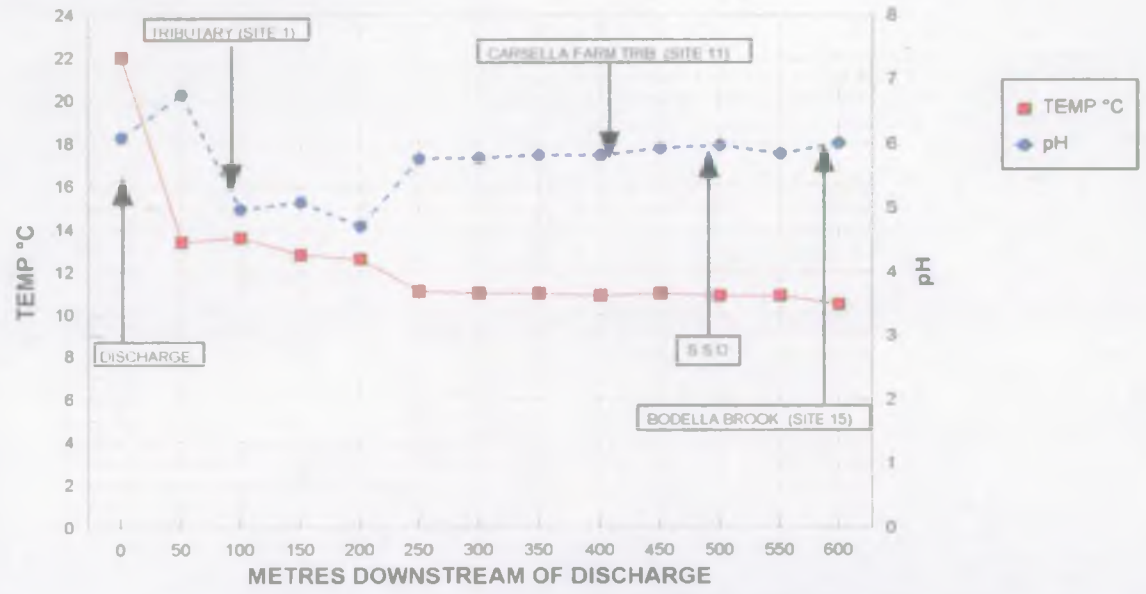
| SITE NO. | SITE | TIME | BOD ( ATU ) mg/l | AMMONIA ( N ) mg/l | S.S 105°C mg/l |
|---|---|---|---|---|---|
| 1 | Upstream Trelavour Discharge | 11:25 AM | 1.00 | 0.03 | 3.00 |
| 2 | **Trelavour Discharge** | | | | **NO DISCHARGE** |
| 4 | St.Dennis Stream - 100m d/s discharge | 11:15 AM | 1.00 | 0.03 | 3.00 |
| 11 | Carsella Farm Tributary - ( 20m u/s confluence with St.Dennis Stream ) | 12:45 PM | 1.00 | 0.03 | 3.40 |
| 13 | St.Dennis Stream - 500m d/s discharge ( 20m d/s Storm Sewage Overflow ) | 12:48 PM | 3.30 | 0.33 | 12.00 |
| 15 | Bodella Brook - ( ~ 10m u/s confluence with St.Dennis Stream ) | 01:05 PM | 1.00 | 0.04 | 3.00 |
| 16 | St.Dennis Stream - 600m d/s discharge ( ~ 10m d/s confluence with Bodella Brook ) - 19C018 | 01:10 PM | 2.30 | 0.20 | 6.50 |

**SURVEY DATE :- 2 - DECEMBER - 1996**
**TABLE D**

## APPENDIX II :- Tables showing Water Analysis Results for each Survey

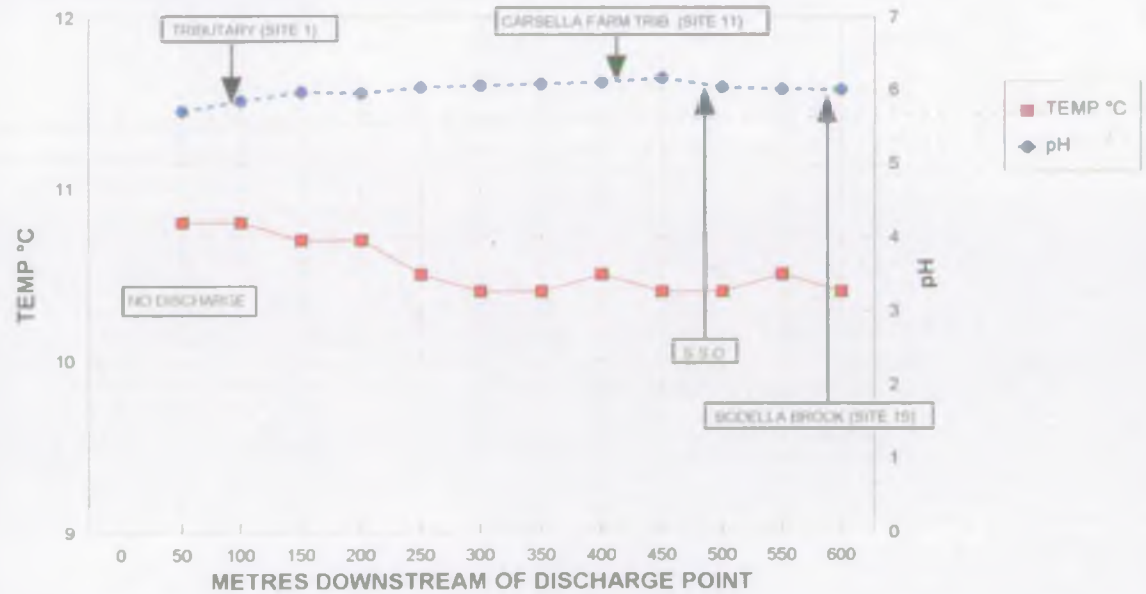
Graph to show pH and Temperature readings downstream of Trelavour Kiln discharge - St.Dennis Stream

Survey Date : 19 - November 1996

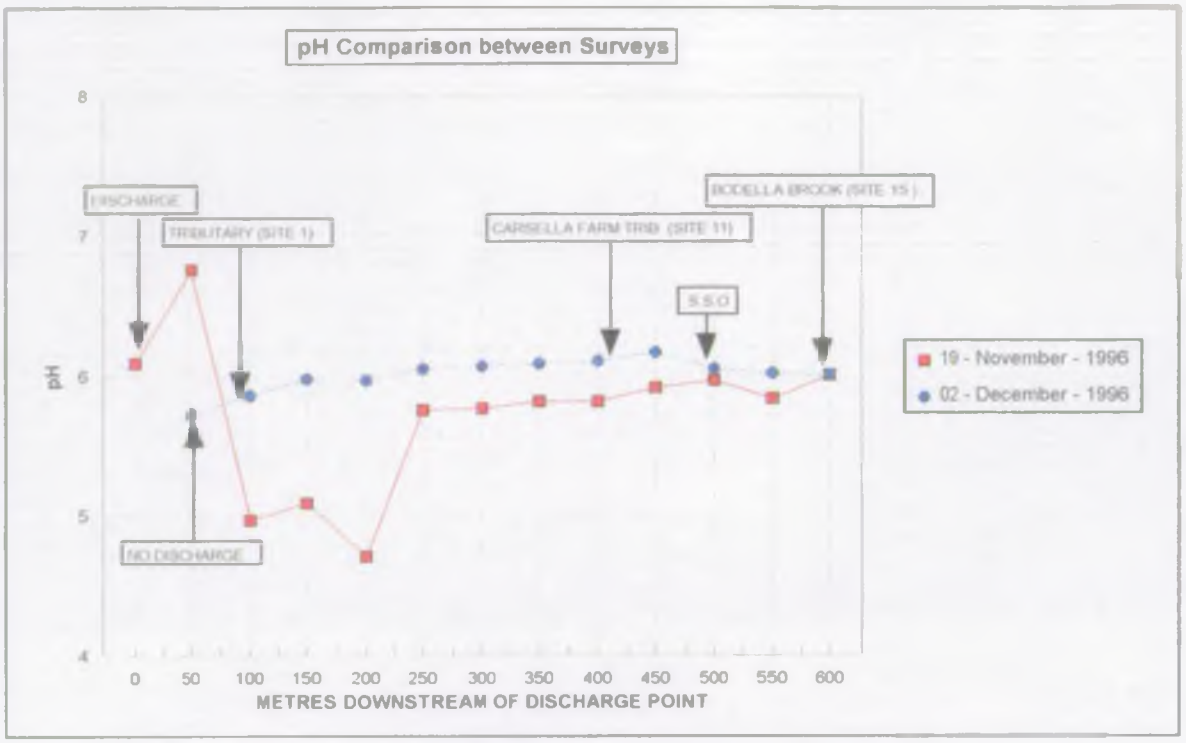


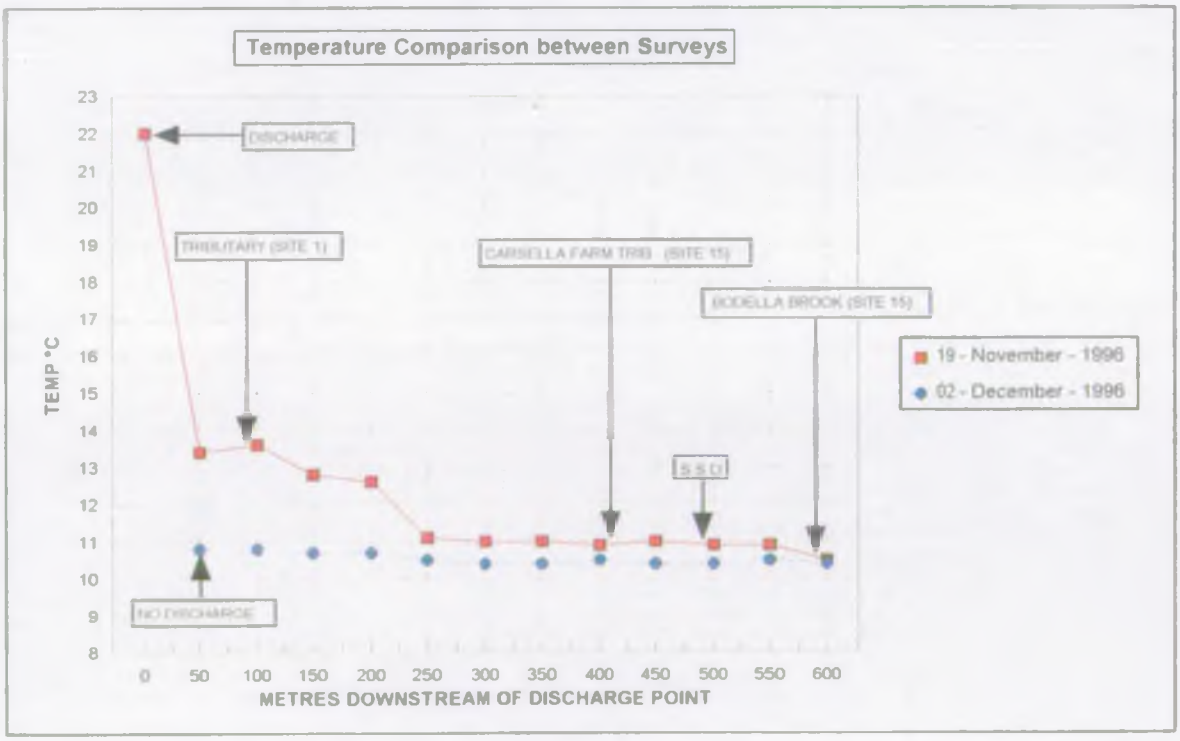

Graph to show pH and Temperature readings downstream of Trelavour Kiln discharge - St.Dennis Stream

Survey Date : 2 - December 1996




NOTE :- Temperature and pH values for the St. Dennis Stream only are shown on these graphs.
Results for the tributaries (sites 1,11 and 15) are listed in Appendix II


pH Comparison between Surveys
DISCHARGE
TRIBUTARY (SITE 1)
CARSELLA FARM TRIB (SITE 11)
BODELLA BROOK (SITE 15)
S.S.O.
NO DISCHARGE
pH
8
7
6
5
4
0 50 100 150 200 250 300 350 400 450 500 550 600
METRES DOWNSTREAM OF DISCHARGE POINT
19 - November - 1996
02 - December - 1996


Temperature Comparison between Surveys
DISCHARGE
TRIBUTARY (SITE 1)
CARSELLA FARM TRIB (SITE 11)
BODELLA BROOK (SITE 15)
S.S.O.
NO DISCHARGE
TEMP °C
23
22
21
20
19
18
17
16
15
14
13
12
11
10
9
8
0 50 100 150 200 250 300 350 400 450 500 550 600
METRES DOWNSTREAM OF DISCHARGE POINT
19 - November - 1996
02 - December - 1996

APPENDIX IV :- CONSENT TO DISCHARGE

NATIONAL RIVERS AUTHORITY — Folio No: NRA-SW-6468

WATER RESOURCES ACT 1991 - CONSENT TO DISCHARGE — Ref No: 048/19C/1924

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The National Rivers Authority, in pursuance of its powers under the above mentioned Act, HEREBY GIVES CONSENT to the discharge described hereunder subject to the terms and conditions set out below.

Name & Address of Applicant: THE GOONVEAN AND ROSTOWRACK CHINA CLAY CO LTD, GOONVEAN WORKS, ST STEPHEN, ST AUSTELL, PL26 7QF

Date of Application: Review

Description of Discharge:

Type: Trade Effluent

From: Trelavour Kilns (C/P 7), St Dennis

To: Carsella Stream

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Conditions

1. General

(a) Except with the agreement of the person making the discharge under this consent, no notice shall be served revoking the consent or modifying the conditions before 31 March 1996.

(b) For the purpose of applying the conditions identified in section 3 below, the discharger shall provide and maintain facilities to the Authority's satisfaction which will enable the Authority's representatives to take flow measurements of the trade effluent which is discharged at the outfall.

The discharger shall identify the facility with a clearly visible sign distinguishing it from any other and provide a clearly visible notch, mark, or device indicating the level equivalent to the maximum instantaneous consented flow.

(c) For the purpose of applying the conditions identified in section 4 below, the discharger shall provide and maintain facilities to the Authority's satisfaction which will enable the Authority's representatives to take discrete samples of the trade effluent which is discharged at the outfall. The discharger shall identify the facility with a clearly visible sign distinguishing it from any other.

(d) The facilities identified in (b) and (c) above, shall be installed in accordance with the plan accompanying this consent to discharge.

(e) Facilities shall be provided for safe and convenient access to enable Authority's representatives at any time to take samples, carry out flow measurements and inspection to ensure that the conditions of this consent are complied with.

(f) A full maintenance agreement to the Authority's satisfaction for the treatment plant shall be established.

(g) Maintenance records shall be provided to Authority staff on request.

2. As to the Outfall

An outfall shall be sited at NGR SW 9479 5722 and shall be so constructed that it is used for the discharge of trade effluent derived only from process waste water arising from the refining and de-watering of china clay.

3. As to Discharge

(a) The maximum instantaneous rate of discharge shall not exceed 18 litres per second.

(b) The volume of effluent discharged shall be limited to that arising from process waste water arising from the refining and de-watering of china clay and in any case shall not exceed 160 cubic metres in any period of twenty four hours.

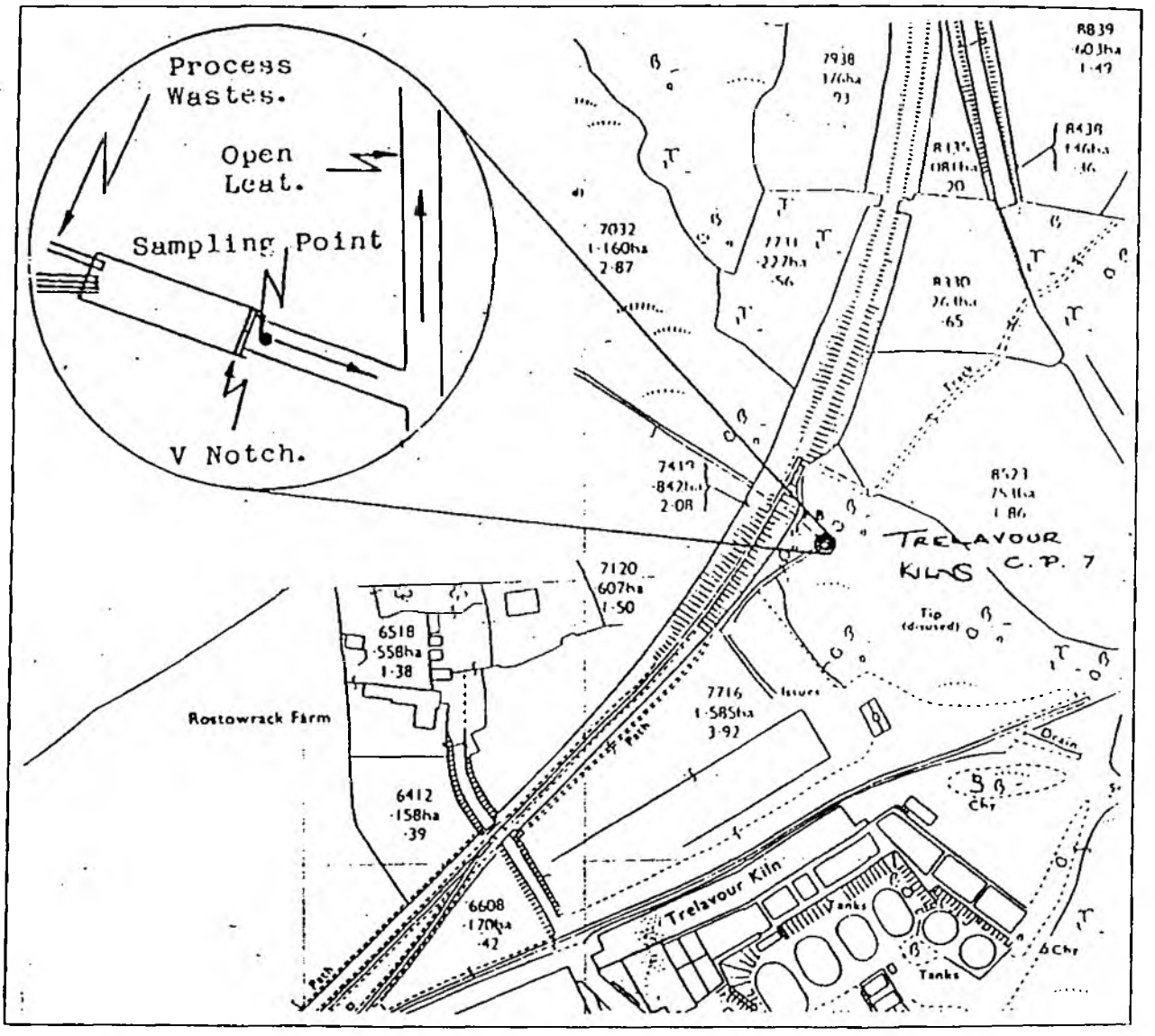
4. As to Discharge Composition

(a) The discharge shall contain no visible signs of oil or grease.

(b) As far as is reasonably practicable, the treatment system shall be operated so as to prevent any matter being present in the effluent which will cause the receiving waters, or any waters of which the receiving waters are a tributary, to be poisonous or injurious to fish in those waters, or to the spawning grounds, spawn or food of fish in those waters, or otherwise cause damage to the ecology of those waters.

NATIONAL RIVERS AUTHORITY
SOUTH WESTERN REGION

CONSENT NUMBER
NRA-SW-6468




| | |
|---|---|
| DATE: FEBRUARY 1994 | SITE: TRELAVOUR KILNS (CP/7)<br>ST DENNIS |
| OUTLET: SW 9479 5722 | |

[4. As to Discharge Composition, continued] NRA-SW-6468

(c) No single sample of the effluent discharged shall have:

(i) in excess of 150 milligrams per litre of suspended solids (measured after drying for one hour at 105°C); ✓

(ii) a pH value less than 5 or greater than 9; ✓

(iii) a temperature in excess of 30°C. ✓

.....
Technical Manager
National Rivers Authority
South Western Region

Manley House
Kestrel Way
Sowton Industrial Estate
Exeter
Devon EX2 7LQ

11/3/94
.....
Date of Consent