

Carnon Valley Update



National Rivers Authority
South West Region

DATE: 30 January 1992

A CLEAR WAY FORWARD

National Rivers Authority
Information Centre
Head Office

Class No

Accession No RI90

The National Rivers Authority - together with other local bodies - is working flat out to deal with tin mine discharges from the Carnon Valley. A clear three stage action plan has been drawn up:

Immediate: Pumping and treatment of mine waters from the Wheal Jane area is being carried out by Carnon Consolidated Ltd with financial and technical support from the NRA. A thorough review is underway to see how improvements to these contingency plans can be made.

Medium Term: The NRA has engaged expert consultants to produce proposals for a biological treatment system using organic material to help remove metals from the mine waters discharging to the Carnon River.

Long Term: The NRA is also considering research into a permanent "green" low-cost, low-tech treatment solution that could deal with other discharges into the valley as well.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

This is situated at Carrick District Council's offices in Pydar Street, Truro and will operate during normal office hours. A special telephone number has been established:

TRURO (0872) 224360

The centre will have up-to-date information from each of the authorities involved.

THE CURRENT SITUATION

The NRA is carrying out regular checks of the local freshwater and estuary areas. The results will be available from the information centre.

Although the area affected by discharges into the Carnon Valley has been subject to pollution for centuries there is little doubt that recent discharges, and especially the event of 13 January, has added to the problem. How significant the additional impact has been is still being assessed. (Some salt water samples take at least two weeks to fully analyse.)

ENVIRONMENT AGENCY



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To give an idea of scale the highest levels of cadmium so far recorded on the lower reaches of the River Carnon (at Devoran Bridge) were 600 parts in a billion parts of water on 14 January, levels have since been decreasing to under 400 parts. The agreed Environmental Quality Standard for cadmium is 1 part. However historically background levels have exceeded 30 parts per billion.

WHAT ADVICE IS AVAILABLE?

Seafood: MAFF and the Department of Health are responsible for advising on the safety of consuming shellfish. They advise that test results taken since the incident indicate that there is no cause for concern on health grounds in eating shellfish from this area.

Water Supplies: South West Water has confirmed that public drinking water supplies are not drawn from the affected area.

Carrick District Council has reported that there are approximately 12 properties whose well and borehole supplies are at possible risk. Its sampling programme has shown no sign of any effect but as a precautionary measure has advised these householders to drink bottled water until the situation improves.

Recreation: The Director of Public Health Medicine has advised that the water quality outside Restrouquet Creek is perfectly safe for recreational use. Carrick District Council, as a precaution, has advised water recreation users to keep clear of the worst affected area (ie Carnon River, Restrouquet Creek). It has confirmed that a person would have to swallow large amounts of the discoloured salt water before it had any effect.

The above advice was current as at 30 January 1992.

THE BACKGROUND

The Carnon Valley has been mined for centuries and there are around 50 abandoned mines in the area. As a result there is an historic background level of pollution in the local water environment.

In March 1991 operations at the last operating tin mine in the valley, Wheal Jane, stopped. Pumps that had been de-watering the mine were removed.

As a result the water in the mine, which was acidic and contained significant levels of metals (including cadmium, zinc, nickel, arsenic, copper and iron) started rising.

The NRA formed a special project team to monitor the highly complex situation and ensure that the mine owners prepared contingency plans.

On 17 November 1991 the water reached the surface and started discharging. Carnon Consolidated Ltd put the contingency plan into action with financial support from the NRA.

The contingency plan - which was required while data was collected to enable medium and long-term plans to be developed and implemented - involved treating the water with lime and pumping it for settlement to the area known as the Tailings Dam.

Although broadly successful for a few weeks, the complexity of the situation was underlined by various difficulties. Some water began to back up in the mine and emerge untreated from various exit routes.

On 4 January 1992 the mine owners stopped pumping to the Tailings Dam for technical reasons. While investigations were taking place on alternative methods of treatment an underground collapse led to water which had backed up in the mine breaking out on 13 January. It was this discharge that caused the recent highly visible discolouration in the estuary.

Pumping to and treatment in the Tailings Dam was started again on 21 January.

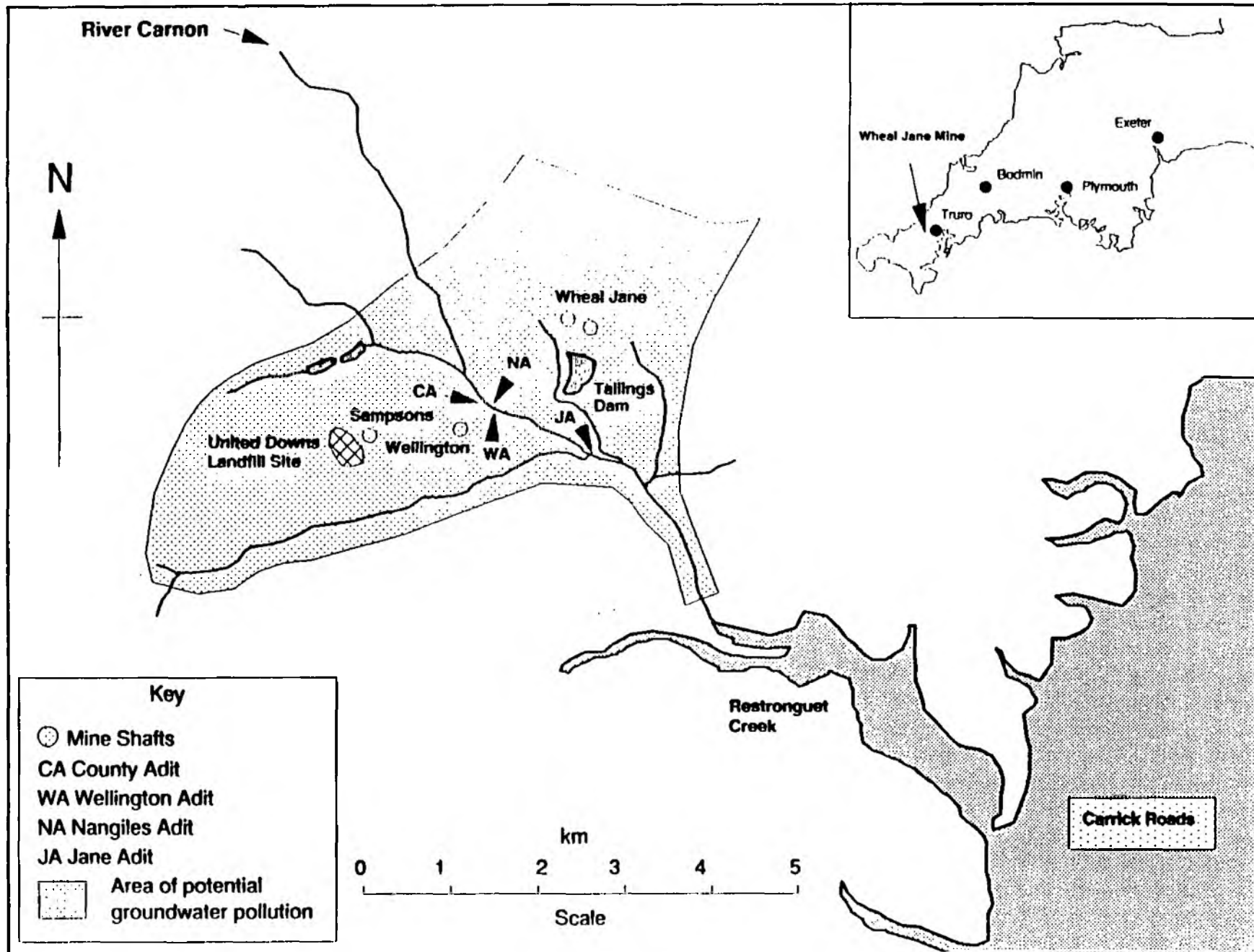
The NRA has pledged to work - together with other interested parties - to minimise the impact of the pollution and seek medium and long-term solutions. Further information sheets will be issued as the situation develops.

The River Carnon Catchment



NRA

National Rivers Authority
South West Region



Issued by: Public Relations, NRA South West, Manley House, Kestrel Way, Exeter, EX2 7LQ Tel: (0392) 444000

Carnon Valley Update



NRA

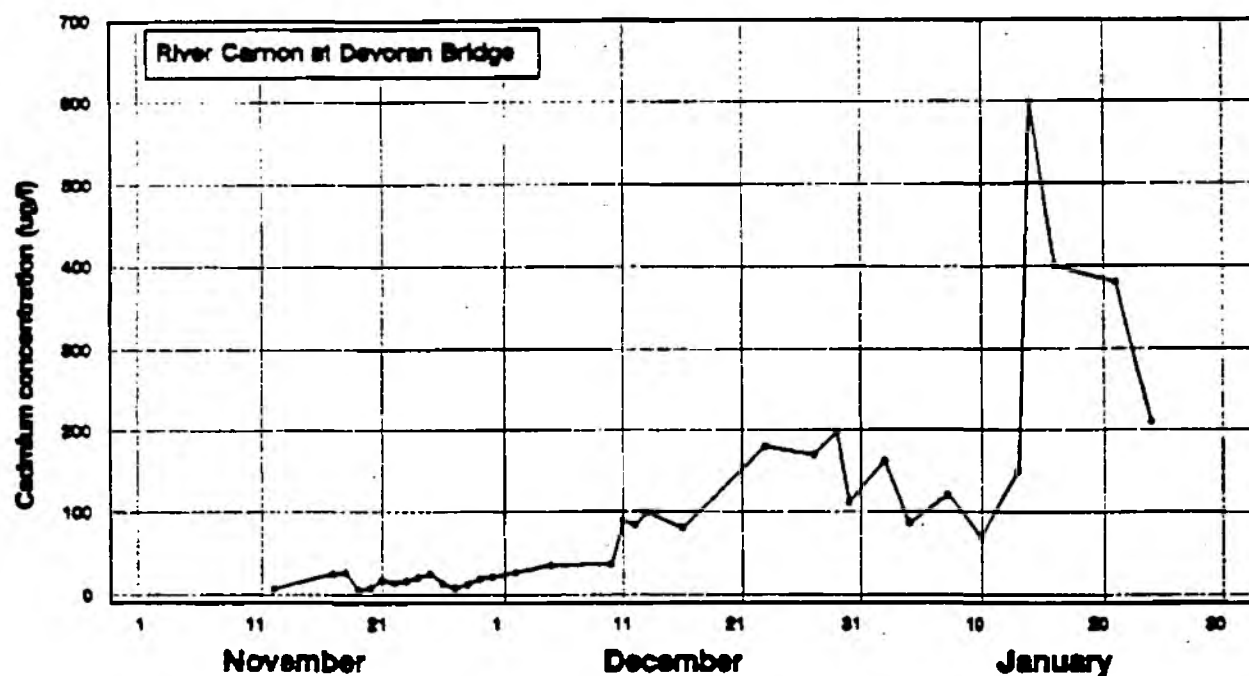
29 January 1992

National Rivers Authority
South West Region

WATER QUALITY IN THE RIVER CARNON

Cadmium is a toxic metal which, under the EC Dangerous Substances Directive, should not exceed a concentration of 1 ug/l (parts per billion) in freshwaters. Historically, because of the local mining industry, this level has usually been exceeded at Devoran Bridge, the most downstream freshwater point, sometimes exceeding 30 ug/l.

When the Jane's adit first started to flow on 17 November 1991, there was a small effect on the river. The slow rise in cadmium levels throughout December was due, almost certainly, to the mine water discharging from the Nangiles area. The collapse of a plug in the Nangiles adit on 14 January 1991 resulted in a large discharge of bad quality water, causing high cadmium concentrations in the river. Subsequently, reduced flow from Nangiles has been matched by reduced concentrations in the river. These are still high and far exceed the standard of 1 ug/l.



Carnon Valley Update



29 January 1992

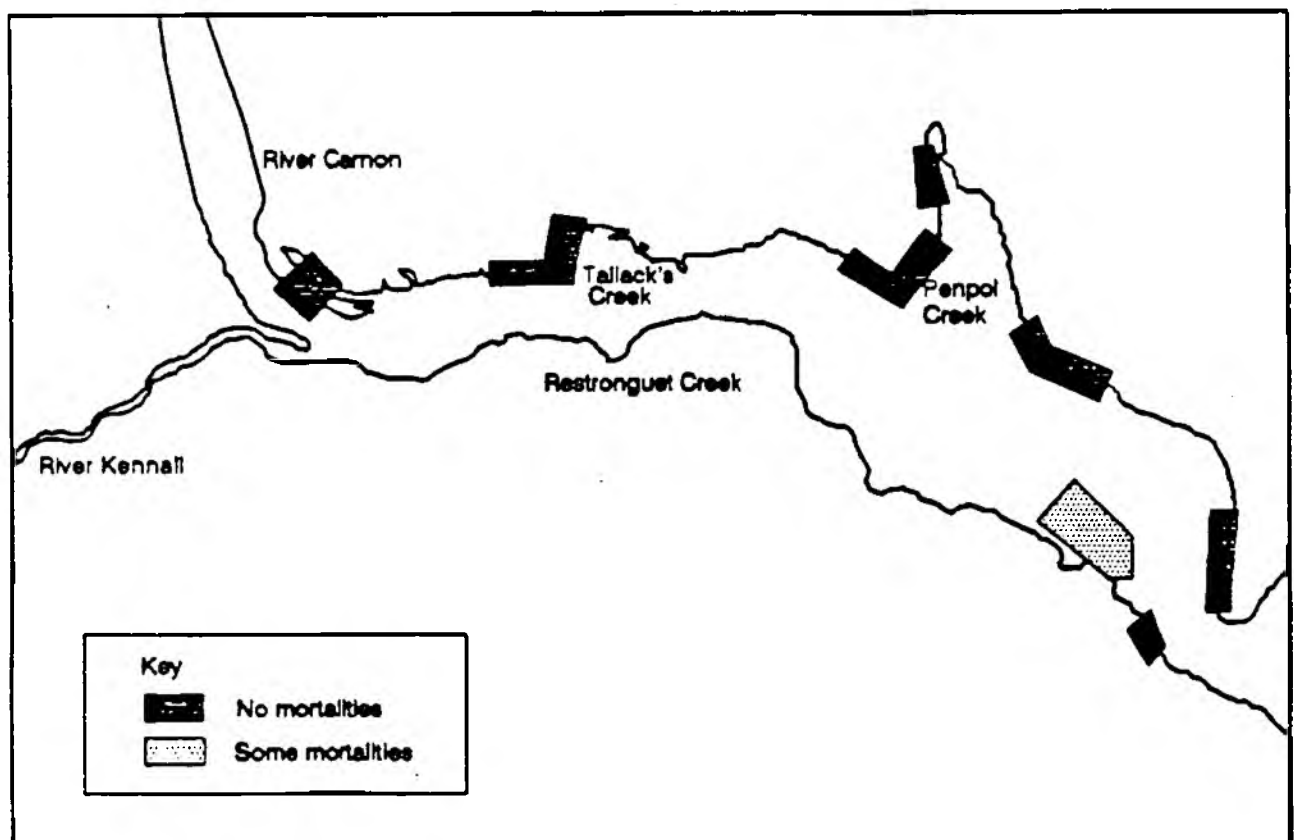
National Rivers Authority
South West Region

TIDAL WATERS BIOLOGY, RESTRONGUET CREEK

A comprehensive base line survey was carried out in July 1991, before any discharge from Wheal Jane. Fauna in the upper and middle reaches of Restronguet Creek was sparse due to historic mining activities, with only two resident species present – a polychaete, Nereis diversicolor, and a bivalve, Scrobicularia plana. These are known to be tolerant of metals. At the mouth of the creek, the fauna was more diverse, with up to 25 species present.

In January 1992, shortly after the pollution incident, a survey indicated no mortalities in the upper and middle reaches. At one site near the mouth of the creek, a few dead cockles and shore crabs were found and an encrusting sponge was peeling off the substrate. However, live specimens of these and other species were present in the immediate vicinity. Some cockles were taken for metal analysis. Results are not yet available and so no conclusions can be drawn.

Future monitoring will include monthly assessments at the mouth of the creek, full surveys repeated in April and July 1992, and special surveys in other areas of concern.



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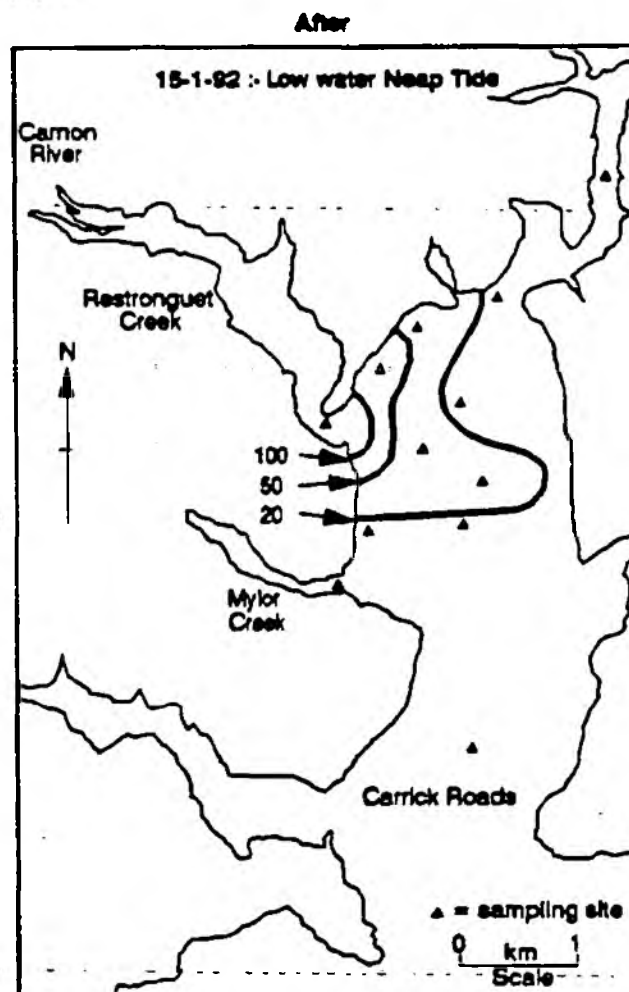
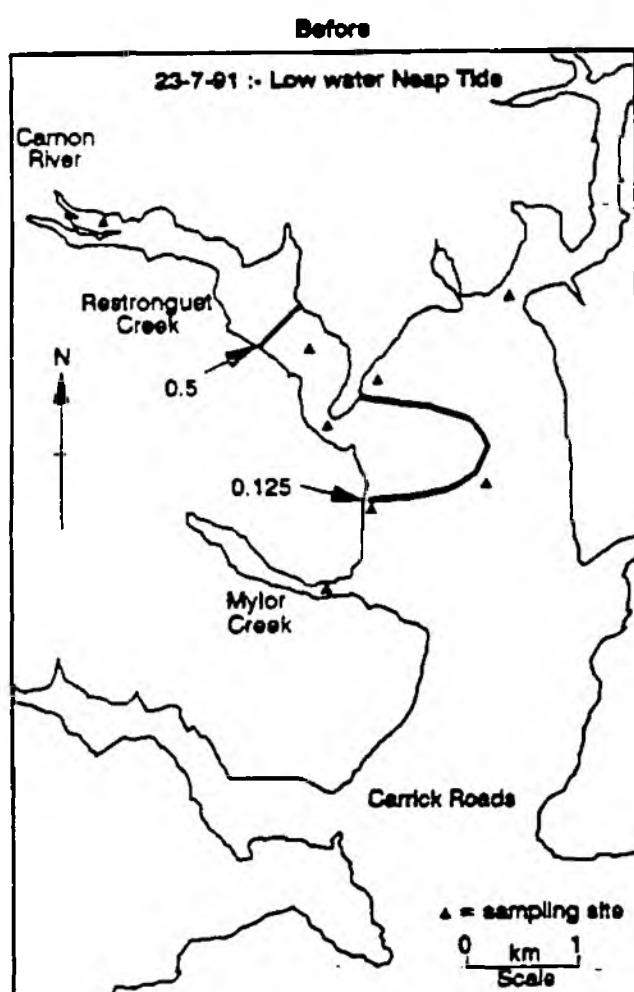
29 January 1992

National Rivers Authority
South West Region

WATER QUALITY IN TIDAL WATERS

When metal rich freshwaters mix with tidal waters, cadmium and many other metals come out of solution. Some are washed out of the estuary and others are deposited within the estuary. The diagram below left shows the situation in July 1991, before any discharge occurred from Wheal Jane. Levels were low and there was no evidence of the standard of 1 ug/l (parts per billion) being exceeded. Interim results from a survey on 15 January 1992 are shown below right. The Restronguet Creek and a substantial part of the Carrick Roads had high values which exceeded the standard. Discolouration could recur in certain tidal and weather conditions, without there having been a further major discharge from Wheal Jane.

Cadmium concentrations (ug/l) in Restronguet Creek



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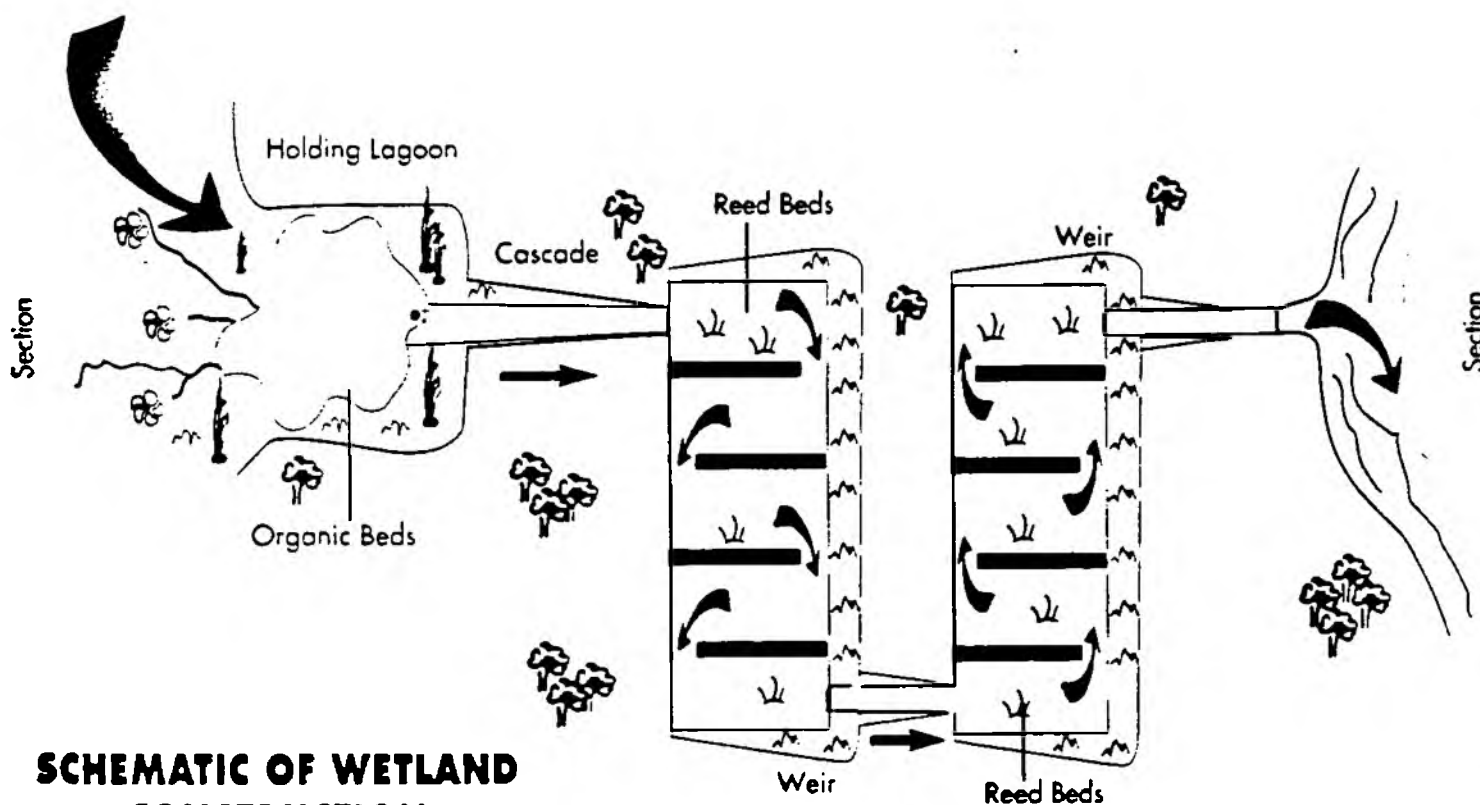
LOOKING FOR THE LONG-TERM SOLUTION

Work on finding a 'Green' solution to the Carnon pollution is already in hand. One possible answer involves the creation of a large wetland area into which discharged mine water will flow.

Percolating through beds of organic material, the water would pass into newly created reed beds. The metals contained in the water would be removed by natural processes as it passed through the beds.

The cleaner water would then flow into the River Carnon and be monitored by the National Rivers Authority.

The artist's impression below shows how a 'Green' solution could work. A specific solution to the River Carnon continues to be developed by the NRA and its specialist consultants.



SCHEMATIC OF WETLAND CONSTRUCTION

A PUBLIC INFORMATION ANNOUNCEMENT BY
CARRICK DISTRICT COUNCIL

FLOODING OF LOCAL TIN MINES
THE ENVIRONMENTAL PUBLIC HEALTH
IMPLICATIONS

CAUSES

Recent flooding of old mine workings has produced a very acidic body of water in the mines which has dissolved high levels of metal compounds including particularly cadmium and zinc.

EFFECT

When the sudden discharge of around 8 million gallons of acidic water into the River Carnon met with neutral sea water - the dissolved metals came out of solution to form a yellowish/orange opaque slick. Highest levels of cadmium so far recorded at Devoran Bridge on the River Carnon were on 14 January (600 parts of cadmium in a billion parts of water). The Environmental Quality Standard for cadmium is 5 parts).

AREA

At its worst Restronguet Creek became discoloured and this spread with the tide to Loe Beach, Mylor Creek and Harbour, into Falmouth Harbour and past Pendennis Point. In the last few days the discolouration has diminished.

WHAT IS THE DISCOLOURATION?

It consists mainly of iron hydroxide which gives the ochre colour together with a mixture of other metals including aluminium, zinc, copper, manganese and lead. Cadmium was also present in levels above recommended Environmental Quality Standards.

IS THE DISCOLOURATION DANGEROUS?

You would have to swallow large amounts of the discoloured salt water before it had any effect on you but, as a sensible precaution, Carrick advised that water recreation users keep clear of the worst affected area. The Director of Public Health Medicine advises that water quality outside Restronguet Creek is perfectly safe for recreational use.

ARE SEAFOOD SUPPLIES AFFECTED?

The Ministry of Agriculture Fisheries and Food and the Department of Health are responsible for advising on the safety of consuming shellfish. They advise that test results taken since the incident indicate that there is no cause for concern on health grounds in eating shellfish from this area.

ARE PRIVATE WATER SUPPLIES AFFECTED?

There are approximately 12 properties whose well and borehole supplies have been identified as being at possible risk from the mine discharge. Carrick's detailed sampling programme has shown no sign of any effect. Again, as a precautionary measure, advice was given to those householders to drink bottled water until the situation improves. Once we have a clearer picture, that advice will be reviewed.

ARE PUBLIC WATER SUPPLIES AFFECTED?

South West Water's supplies are not drawn from the affected area.

WHAT IS BEING DONE NOW?

Short-term measures are already in effect to minimise the problem now. The National Rivers Authority and mine owners are working to find an effective long-term environmentally sound solution which will improve the whole of Restronguet Creek.

WHAT HAS CARRICK DONE?

To-date, Carrick members and officers have tried to assist anyone concerned by the incident by:

- ★ monitoring water supplies;
- ★ checking river and sea water results;
- ★ issuing warning advice where necessary;
- ★ calling together local shell fishermen to keep them informed;
- ★ pressing Ministers for urgent Government funding; and
- ★ reassuring tourist interest by providing balanced, sensible advice to counteract media over-reaction.

CARRICK DISTRICT COUNCIL, FALMOUTH AND TRURO PORT HEALTH AUTHORITY, THE MINISTRY OF AGRICULTURE FISHERIES AND FOOD, CORNWALL AND ISLES OF SCILLY HEALTH AUTHORITY AND NATIONAL RIVERS AUTHORITY HAVE JOINED TOGETHER TO PROVIDE A SINGLE INFORMATION SERVICE.

THIS IS SITUATED AT CARRICK DISTRICT COUNCIL'S OFFICES IN TRURO AND CAN BE CONTACTED DURING NORMAL OFFICE HOURS ON:

0872 224360

IF YOU ARE STILL CONCERNED, YOU ARE INVITED TO A PUBLIC MEETING IN TRURO CITY HALL AT 7.30pm, ON FRIDAY 31 JANUARY

**CARRICK
DISTRICT
COUNCIL**



Carnon Valley Update



DATE: 14 February 1992

NRA ANNOUNCE NEW TIN MINE INITIATIVES

National Rivers Authority

South West Region

The National Rivers Authority has announced a new package of initiatives to help improve the water environment in the Carnon Valley.

Further steps have been taken to support both the immediate, medium and long-term treatment of tin mine discharges. These include:

- * The doubling, from 14 February, of the amount of water being pumped and treated by Carnon Consolidated Ltd.

A special pump with acid resistant parts from Sweden has been installed, bringing the total on site to three. This will increase the treated flow to 2 million gallons a day and significantly reduce the amount of untreated water leaving the Nangiles adit (currently ranging between 1 and 3 million gallons a day).

The enhanced treatment follows detailed work by scientists to stabilise the acidity and settlement of metals.

- * Investigations are now also under way to try and further increase the amount of water being treated. The aim is to treat all the remaining flow, thereby stopping the discharge from the Nangiles adit.
- * Mining engineers are on site today reassessing the structural stability of underground adits and to consider if any necessary preventative work is required.
- * Consultants are continuing special studies of biochemical treatment systems in the USA and Canada prior to making proposals next month. Experts from Boston USA visited the Carnon Valley last week.
- * Meanwhile the NRA is progressing with preparations for the installation of treatment by starting a full-scale land survey of the Carnon Valley.

The NRA is also approaching a number of organisations - including the European Commission - to seek sponsorship for Research and Development on a longer term solution for the Valley.

The NRA is continuing to carry out work on the environmental impact of the discharges. This includes:

- * The establishment of a special conservation steering group to advise on the studies required to determine if there has been any impact on plants, animals, birds and general ecology. Members will also advise on the conservation aspects of the long term solution.

There will be a meeting of the new group next week and participants include English Nature, Cornwall Trust for Nature Conservation, RSPB and Cornwall Biological Records Unit.

- * The publication of the latest results from the NRA's on-going monitoring programme.

Commenting today NRA South West Environmental Protection Manager Clem Davies said, "The NRA is continuing to do all it can to minimise the impact of the discharges and to secure medium and long-term solutions. Everyone involved is determined to progress this complex project as rapidly as possible".

THE CURRENT SITUATION

FRESHWATER

Cadmium and zinc concentrations in the River Carnon at Devoran Bridge have remained fairly stable since the collapse of the plug in the Nangiles adit on 13 January 1992.

Details are given on the attached sheet and these show that the levels still far exceed Environmental Quality Standards for cadmium (= 1 ug/l or parts per billion) and zinc (= 500 ug/l or parts per billion).

The successful treatment of half of the total discharge of mine water has prevented further serious pollution. However, river water quality continues to be poor at Devoran Bridge because the remaining half of untreated mine water is entering the river from Nangiles adit.

As announced above, plans are now well in hand to start treating this remaining discharge.

ESTUARY

Results of sampling in Restronguet Creek and the Carrick Roads are now becoming available. Attached sheets give data for arsenic and zinc levels in sea water and for NRA tests on oysters.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

This is situated at Carrick District Council's offices in Pydar Street, Truro and will operate during normal office hours. A special telephone number has been established:

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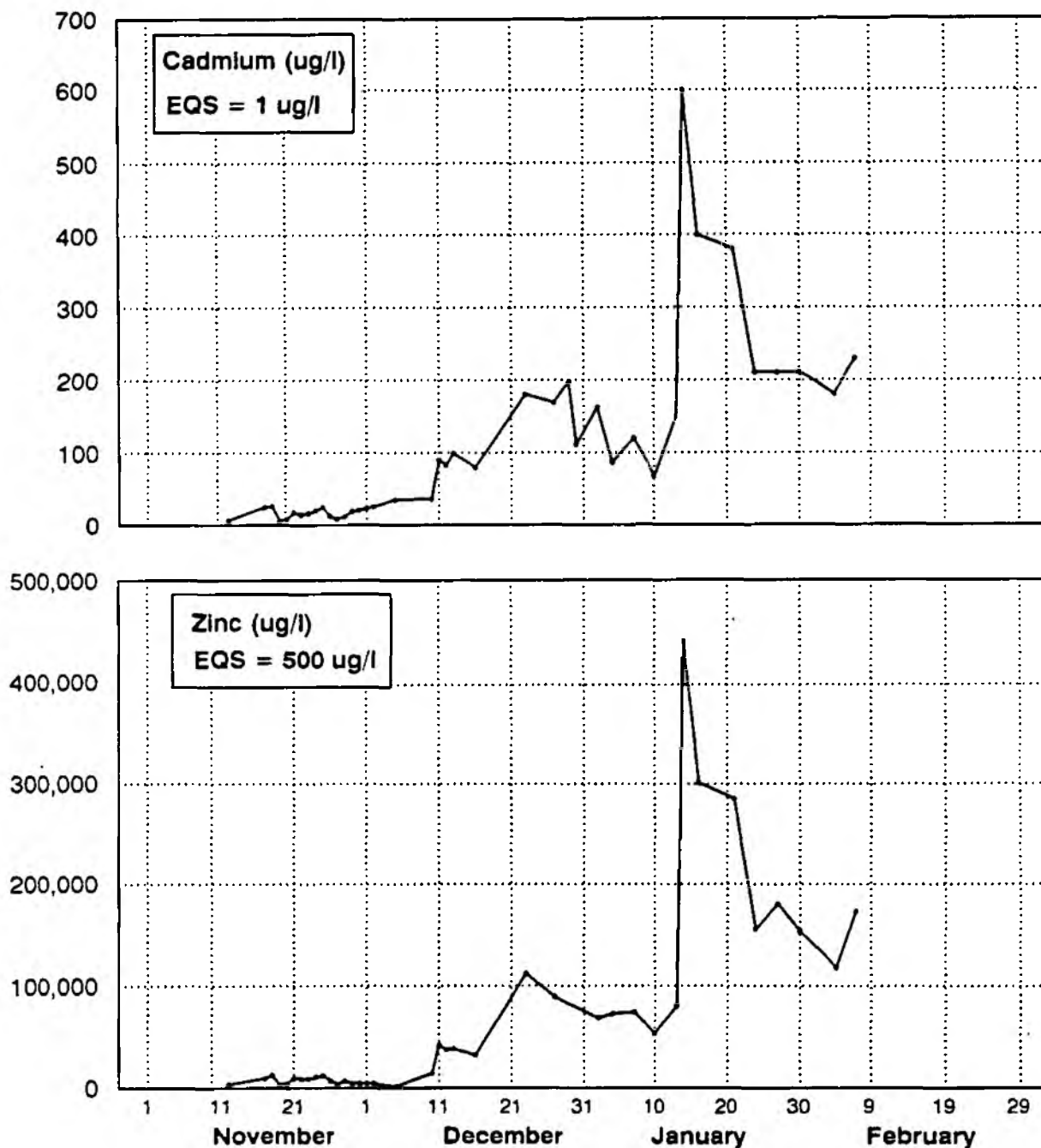
NRA

14 February 1992

National Rivers Authority
South West Region

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



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National Rivers Authority
South West Region

WATER QUALITY IN TIDAL WATERS

When the highly acidic, metals rich water from the River Carnon mixes with seawater in Restronguet Creek, trace metals come out of solution. Because of the large amount of iron in the river water, a rusty coloured orange plume is formed in the estuary.

Not all the metals will come out of solution. A certain amount remains in the dissolved phase.

To date only a limited amount of data is available for the considerable number of seawater samples that have been collected since the pollution incident. The analysis methods used to measure concentrations of trace metals in seawater are extremely complicated and time consuming. In addition, concentrations at some sites have been so high that several analyses have to be carried out on the same sample before an accurate concentration can be determined.

Arsenic

The environmental quality standard (EQS) for dissolved Arsenic in estuaries is 25 $\mu\text{g/l}$ (parts per billion). The distribution of dissolved arsenic in Restronguet Creek and the Carrick Roads in July 1991, before any discharge from Wheal Jane, and on 15 January 1991, and 29 January 1991 are shown below. For all dates the "worst case" concentrations are shown, ie concentrations at Low Water.

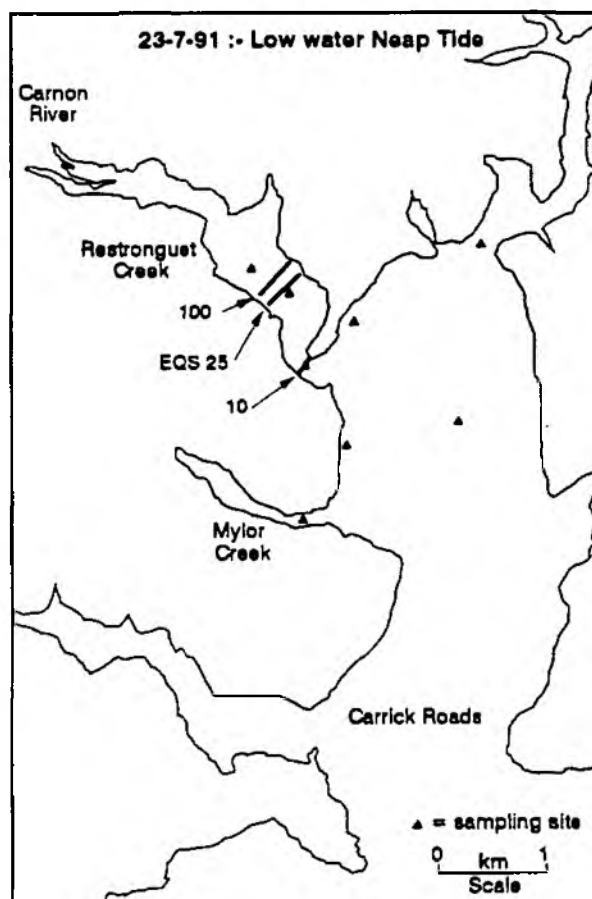
In July 1991, the EQS for arsenic was exceeded along three-quarters of Restronguet Creek and concentrations in the Carrick Roads were below the EQS concentration.

By 15 January 1992, concentrations in Restronguet Creek were very high (up to 600 $\mu\text{g/l}$), and the EQS was exceeded in the whole of Restronguet Creek and part of the Carrick Roads.

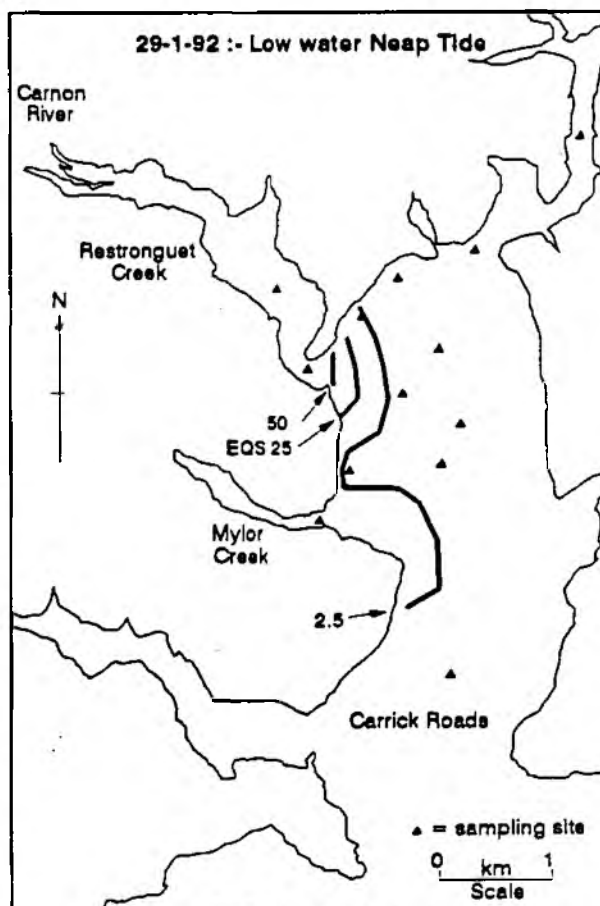
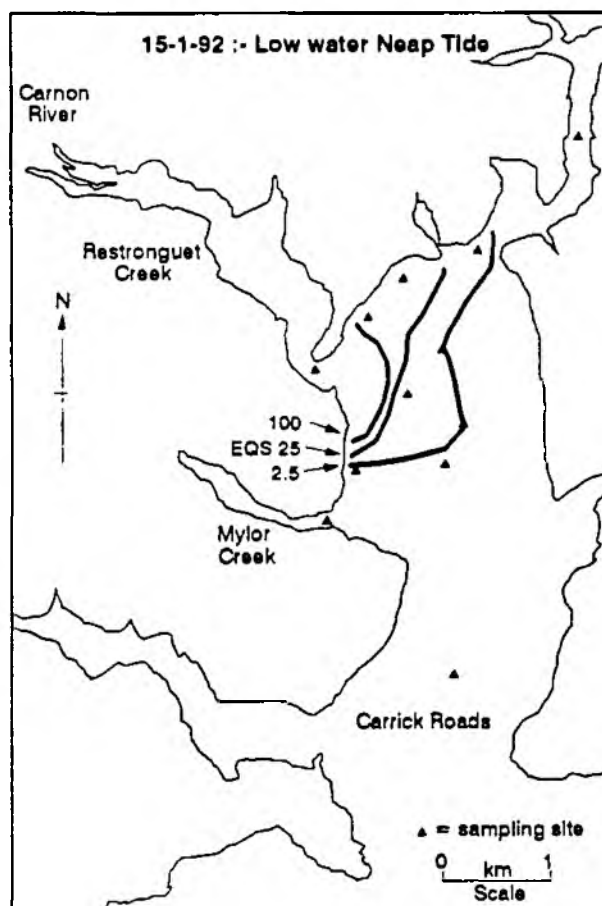
By 29 January 1992, concentrations of arsenic had decreased slightly, and the EQS was exceeded in Restronguet Creek and a small area in the Carrick Roads in the immediate vicinity of the mouth of the Creek. The highest concentration recorded in the Creek was 72 $\mu\text{g/l}$.

Dissolved Arsenic concentrations ($\mu\text{g/l}$) in Restronguet Creek

Before



After



Zinc

The EQS for dissolved zinc in estuarine waters is $40\mu\text{g/l}$. The distribution of dissolved zinc in the surface waters of Restronguet Creek and Carrick Roads, in July 1991, before the discharge from Wheal Jane, and on 15 January 1992 are shown below. For both dates, the "worst case" concentrations are shown, ie at low water.

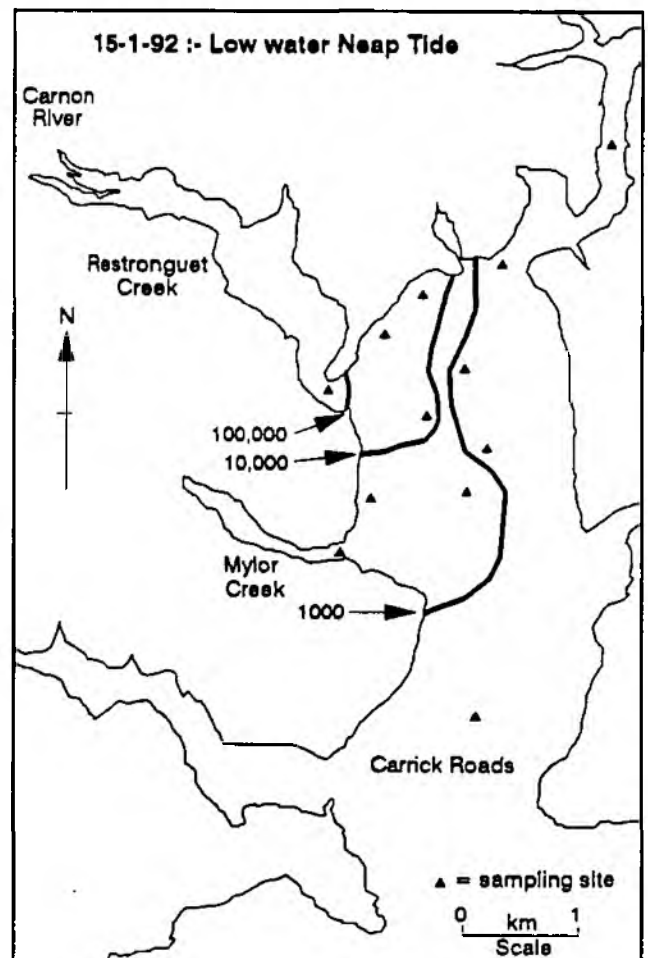
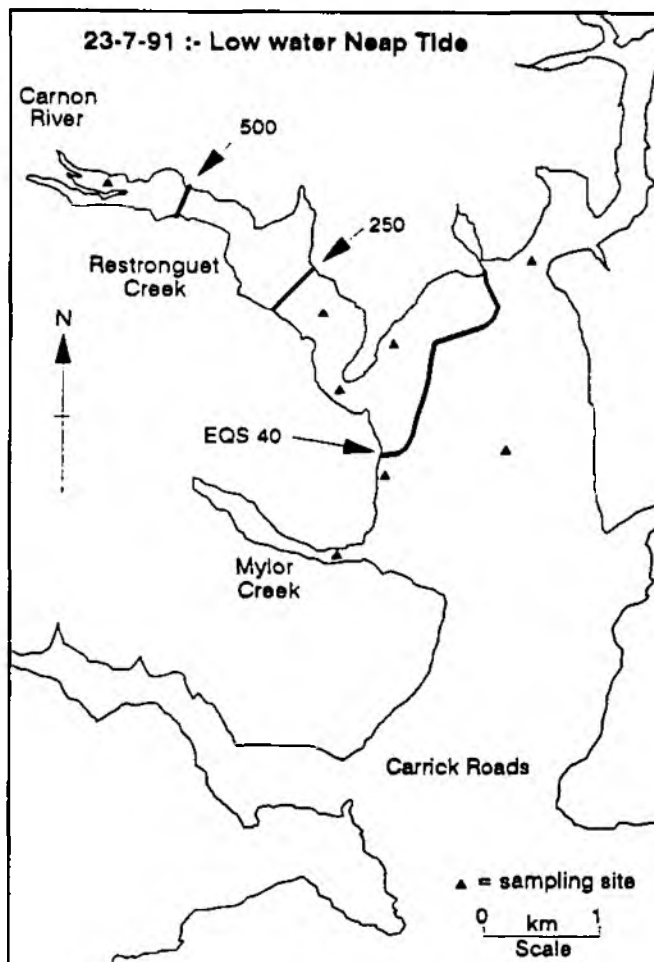
In July 1991, the EQS was exceeded in Restronguet Creek and in the Carrick Roads, in the vicinity of the mouth of the Creek. The highest concentration recorded in the Creek was $650\mu\text{g/l}$.

On 15 January 1992, extremely high concentrations of zinc, exceeding the EQS were found at all sites sampled in Restronguet Creek and the Carrick Roads. The highest recorded concentration was $120,000\mu\text{g/l}$, at the mouth of Restronguet Creek. These extremely high concentrations were found in the surface waters associated with the pollution plume. Concentrations in the bottom waters in the Carrick Roads were much lower, for example at one site, a concentration of $600\mu\text{g/l}$ was found at the surface, and $44\mu\text{g/l}$ at the bottom.

Zinc concentrations ($\mu\text{g/l}$) In Restronguet Creek

Before

After



Carnon Valley Update



NRA

National Rivers Authority
South West Region

14 February 1992

TRACE METALS IN OYSTERS FROM RESTRONGUET CREEK AND THE HELFORD RIVER

Samples of oysters were collected by the NRA on 17 January 1992, from Restronguet Creek and Helford River. The results were as follows:

| Site | Concentration, parts per million dry weight | | | | | |
|-------------------|---|--------|------|------|--------|------|
| | Cadmium | Copper | Iron | Lead | Nickel | Zinc |
| Restronguet Creek | 3.7 | 1320 | 221 | 24 | <0.5 | 6950 |
| Helford River | 2.0 | 380 | 216 | 8.8 | <0.5 | 3560 |

Concentrations of metals in oysters from Restronguet Creek are high, but are comparable with other data from the Creek, including current MAFF (Ministry of Agriculture, Fisheries and Food) data. Concentrations in oysters from the Helford River are much lower than in Restronguet Creek, and are comparable with other monitoring data obtained by the NRA and its predecessor, since 1988.

Therefore, these results indicate that there was no evidence of accumulation of trace metals in oysters, at the time these samples were collected.

MAFF are regularly collecting oyster samples from the Fal area to monitor trace metal concentrations.

Carnon Valley Update



NRA

National Rivers Authority
South West Region

DATE: 28 February 1992

TREATMENT DEVELOPMENTS

The National Rivers Authority is continuing to work with Carnon Consolidated Ltd in developing treatment of mine water discharges in the Tailings Dam.

Following the doubling of the amount of discharge being treated earlier this month, further initiatives are currently being taken to improve water quality.

On 27 February the pumping operation was altered so that both pumps were operating from one shaft. This is intended to enable better control of lime treatment.

The NRA stresses that the immediate treatment operation is very complex and finely balanced. Every effort is being made to enhance the level of treatment while medium and long-term solutions are worked on.

LATEST RESULTS

The latest results from sampling of the River Carnon and the tidal waters are attached. These all show a general improvement since the major discharge of January 13.

CONSERVATION

The first meeting of a Conservation Group to look at whether there has been an impact on plants, animals, birds and general ecology has been held. Various organisations are now working up proposals for monitoring programmes and further meetings will take place to progress the work.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

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Carnon Valley Update



NRA

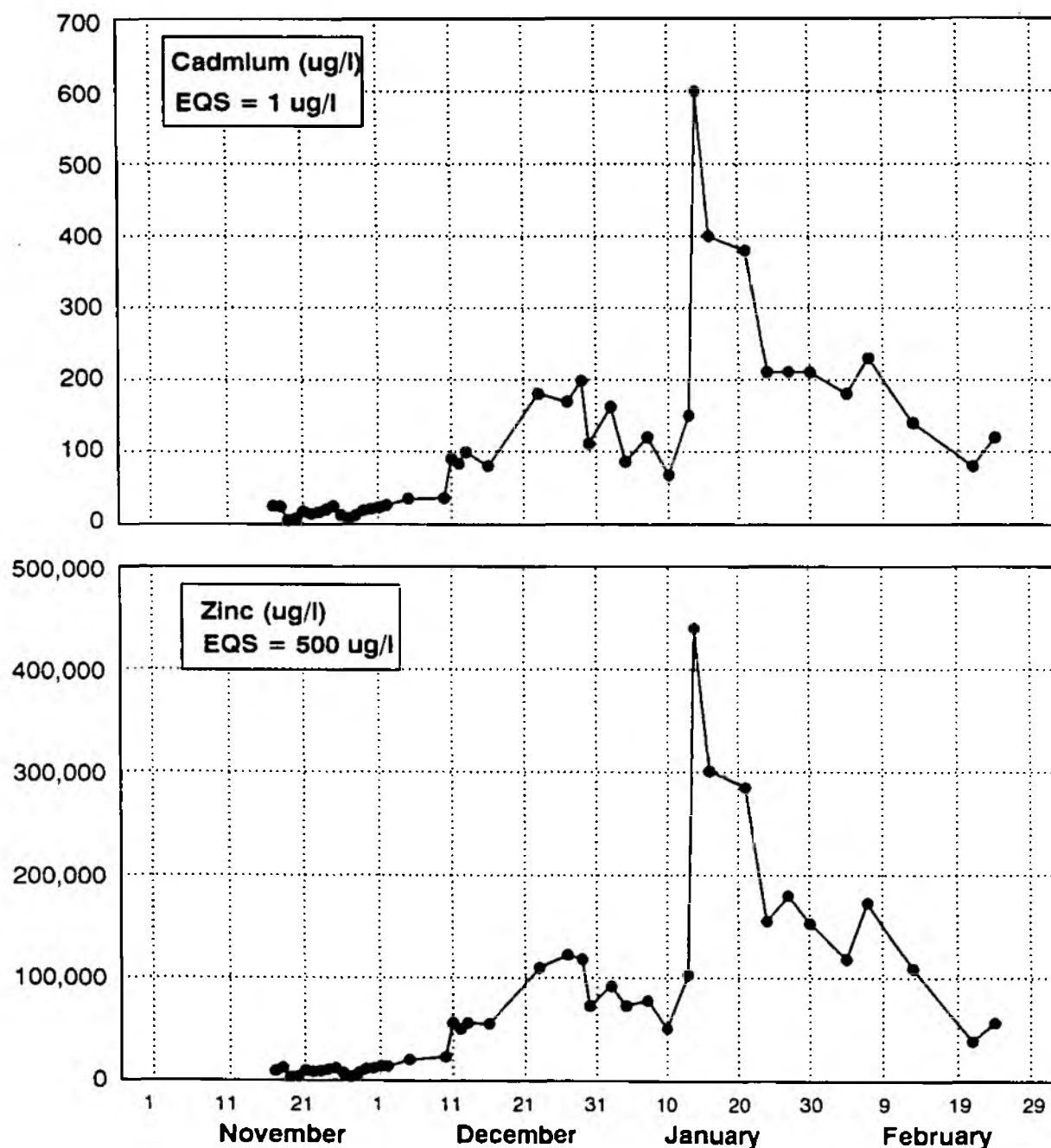
28 February 1992

National Rivers Authority

South West Region

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



*National Rivers Authority
South West Region*

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DISSOLVED ZINC: FAL ESTUARY SYSTEM, 23 JANUARY 1992

Water samples were collected by the NRA from the sites shown in figure 1. Surface and bottom waters at the site at Turnaware Bar were sampled 9 times over a 13 hour tidal cycle.

The results are shown in the attached table. The Environmental Quality Standard for dissolved zinc ($40 \mu\text{g/l}$, or parts per billion) was exceeded at all sites, except in the Carrick Roads off St Anthony Head and in the Percuil River off St Mawes Beach. Although the concentrations of dissolved zinc in Restronguet Creek were lower than on 15 January 1992, concentrations at the sites sampled in the Carrick Roads north of Falmouth, and in the Fal estuary were generally higher than on 15 January. On 15 January, the highest zinc concentrations were usually found at the surface, associated with the pollution plume. On 23 January, there was less of a difference between surface and bottom water concentrations. These differences observed between the two sampling dates are due to the plume of contaminated water spreading and mixing within the area.

The results from the samples collected at Turnaware Bar, shown in Figure 2, show these mixing processes. Zinc concentrations were higher during the flood tide and at high water, showing that contaminated water is being carried into the Fal estuary by the incoming tide.

NRA SOUTH WEST REGION - TIDAL WATERS INVESTIGATION UNIT

23 January 1992 Survey, Dissolved Zinc Concentrations in the Fal System

| Site | Dissolved Zinc Concentration ($\mu\text{g/l}$) | | | |
|------------------------------------|--|---------|-----------|--------|
| | High Water | | Low Water | |
| | Surface | Bottom | Surface | Bottom |
| Restronguet Creek off Pandora Inn | 568 | 416 | 1405 | 32500 |
| Tresillian River at Malpas | 654 | No data | | |
| Truro River above Malpas Buoy | 319 | 321 | No data | |
| Truro River above Fal confluence | 313 | No data | | |
| River Fal at Ruan | 140 | | | |
| Turnaware Bar - Fixed Station | see attached graph | | | |
| Carrick Roads at Messack Buoy | 406 | 183 | 590 | 425 |
| Carrick Roads at Vilt Buoy | 171 | 123 | 187 | 280 |
| Carrick Roads at Gyllingvase Beach | 61 | No data | | |
| Carrick Roads at Swanpool Beach | 63 | No data | | |
| Carrick Roads at Maen Porth Beach | 70 | No data | | |
| Carrick Roads at St Anthony Head | 16 | No data | | |
| Percuil River at St Mawes Beach | 14 | No data | | |

Environmental Quality Standard for Dissolved Zinc = 40 $\mu\text{g/l}$

FIGURE 1

NRA SW REGION - TIDAL WATERS INVESTIGATION UNIT
23.01.92 : SAMPLING SITES

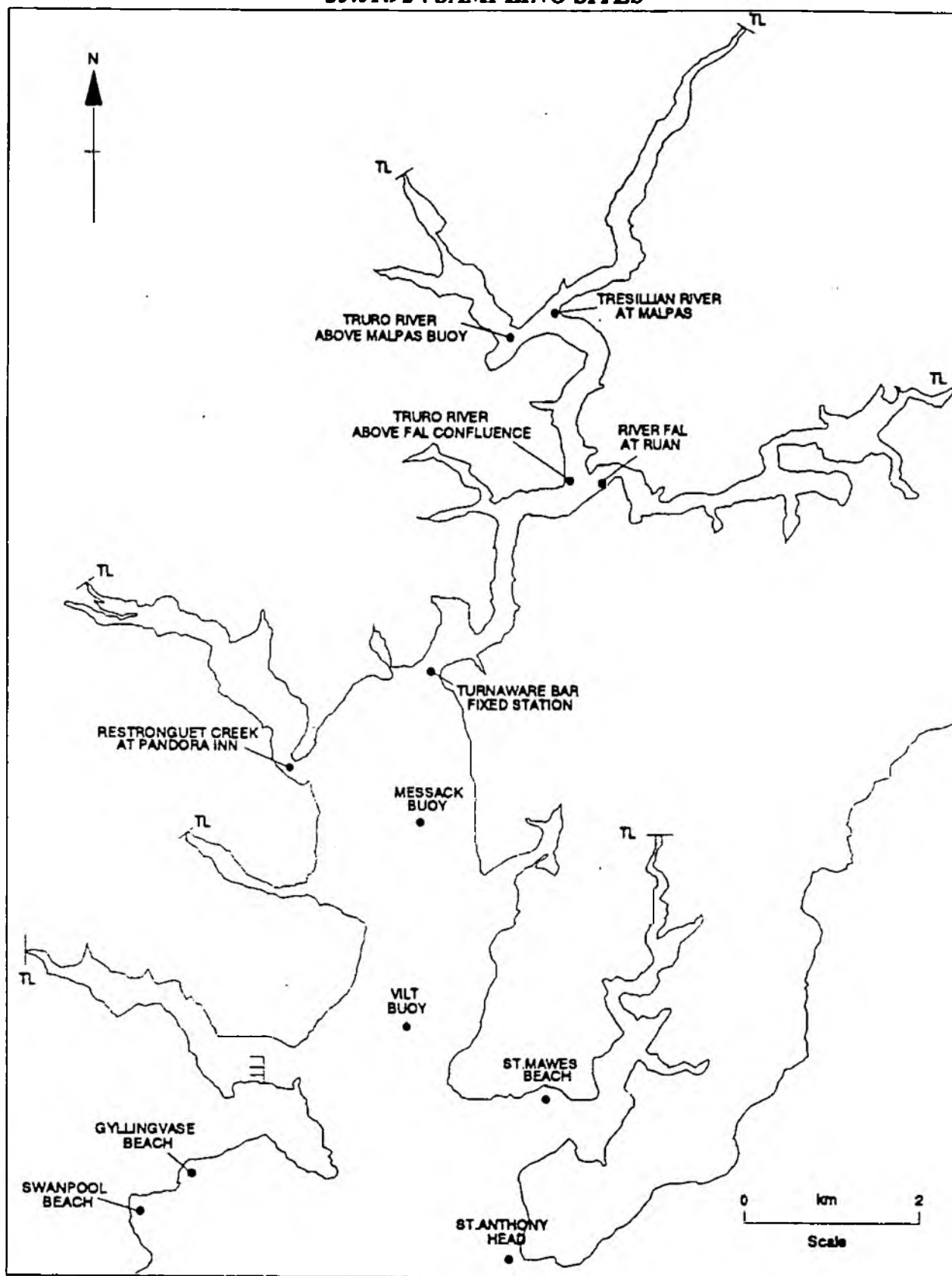
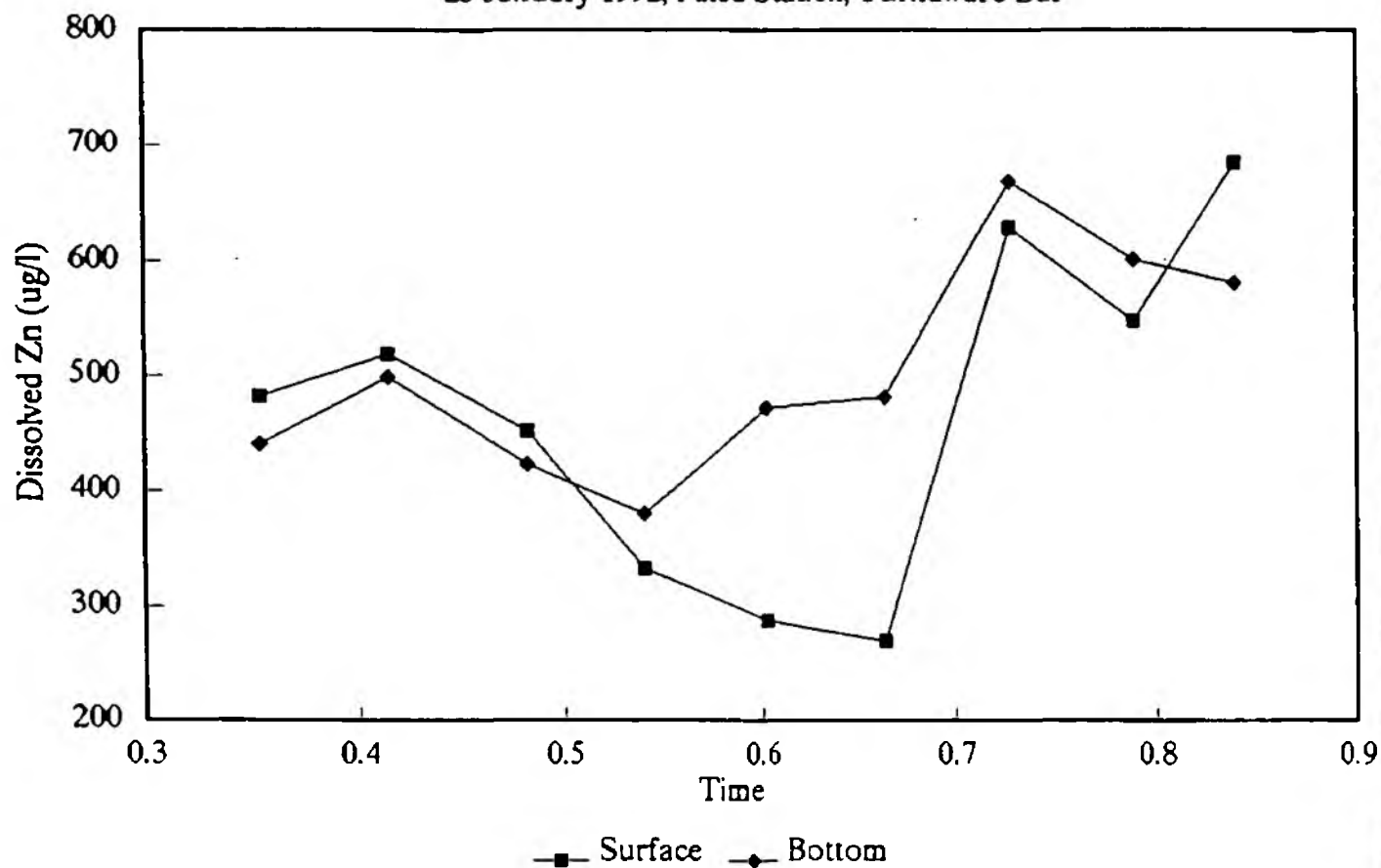


FIGURE 2

Temporal Variations of Dissolved Zinc

23 January 1992, Fixed Station, Turnaware Bar



HW Falmouth 20:11 (0.841), LW 12:00 (0.5)

Carnon Valley Update



National Rivers Authority
South West Region

28 February 1992

WATER QUALITY : FIXED STATION, RESTRONGUET CREEK

During NRA surveys of Restronguet Creek and Carrick Roads carried out on the 15 and 29 January 1992, a "Fixed Station" was occupied at the mouth of Restronguet Creek. A Fixed Station is a site where samples are collected at regular intervals for 13 hours, over a tidal cycle, for trace metals and a range of supporting measurements including salinity, pH and tidal current speed and direction. Because the tide makes a major impact on water quality, these stations provided valuable information about changes in water quality at different tidal states and the mixing of the pollution plume in the estuarine environment.

Attached are graphs showing the variations of pH and salinity, with depth over the tidal cycle, Figures 1 and 2 respectively, on 15 and 29 January. Current meter data were used to determine the times of high and low water accurately, and these are indicated on the graphs.

Data from the 15 January show that three hours either side of low water very low pH values, as low as 4.65, were recorded in the surface water in the creek, down to depth of approximately 2 metres (the normal pH range for estuaries is 7 to 8.5). The low salinities at the same depths show that a large amount of fresh water of low pH was responsible for these low estuarine pH values.

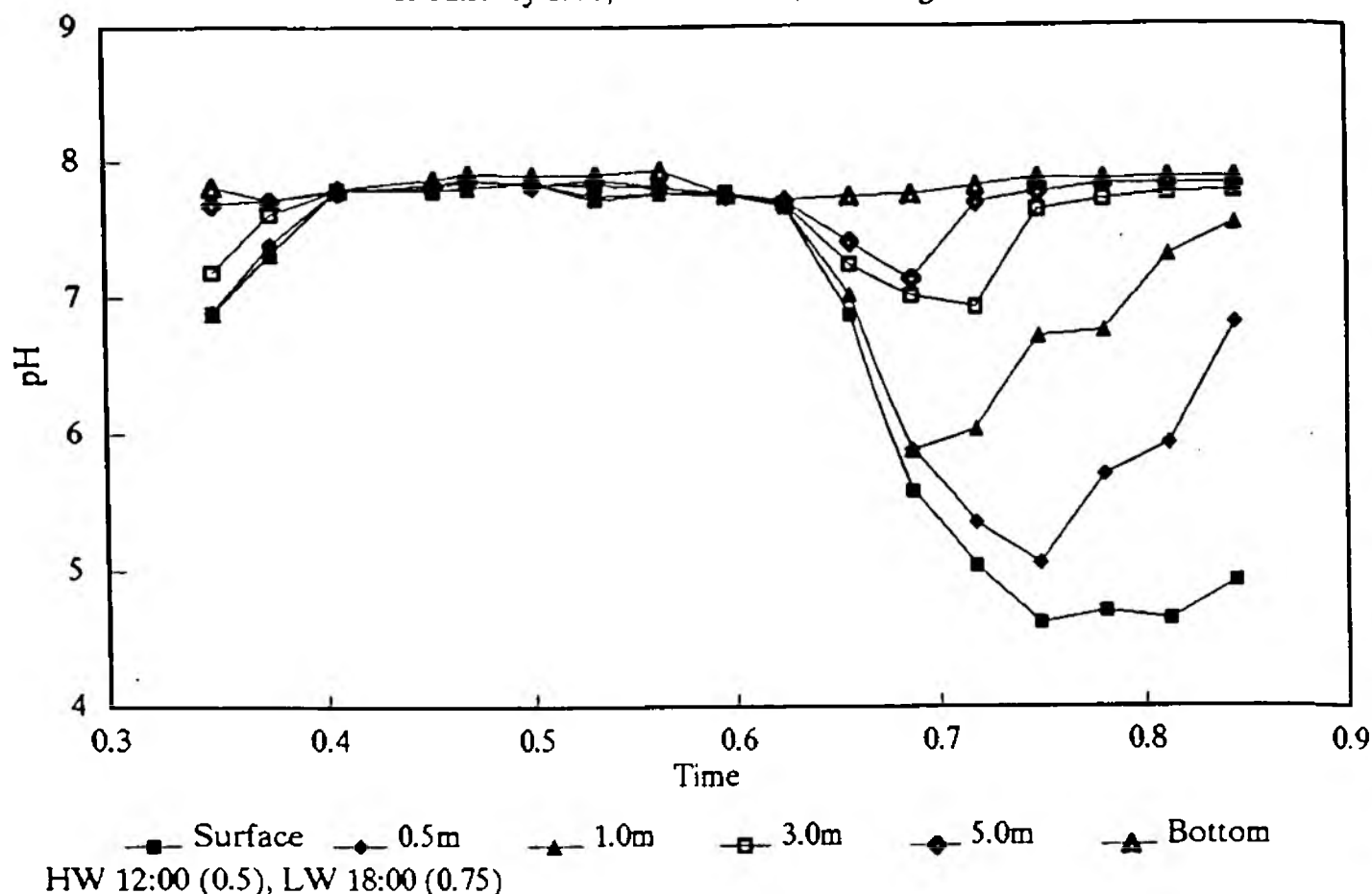
Data from the 29 January show that the situation had improved considerably. Although pH was still low at low water, (the pH = 5.75), low pH values occurred for less time during the tidal cycle, and only in the surface meter of water. Salinities were also higher around low water, indicating that there was less freshwater entering the Creek.

The effect on trace metals concentrations of these observations can be seen using the example of zinc on 15 January. Figure 3 shows the variation of dissolved zinc concentrations over the tidal cycle. The concentrations in the bottom water varied slightly during the tidal cycle; this corresponded to small variations in salinity and pH in bottom water. However, at the surface very large variations in dissolved zinc concentration were observed, with the highest concentrations being associated with the lowest pH and salinity values. When river water mixes with estuary water, some of the trace metals come out of solution, however if the pH in the estuary is low, more of the trace metals will stay in solution than at normal estuary pH values.

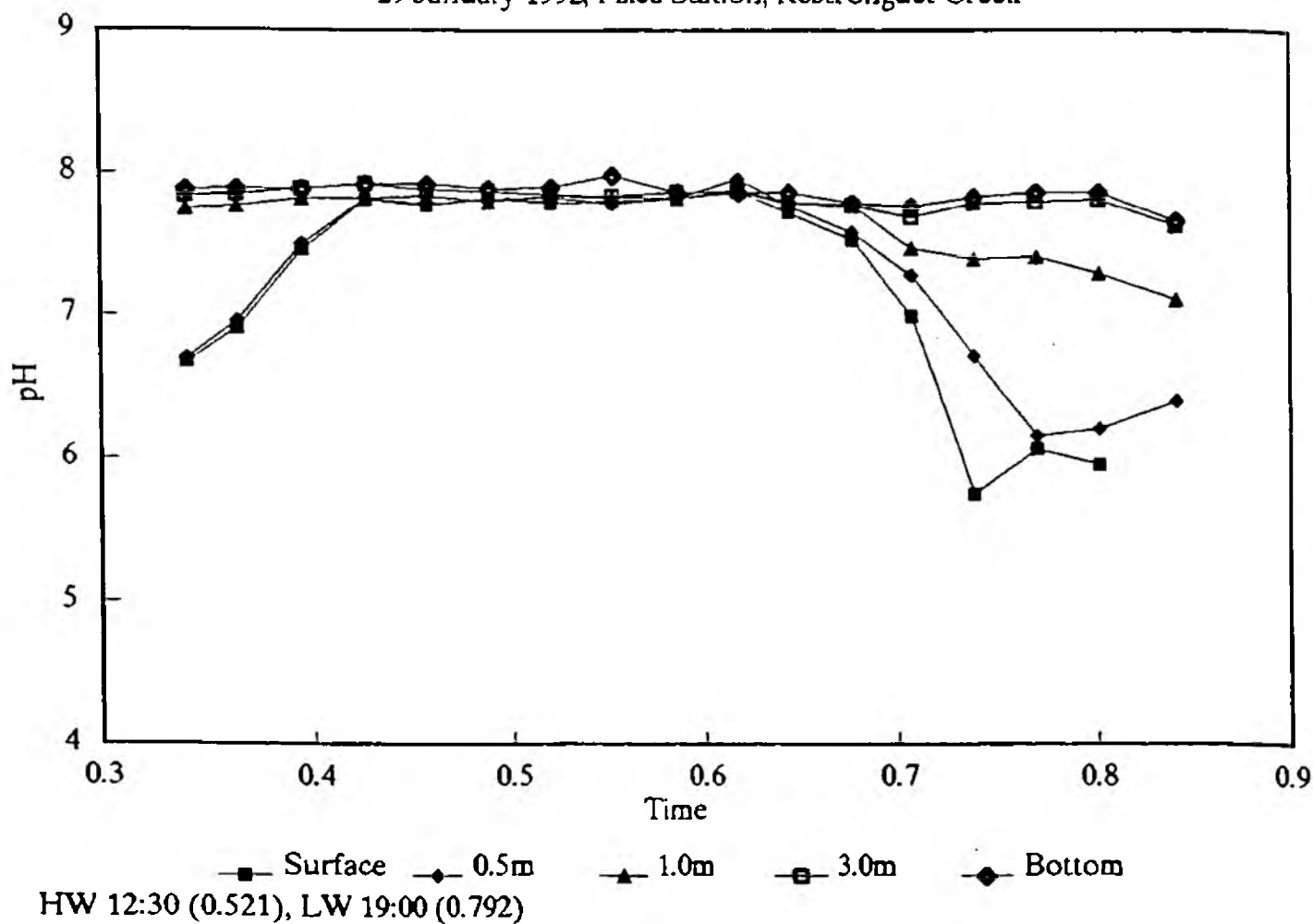
Temporal Variations of pH

FIGURE 1

15 January 1992, Fixed Station, Restronguet Creek



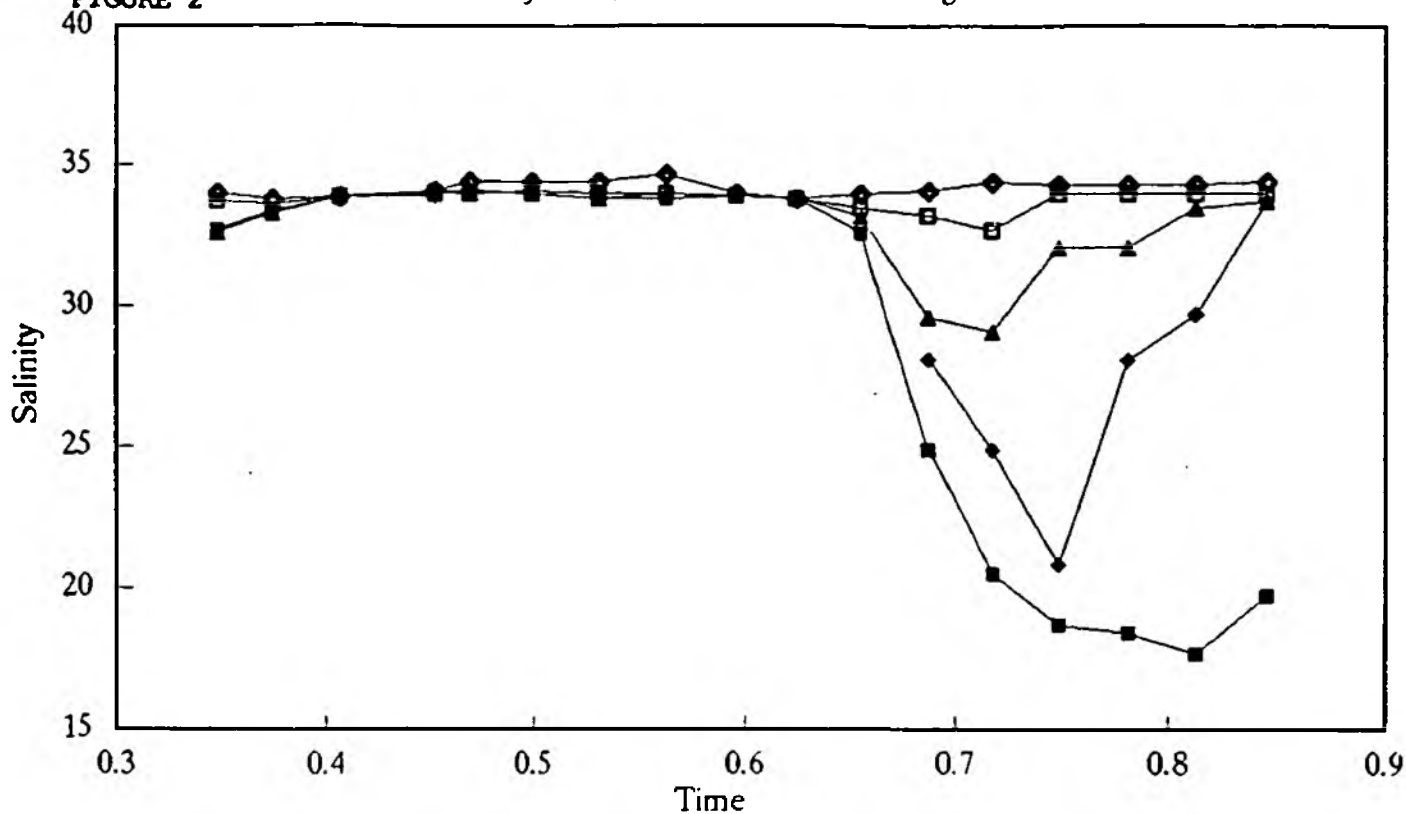
29 January 1992, Fixed Station, Restronguet Creek



Temporal Variations of Salinity

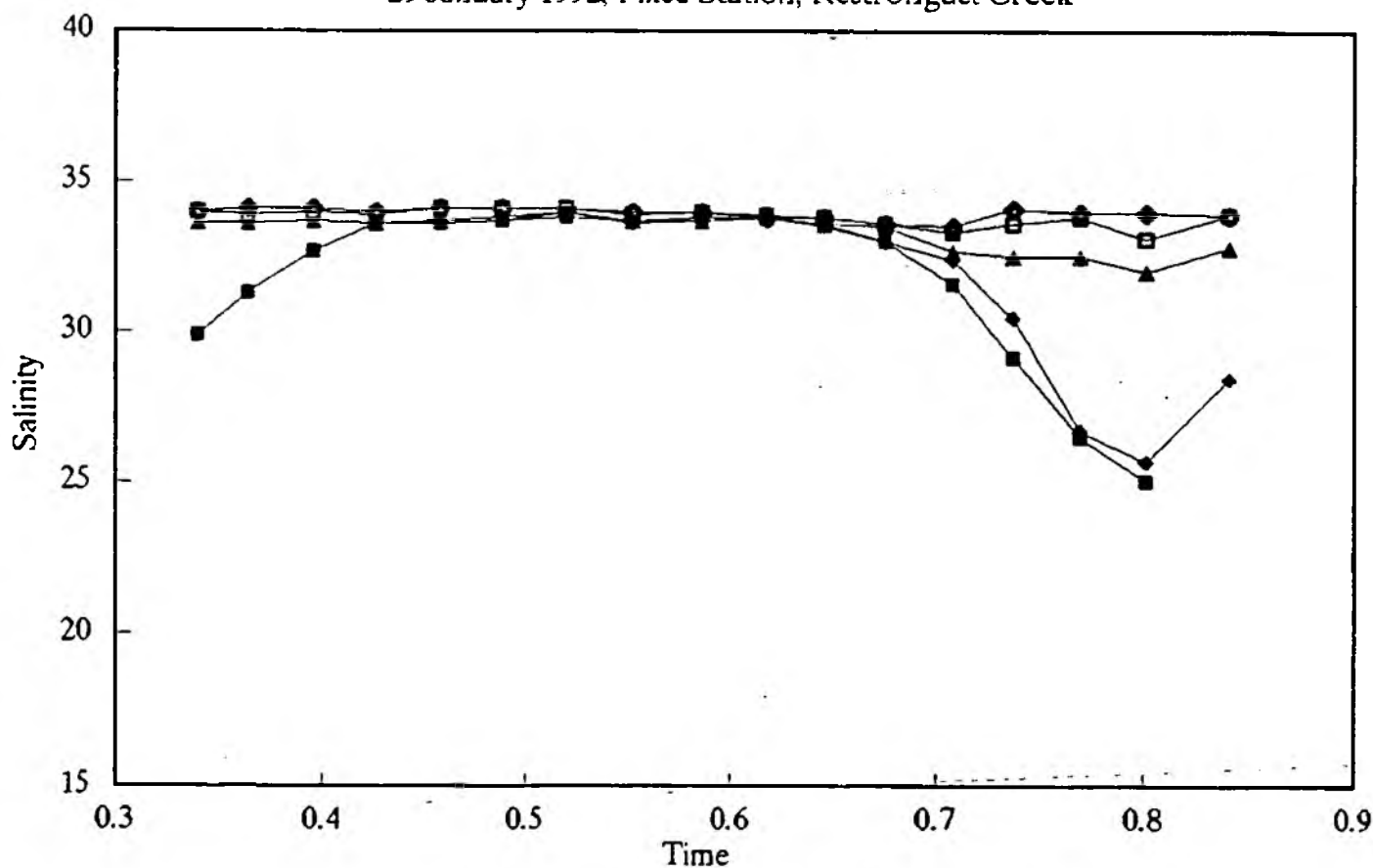
15 January 1992, Fixed Station, Restronguet Creek

FIGURE 2



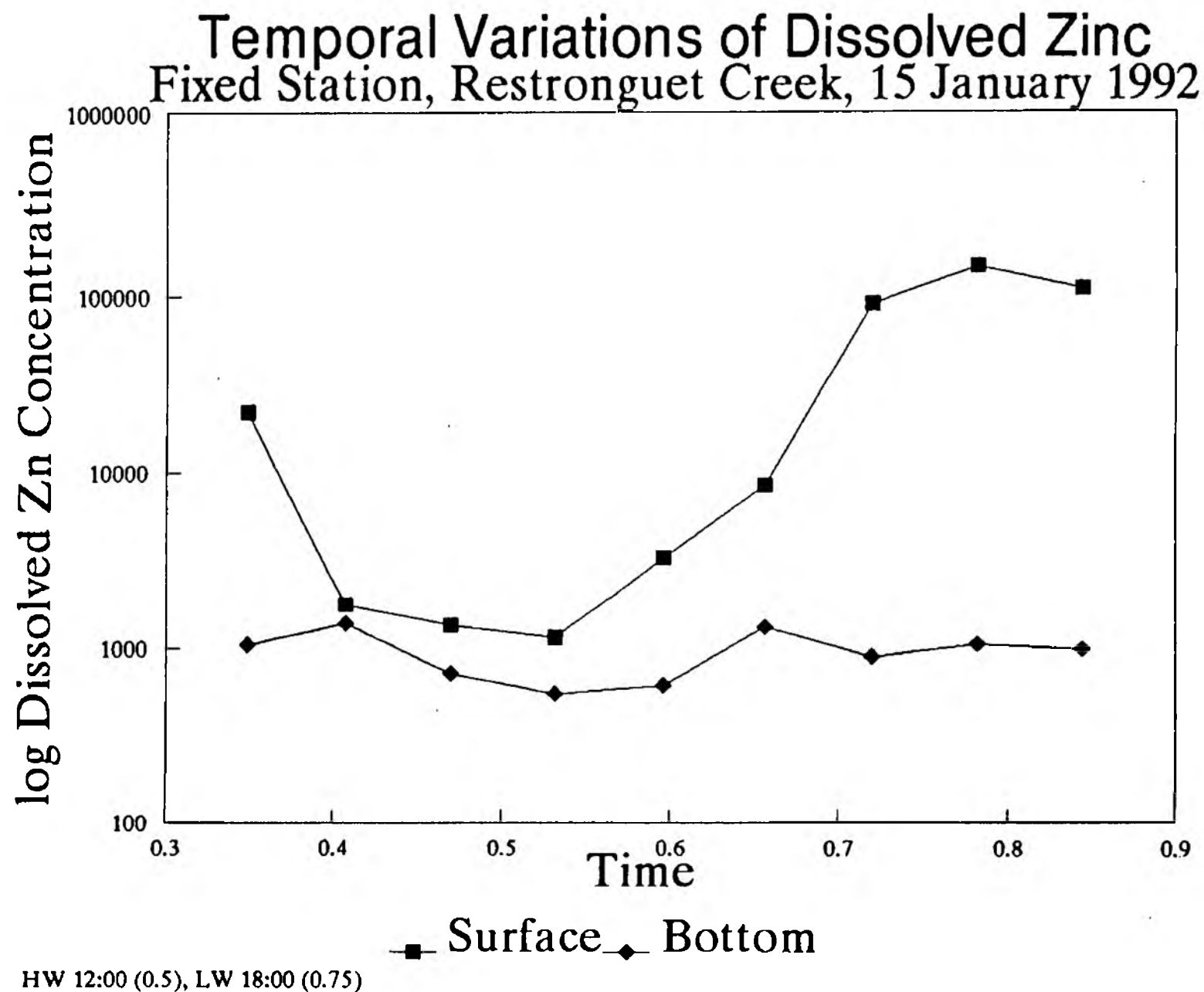
HW 12:00 (0.5), LW 18:00 (0.75)
 —■— Surface —◆— 0.5m —▲— 1.0m —□— 3.0m —◇— Bottom

29 January 1992, Fixed Station, Restronguet Creek



HW 12:30 (0.521), LW 19:00 (0.792)
 —■— Surface —◆— 0.5m —▲— 1.0m —□— 3.0m —◇— Bottom

FIGURE 3



Carnon Valley Update



NRA

National Rivers Authority
South West Region

DATE: 13 March 1992

TREATMENT CONTINUES

The National Rivers Authority is continuing to work with Carnon Consolidated Ltd in treating around 2.2 million gallons of mine water a day in the Tailings Dam.

On-site supervision is aimed at closely controlling and improving the quality of the discharge to the river.

The treatment has successfully reduced the acidity and metal content of the water since the major discharge of 13 January (see latest results attached).

The lowest reading of cadmium at Devoran Bridge since that discharge was recorded on 3 March. This showed a level of 77 parts per billion compared to 600 on 13 January.

The results, however, do fluctuate according to conditions. The NRA stresses, once again, that the current treatment is very finely balanced. Recent high winds, for example, have caused difficulties in settling out the metals.

Nevertheless every effort is being made to manage the treatment as effectively as possible while the medium and long-term solutions are worked on.

ENVIRONMENTAL QUALITY STANDARDS

A note explaining what Environmental Quality Standards (EQSS) are and how they relate to the Carnon Valley is attached.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

This is situated at Carrick District Council's offices in Pydar Street, Truro and will operate during normal office hours. A special telephone number has been established:

TRURO (0872) 224360

The centre has up-to-date information from each of the authorities involved.

Carnon Valley Update



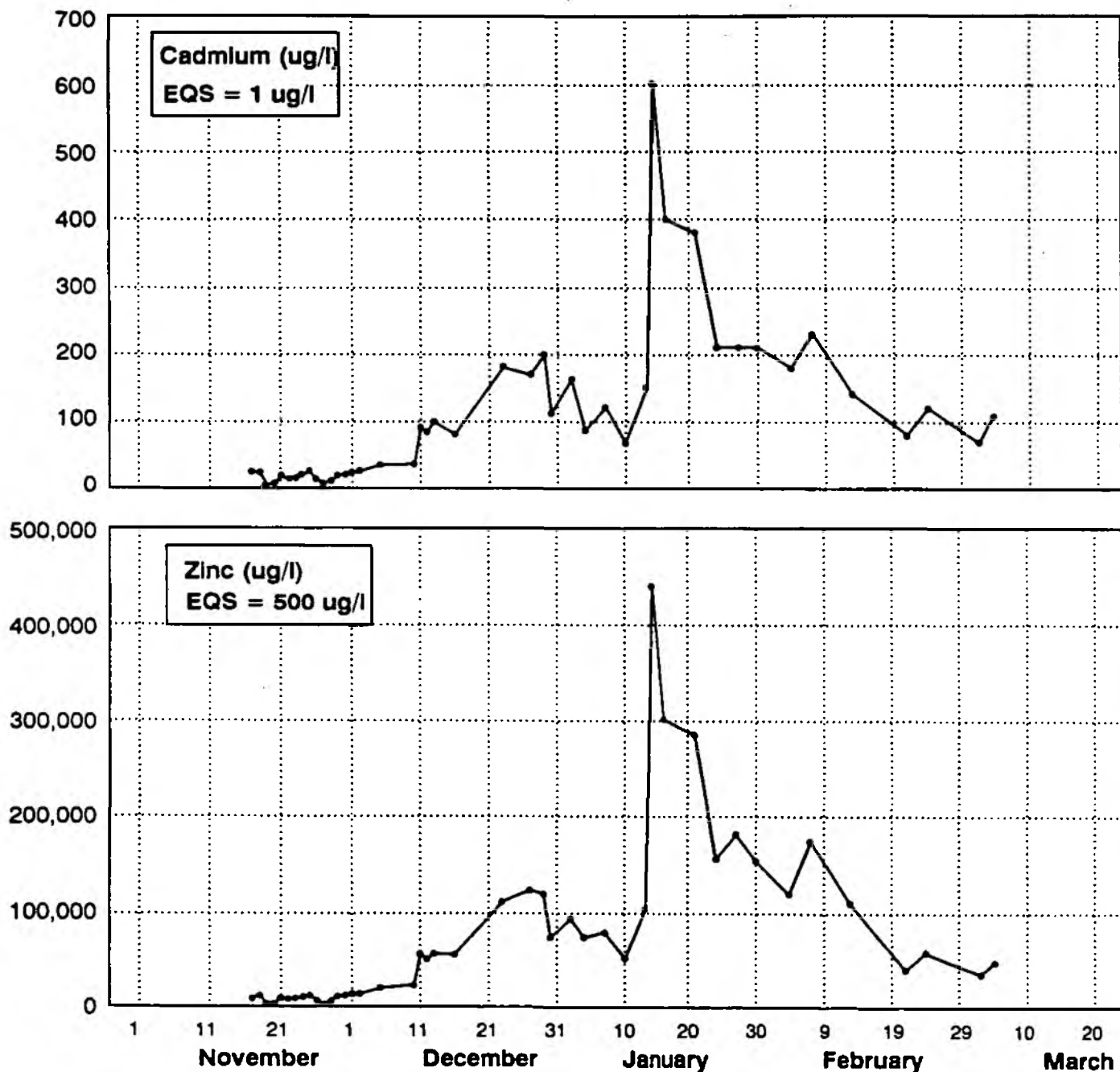
NRA

13 March 1992

National Rivers Authority
South West Region

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority
South West Region

13 March 1992

TRACE METAL CONCENTRATIONS IN COCKLES FROM RESTRONGUET CREEK, 17 JANUARY 1992

During a biological survey of Restronguet Creek carried out on 17 January 1992 by the NRA, 12 cockles (*Cerastoderma edule*) were found on the surface of the sand flats at Restronguet Passage. The cockles were moribund, that is they were gaping abnormally which indicates they were under stress. The cockles were collected for chemical analysis.

The results of the chemical analysis are as follows:

Trace Metal Concentrations (parts per million wet weight)

| Cadmium | Chromium | Copper | Iron | Lead | Mercury | Nickel | Zinc |
|---------|----------|--------|------|------|---------|--------|------|
| 0.12 | 0.84 | 47 | 554 | 0.76 | <0.01 | 2.3 | 267 |

Concentrations of copper and zinc in the cockles are high, but are comparable with historical data for cockles from Restronguet Creek.

The reason for the moribund condition of the cockles is not known, however high trace metal concentrations, low pH and large salinity changes in the water column on that day may have been responsible.

Carnon Valley Update



NRA

National Rivers Authority

South West Region

13 March 1992

ENVIRONMENTAL QUALITY STANDARDS APPLICABLE TO THE RIVER CARNON AT DEVORAN BRIDGE, RESTROUQUET CREEK AND THE CARRICK ROADS.

The Dangerous Substances Directive was published by the Council of the European Communities in 1976 to provide legislation for the control of certain dangerous substances discharged to the aquatic and marine environment. The UK Government is addressing the requirements of the Directive by the introduction of regulations in the form of Statutory Instruments and notices through the Water Resources Act 1991

The Directive established two lists of compounds. List I contains substances regarded as particularly dangerous because of their toxicity, persistence and bioaccumulation. List II consists of less dangerous substances which can have a deleterious effect on the aquatic and marine environment. Discharges of List I substances must be controlled by Directive Standards issued through Daughter Directives and those of List II substances must be controlled by National Standards.

List I - Cadmium

The NRA monitors controlled waters in the vicinity of discharges which contain List I substances. It also undertakes general environmental monitoring at locations further removed from these discharges. A Daughter Directive has been issued for the List I substance cadmium. It sets standards for total cadmium in freshwaters of 5 $\mu\text{g/l}$ (parts per billion) at locations near a discharge and 1 $\mu\text{g/l}$ at a far field site downstream of the discharge, and standards for dissolved cadmium of 5 $\mu\text{g/l}$ in estuary waters and 2.5 $\mu\text{g/l}$ in marine waters near a discharge and 1 $\mu\text{g/l}$ in estuary waters and 0.5 $\mu\text{g/l}$ in marine waters unaffected by a discharge.

The UK Government has addressed these regulations by issuing a Statutory Instrument stating mandatory standards for cadmium of 5 $\mu\text{g/l}$ (total) in freshwater, and 2.5 $\mu\text{g/l}$ (dissolved) in coastal waters and relevant territorial waters which includes estuaries. The NRA reports the results of monitoring annually to the Department of the Environment (DoE).

continued....

ENVIRONMENTAL QUALITY STANDARDS.....(continued)

List II

Environmental quality standards for List II substances are being introduced by the DoE. However, they have not been issued through Statutory Instruments, but through a DoE Circular, 7/89, and are, therefore, not mandatory, although they are advised standards which the Government intends should be met. The standards are related to different recognised uses of water. The NRA reports the results of monitoring annually to the DoE.

The relevant List II standards are:

River Carnon at Devoran Bridge

For the Protection of Aquatic Life.

| | | |
|-------------------|---|-----------------------|
| Dissolved copper | = | 28 $\mu\text{g/l}$ |
| Total zinc | = | 500 $\mu\text{g/l}$ |
| Dissolved nickel | = | 200 $\mu\text{g/l}$ |
| Dissolved arsenic | = | 50 $\mu\text{g/l}$ |
| Dissolved iron | = | 1,000 $\mu\text{g/l}$ |
| Dissolved lead | = | 250 $\mu\text{g/l}$ |
| pH | = | 6.0 to 9.0 |

Standards are related to the hardness of river water and may change from time to time if hardness changes.

Restronquet Creek and Carrick Roads

For the Protection of Salt Water Life

| | | |
|-------------------|---|-----------------------|
| Dissolved copper | = | 5 $\mu\text{g/l}$ |
| Dissolved zinc | = | 40 $\mu\text{g/l}$ |
| Dissolved nickel | = | 30 $\mu\text{g/l}$ |
| Dissolved arsenic | = | 25 $\mu\text{g/l}$ |
| Dissolved iron | = | 1,000 $\mu\text{g/l}$ |
| Dissolved lead | = | 25 $\mu\text{g/l}$ |

NB All standards are expressed as an annual average except pH which is expressed as a 95 percentile.

The shellfish area at Turnaware Bar in the Carrick Roads is identified under the EC Directive on the Quality Required of Shellfish Waters, and therefore different standards for trace metal concentrations and pH apply here. Details of these standards will be published later.

The standards shown above apply to the River Carnon, Restrionquet Creek and Carrick Roads (except Turnaware Bar). However, it is recognised that meeting the objectives of these standards is going to be difficult in the short term. Therefore a staged approach to meeting these objectives is being developed by the NRA.

Carnon Valley Update

DATE: 27 MARCH 1992



National Rivers Authority
South West Region

TREATMENT LATEST

The National Rivers Authority is continuing to work with Carnon Consolidated Ltd in supervising and controlling the treatment process.

Despite difficult weather conditions, particularly strong winds, the quality of the discharge has stabilised in recent weeks (see latest results attached).

For over a month, cadmium levels at Devoran Bridge have fluctuated around the 100 parts per billion mark. The peak during the major discharge on 13 January was 600.

Consultants examining the options for medium and long-term treatment are completing their field work in the USA. Their full report to the NRA is now expected in mid-April. This slight extension has been agreed to allow full analysis of the fieldwork to take place.

CONSERVATION

The Fal Estuary is an important ecological site. It includes a number of Sites of Special Scientific Interest, designated because of the diversity of intertidal habitats.

The estuary also has nationally important marine communities including large areas of eel grass (*Zostera*) and extensive areas of coral-like seaweed, known as maerl. The estuary supports the only known living deposit of maerl in Southern Britain.

Nationally important populations of wintering birds are also found in the estuary.

The National Union for the Conservation of Nature and Natural Resources has listed the area as a Threatened Community in the Invertebrate Red Data Book (1983).

Several interested groups have supported the establishment of the estuary as a marine conservation area, on a voluntary basis. The purpose of the 'Roseland Voluntary Marine Conservation Area' is to ensure that the users of the area understand its importance and do not unwittingly destroy the wildlife.

The National Rivers Authority has established a Conservation Steering Group to consider an ecological monitoring programme to appraise the impact of pollution from discharges in the Carnon Valley. Interested parties on the Group include English Nature, The Cornwall Trust for Nature Conservation, The Institute of Cornish Studies and The Royal Society for the Protection of Birds (RSPB).

Continued.....

UPDATE/27 MARCH....2

The Steering Group has recommended surveys of impact on:

1. Intertidal habitats
2. Sub-tidal habitats, including eel grass and maerl beds
3. Bird populations

Preparations to enable all these impact assessments to take place are being progressed by the NRA.

Elements of field work are already underway. The Institute of Cornish Studies are surveying the intertidal habitats and will be producing a report.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture, Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

This is situated at Carrick District Council's offices in Pydar Street, Truro and will operate during normal office hours. A special telephone number has been established:

TRURO (0872) 224360

The centre has up-to-date information from each of the authorities involved.

Carnon Valley Update



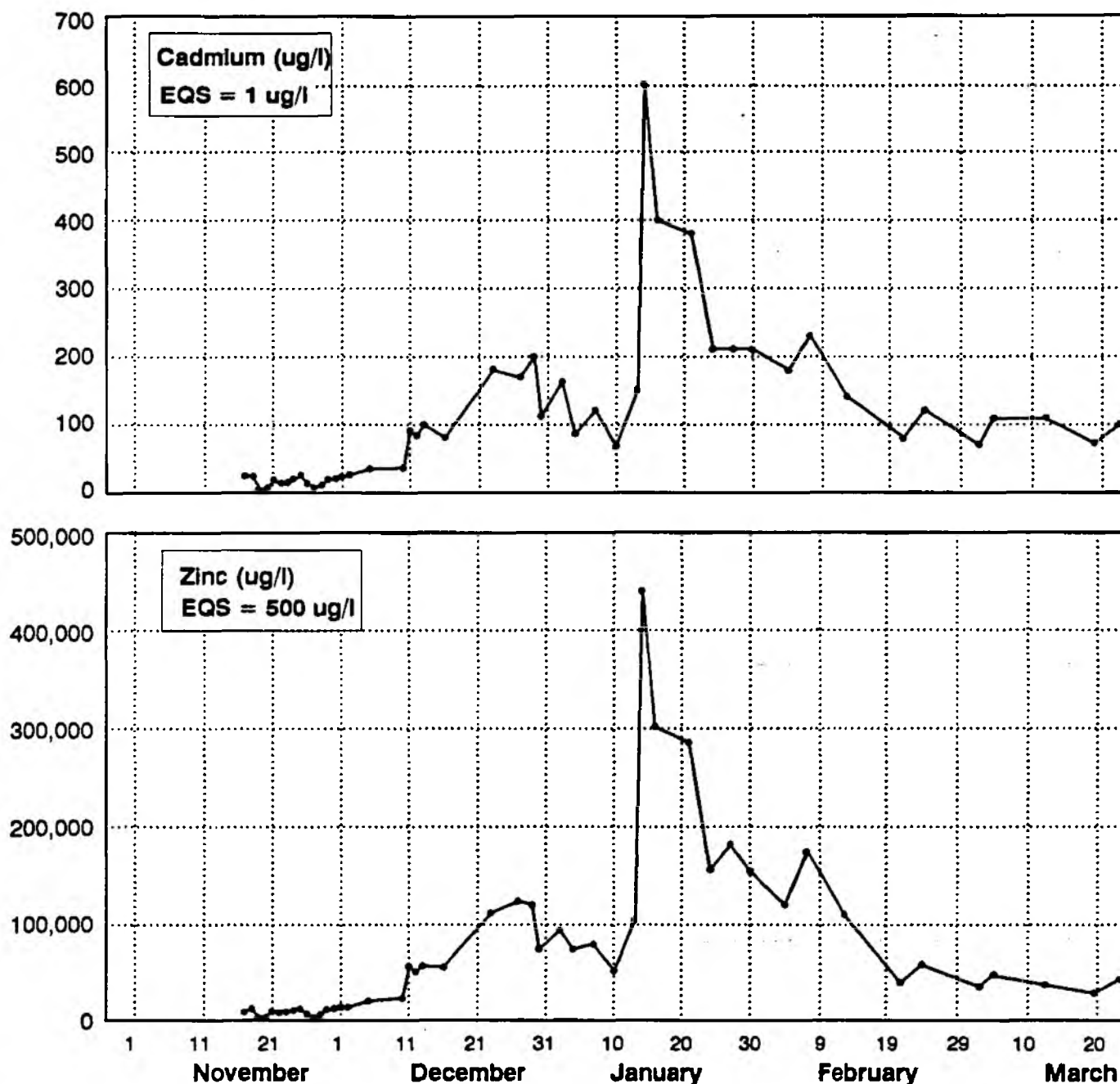
NRA

27 March 1992

National Rivers Authority
South West Region

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority

South West Region

DATE: 10 APRIL 1992

ENCOURAGING PROGRESS

The National Rivers Authority has reported encouraging progress with the control of discharges into the Carnon Valley.

The last two river sample results have been well within the background levels experienced before mine water started discharging from Wheal Jane last November.

The latest sample taken on Monday 6 April produced a cadmium level at Devoran Bridge on the River Carnon of 11 parts per billion (ppb). The previous one on 31 March had a level of 18 ppb.

These new figures compare with 600 ppb at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 ppb (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by over 30 ppb.

The NRA stresses, however, that despite the progress made with Carnon Consolidated Ltd in supervising and controlling the treatment process, the system is still vulnerable to adverse weather conditions including heavy rain and strong winds.

Consultants are currently examining options for medium and long term treatment and are due to report to the NRA later this month.

ESTUARY LATEST

The NRA will continue to monitor the water quality in Restronguet Creek and Carrick Roads, and will be carrying two major surveys of these areas on 15 April and 21 April 1992. These will enable comparisons to be made with the full surveys of 15 and 29 January 1992 and July 1991.

Water samples have also been collected weekly from Restronguet Creek and Carrick Roads since the major discharge in January.

Data collected from a site at the mouth of Restronguet Creek show that there has been a considerable reduction in the concentration of trace metals in the Creek since this pollution incident.

For example at low water (the worst case situation) on 15 January 1992, concentrations of zinc and cadmium of 142,000 ppb and 160 ppb respectively were found. By 12 March 1992 (the last date for which the lengthy analysis has so far been completed) the concentrations had decreased to 1900 ppb and 6.36 ppb of zinc and cadmium, respectively.

Continued....

CARRICK VALLEY UPDATE/2

However, these concentrations are still above the Environmental Quality Standards (EQS) concentrations of 40 ppb zinc and 2.5 ppb cadmium.

On the basis of these latest results Carrick District Council have, on the advice of the Director of Public Health Medicine, partially lifted their warning advice to leisure users in Restronguet Creek as follows:

"Carrick have now withdrawn the original line drawn across the neck of Restronguet Creek where it meets the Carrick Roads, up to a line drawn across the Creek from Point Quay to Halwyn. The limited tidal dilution above Point Quay makes it advisable to continue the warning advice between Point Quay and Devoran Bridge for such activities as windsurfing and swimming, which may involve the swallowing of Creek water."

Similarly in this upper part of the creek it is recommended that children do not play, paddle or swim above Point Quay. Signs will be erected within the next week to this effect."

CONSERVATION

A contract has now been let for survey work on the possible impact of the discharges on underwater estuary habitats, including the eel grass (zostera) and the extensive areas of coral-like seaweed known as maerl. The estuary supports the only known living deposit of maerl in Southern Britain.

S. Busters of Dyfed, Wales, an association of independent divers, marine biologists and underwater cameramen will be starting work on the survey on 23 April 1992.

The contractor's team, which will consist of at least three divers, have past experience of surveying the Fal Estuary.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

This is situated at Carrick District Council's offices in Pydar Street, Truro and will operate during normal office hours. A special telephone number has been established: TRURO (0872) 224360

The centre has up-to-date information from each of the authorities involved.

Carnon Valley Update



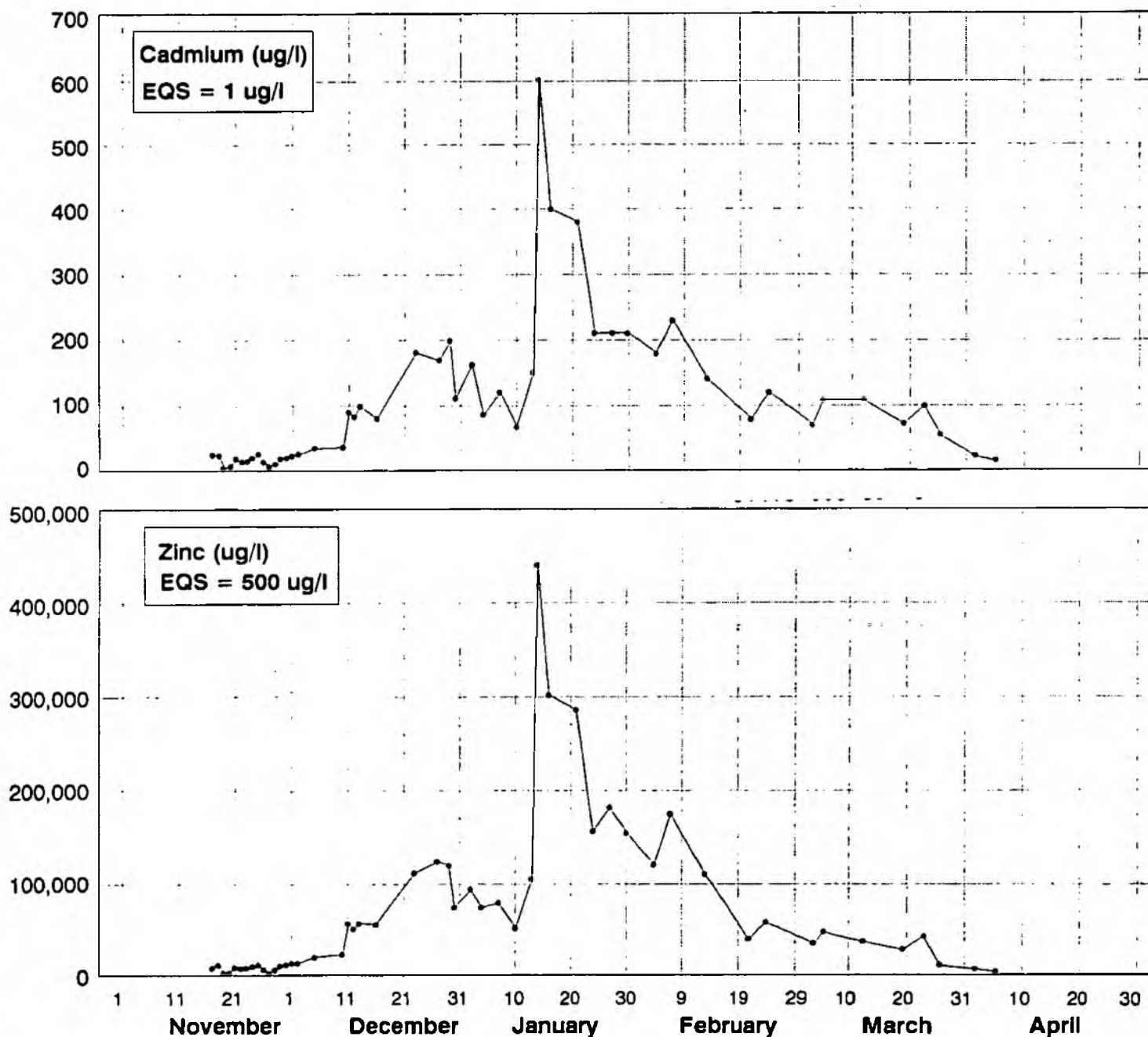
NRA

10 April 1992

WATER QUALITY IN THE RIVER CARNON.

National Rivers Authority
South West Region

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority
South West Region

DATE: 22 MAY 1992

TREATMENT LATEST

The National Rivers Authority is continuing to work with Carnon Consolidated Ltd in supervising and controlling the treatment process.

A consultants' report on options for medium and long term treatment is currently being studied by the NRA.

An announcement on the way forward will be made following this consideration.

LATEST WATER QUALITY RESULTS

Water quality in the River Carnon has continued to fluctuate around the background levels recorded prior to the major discharge in January.

The latest reading (taken on 18 May) produced a cadmium level at Devoran Bridge of 38 parts per billion (ppb). The previous one on 15 May was 30 ppb, and on 14 May it was 25 ppb.

These new figures compare with 600 ppb at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 ppb (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by over 30 ppb.

The NRA stresses once again, however, that the treatment system being operated in conjunction with Carnon Consolidated Ltd remains vulnerable to adverse weather conditions including heavy rain and strong winds.

ESTUARY LATEST

Data collected by the NRA at a monitoring station in Restronguet Creek continues to show a reduction in the concentration of trace metals in the Creek.

Samples were originally collected in July 1991 before the major discharge and monitoring has continued to date. This enables a full comparison to be made.

ZINC

The EQS for zinc in estuaries is 40 ppb. The latest result (April 15 1992) gives a concentration of 591 ppb. Whilst this is still well above the EQS value it is approaching the historical background level.

In July 1991 zinc had a high of 218 ppb (above the EQS limit) and a low of 22 ppb (below the EQS limit).

Continued....

CARNON VALLEY UPDATE/2

After the water began flowing out of the mine they rose to give a high of 142,000 ppb and a low of 1,120 ppb, both well above the EQS value.

IRON

The presence of this metal - which was a major contributor to the large plumes of orange floc earlier this year - has dropped below its EQS.

The EQS for iron is 1000 ppb and results show that on April 15 the highest level was 200 ppb, compared with 10,300 ppb on 1 January 1992.

COPPER

The EQS for copper is 5 ppb. At the end of March copper had a high of 47 ppb. Whilst this is still above the EQS value it is approaching the historical background level of about 20 ppb.

ARSENIC

At the end of March the level of arsenic was 12.2 ppb, below the EQS of 25 ppb.

In January 1992 concentrations of arsenic in Restronguet Creek were up to 600 ppb.

CADMIUM

Latest results for the end of March give cadmium a high of 2.5 ppb which is the EQS limit.

During the major incident values rose to a high of 160 ppb and a low of 2.7 ppb.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

This is situated at Carrick District Council's offices in Pydar Street, Truro and will operate during normal office hours. A special telephone number has been established:

TRURO (0872) 224360

The centre has up-to-date information from each of the authorities involved.

Carnon Valley Update



NRA

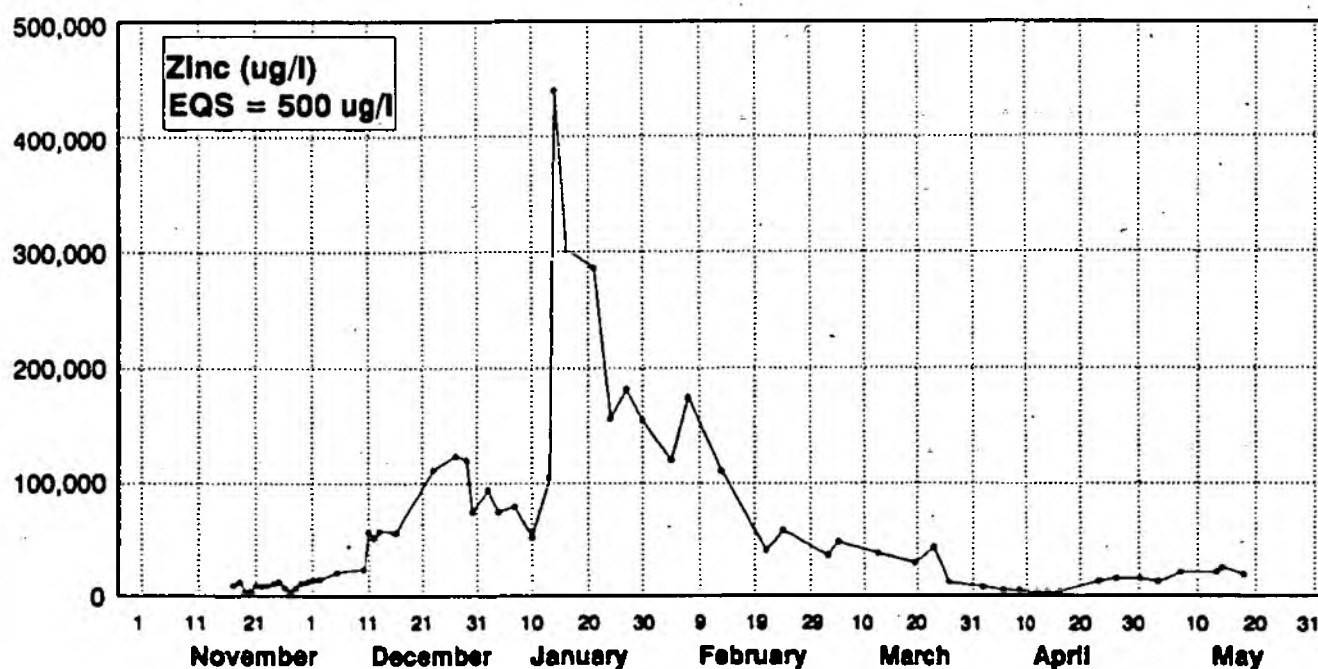
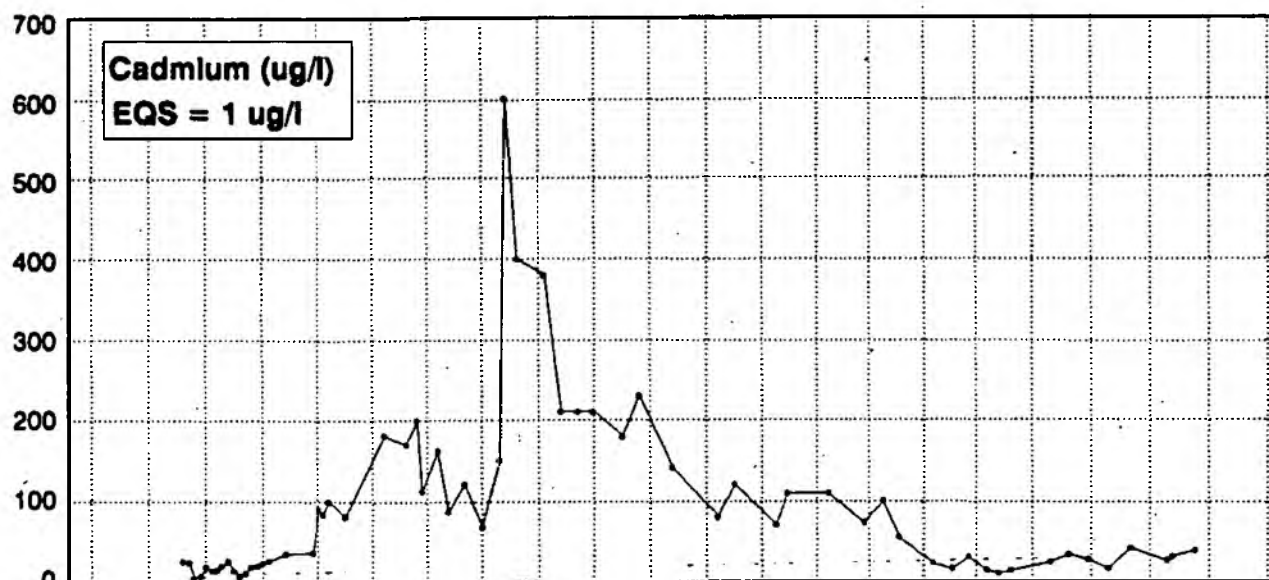
National Rivers Authority

South West Region

22 May 1992

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

DATE: 5 JUNE 1992

National Rivers Authority

South West Region

TREATMENT LATEST

The National Rivers Authority is continuing its study of the consultants' report on medium and long term treatment.

An announcement on the way forward will be made as soon as possible, following full consideration of this extremely complex issue.

Meanwhile the NRA is continuing to work with Carnon Consolidated Ltd in supervising and controlling the treatment process.

LATEST WATER QUALITY RESULTS

Water quality in the River Carnon continues to fluctuate and recent readings at Devoran Bridge have shown a slight overall increase in cadmium concentrations.

The latest reading (taken on 28 May) produced a cadmium concentration at Devoran Bridge of 36 ppb (see graphs attached).

Higher than average rainfall during April has resulted in increased flows from the Nangiles Adit, leading to increased levels of cadmium entering the river. At Camborne, the rainfall station closest to Wheal Jane, rainfall for April was 176% of the long term average.

These new cadmium figures compare with 600 parts per billion (ppb) at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 ppb (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 ppb.

Rainfall was well below average in the area during May (21% of long term average) and reduced cadmium levels are expected during June to reflect this fact.

Nevertheless, sudden severe weather - such as the very heavy rainfall experienced locally in the past few days - could reverse the effect. The NRA stresses once again that the treatment system being operated in conjunction with Carnon Consolidated Ltd remains vulnerable to adverse weather conditions.

ESTUARY LATEST

Most recent results of estuary surveys show varying trends in water quality.

Continued....

CARNON VALLEY UPDATE/2

A full set of results for April 24 - from the NRA fixed station at the mouth of Restronguet Creek - is available only for zinc and arsenic.

Zinc - The EQS for zinc in estuaries is 40 ppb. The latest result (24 April 1992) gives a concentration of 901 ppb. The previous reading (15 April 1992) was 591 ppb.

These values compare with 142,000 ppb at the height of the discharge in January.

It is not possible to predict if there has been a change in the trend of zinc concentrations until results of later surveys are known.

Arsenic - The EQS for arsenic in estuaries is 25 ppb.

On 24 April 1992 arsenic had a concentration of 2.7 ppb. The previous result (15 April) was 6.4 ppb. This is in line with the general downward trend since January 15 when arsenic reached a high of 600 ppb.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

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TRURO (0872) 224360

The centre has up-to-date information from each of the authorities involved.

Carnon Valley Update



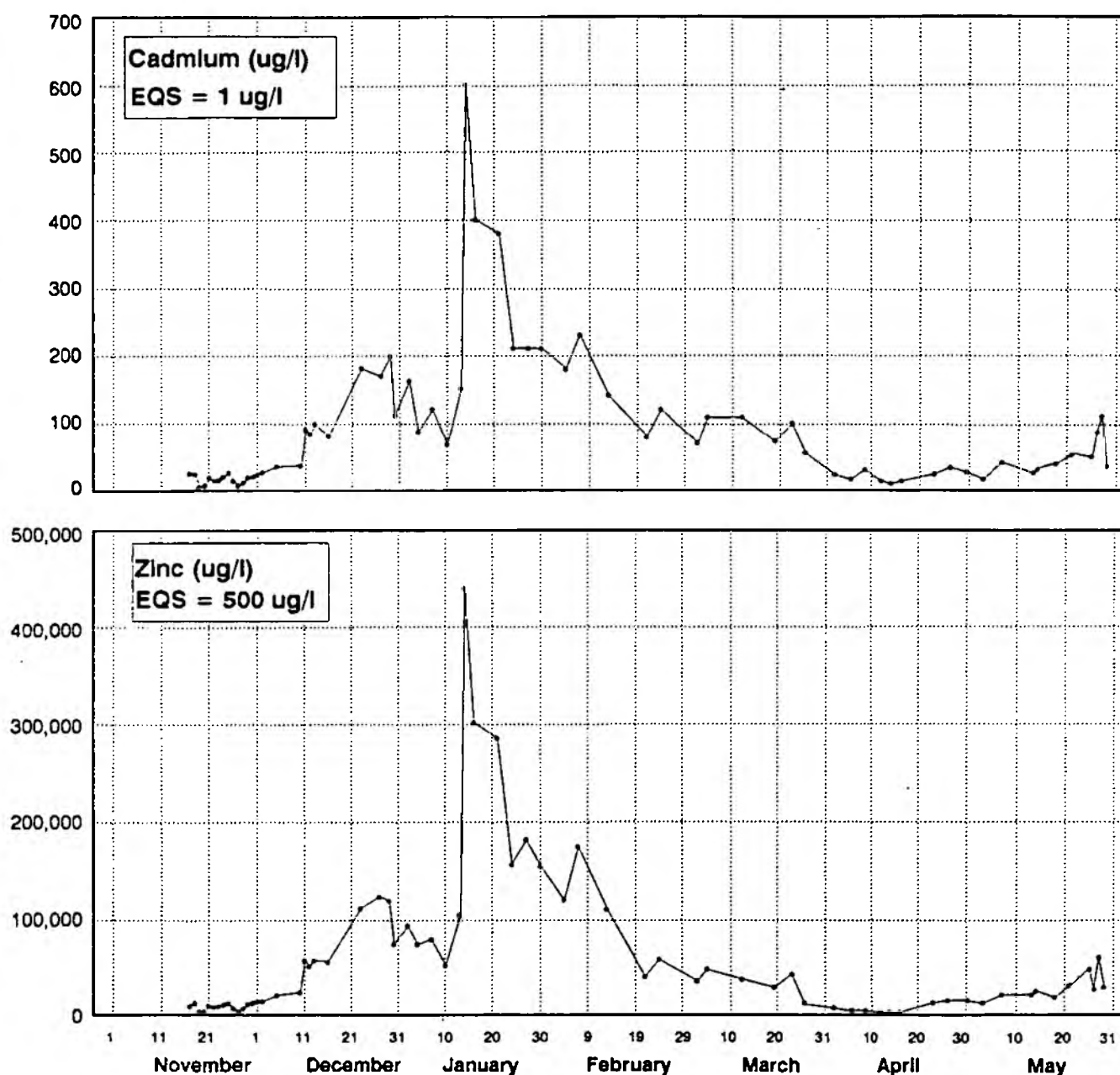
NRA

5 June 1992

National Rivers Authority
South West Region

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

DATE : 3 JULY 1992

*National Rivers Authority
South West Region*

WATER QUALITY : RIVER CARNON

Water quality in the River Carnon improved during June (see attached graphs). In May cadmium levels had risen in response to April rainfall. A dry May has now led, as predicted, to a subsequent reduction in cadmium concentrations.

The cadmium readings during June were consistent. The latest sample result (taken on 25 June) produced a cadmium concentration at Devoran Bridge of 31 parts per billion (ppb). The reading on 18 June was 35 ppb, 11 June 28 ppb and 4 June 30 ppb.

These new cadmium figures compare with 600 parts per billion (ppb) at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 ppb (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 ppb.

WATER QUALITY : RESTRONGUET CREEK

The lengthy analysis carried out on water samples collected by the NRA in Restronguet Creek and Carrick Roads during two major surveys in April is now virtually complete. The results show that water quality in the area is continuing to improve.

At the end of April at the mouth of Restronguet Creek surface water concentrations of cadmium at low water, the worst case situation, had fallen below the Environmental Quality Standard (EQS) for the first time since the pollution incident in January. Surface water concentrations of zinc at high water had also fallen below the EQS for the first time.

The water quality in Restronguet Creek and the Carrick Roads is continuing to be monitored carefully. The NRA's tidal waters investigation team have just completed two more major surveys of the area.

TREATMENT

The NRA once again stresses that the current treatment system being operated in conjunction with Carnon Consolidated Ltd, remains vulnerable to adverse weather conditions.

The Authority is continuing its study of the consultant's report on medium and long term treatment.

An announcement on the way forward will be made as soon as possible, following full consideration of this extremely complex issue.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture, Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

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Carnon Valley Update



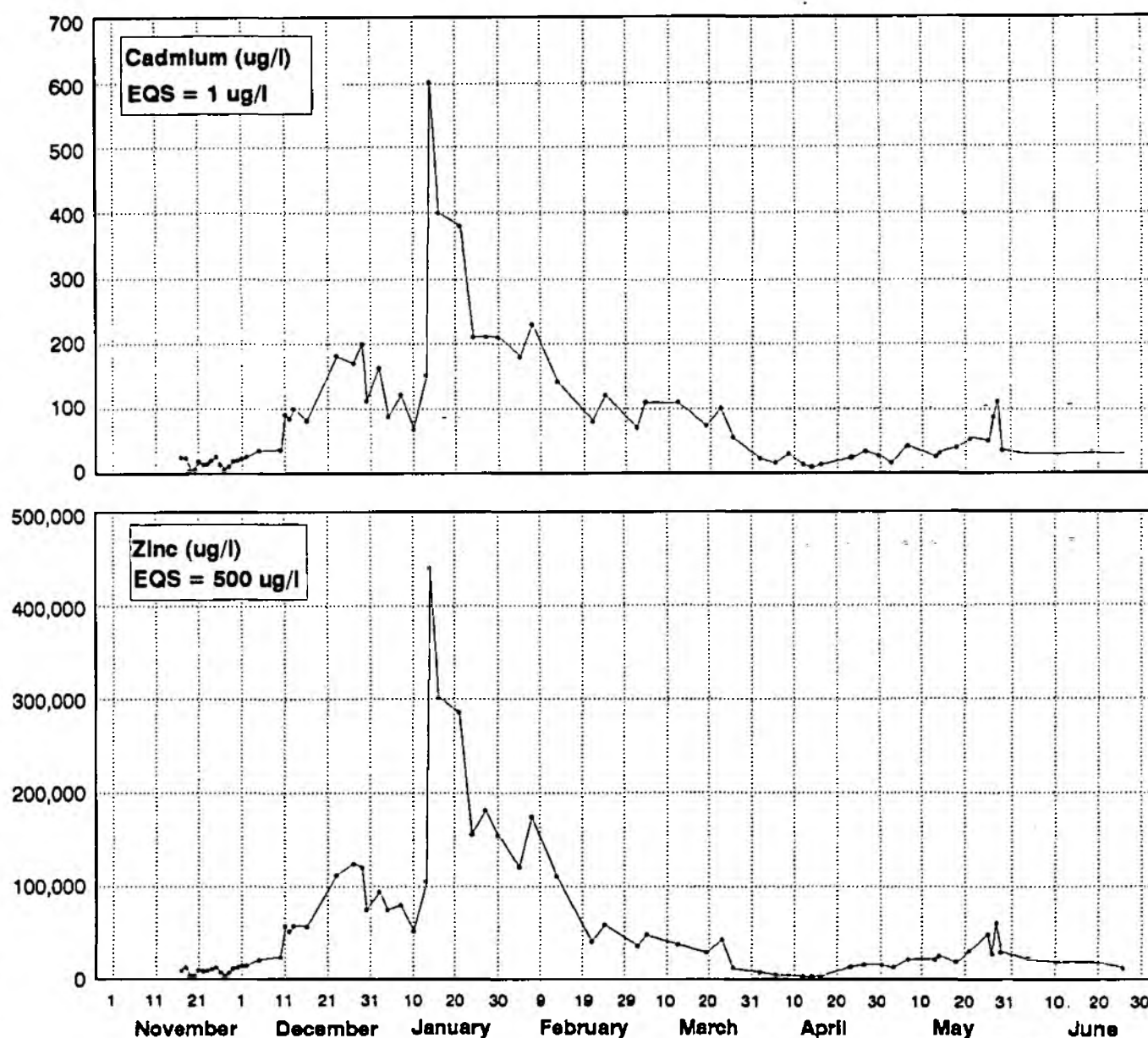
NRA

Natural Rivers Authority
South West Region

3 July 1992

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

DATE: 31 JULY 1992

National Rivers Authority

South West Region

WATER QUALITY: RIVER CARNON

The latest water quality samples from the River Carnon have produced the best results since the major discharge in January (see attached graphs).

The latest sample (taken on 23 July) produced a cadmium concentration at Devoran Bridge of 6 parts per billion (ppb). The reading on 16 July was 12 ppb, 9 July 11 ppb and 2 July 15 ppb.

These new cadmium figures compare with 600 ppb at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 ppb (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 ppb.

The continuing dry weather has helped keep levels of cadmium down.

The NRA once again stresses that the current treatment system being operated in conjunction with Carnon Consolidated Ltd, remains vulnerable to adverse weather conditions.

In the light of this latest information and continuing improvement in results Carrick District Council, after consultation with their Medical Officer, has agreed to remove all current restrictions on Restronguet Creek and will be removing warning notices within the next few days.

Carrick District Council stresses that should there be any significant deterioration in standards the restrictions will be reimposed and public warnings issued.

PUBLIC INFORMATION

All public bodies involved with this issue have recognised the need for easy public access to information.

The NRA, Carrick District Council, Falmouth and Truro Port Health Authority, the Ministry of Agriculture Fisheries and Food and the Cornwall and Isles of Scilly Health Authority have joined together to provide a single information service centre.

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Carnon Valley Update



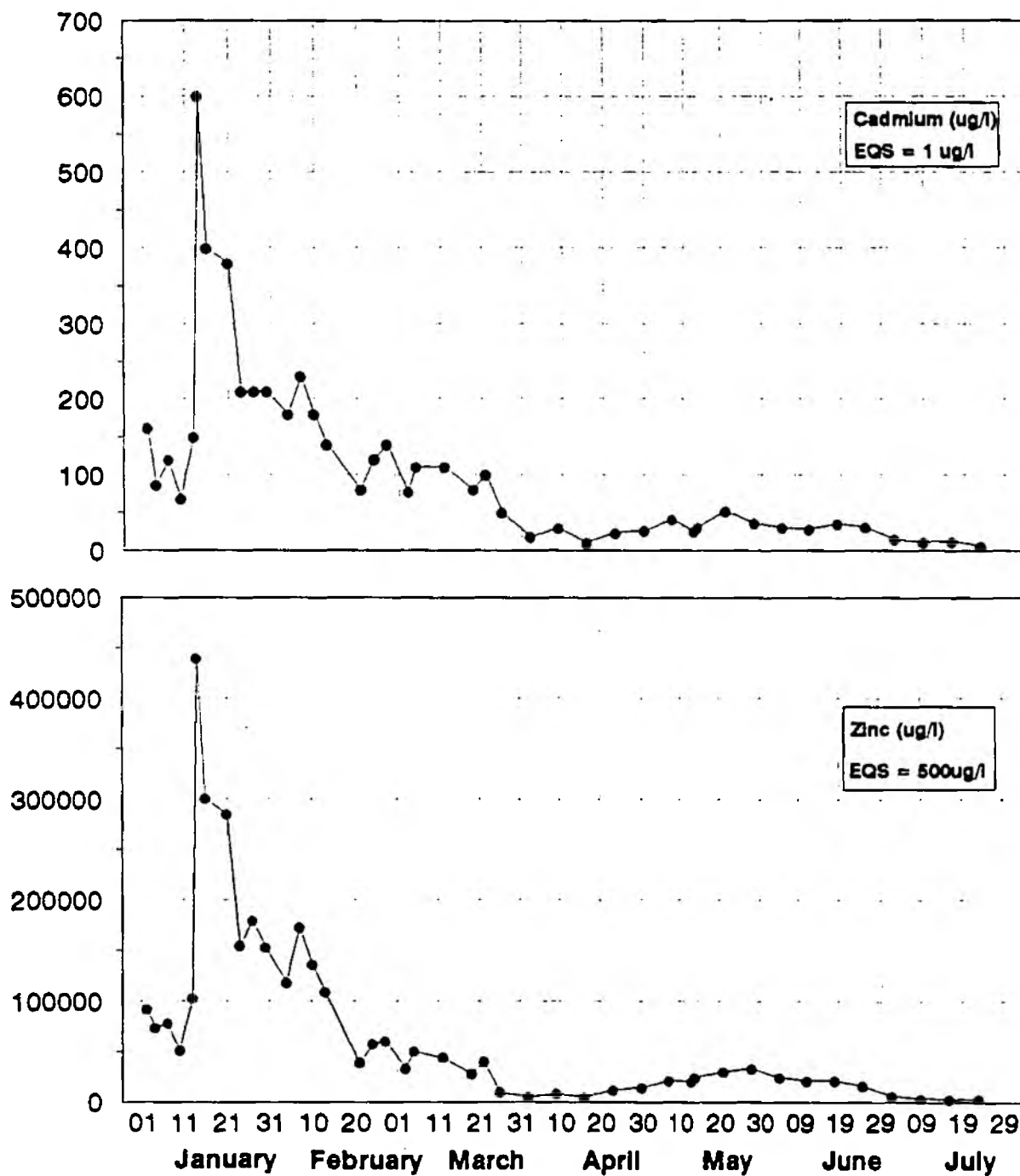
NRA

National Rivers Authority
South West Region

31 July 1992

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority
South West Region

DATE 28 AUGUST 1992

WATER QUALITY: RIVER CARNON

The latest water quality samples from the River Carnon have again produced some of the best results since the major discharge in January (see attached graphs).

The latest sample (taken on 20 August) produced a cadmium concentration at Devoran Bridge of 5 micrograms per litre ($\mu\text{g/l}$). The reading on 13 August was 13 $\mu\text{g/l}$, 6 August 8 $\mu\text{g/l}$ and 30 July 5 $\mu\text{g/l}$.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA once again stresses that the current treatment system being operated in conjunction with Carnon Consolidated Ltd, remains vulnerable to adverse weather conditions. As an example of this, recent wet weather has resulted in a small rise in the level of mine water. There is still some capacity within the mine as a consequence of pumping operations carried out since January by the mining company.

The NRA and the company are working together to improve the contingency arrangements to deal with adverse weather conditions.

WATER QUALITY: RESTRONGUET CREEK

Analysis carried out on water samples collected by the NRA in Restronguet Creek and Carrick Roads during a major neap tide survey on 24 June is complete. The results show that water quality in the area is continuing to improve.

At the mouth of Restronguet Creek surface water concentrations of cadmium at low water, the worst case situation, were well below the Environmental Quality Standard (EQS). Cadmium (EQS 2.5 $\mu\text{g/l}$) has decreased from 2.0 $\mu\text{g/l}$ at the end of April to 1.3 $\mu\text{g/l}$ at the end of June.

Surface water concentrations of zinc at low water have also fallen. Zinc (EQS 40 $\mu\text{g/l}$) has improved from 901 $\mu\text{g/l}$ in April to 591 $\mu\text{g/l}$ in June. This continues to approach the equivalent historical background level of around 200 $\mu\text{g/l}$.

Two further major surveys are planned for October/November 1992.

Carnon Valley Update



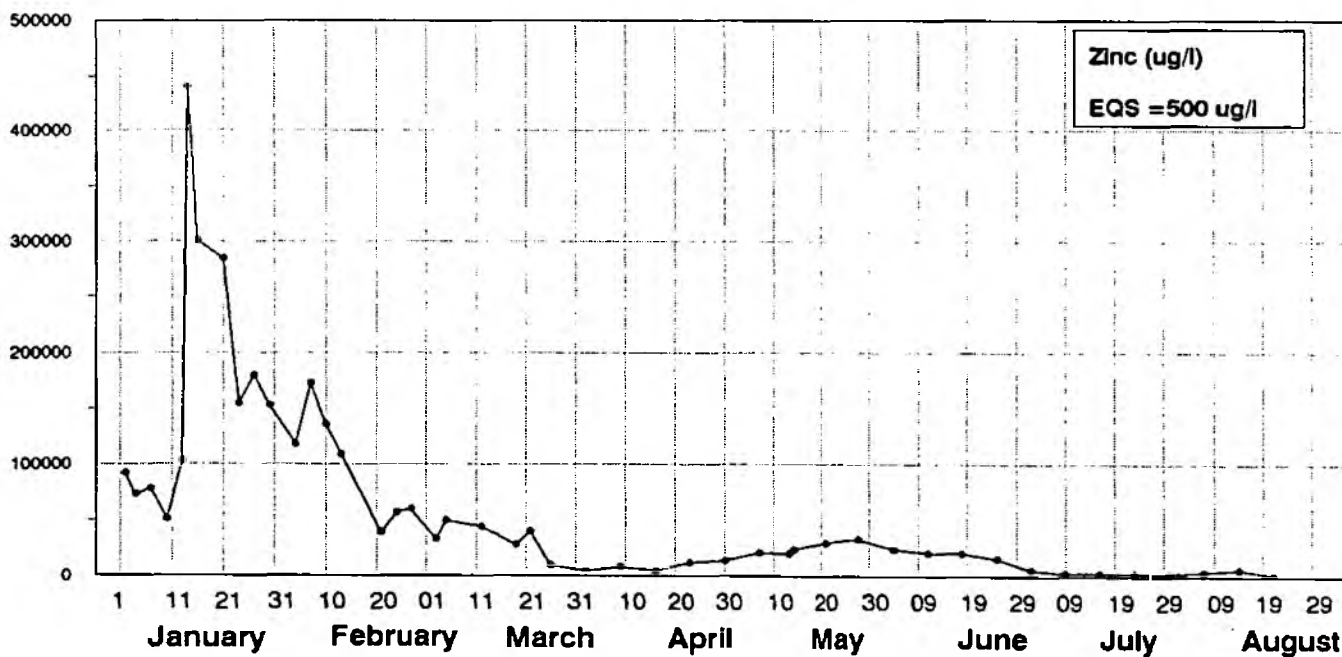
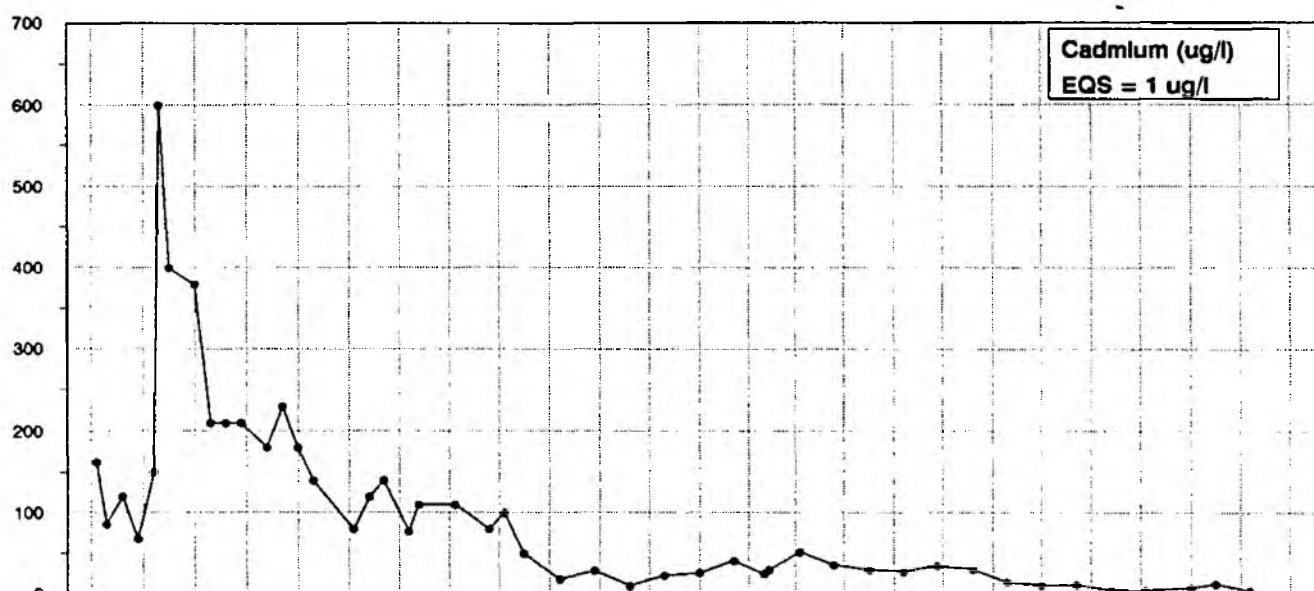
NRA

National Rivers Authority
South West Region

28 August 1992

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority
South West Region

DATE: 25 SEPTEMBER 1992

WATER QUALITY: RIVER CARNON

The latest water quality samples from the River Carnon have continued to produce encouraging results (see attached graphs).

The most recent sample result available (taken on 17 September) produced a cadmium concentration at Devoran Bridge of 6 micrograms per litre ($\mu\text{g/l}$). The readings were 6 $\mu\text{g/l}$ on 10 September, 5 $\mu\text{g/l}$ on 3 September and 11 $\mu\text{g/l}$ on 27 August.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA once again stresses that the current treatment system being operated in conjunction with Carnon Consolidated Ltd, remains vulnerable to adverse weather conditions.

The NRA and the company are working together to improve contingency arrangements. For example a third pump will soon be installed to help deal with the higher flows that can follow periods of heavy rainfall.

WATER QUALITY: ESTUARY

Analysis of samples collected by the NRA in Restronquet Creek and Carrick Roads during a major spring tide survey on 1 July is complete.

Concentrations of trace metals have stabilized to levels well below those at the time of the major discharge in January 1992.

At the mouth of Restronquet Creek the results for samples at low water (worst case situation) were as follows: Zinc (EQS = 40 $\mu\text{g/l}$) had a surface low water value of 908 $\mu\text{g/l}$ compared to 591 $\mu\text{g/l}$ on 24 June. Cadmium (EQS = 2.5 $\mu\text{g/l}$) reached 3.0 $\mu\text{g/l}$, compared to 1.3 $\mu\text{g/l}$ on 24 June.

For the samples taken at high water (best case situation) the results at the mouth of Restronquet Creek were as follows: Zinc had a surface high water value of 60 $\mu\text{g/l}$ (very close to its EQS of 40 $\mu\text{g/l}$), compared to 124 $\mu\text{g/l}$ on 24 June. Cadmium reached 0.15 $\mu\text{g/l}$ (well below its EQS of 2.5 $\mu\text{g/l}$), compared to 0.37 $\mu\text{g/l}$ on 24 June.

The next two surveys (spring and neap tides) will be carried out in the first half of October.

Graphs showing results from the NRA's fixed station in Restronquet Creek are attached.

Carnon Valley Update



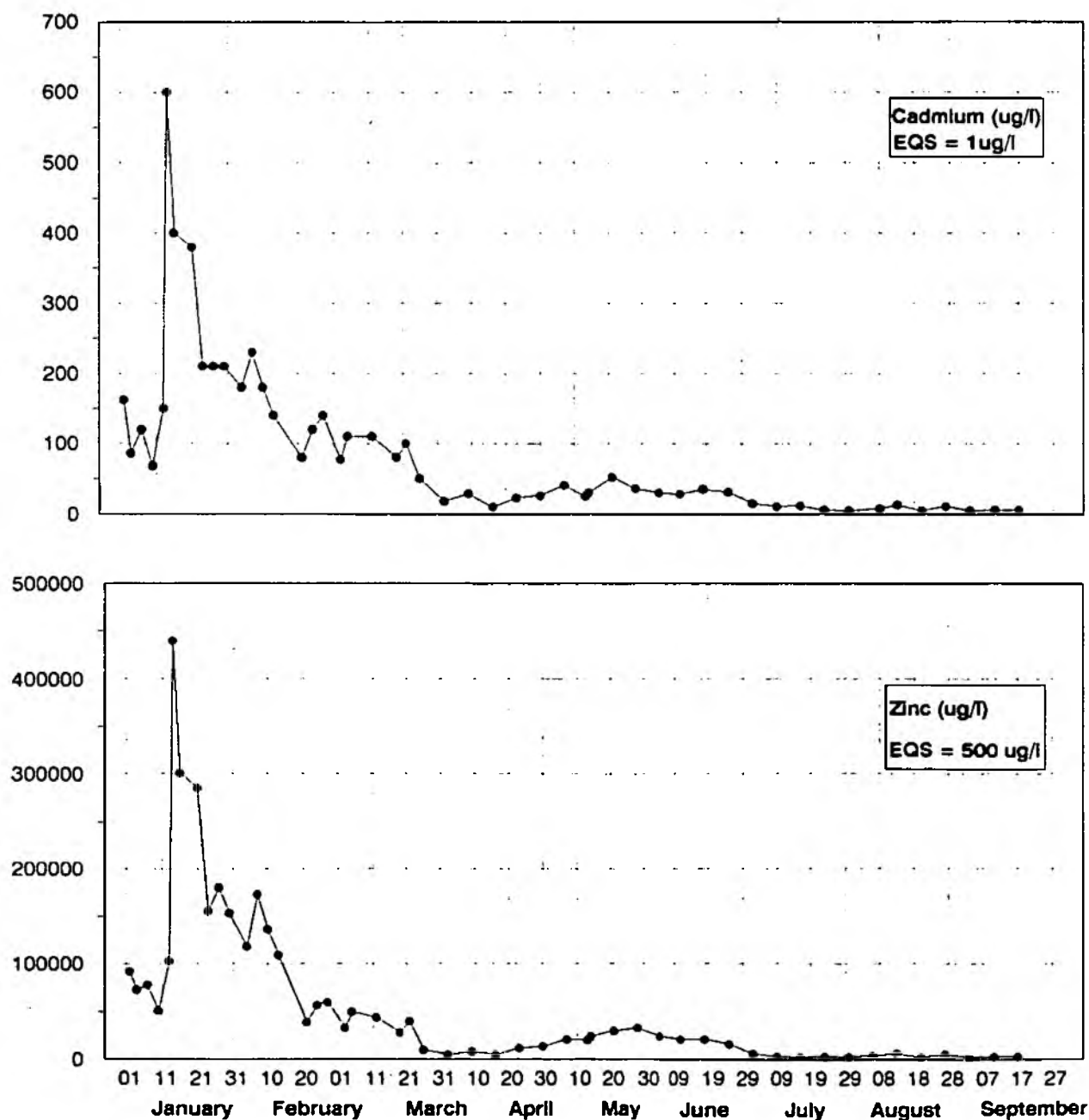
NRA

National Rivers Authority
South West Region

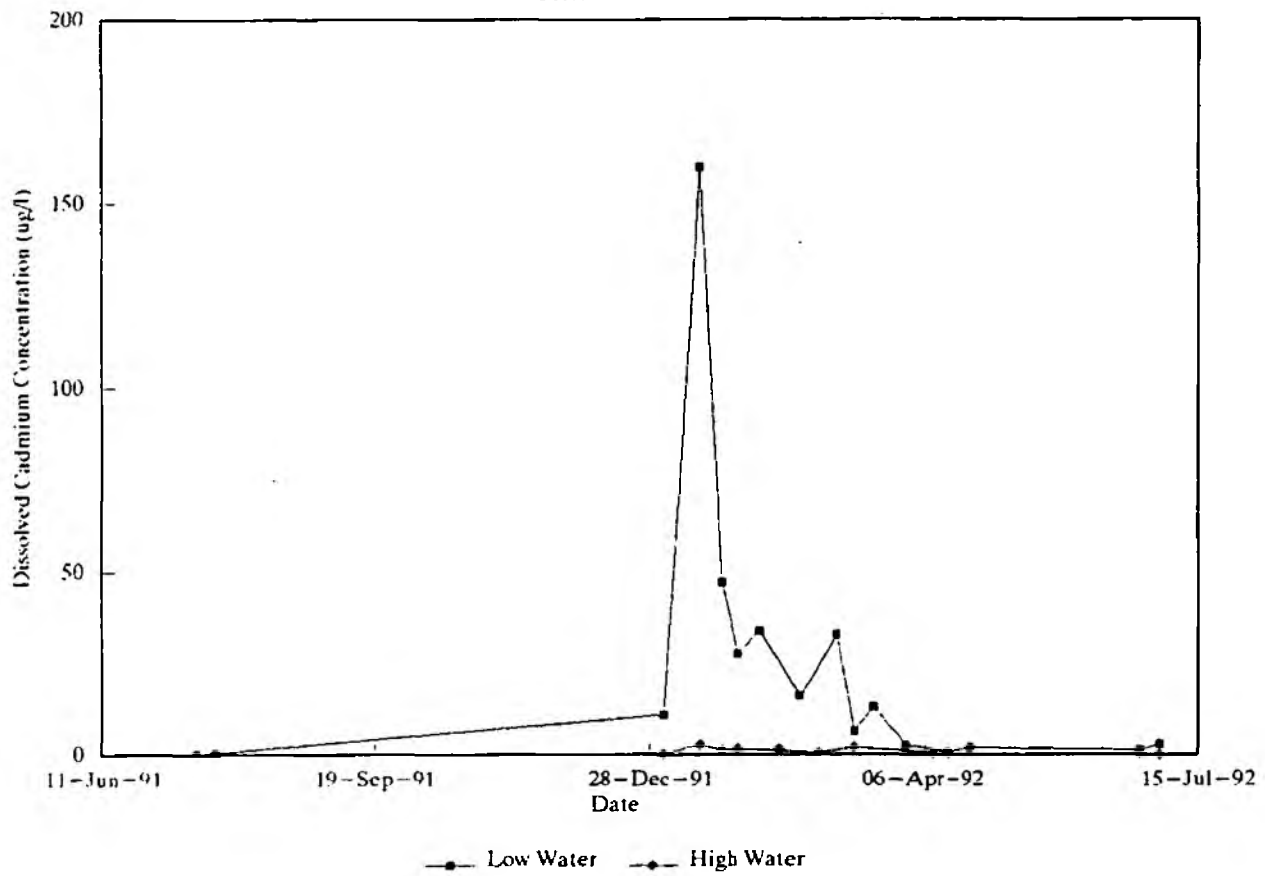
25 September 1992

WATER QUALITY IN THE RIVER CARNON.

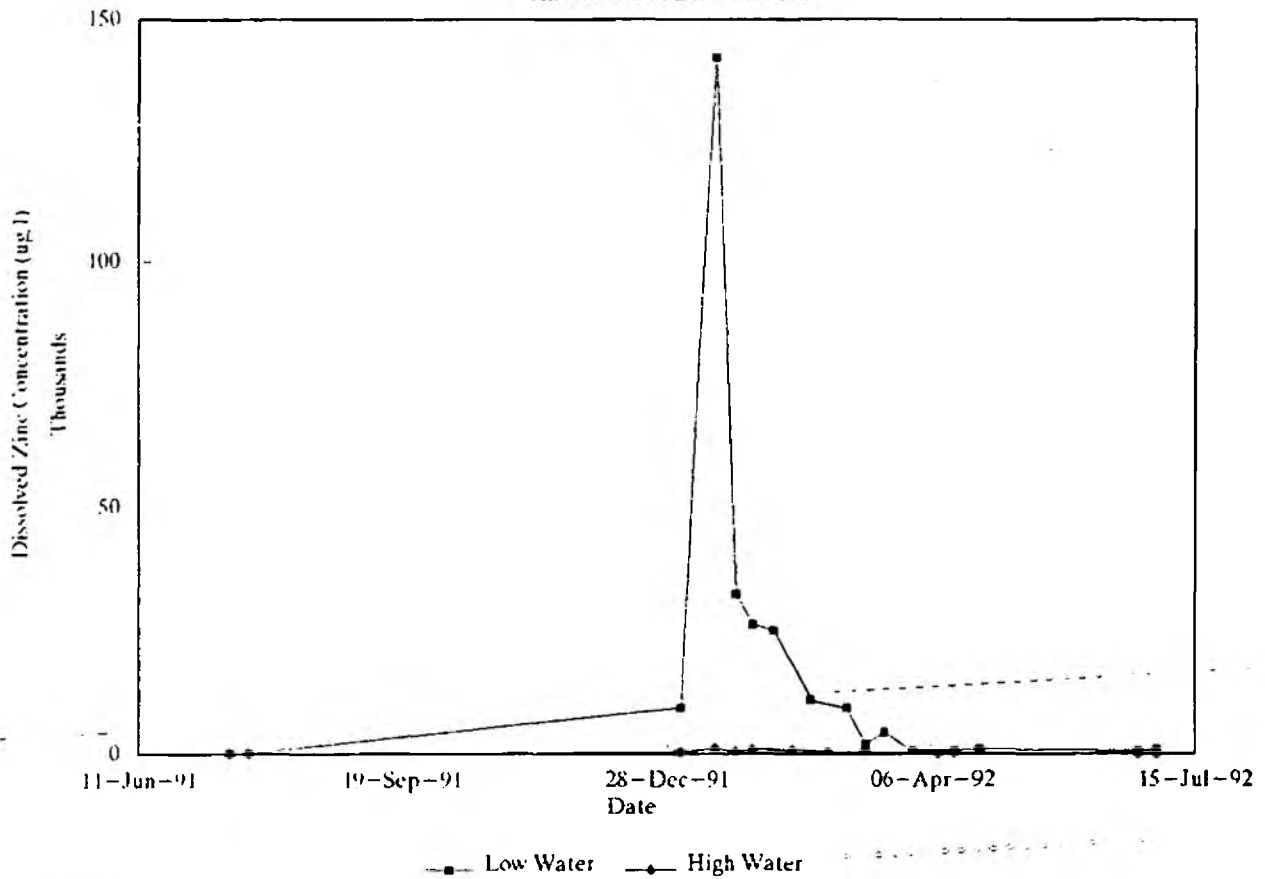
This sheet shows the latest results for cadmium and zinc concentrations at Devoran Bridge.



Wheal Jane Pollution Incident – Restronguet Creek Fixed Station
Time Series of Dissolved Cadmium



Wheal Jane Pollution Incident – Restronguet Creek Fixed Station
Time Series of Dissolved Zinc



Carnon Valley Update



DATE : 23 OCTOBER 1992

National Rivers Authority
South West Region

WATER QUALITY : RIVER CARNON

The latest water quality samples from the River Carnon have continued to produce encouraging results (see attached graphs).

The most recent sample result available (taken on 13 October) produced a cadmium concentration at Devoran Bridge of 10 micrograms per litre ($\mu\text{g/l}$). The readings were 9 $\mu\text{g/l}$ on 6 October, 9 $\mu\text{g/l}$ on 1 October, and 6 $\mu\text{g/l}$ on 24 September.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA once again stresses that the current treatment system being operated in conjunction with Carnon Consolidated Ltd, remains vulnerable to adverse weather conditions.

The NRA and the company are working together to improve contingency arrangements. A third pump has now been installed to help deal with the higher flows that can follow periods of heavy rainfall.

WATER QUALITY : ESTUARY

The two major October surveys (spring and neap tides) have now been completed throughout Restronguet Creek and Carrick Roads.

Water, sediment and biological samples were collected by the NRA's Tidal Waters Investigation Unit for chemical analysis. The samples are now being processed at NRA laboratories.

Carnon Valley Update



NRA

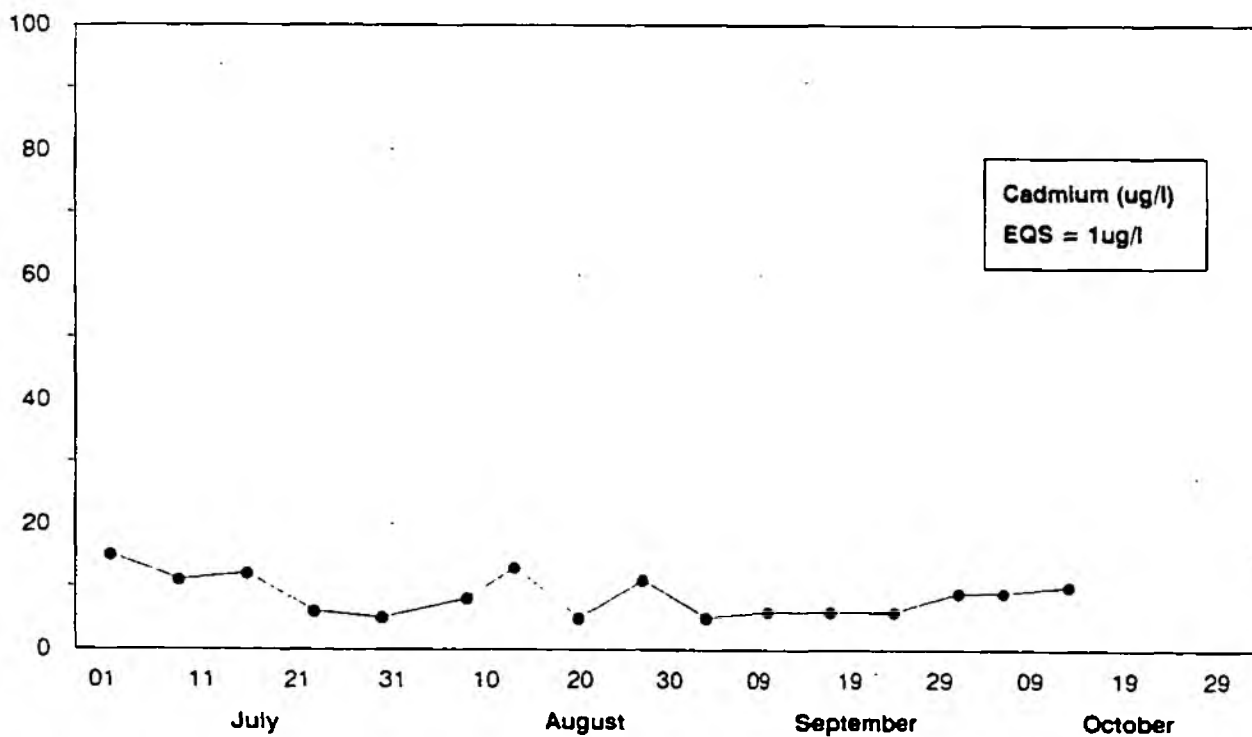
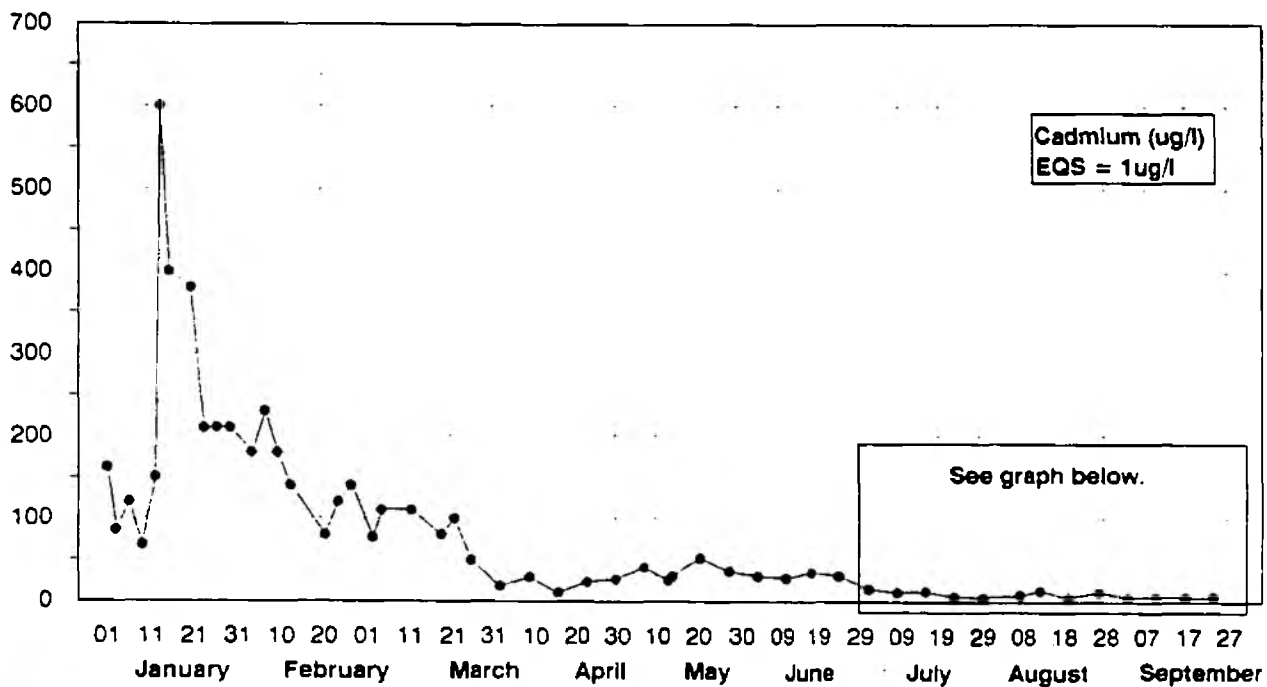
National Rivers Authority

South West Region

23 October 1992

WATER QUALITY IN THE RIVER CARNON.

This sheet shows the latest results for cadmium concentrations at Devoran Bridge.



Carnon Valley Update



NRA

DATE: 20 NOVEMBER 1992

National Rivers Authority
South West Region

WATER QUALITY: RIVER CARNON

The latest water quality samples from the River Carnon have continued to produce encouraging results (see attached graphs).

The most recent sample result available (taken on 10 November) produced a cadmium concentration at Devoran Bridge of 5 micrograms per litre ($\mu\text{g/l}$). The readings were 15 $\mu\text{g/l}$ on 3 November, 8 $\mu\text{g/l}$ on 27 October, and 12 $\mu\text{g/l}$ on 20 October.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA once again stresses that the current treatment system being operated in conjunction with Carnon Consolidated Ltd, remains vulnerable to adverse weather conditions ie the higher flows that can follow periods of heavy rainfall.

WATER QUALITY: ESTUARY

Analysis of samples collected by the NRA in Restronguet Creek and Carrick Roads during two major surveys in October (spring/neap tides) is now complete.

Concentrations of metals have stabilized at levels well below those at the time of the major discharge in January 1992 (see attached graphs).

During both October surveys, concentrations of cadmium never exceeded its EQS of 2.5 $\mu\text{g/l}$ at any of the sites sampled, throughout Restronguet Creek and Carrick Roads.

Whilst zinc still exceeded its EQS of 40 $\mu\text{g/l}$ in Restronguet Creek, it remained below its EQS at most of the sites sampled in Carrick Roads. At low water (the worst case situation) only three of the Carrick Roads sites, which are in the vicinity of Restronguet Creek, exceeded the EQS. At high water (the best case) only one site exceeded the EQS.

Continued....

Detailed results at the mouth of Restronguet Creek were as follows:

7 October 1992 (neap tide)

At low water, the worst case situation, the concentrations of dissolved zinc (EQS = 40 $\mu\text{g/l}$) and dissolved cadmium (EQS = 2.5 $\mu\text{g/l}$) were 676 $\mu\text{g/l}$ and 1.0 $\mu\text{g/l}$ respectively, compared to 591 $\mu\text{g/l}$ and 1.3 $\mu\text{g/l}$ on 24 June 1992, the last neap tide survey.

At high water, the best case situation, the concentrations of dissolved zinc and dissolved cadmium were 116 $\mu\text{g/l}$ and 0.3 $\mu\text{g/l}$ respectively, compared to 124 $\mu\text{g/l}$ and 0.37 $\mu\text{g/l}$ on 24 June.

14 October 1992 (spring tide)

At low water, the worst case situation, the concentrations of dissolved zinc and dissolved cadmium were 805 $\mu\text{g/l}$ and 1.2 $\mu\text{g/l}$, compared to 908 $\mu\text{g/l}$ and 3.0 $\mu\text{g/l}$ on 1 July 1992, the last spring tide survey.

At high water, the best case situation, the concentrations of dissolved zinc and cadmium were 50 $\mu\text{g/l}$ and 0.1 $\mu\text{g/l}$ respectively, compared to 60 $\mu\text{g/l}$ and 0.15 $\mu\text{g/l}$ on 1 July.

Carnon Valley Update



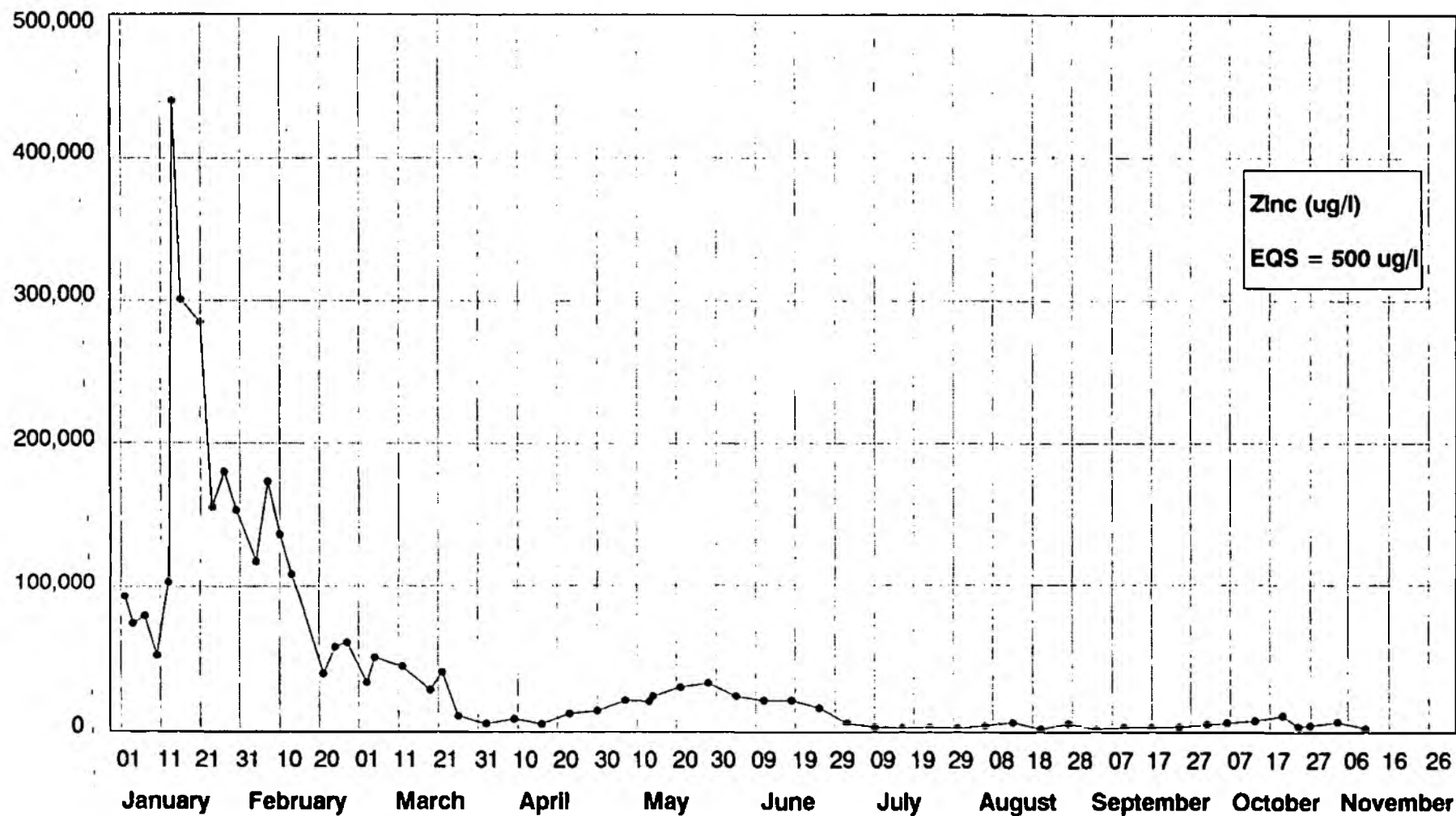
NRA

National Rivers Authority
South West Region

20 November 1992

WATER QUALITY IN THE RIVER CARNON

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Issued by: Public Relations, NRA South West, Manley House, Kestrel Way, Exeter, EX2 7LQ. Tel: (0392) 444000

Carnon Valley Update



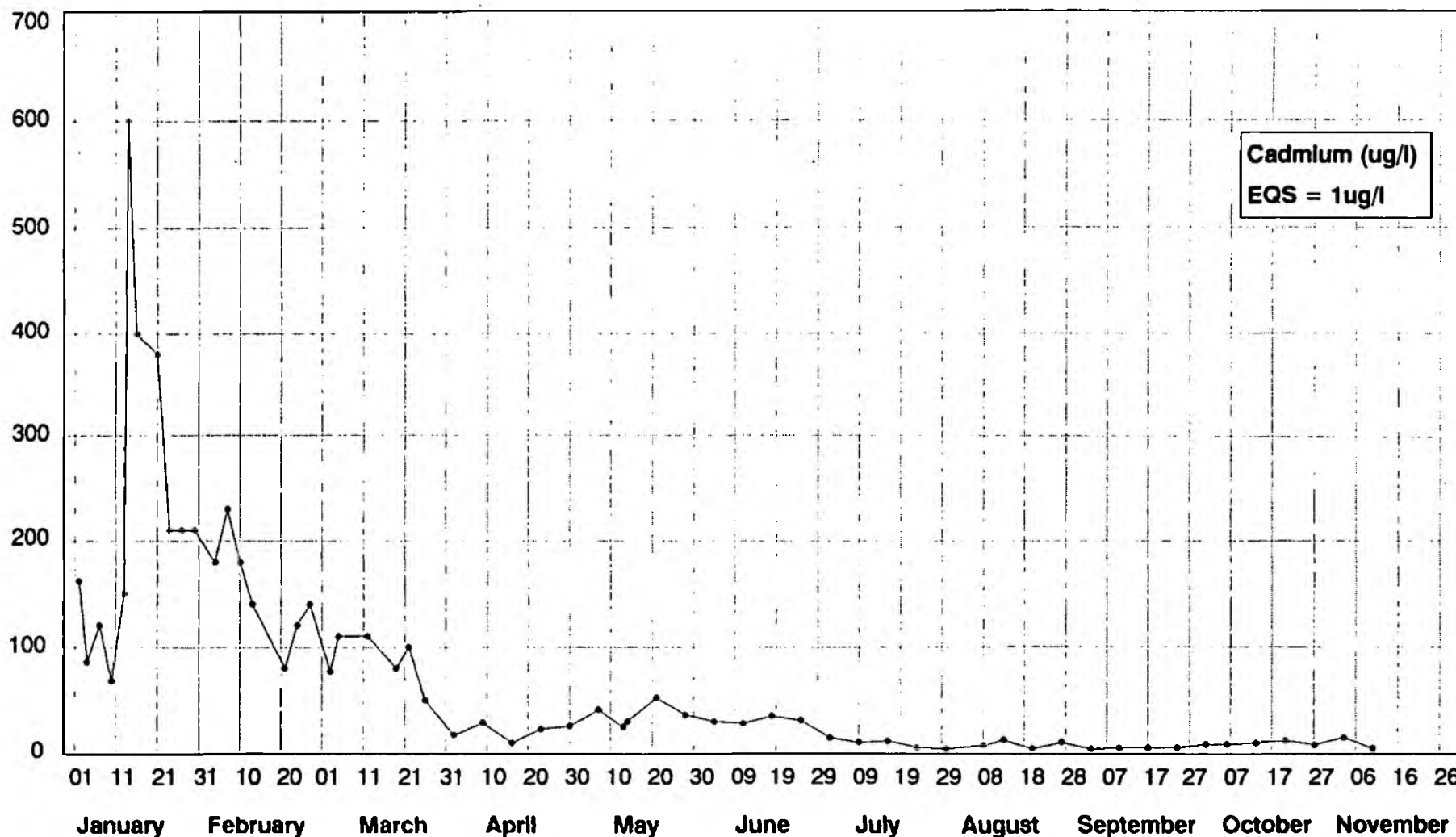
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National Rivers Authority
South West Region

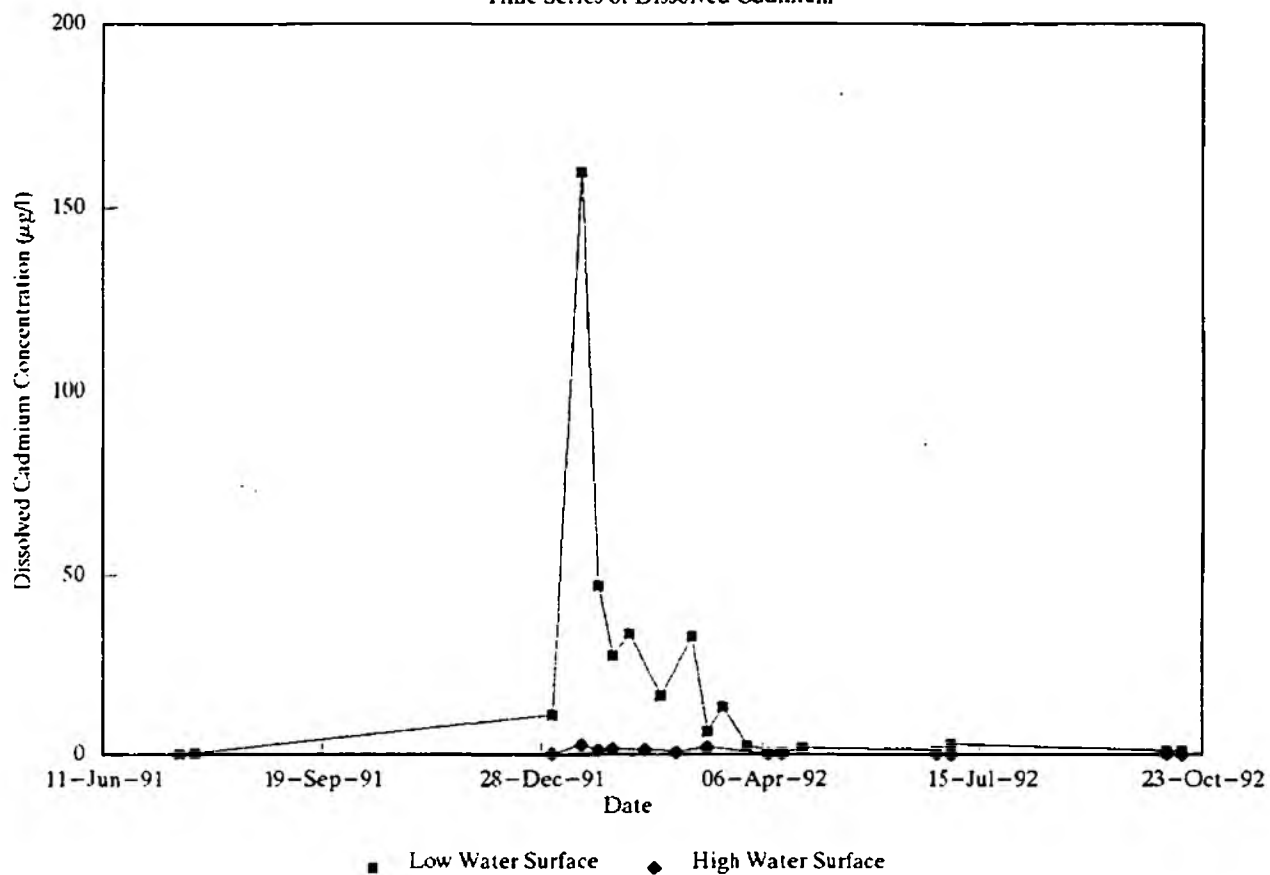
20 November 1992

WATER QUALITY IN THE RIVER CARNON

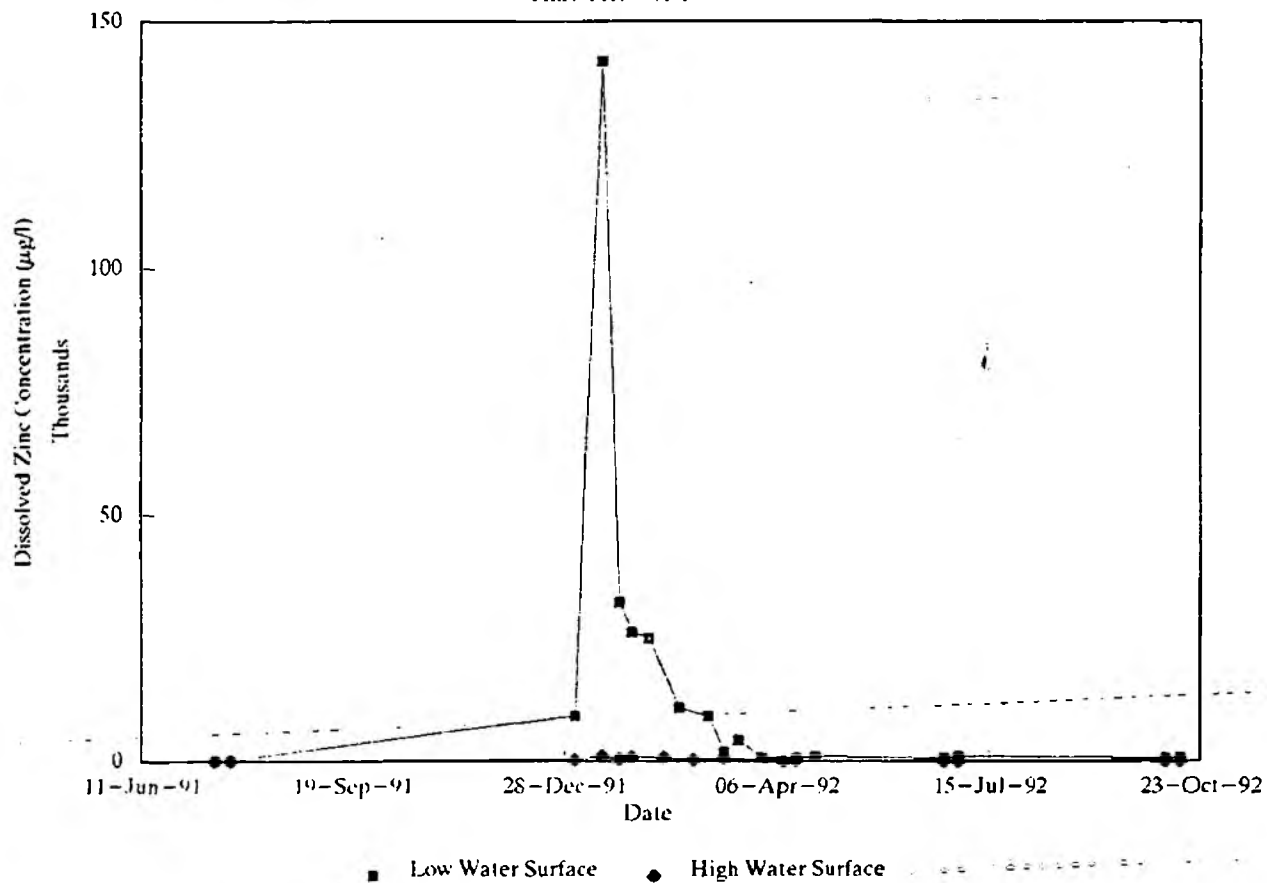
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



Wheal Jane Pollution Incident – Restronguet Creek Fixed Station
Time Series of Dissolved Cadmium



Wheal Jane Pollution Incident – Restronguet Creek Fixed Station
Time Series of Dissolved Zinc





NRA

National Rivers Authority
South West Region

N E W S R E L E A S E

4 December 1992

NRA ANNOUNCES PLANS FOR UNIQUE WHEAL JANE PROJECT

The National Rivers Authority today announced details of a major project to improve the treatment of contaminated mine water flowing from the disused Wheal Jane tin mine in Cornwall.

The move follows an international search for a way forward and government approval this week for an £8 million scheme to develop a long term treatment solution.

The NRA said that studies had shown Wheal Jane to be unique in its combination of high and variable flows, extreme acidity and high concentrations of metals.

As a result there is no easy solution immediately available. One will have to be developed to suit the special circumstances of the Carnon valley.

The sanctioned project therefore consists of a series of experimental treatment methods. These will be tried out over the next three years and assessed to determine the best practical and cost-effective system for the future.

Key elements of the pilot study will include:

- * flow control to limit the quantity of contaminated water needing treatment,
- * primary treatment to reduce the acidity - methods will include anoxic lime-stone drains and organic slurry ponds,
- * secondary treatment to achieve the controlled deposition of metals - methods will include oxidation ditches, and possibly sludge recirculation systems and sludge drying,
- * tertiary treatment to provide final "polishing" - methods will include constructing artificial marshes to test different species of aquatic plants.

During the experimental period, the present treatment system, thanks to the continued cooperation of Carnon Consolidated Limited, will continue to operate to minimize excess untreated flows to the river.

"A pilot plant is the only realistic way forward", said NRA Wheal Jane Project Manager, Roger Hamilton. "We could not build a full scale system immediately. There are no methods currently available that guarantee success in the Wheal Jane conditions.

Continued ...2

For further information please contact Public Relations,
Manley House, Kestrel Way, Exeter, Devon, EX2 7LO.
Tel: Exeter (0392) 444000
Direct line: Exeter (0392) 442008
Fax: (0392) 444238

NRA ANNOUNCES PLANS FOR UNIQUE WHEAL JANE PROJECT/2

"We will be testing a variety of methods used successfully in the United States to deal with small scale problems in metal and coal mining areas. They will be assessed for their ability to reduce acidity and remove metals from the water.

"We are concentrating on passive methods, using natural, physical, chemical and biological processes. These offer a green low-tech, low cost solution.

"The result of the pilot study will then be used in developing proposals for a full scale treatment system", he said.

Much of the pilot work will be let under contract. The first stage will be to undertake detailed design. Once planning permission is obtained, construction will begin. This is expected to take up to a year. Two further years will be needed to allow biological systems to grow to their full capability, and for testing the various methods.

Subsequent development of a full scale system is also likely to require two to three years. It is inevitable that some untreated water will be discharged to the river during this period, although there will be a progressive increase in the ability to treat mine water by natural means.

The NRA said today that it recognized the enormous public interest there would be in this unique project. It pledged to keep the public informed of progress. A visitor centre will be developed.

"The proposed scheme has a number of advantages beyond that of improving and protecting water quality in the Carrick Roads. These include educational benefits, the development of a tourist attraction and, for the companies involved in the scheme, the development of skills which can be utilized in resolving similar problems elsewhere. There are many discharges of acid mine waters in other parts of the country, and overseas. The knowledge and skills generated here are likely to have a commercial value", said Mr. Hamilton.

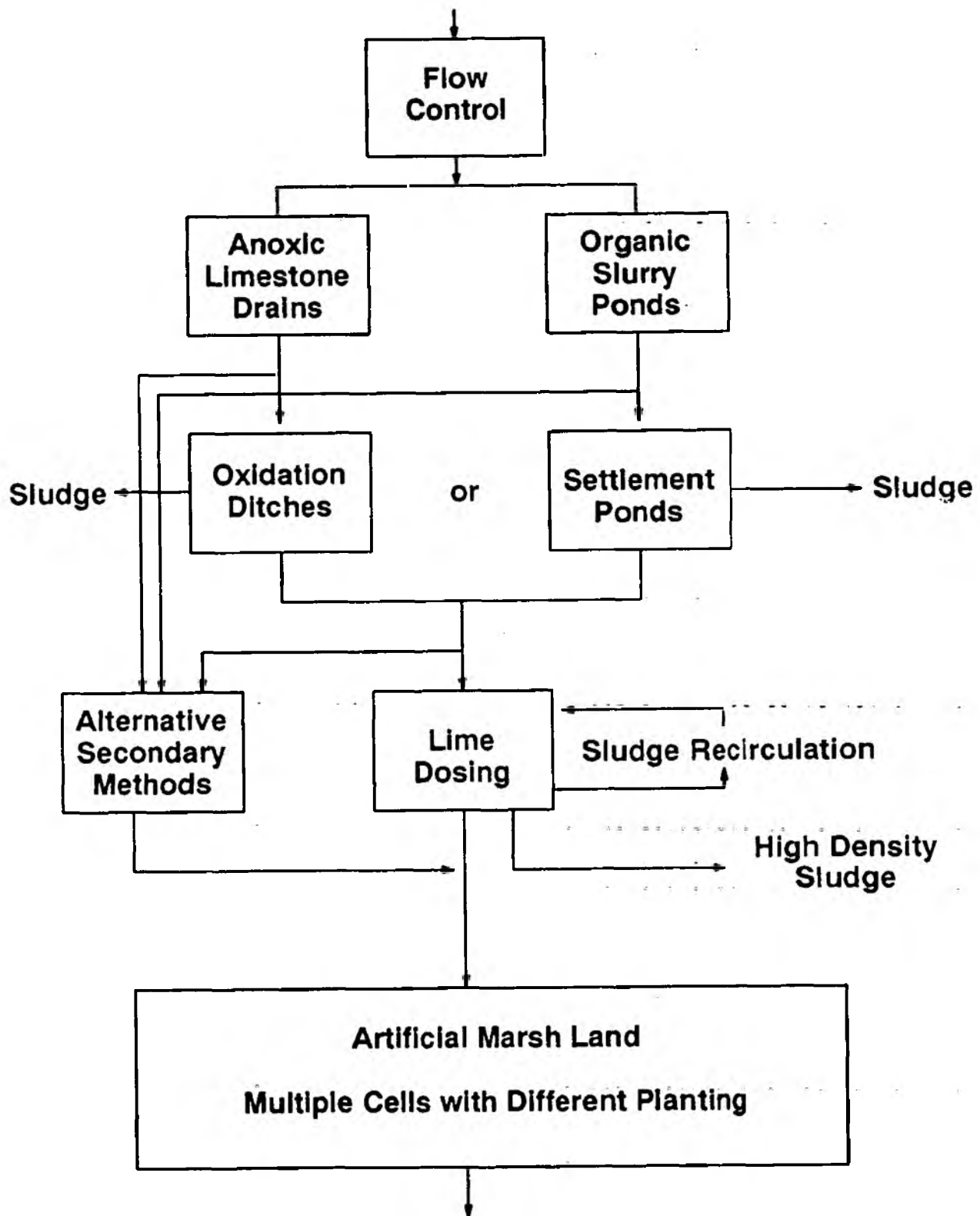
"The NRA has always considered the Wheal Jane problem to be a community problem, requiring a community solution. The assistance of many organizations and individuals is gratefully acknowledged. Some issues such as land purchase and obtaining planning permissions remain to be dealt with, and the cooperation of relevant parties in these matters is being sought.

"There is now a clear way forward. The NRA has already started work on the new project and aims to make progress on the ground as quickly as possible" he said.

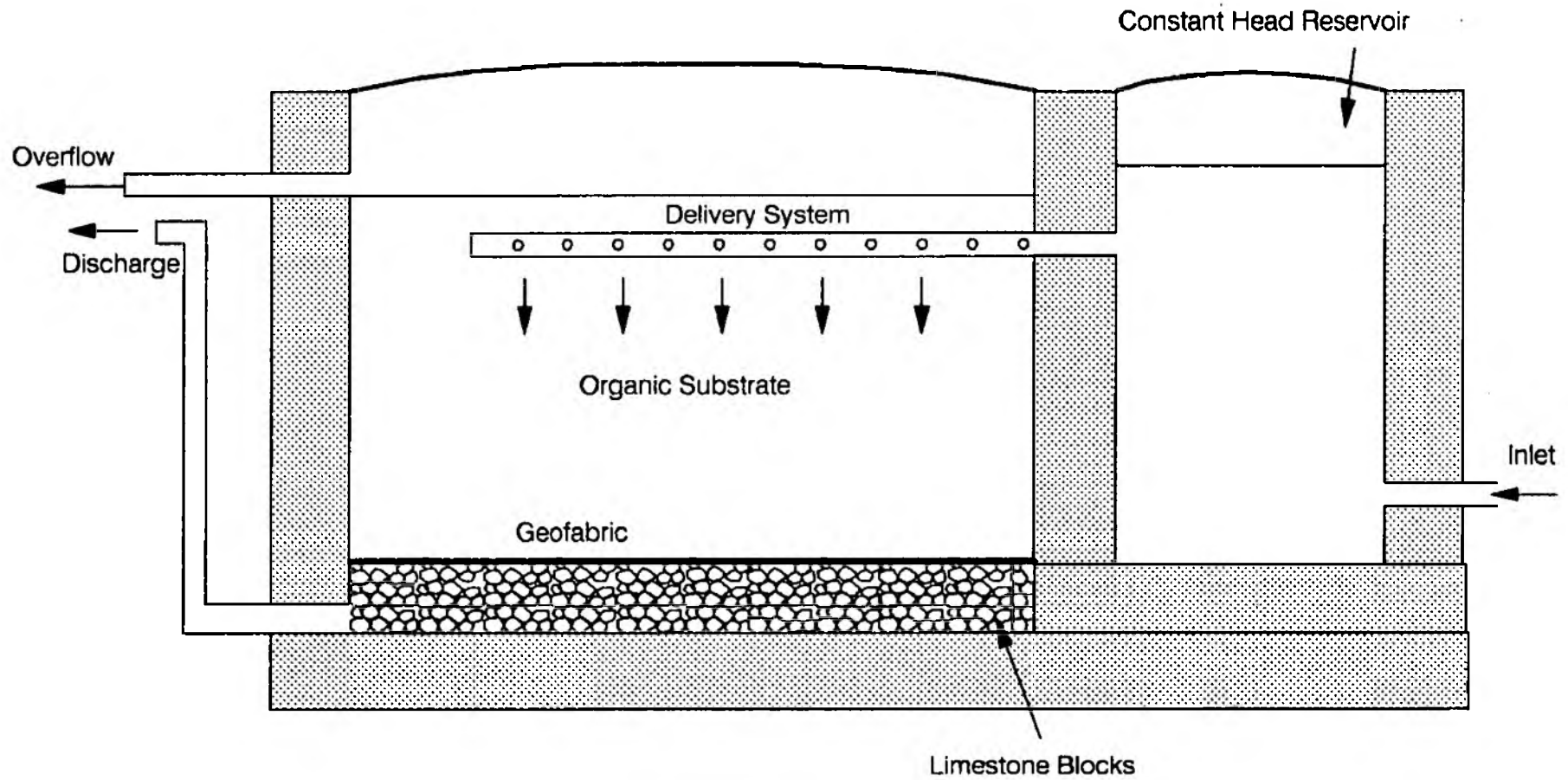
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Wheal Jane

Pilot Scale System

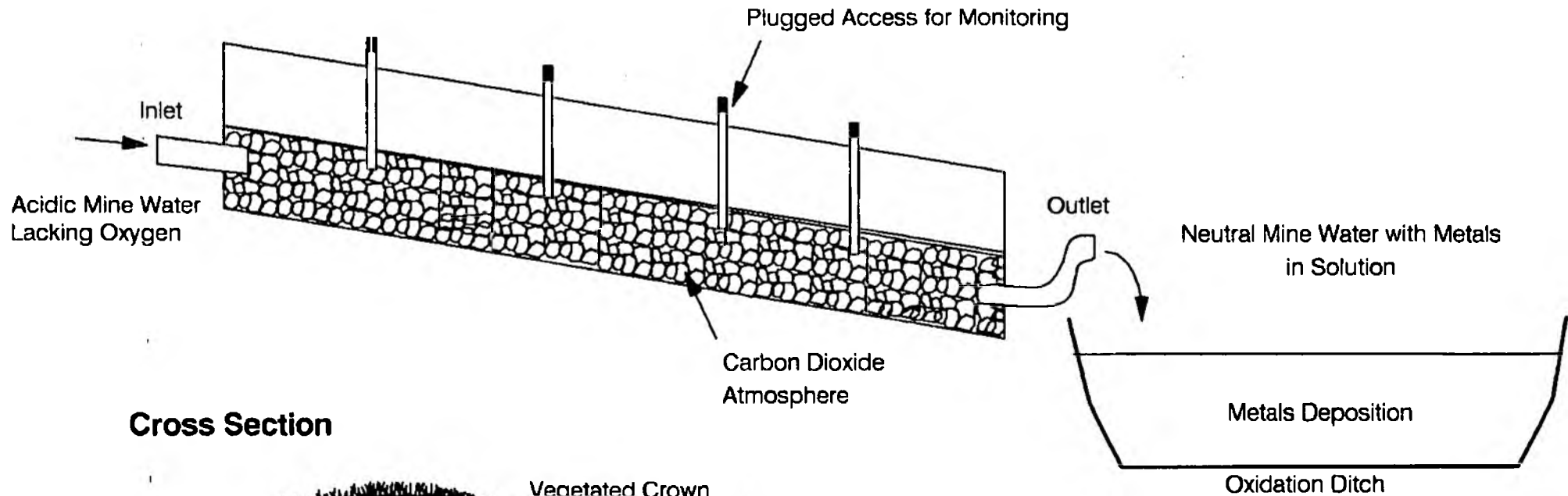


Organic Slurry Pond

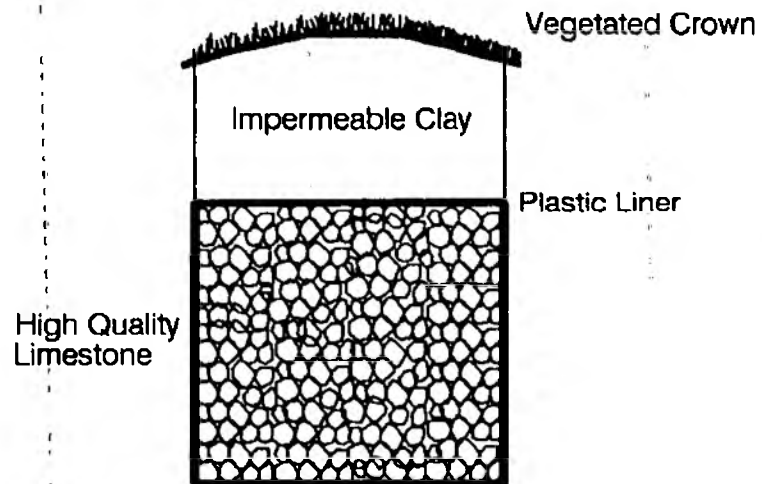


Primary Treatment Anoxic Limestone Drain

Long Section



Cross Section



Carnon Valley Update



NRA

DATE: 18 DECEMBER 1992

National Rivers Authority
South West Region

WATER QUALITY: CARNON RIVER

The heavy rainfall of recent weeks greatly increased the flow of untreated minewater from the disused Wheal Jane mine and from other old mining adits in the area, particularly the County Adit.

As a result there was an inevitable rise in metal loadings in the Carnon River. Some discolouration occurred for a variety of reasons including natural run-off and because of extremely high river flows dislodging old deposits of ochre from the river bed.

At the peak of the rainfall event over 8 million gallons a day (mgd) were discharging from Wheal Jane.

The pumping and treatment operation being carried out by Carnon Consolidated Ltd, and funded by the NRA, dealt with up to 3.3 mgd of this flow. The balance flowed, untreated, from the Nangiles Adit.

Sampling over the past month shows a rise in metal concentrations (see attached graphs). The most recent sample result available (taken on 11 December 1992) produced a cadmium concentration at Devoran Bridge of 17 micrograms per litre ($\mu\text{g/l}$). The readings were 16 $\mu\text{g/l}$ on 8 December, 12 $\mu\text{g/l}$ on 1 December, 9 $\mu\text{g/l}$ on 27 November, and 5 $\mu\text{g/l}$ on 24 and 17 November.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

WATER QUALITY: ESTUARY

Because of the recent increased flow of untreated water from the Wheal Jane mine, continuous monitoring equipment was deployed at the mouth of Restronquet Creek at the end of November 1992. An unscheduled full water quality survey was carried out in Restronquet Creek and Carrick Roads on 3/4 December 1992. Samples are now being processed. So far analysis for arsenic has been completed.

At the mouth of Restronquet Creek, the low water surface concentration (worst case situation) of dissolved arsenic was 20.8 $\mu\text{g/l}$, which is below its EQS for dissolved arsenic of 25 $\mu\text{g/l}$. This compares with 18.3 $\mu\text{g/l}$ on 14 October 1992, (the last major survey), and 597 $\mu\text{g/l}$ at the height of the January 1992 incident.

Continued....

CARNON VALLEY UPDATE/2

The total arsenic (dissolved plus particulate) had a low water surface concentration of 60.0 $\mu\text{g/l}$. This has increased from 25.3 $\mu\text{g/l}$ on 14 October 1992, but compares to a high of 1043 $\mu\text{g/l}$ in January 1992.

Visual observations indicated a reappearance of some orange coloration in the upper third of Restronguet Creek. However, because the riverine input was at flood levels, it is not possible to say whether this was due to a resuspension of sediments, or because a deterioration in water quality led to a precipitation of iron ochre. This will be clarified when the full analytical results are known.

The next major survey is scheduled for mid-January 1993. Others surveys will be carried out as dictated by circumstances.

THE WAY FORWARD

Work is now underway on the major project to improve the treatment of contaminated mine water.

This follows the international search for a way forward and Government approval of an £8 million scheme to develop a long term treatment solution.

Wheal Jane is unique in its combination of high and variable flows, extreme acidity and high concentrations of metals.

As a result there is no easy solution immediately available. One will have to be developed to suit the special circumstances of the Carnon Valley.

The sanctioned project therefore consists of a series of experimental treatment methods. These will be tried out over the next three years and assessed to determine the best practical and cost-effective system for the future.

Key elements of the pilot study will include:

- * Flow control to limit the quantity of contaminated water needing treatment;
- * Primary treatment to reduce the acidity - methods will include anoxic limestone drains and organic slurry ponds;
- * Secondary treatment to achieve the controlled deposition of metals - methods will include oxidation ditches, and possibly sludge recirculation systems and sludge drying;
- * Tertiary treatment to provide final "polishing" - methods will include constructing artificial marshes to test different species of aquatic plants.

During the experimental period, the present treatment system, thanks to the continued cooperation of Carnon Consolidated Ltd, will continue to operate to minimise excess untreated flows to the river.

Continued....

CARNON VALLEY UPDATE/3

Much of the pilot work will be let under contract. The first stage will be to undertake detailed design. Once planning permission is obtained, construction will begin. This is expected to take up to a year. Two further years will be needed to allow biological systems to grow to their full capability, and for testing the various methods.

Subsequent development of a full scale system is also likely to require two to three years. It is inevitable that some untreated water will be discharged to the river during this period, although there will be a progressive increase in the ability to treat mine water by natural means.

The NRA has recognised the enormous public interest there would be in this unique project. It has pledged to keep the public informed of progress. A visitor centre will be developed.

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Carnon Valley Update

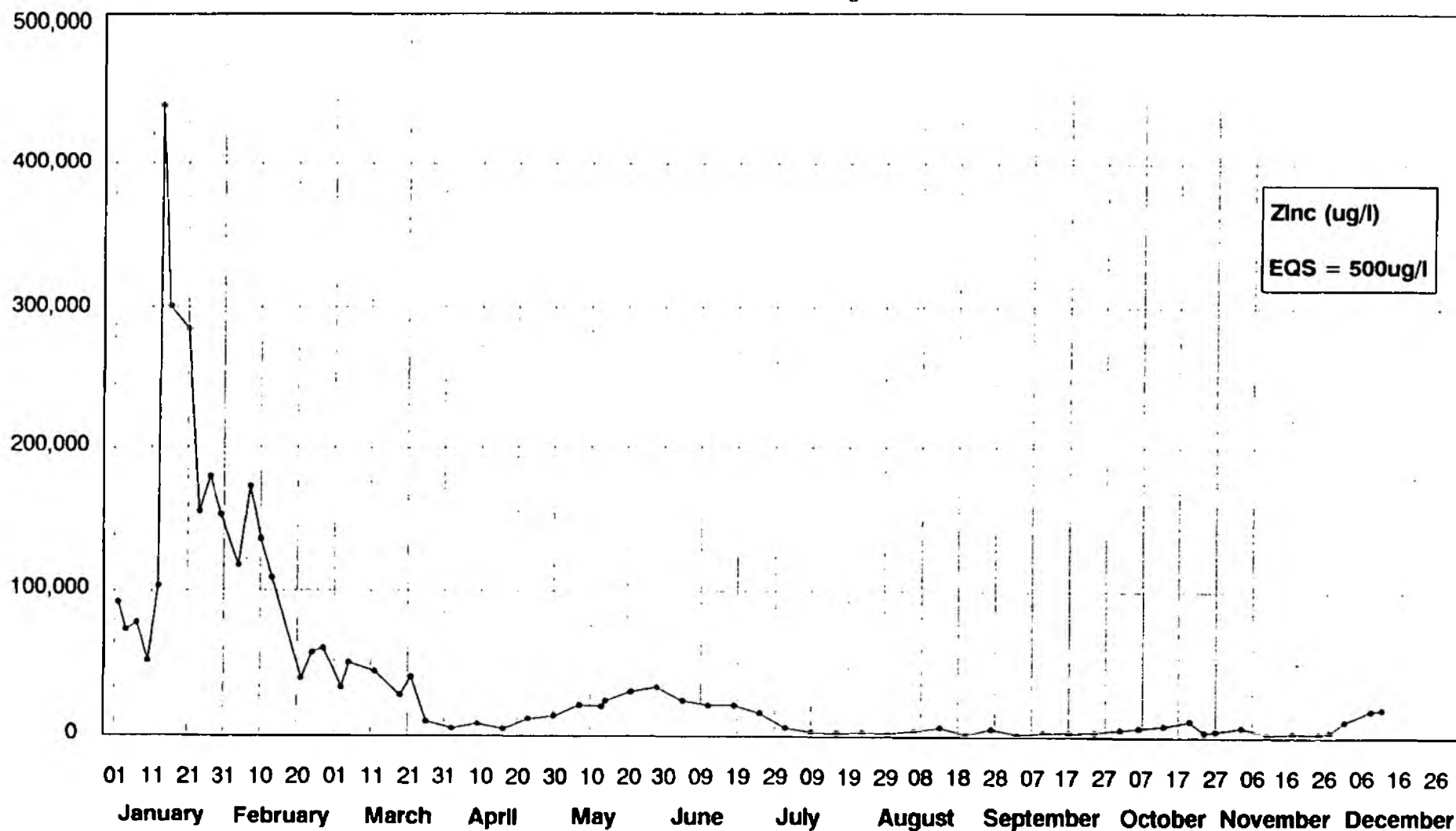


NRA
National Rivers Authority
South West Region

18 December 1992

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for zinc concentrations at Devoran Bridge



Carnon Valley Update



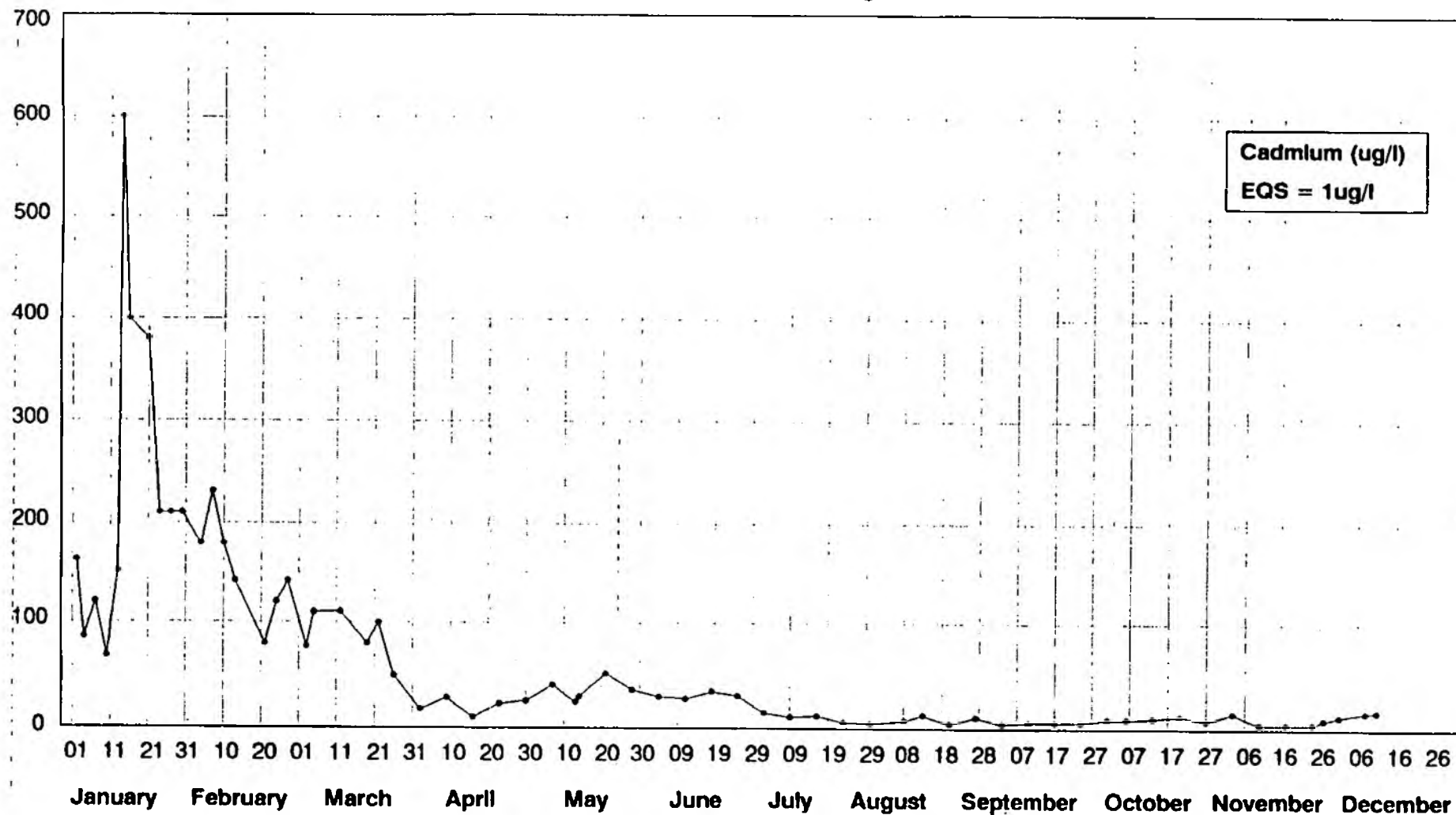
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National Rivers Authority
South West Region

18 December 1992

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for cadmium concentrations at Devoran Bridge



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Carnon Valley Update



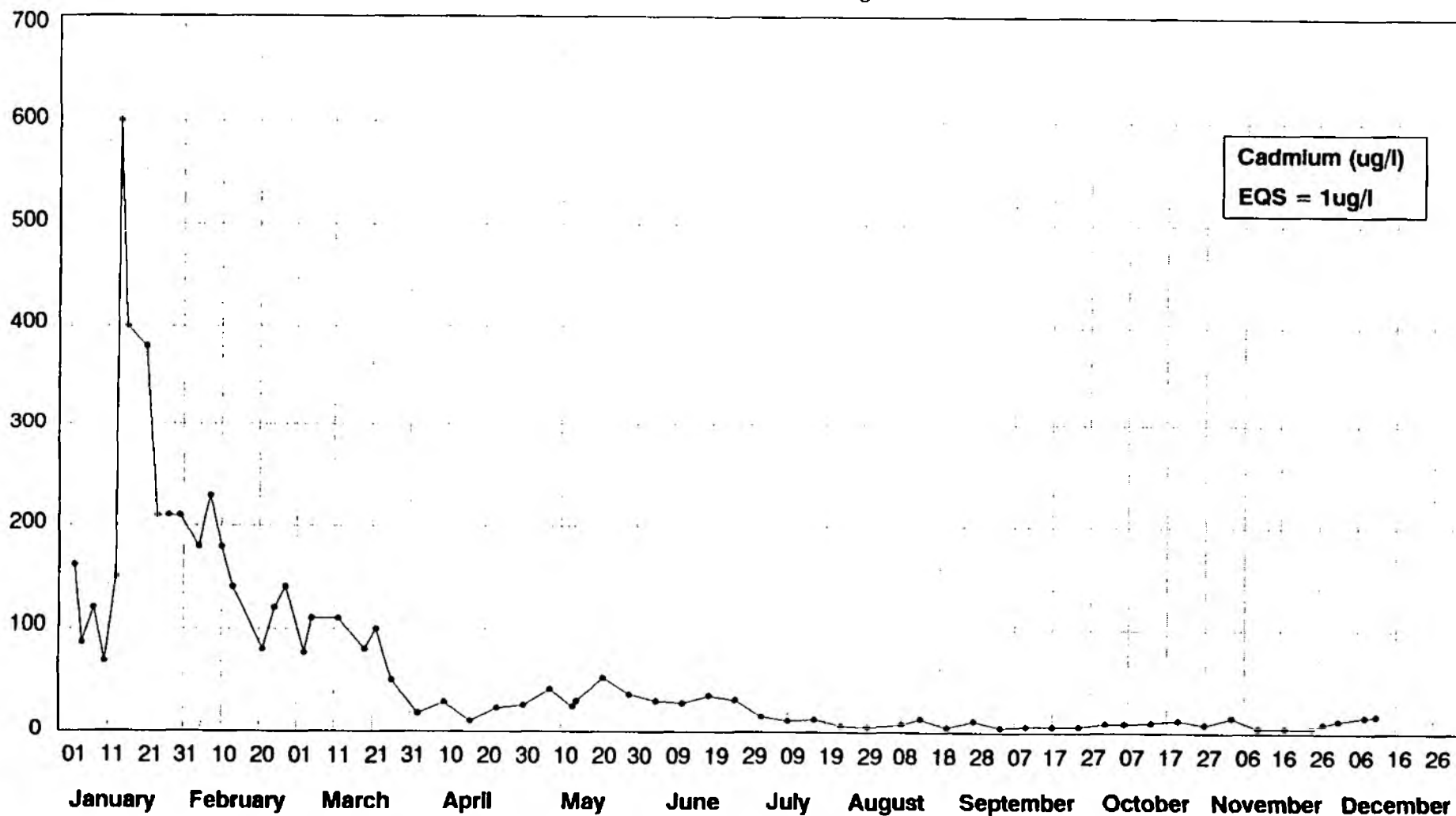
NRA

National Rivers Authority
South West Region

18 December 1992

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for cadmium concentrations at Devoran Bridge



Carnon Valley Update

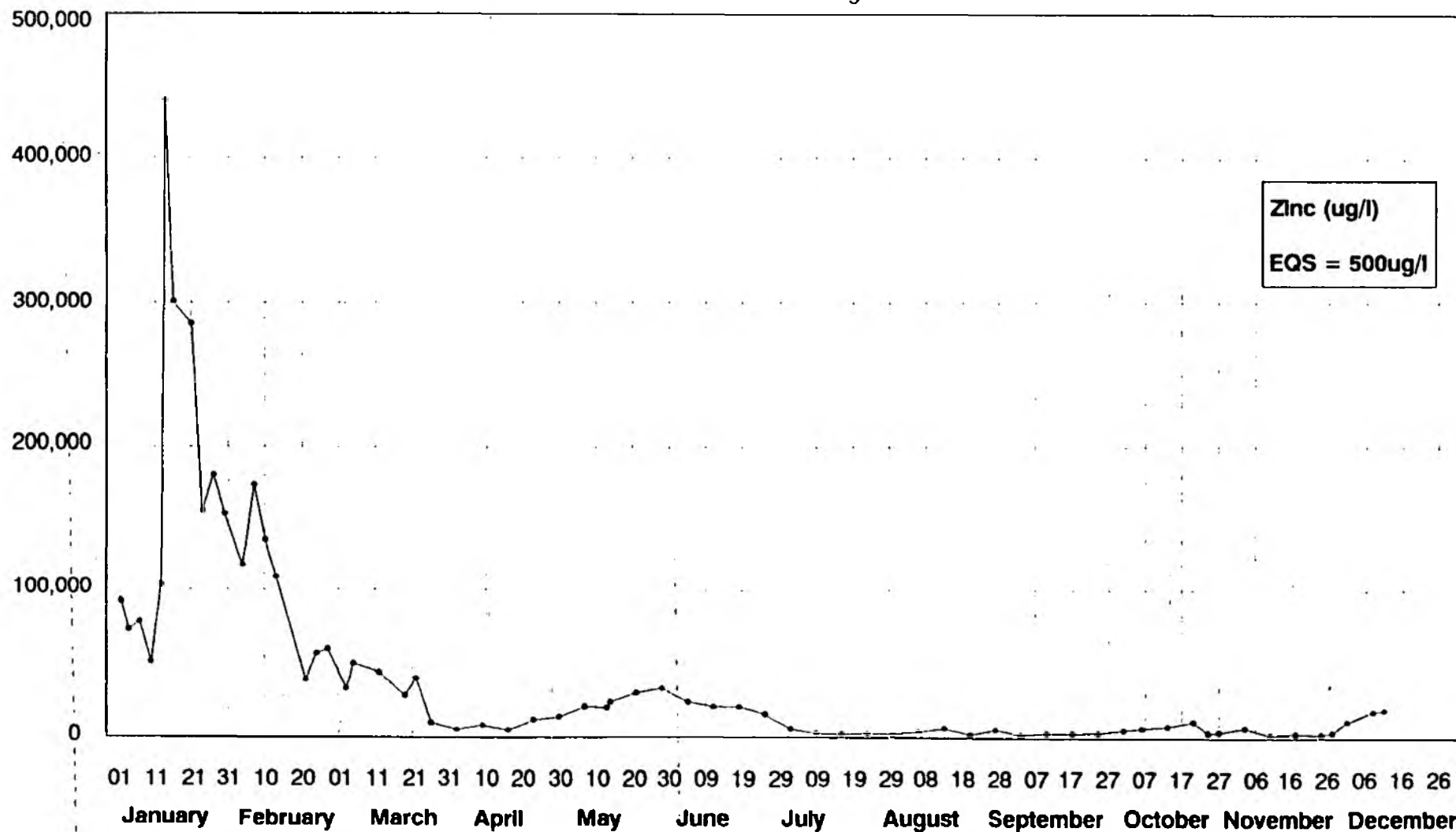


NRA
National Rivers Authority
South West Region

18 December 1992

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for zinc concentrations at Devoran Bridge



Issued by: Public Relations, NRA South West, Manley House, Kestrel Way, Exeter, EX2 7LQ. Tel: (0392) 444000

Carnon Valley Update



NRA

DATE: 15 JANUARY 1993

National Rivers Authority

South West Region

WATER QUALITY LATEST

A combination of poor weather and short-term pump failures has contributed to the increase in metal loadings in the Carnon River over the past month (see attached graphs).

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is now working to its full capacity of up to 3.3 million gallons a day.

The most recent sample result available (taken on 8 January 1993) produced a cadmium concentration at Devoran Bridge of 19 microgrammes per litre ($\mu\text{g/l}$). The readings were 29 $\mu\text{g/l}$ on 5 January 1993, 25 $\mu\text{g/l}$ on 31 December 1992, 16 $\mu\text{g/l}$ on 29 December 1992, 14 $\mu\text{g/l}$ on 22 December 1992, 19 $\mu\text{g/l}$ on 17 December 1992 and 17 $\mu\text{g/l}$ on 15 December 1992.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

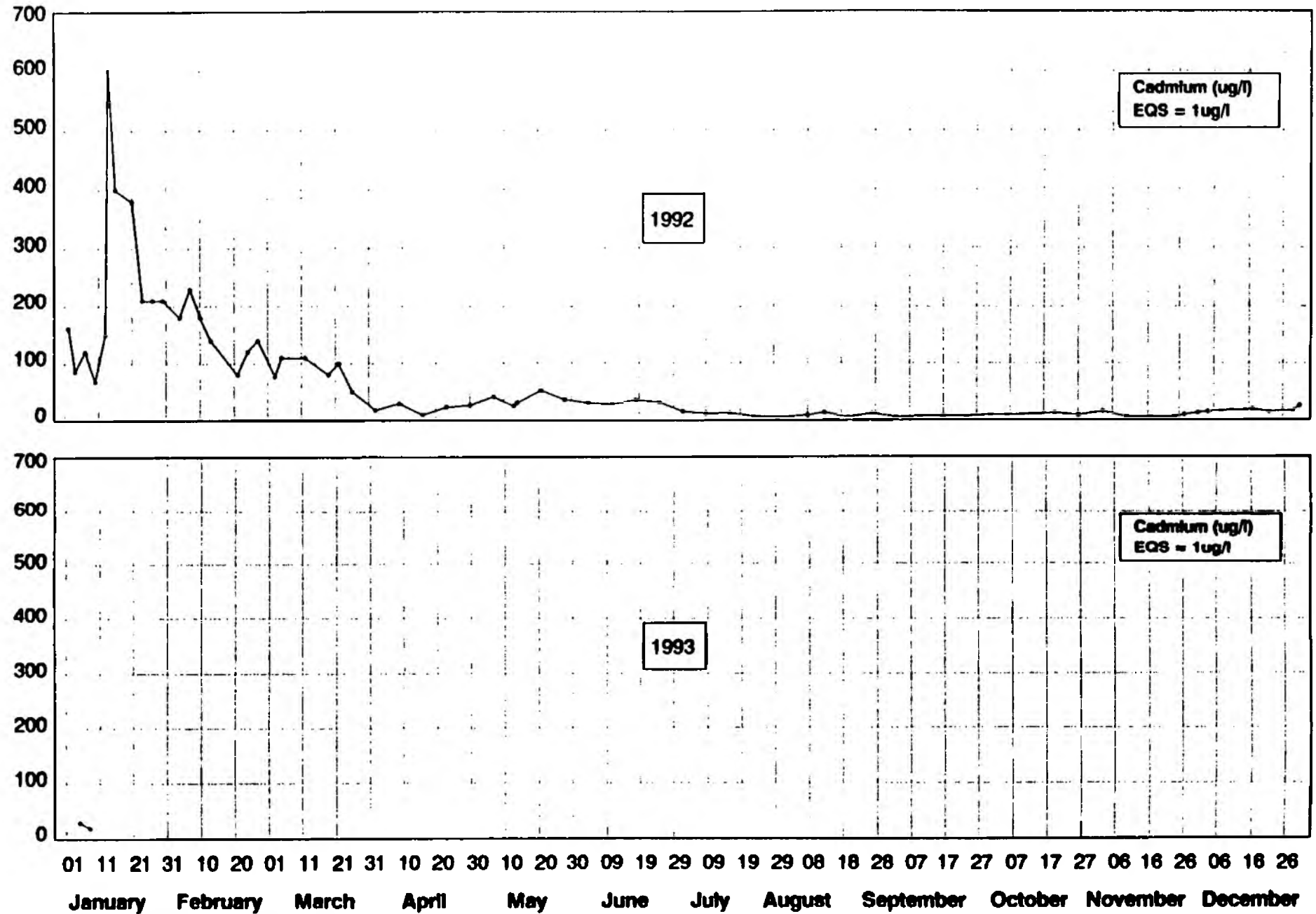
Meanwhile results from the extra NRA tidal waters survey on 3 December 1992 are currently being processed.

A scheduled NRA survey at sites throughout Restronguet Creek and Carrick Roads was completed on 13 January 1993. This included water quality and biological monitoring. The results of this work are also now being analysed.

WATER QUALITY IN THE CARNON RIVER

15 January 1993

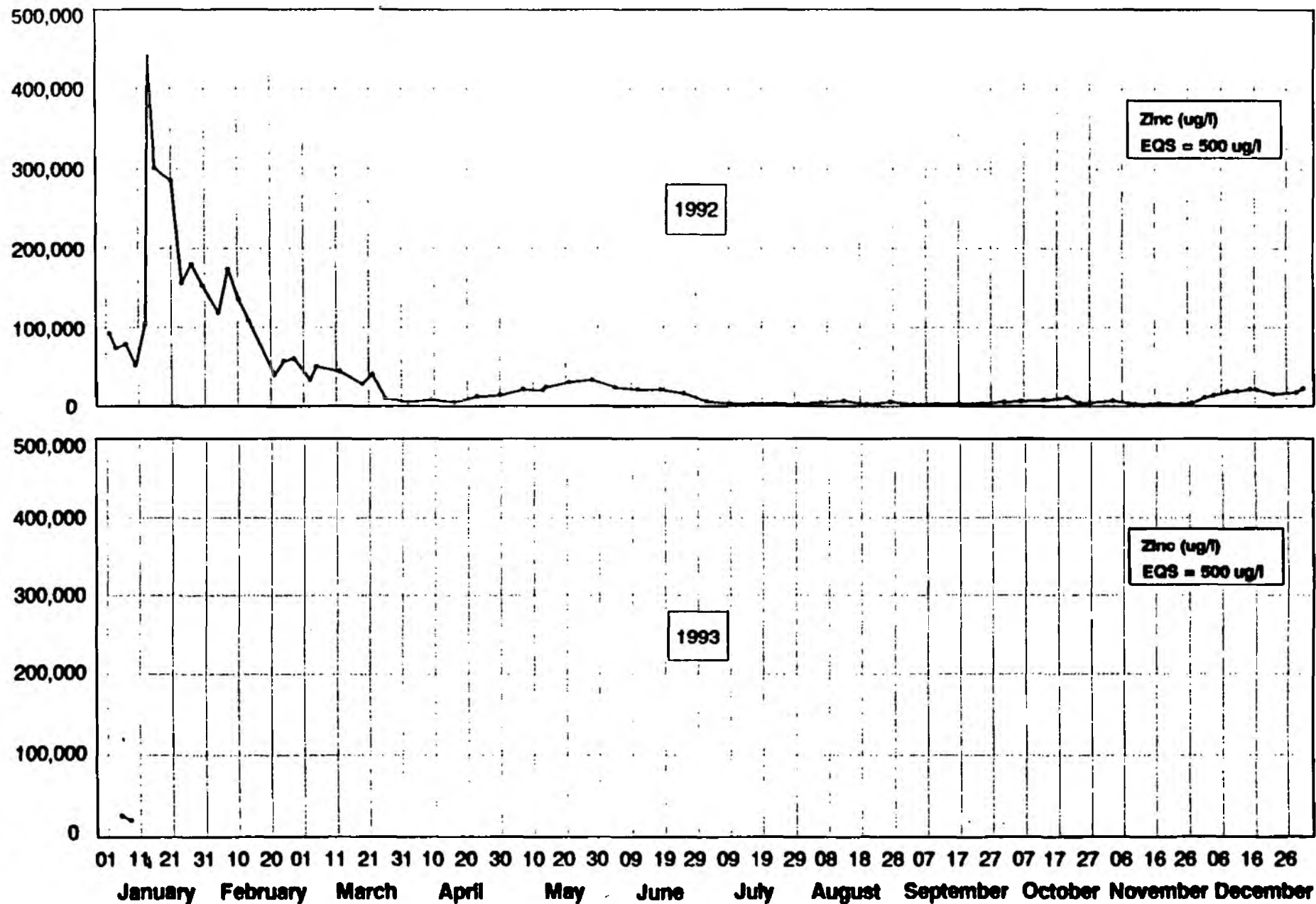
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



WATER QUALITY IN THE CARNON RIVER

15 January 1993

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

DATE: 12 FEBRUARY 1993

National Rivers Authority
South West Region

WATER QUALITY NEWS

Water quality in the Carnon River has stabilised following the easing of earlier difficulties with poor weather and short-term pump failures (see attached graphs).

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is continuing to work to its full capacity of up to 3.3 million gallons a day.

As a result the amount of water flowing untreated from Nangiles Adit is being reduced - currently at a rate of 200,000 gallons a day.

Earlier this week around 1.8 million gallons a day (mgd) was discharging from the adit. At the height of the recent bad weather over 5 mgd were being discharged.

The most recent sample result available (taken on 2 February 1993) produced a cadmium concentration at Devoran Bridge of 12 microgrammes per litre ($\mu\text{g/l}$). The readings were 16 $\mu\text{g/l}$ on 29 January, 13 $\mu\text{g/l}$ on 26 January, 12 $\mu\text{g/l}$ on 22 January, 14 $\mu\text{g/l}$ on 19 January, and 10 $\mu\text{g/l}$ on both the 15 and 12 January.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

Two stand-by pumps have now been brought to the site so that, in the event of failures, replacements can be quickly installed.

Meanwhile work continues on preparations for the various long term treatment initiatives which were announced in December.

ESTUARY SURVEY RESULTS

Results from the 3 December 1992 tidal waters survey are now available. A deterioration in water quality, between October 1992 and December 1992, was noted. This was due to the adverse weather conditions experienced at the end of November/beginning of December 1992.

Continued....

At the mouth of Restronguet Creek the low water surface samples ("worst case" situation) had the following dissolved concentrations:

Zinc (EQS 40 $\mu\text{g/l}$) had a concentration of 3250 $\mu\text{g/l}$. This compares with the 14 October 1992 result of 805 $\mu\text{g/l}$, and the January 1992 high of 142000 $\mu\text{g/l}$.

Cadmium (EQS 2.5 $\mu\text{g/l}$) had a concentration of 3.03 $\mu\text{g/l}$. This compares with the 14 October 1992 result of 1.16 $\mu\text{g/l}$, and to the January 1992 high of 160 $\mu\text{g/l}$.

The samples taken from the January 1993 surveys are currently being analysed.

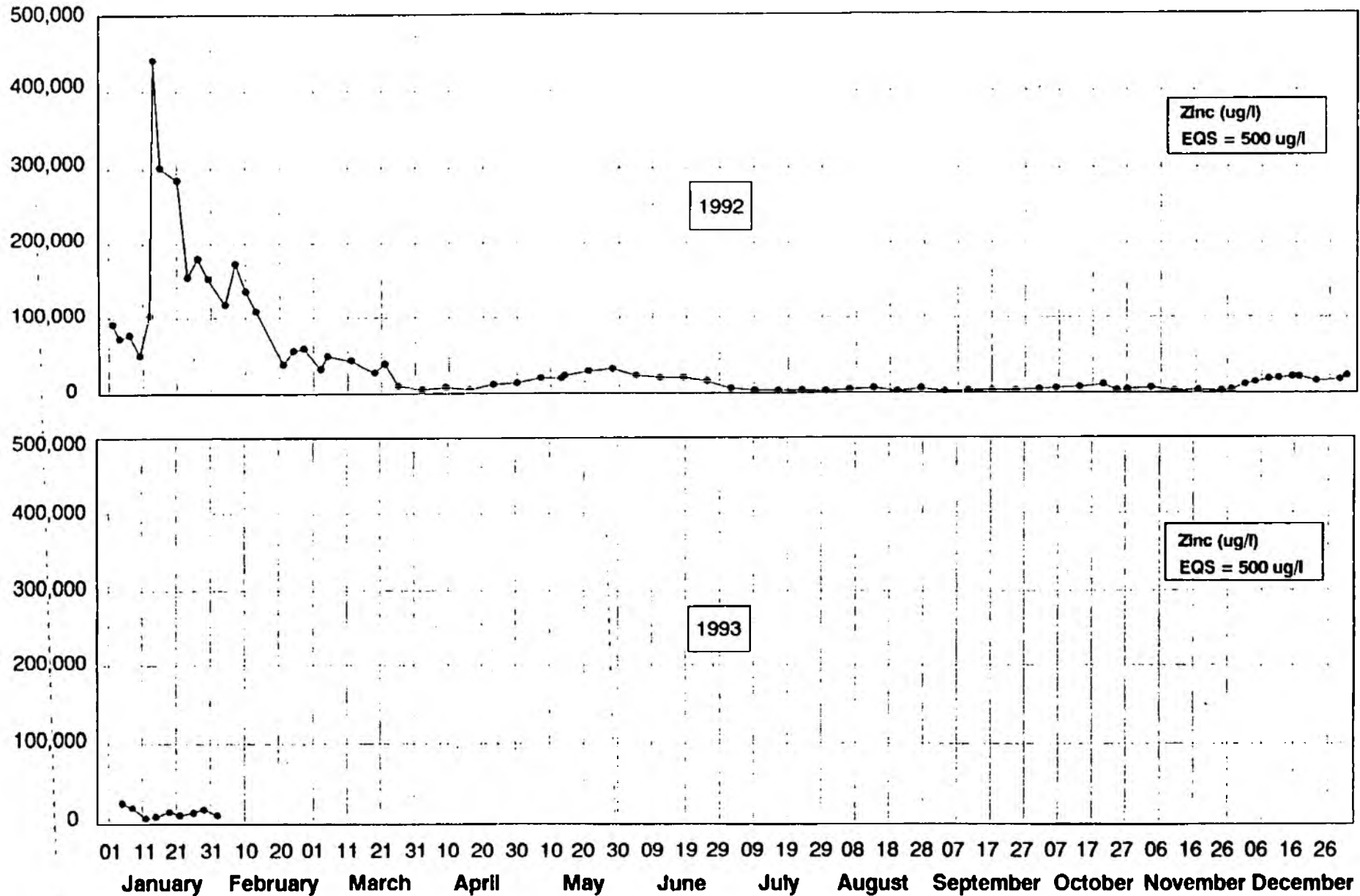
Visual observations made on 9 February 1993 still indicate an ochrous plume travelling down Restronguet Creek and the west coast of Carrick Roads at least as far as Mylor Creek, on the ebb tide. Continuous monitoring equipment is still being deployed at the mouth of Restronguet Creek.

The next scheduled tidal waters surveys are planned for mid-April 1993.

WATER QUALITY IN THE CARNON RIVER

12 February 1993

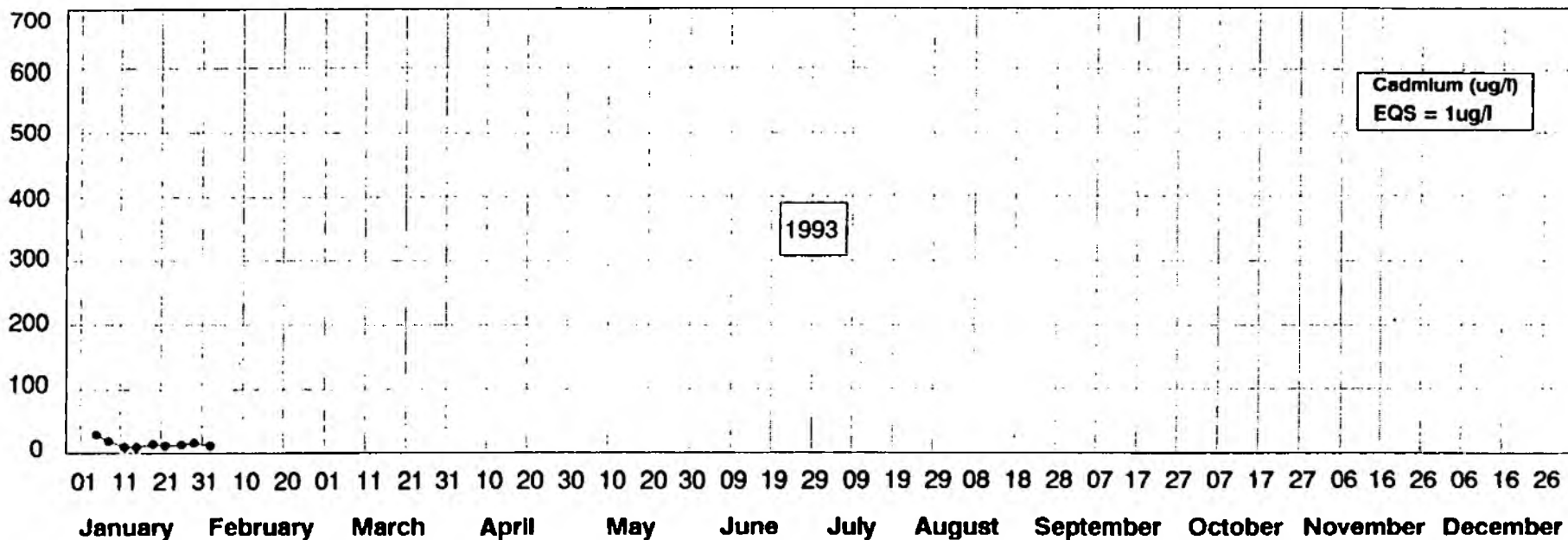
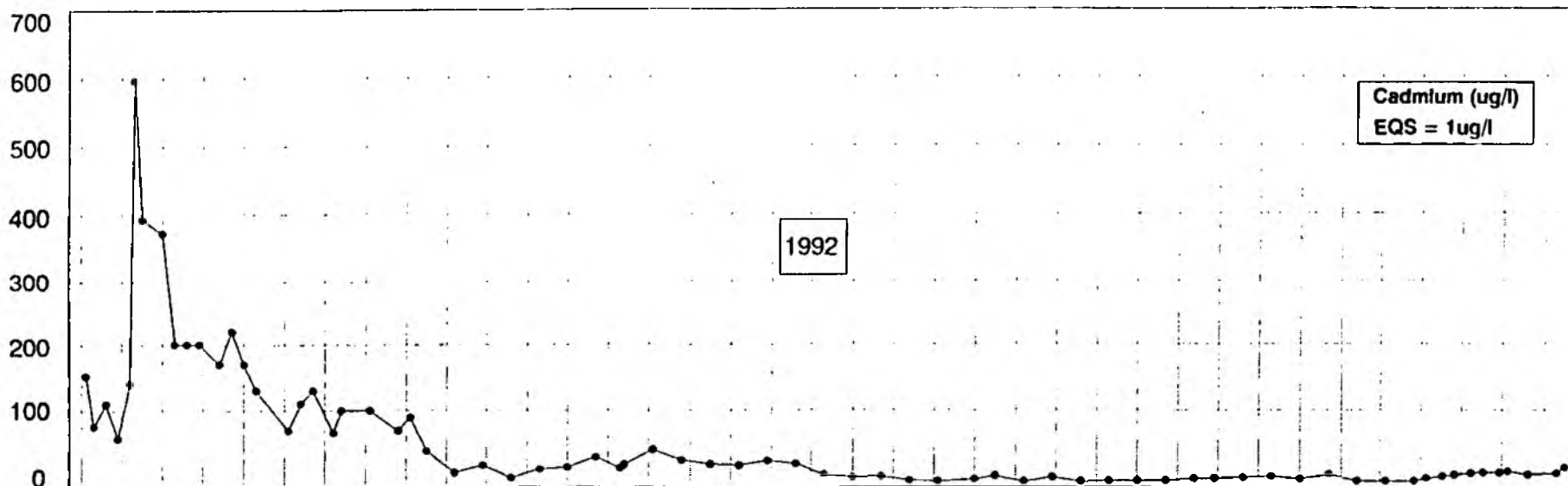
This sheet shows the latest results for zinc concentrations at Devoran Bridge.



WATER QUALITY IN THE CARNON RIVER

12 February 1993

This sheet shows the latest results for cadmium concentrations at Devoran Bridge



Carnon Valley Update



NRA

DATE: 12 MARCH 1993

National Rivers Authority
South West Region

WATER QUALITY NEWS

Water quality in the Carnon River has continued to stabilise (see attached graphs) and the latest sample result for cadmium is the lowest concentration recorded so far this year.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is continuing to work to its full capacity of up to 3.3 million gallons a day.

The amount of water flowing untreated from Nangiles Adit has now been reduced to less than half a million gallons a day.

The most recent sample result available (taken on 5 March 1993) produced a cadmium concentration at Devoran Bridge of 7 microgrammes per litre ($\mu\text{g/l}$) - the lowest reading so far this year. The readings were 8 $\mu\text{g/l}$ on 2 March; 9 $\mu\text{g/l}$ on 26 February; 9 $\mu\text{g/l}$ on 23 February; 11 $\mu\text{g/l}$ on 19 February; 12 $\mu\text{g/l}$ on 16 February; 13 $\mu\text{g/l}$ on 12 February; 16 $\mu\text{g/l}$ on 9 February and 14 $\mu\text{g/l}$ on 5 February.

These new cadmium figures compare with 500 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

Two stand-by pumps are on site so that, in the event of failures, replacements can be quickly installed.

Meanwhile work continues on preparations for the various long term treatment initiatives which were announced in December.

ESTUARY LATEST

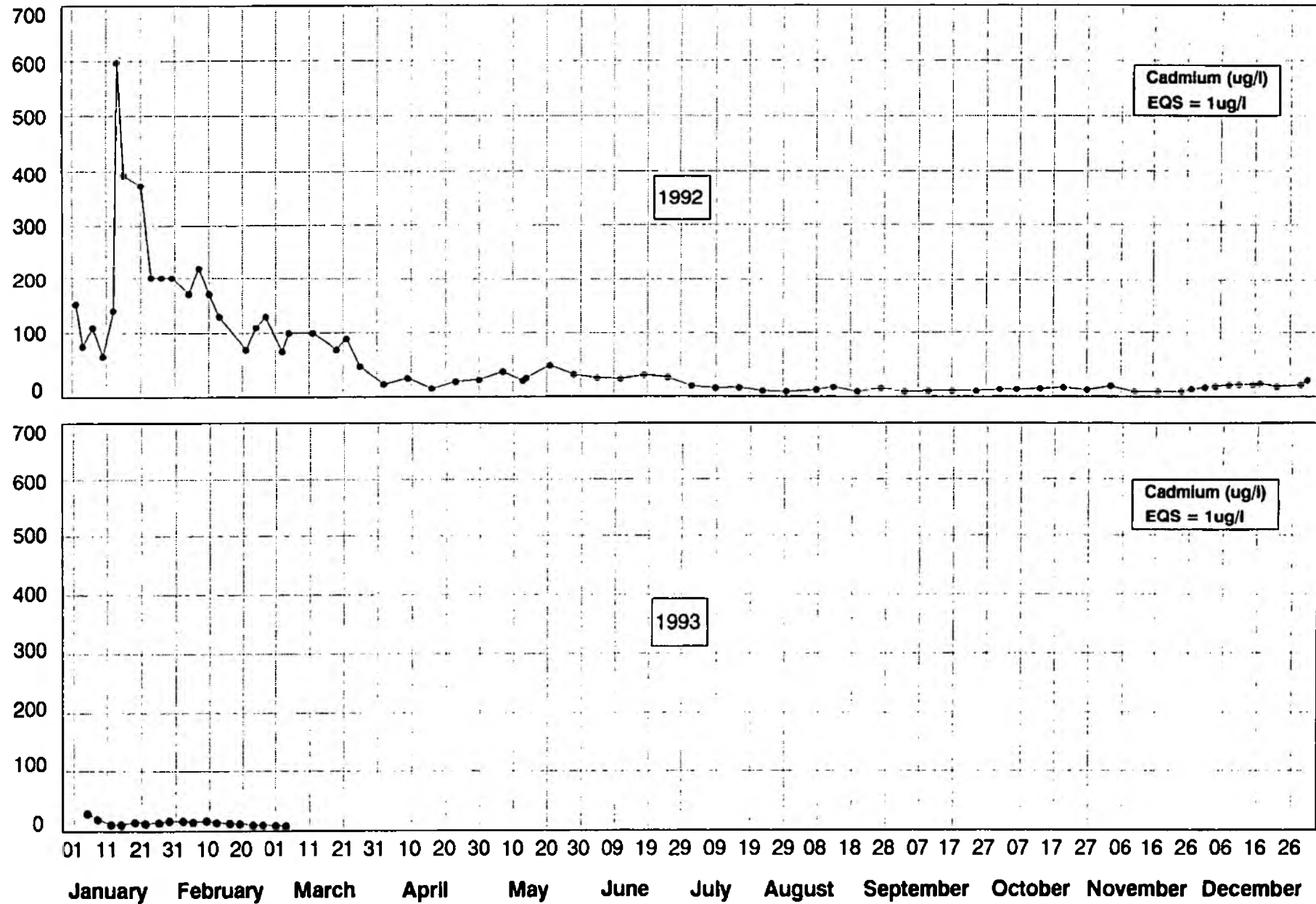
The samples taken from the January 1993 surveys are being analysed.

Continuous monitoring equipment is still being deployed at the mouth of Restronguet Creek. The next scheduled tidal water surveys are planned for mid-April 1993.

WATER QUALITY IN THE CARNON RIVER

12 March 1993

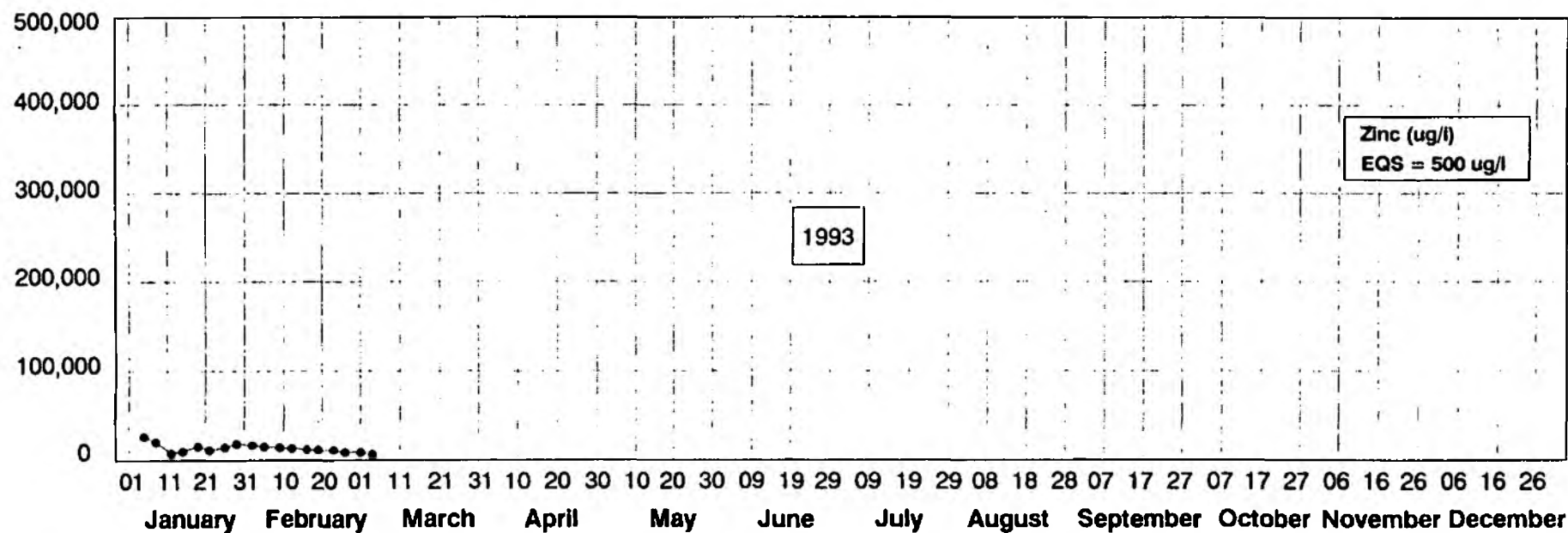
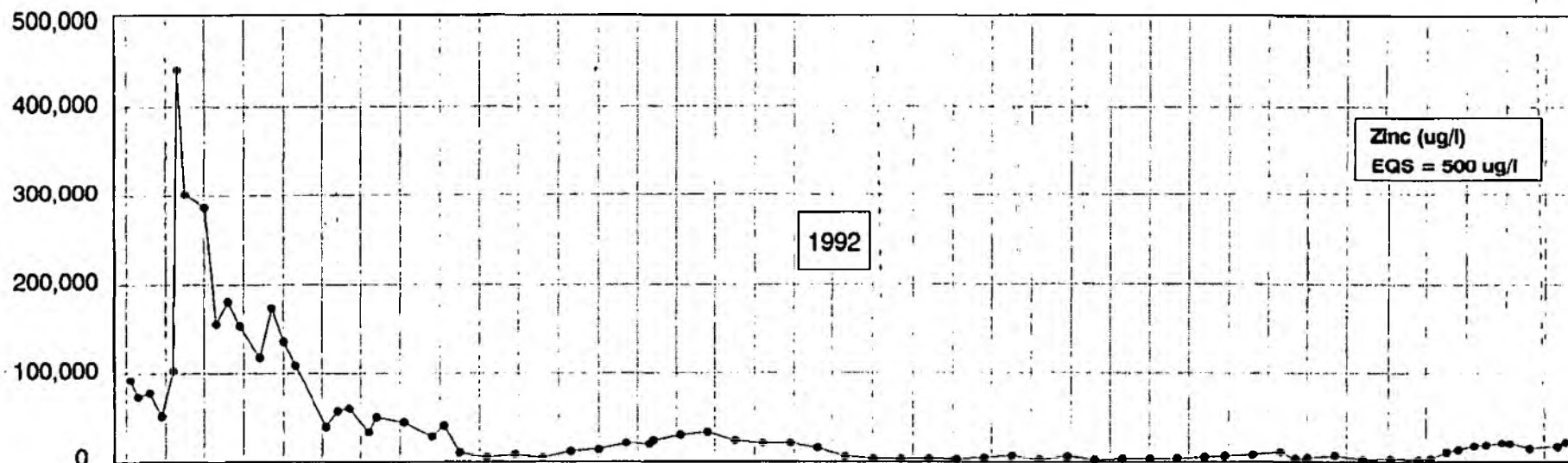
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



WATER QUALITY IN THE CARNON RIVER

12 March 1993

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority
South West Region

DATE: 8 APRIL 1993

WATER QUALITY NEWS

The total flow of minewater from the disused Wheal Jane mine is currently being treated and there is no discharge of untreated minewater from the Nangiles adit.

This follows low rainfall during February and early March.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is working to its full capacity of up to 3.3 million gallons a day.

Water quality in the Carnon River continues to stabilise (see attached graphs). Latest samples results for cadmium range between 5 and 9 microgrammes per litre ($\mu\text{g/l}$).

The most recent sample result available (taken on March 30 1993) produced a cadmium concentration at Devoran Bridge of 8 $\mu\text{g/l}$. The readings were 8 $\mu\text{g/l}$ on 26 March; 5 $\mu\text{g/l}$ on 23 March; 5 $\mu\text{g/l}$ on 19 March; 8 $\mu\text{g/l}$ on 16 March; 8 $\mu\text{g/l}$ on 12 March; 9 $\mu\text{g/l}$ on 9 March.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

Two stand-by pumps are on site so that, in the event of failures, replacements can be quickly installed.

ESTUARY LATEST

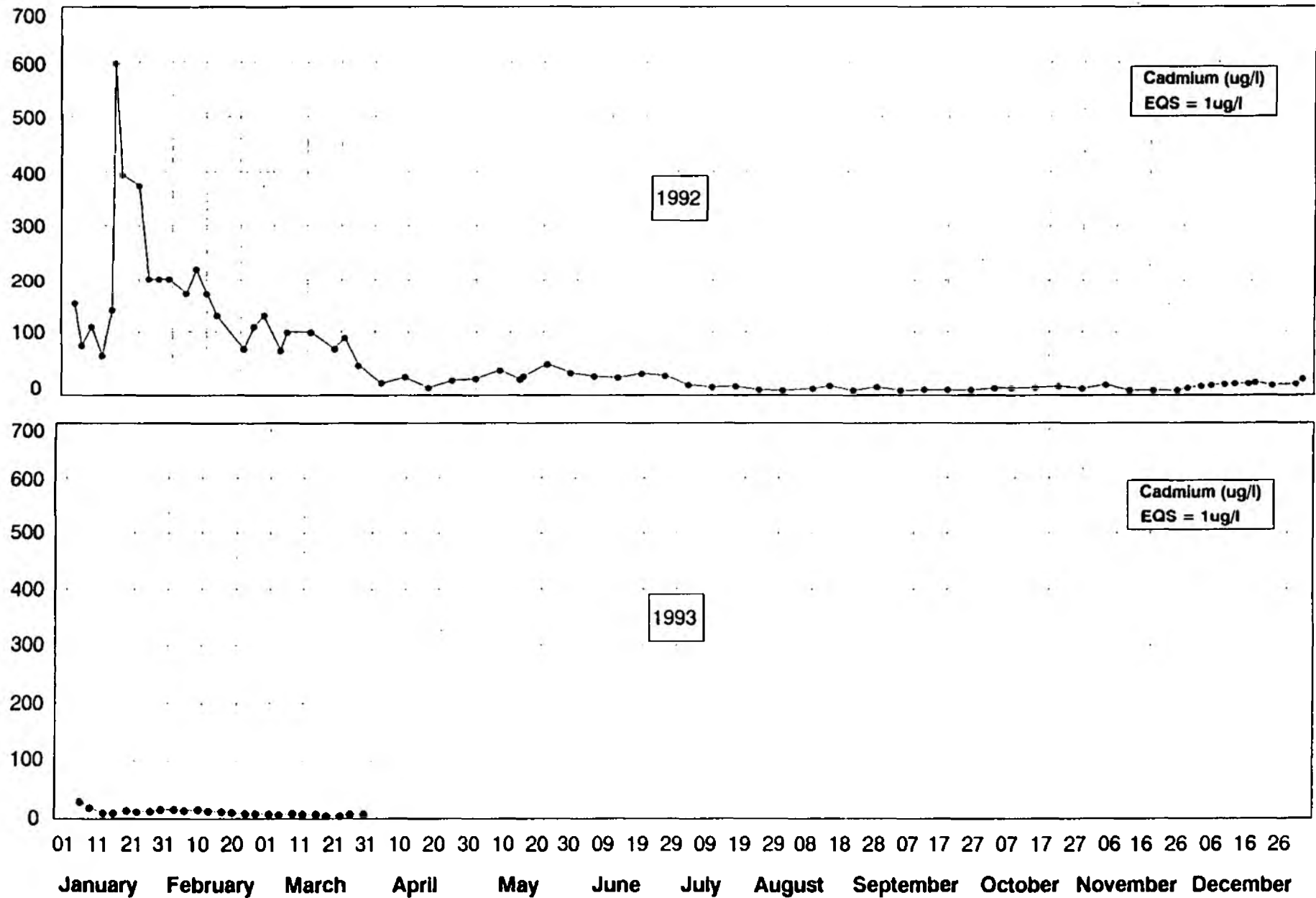
Analysis of samples taken from the January 1993 survey has been completed.

Due to the stable water quality conditions the frequency of tidal water surveys is being reduced. The next survey is now due to take place in July.

WATER QUALITY IN THE CARNON RIVER

08 April 1993

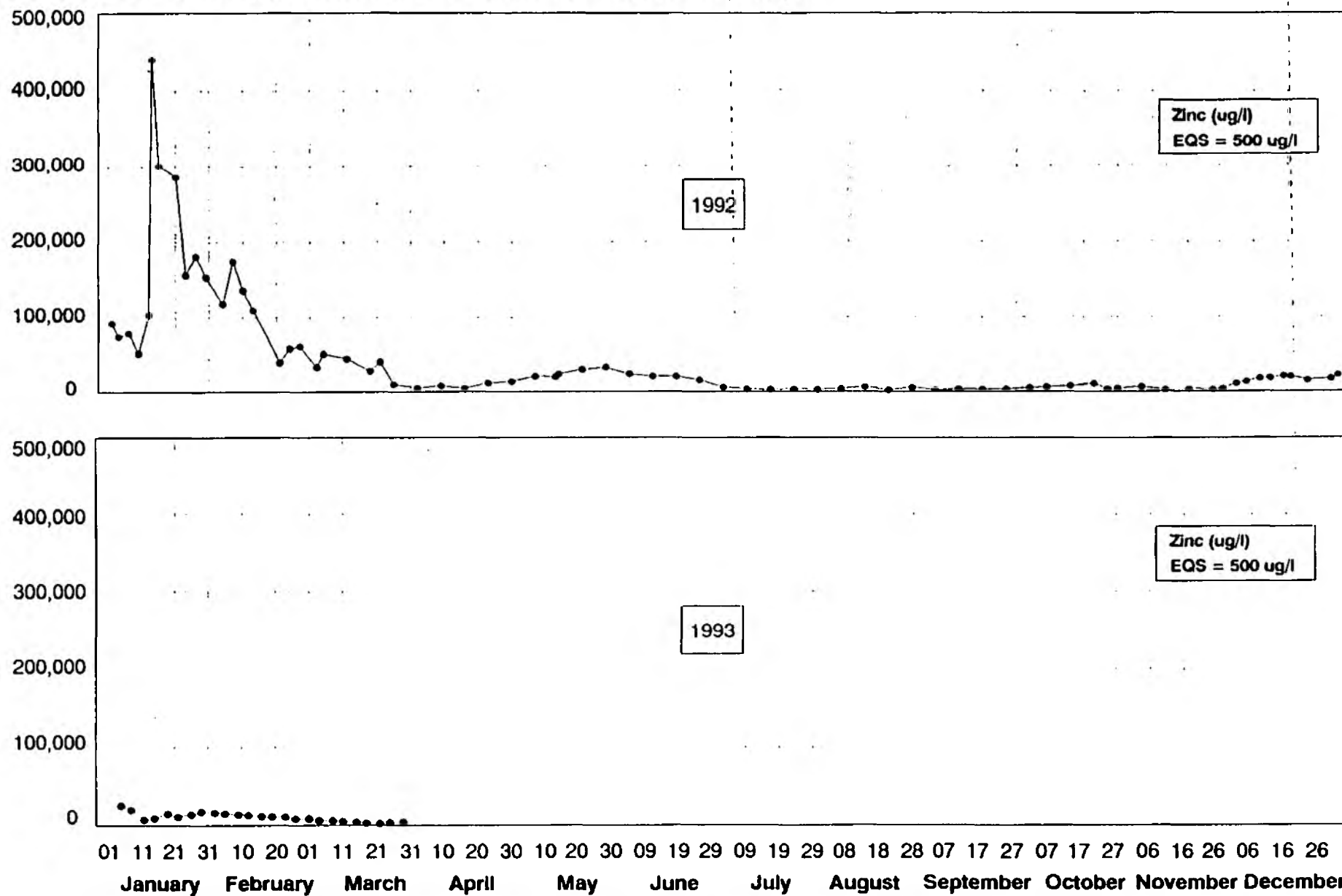
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



WATER QUALITY IN THE CARNON RIVER

08 April 1993

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority
South West Region

DATE: 7 MAY 1993

WATER QUALITY NEWS

Water quality in the Carnon River has been very consistent over the past month (see attached graphs) with concentrations of cadmium down to their lowest levels this year.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is continuing to work to its full capacity of up to 3.3 million gallons a day.

The most recent sample result available (taken on 30 April) produced a cadmium concentration at Devoran Bridge of 4 microgrammes per litre ($\mu\text{g/l}$). Other readings were 6 $\mu\text{g/l}$ on 27 April, 5 $\mu\text{g/l}$ on 24 April, 5 $\mu\text{g/l}$ on 20 April, 6 $\mu\text{g/l}$ on 16 April, 4 $\mu\text{g/l}$ on 13 April, 8 $\mu\text{g/l}$ on 9 April, 8 $\mu\text{g/l}$ on 6 April and 5 $\mu\text{g/l}$ on 2 April.

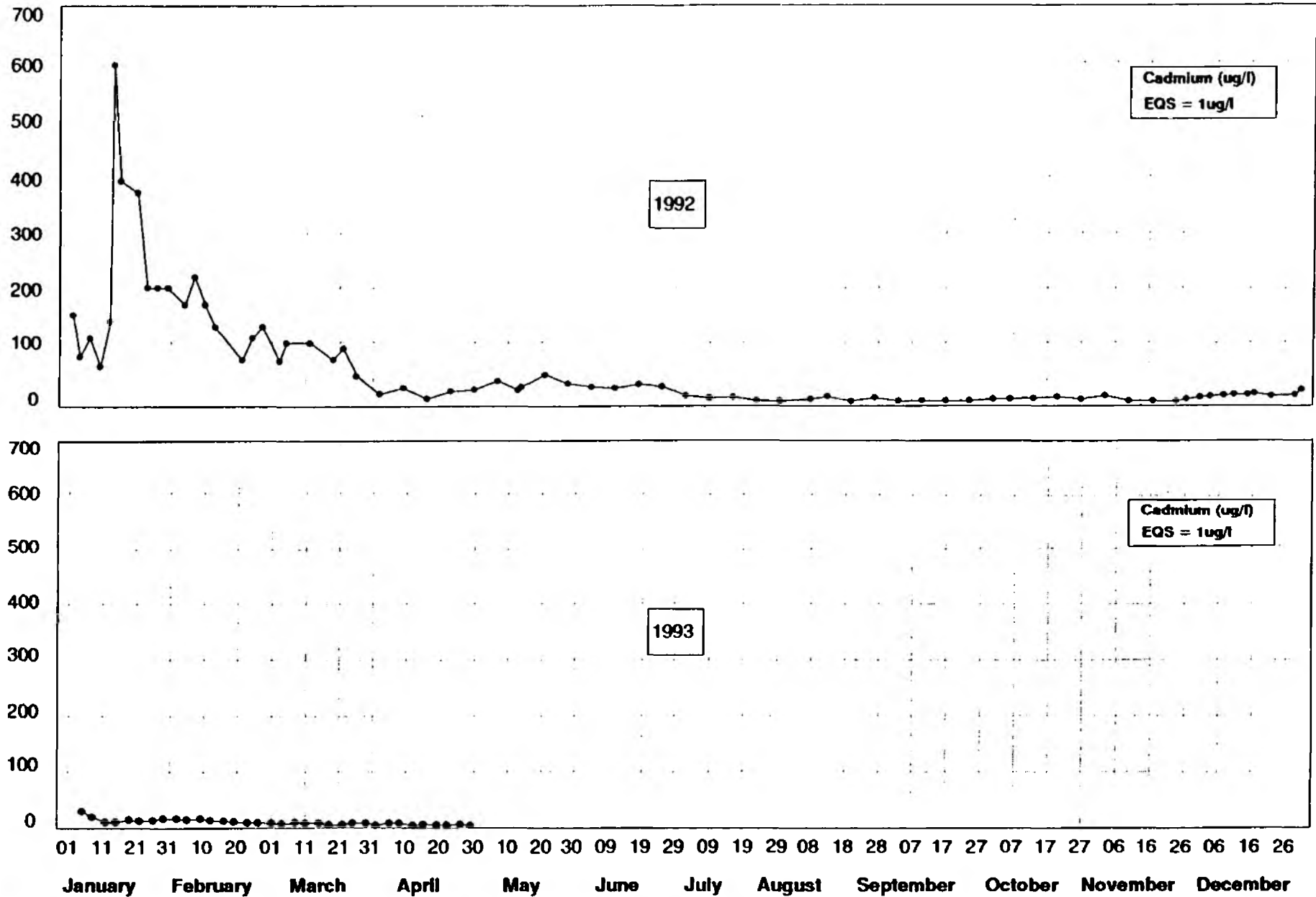
These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

WATER QUALITY IN THE CARNON RIVER

07 May 1993

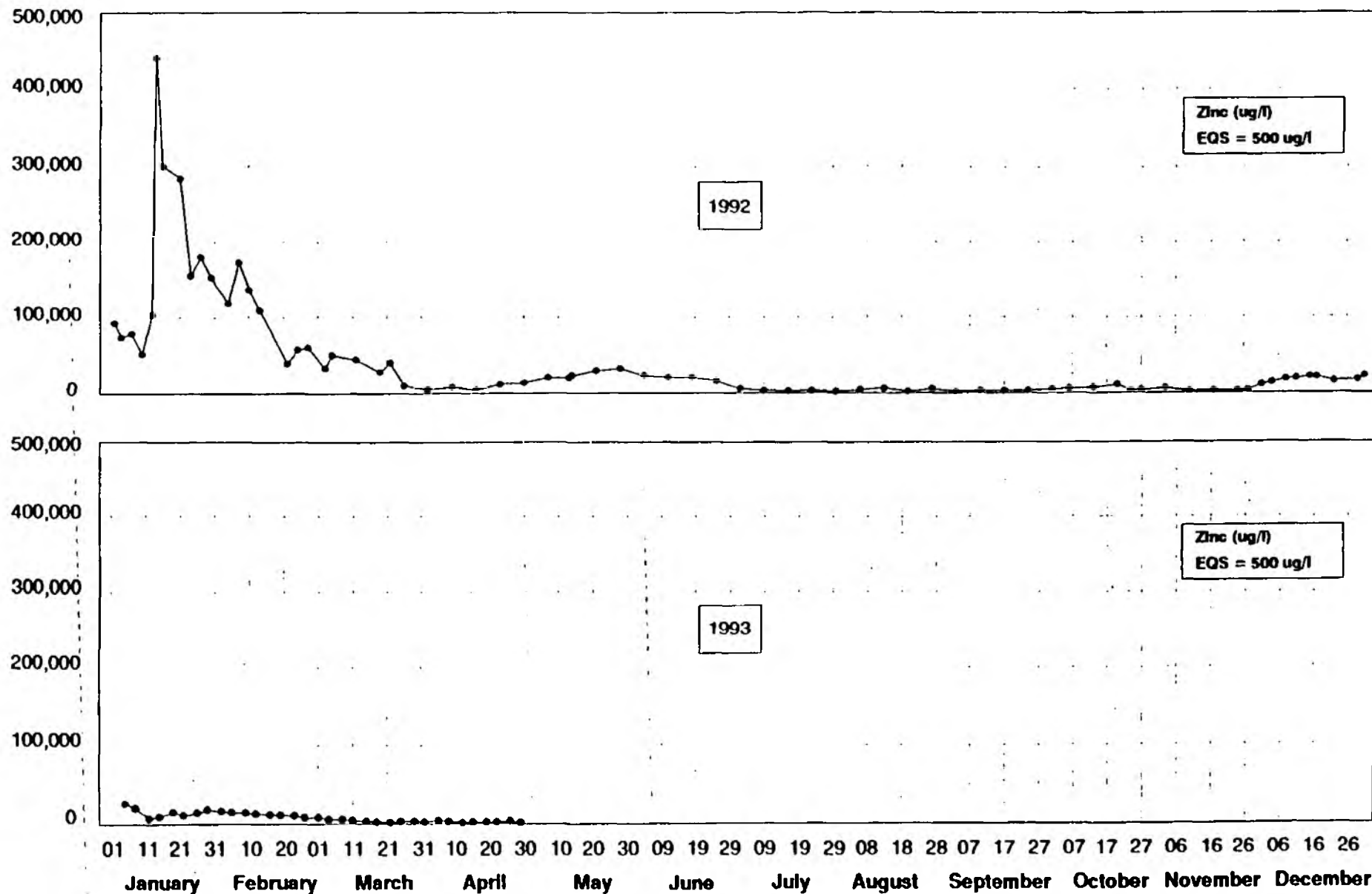
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



WATER QUALITY IN THE CARNON RIVER

07 May 1993

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority

South West Region

DATE: 4 JUNE 1993

WATER QUALITY NEWS

Water quality in the Carnon River has remained very consistent over the past month (see attached graphs) with concentrations of cadmium continuing to be at their lowest levels since the major discharge last year.

The most recent sample result available (taken on 25 May) produced a cadmium concentration at Devoran Bridge of 4 microgrammes per litre ($\mu\text{g/l}$). Other readings were 6 $\mu\text{g/l}$ on 4 May, 5 $\mu\text{g/l}$ on 11 May, and 4 $\mu\text{g/l}$ on 18 May.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

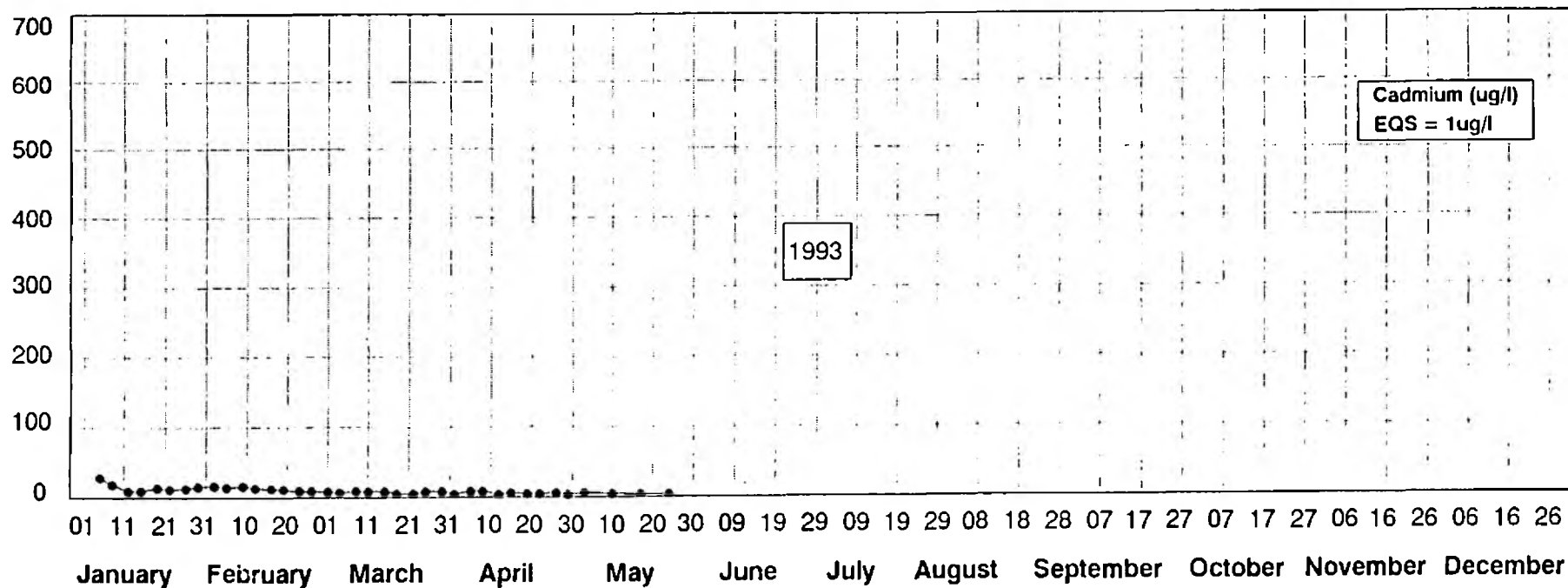
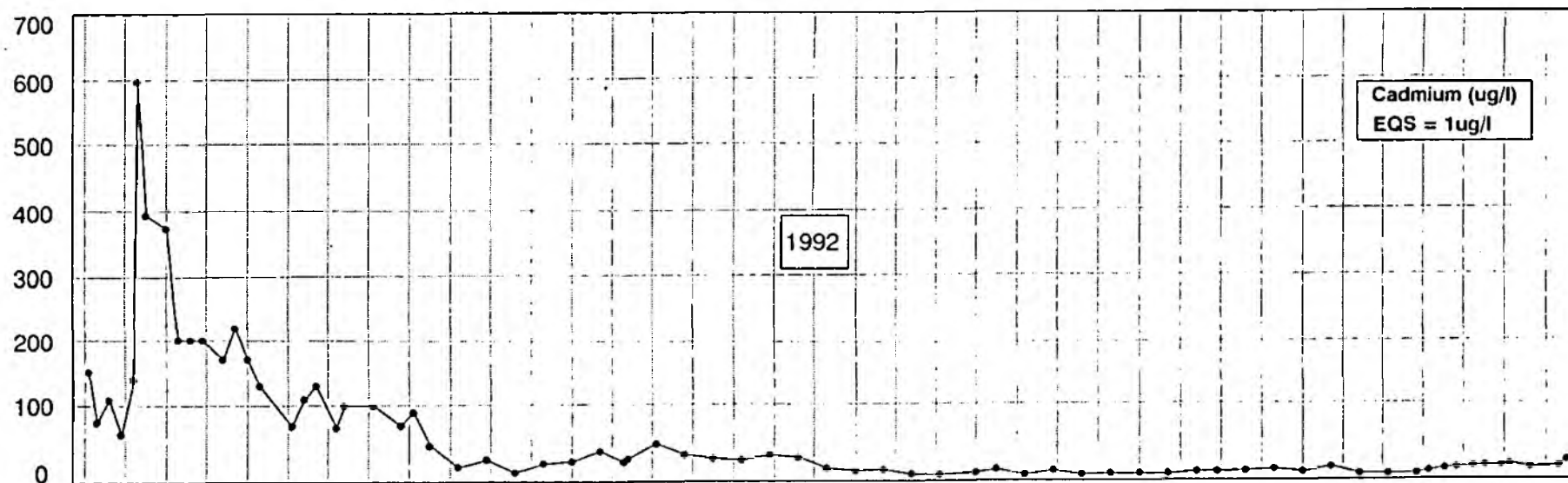
The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures. This was underlined during the electrical storm of 24 May when all three pumps were put out of action for three hours. In this instance there was enough spare capacity in the mine to cope with the flow.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA is now continuing to work to its full capacity of up to 3.3 million gallons a day.

04 June 1993

WATER QUALITY IN THE CARNON RIVER

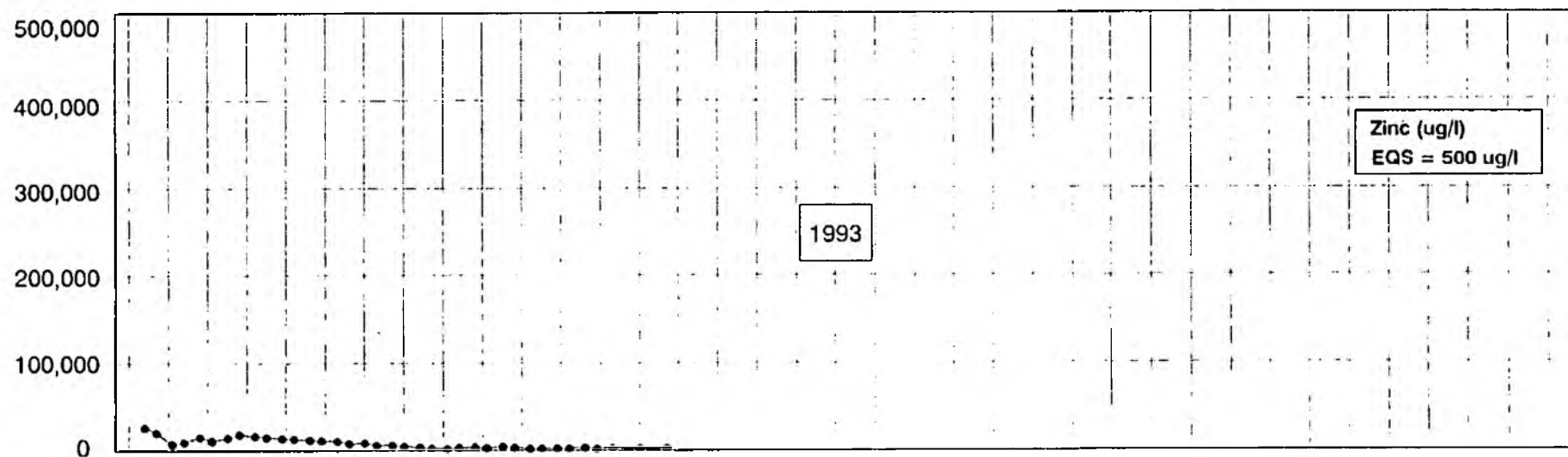
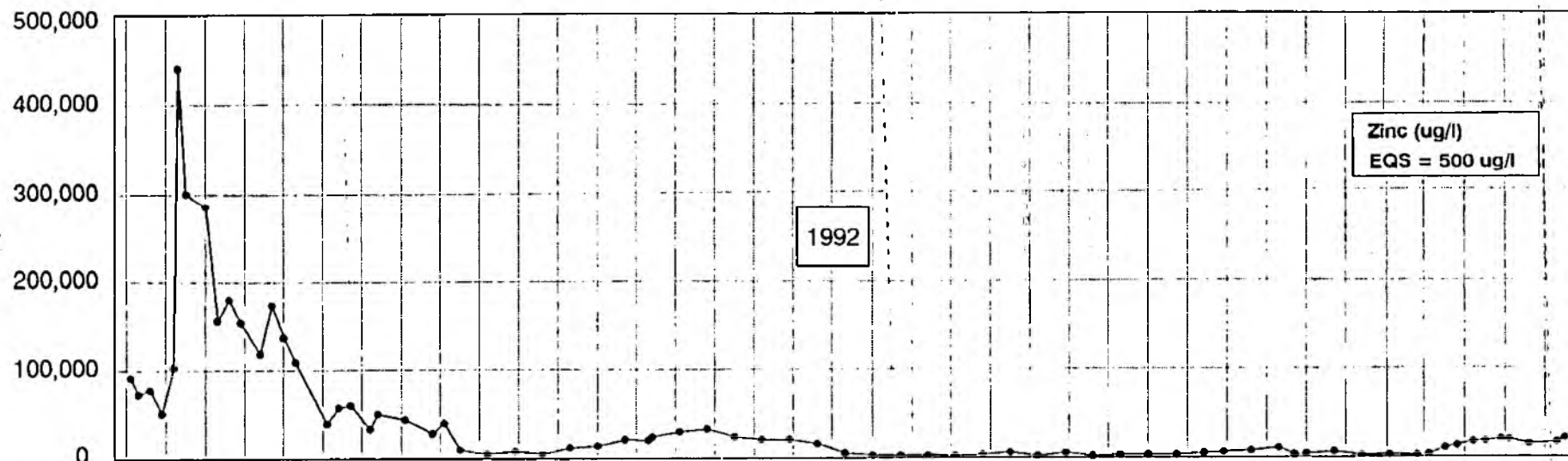
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



WATER QUALITY IN THE CARNON RIVER

04 June 1993

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



01 11 21 31 10 20 01 11 21 31 10 20 30 10 20 30 09 19 29 09 19 29 08 18 28 07 17 27 07 17 27 06 16 26 06 16 26
January February March April May June July August September October November December

Carnon Valley Update



NRA

*National Rivers Authority
South West Region*

DATE: 2 JULY 1993

WATER QUALITY NEWS

Water quality in the Carnon River has remained fairly consistent over the past month (see attached graphs) with concentrations of cadmium ranging between 4 and 8 microgrammes per litre ($\mu\text{g/l}$).

The most recent sample result available (taken on 25 June) produced a cadmium concentration at Devoran Bridge of 8 $\mu\text{g/l}$. Other readings were 6 $\mu\text{g/l}$ on 18 June; 7 $\mu\text{g/l}$ on 11 June and 6 $\mu\text{g/l}$ on 4 June.

These new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the National Rivers Authority, is continuing to work to its full capacity of up to 3.3 million gallons a day. The NRA is currently examining these operations with a view to improving their efficiency and reliability.

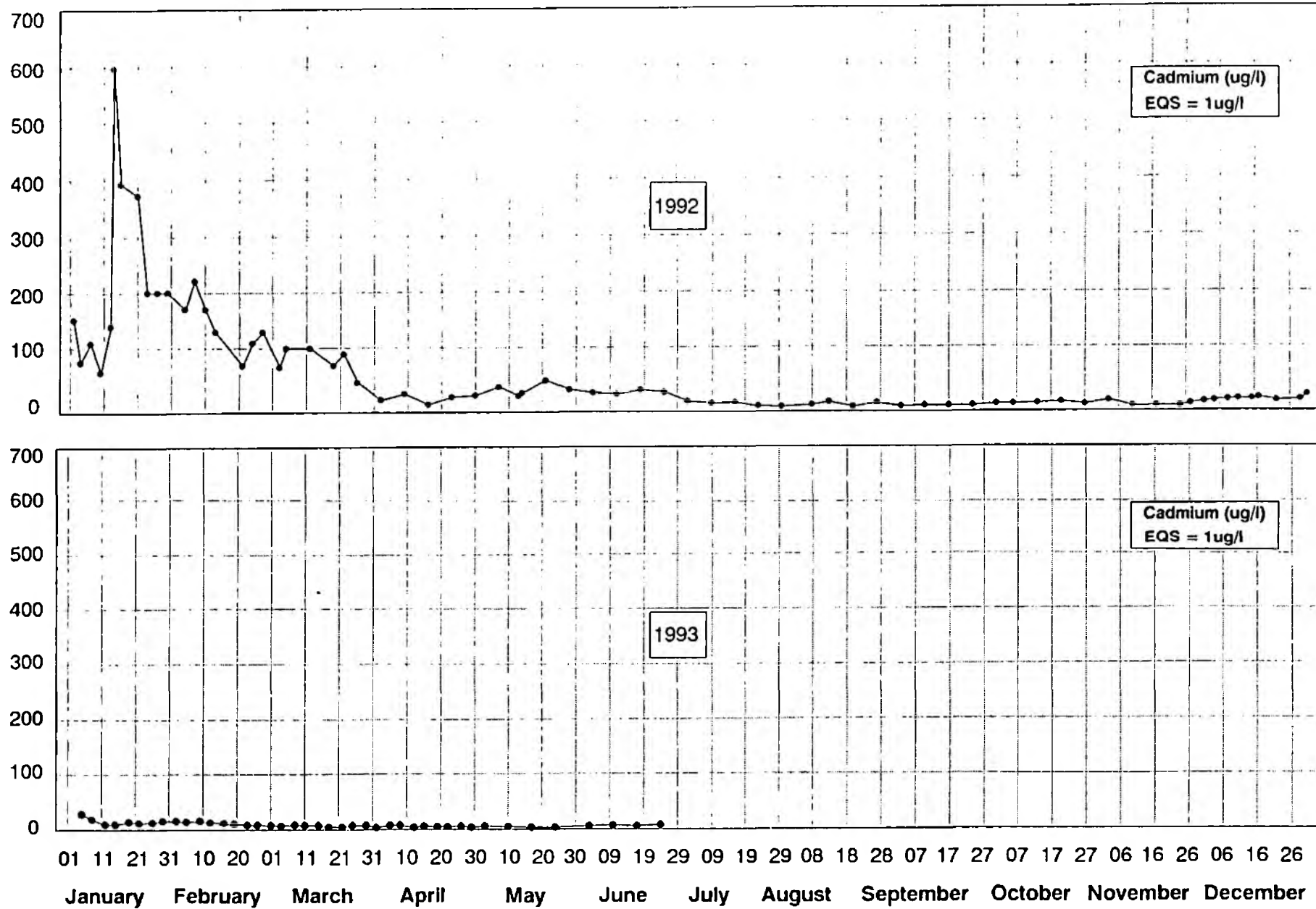
The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

Following above average rainfall in May and early June untreated water has recommenced flowing from the Nangiles Adit. The discharge is currently approximately 1.5 million gallons a day. However, because of high flows in the Carnon River the mine discharge is having little effect on overall water quality.

WATER QUALITY IN THE CARNON RIVER

02 July 1993

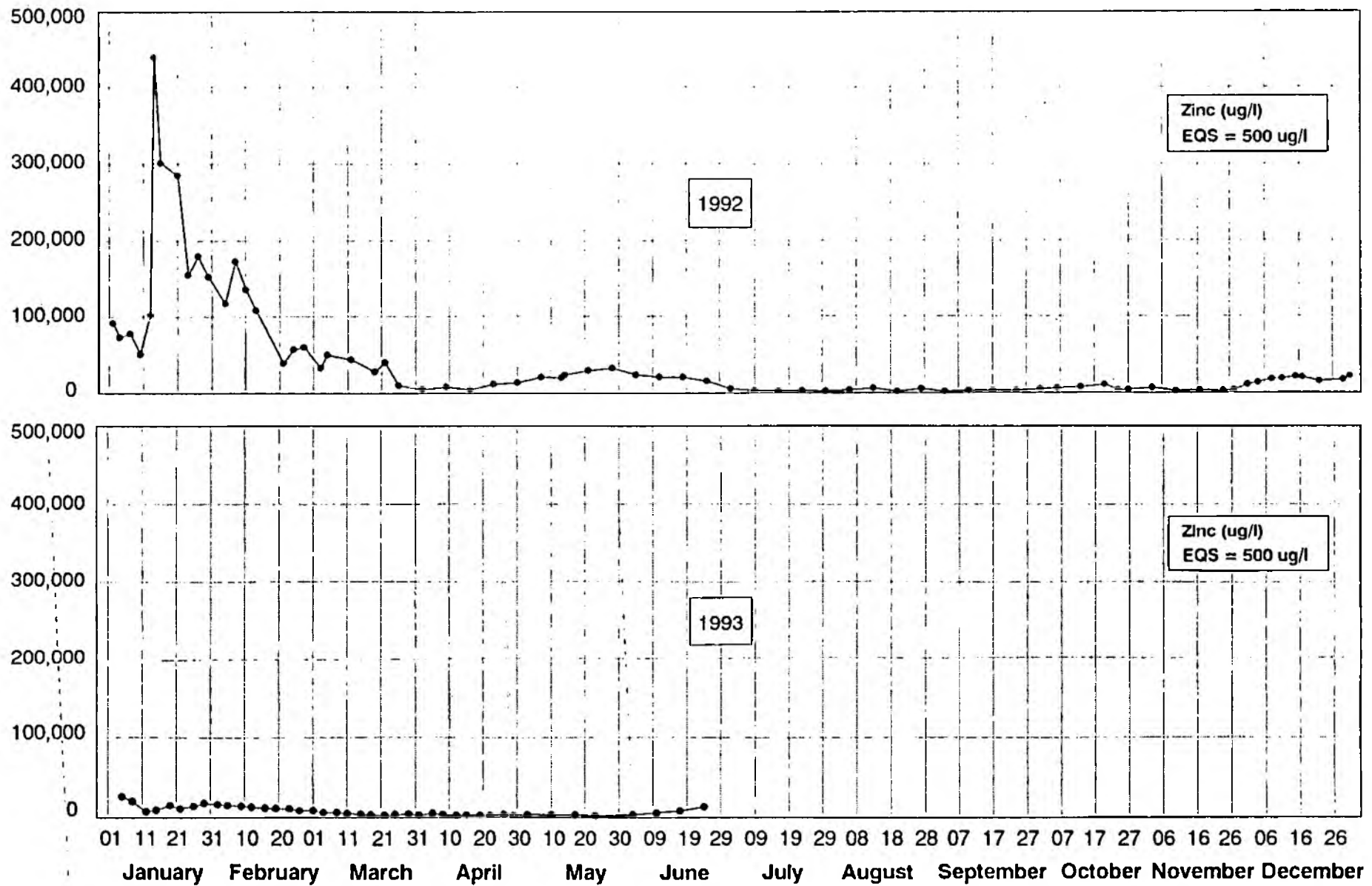
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



WATER QUALITY IN THE CARNON RIVER

02 July 1993

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority
South Western Region

DATE: 27 AUGUST 1993

WATER QUALITY NEWS

Water quality in the Carnon River has again remained consistent over the past month (see attached graphs) with concentrations of cadmium ranging between 6 and 7 microgrammes per litre ($\mu\text{g/l}$).

The most recent sample result available (taken on 17 August) produced a cadmium concentration at Devoran Bridge of 7 $\mu\text{g/l}$. Other readings were 6 $\mu\text{g/l}$ on 10 August and 6 $\mu\text{g/l}$ on 3 August.

The total flow of minewater from the disused Wheal Jane mine is currently being treated and there is no discharge of untreated minewater from the Nangiles adit.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is working to its full capacity of up to 3.3 million gallons a day.

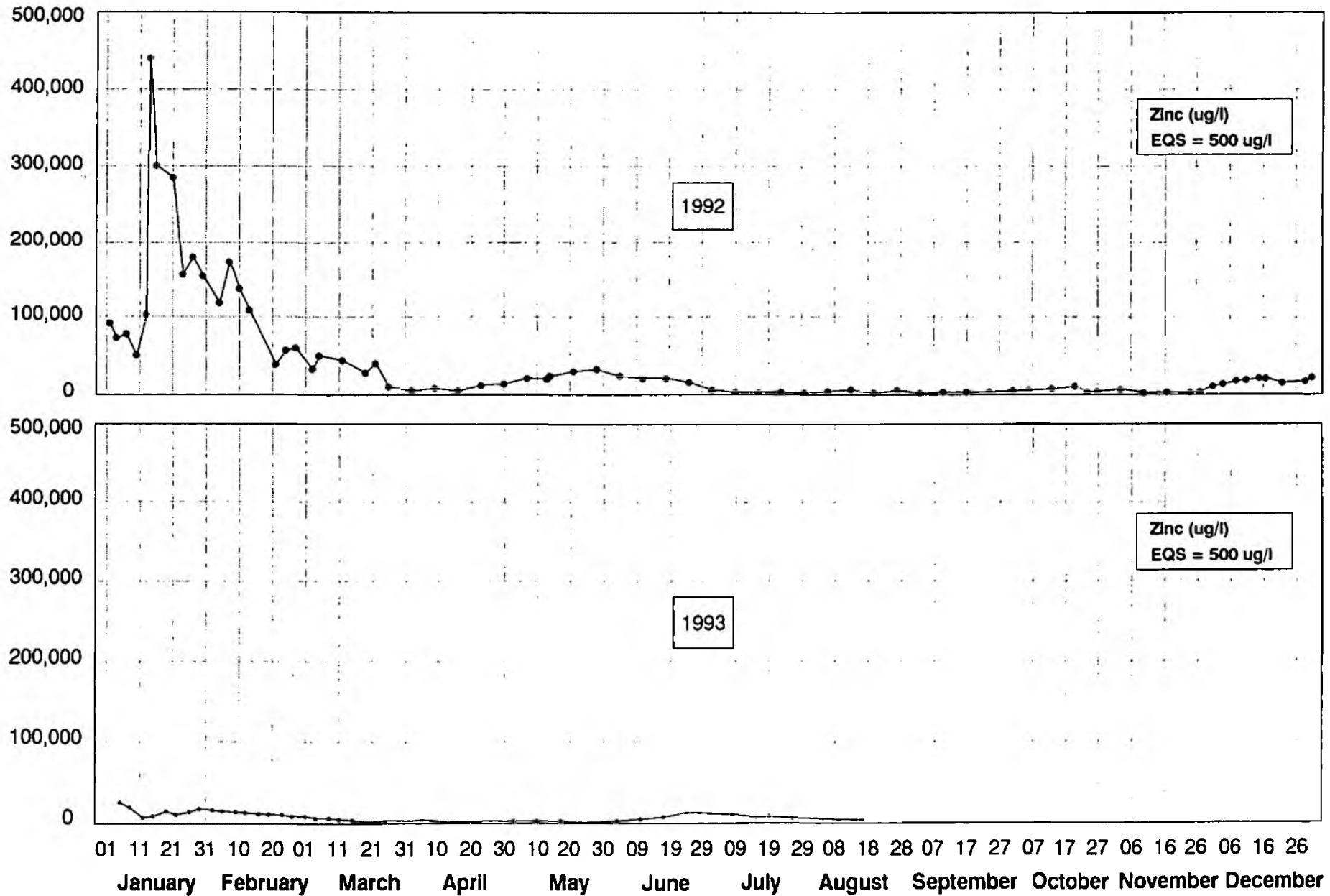
The new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

WATER QUALITY IN THE CARNON RIVER

27 August 1993

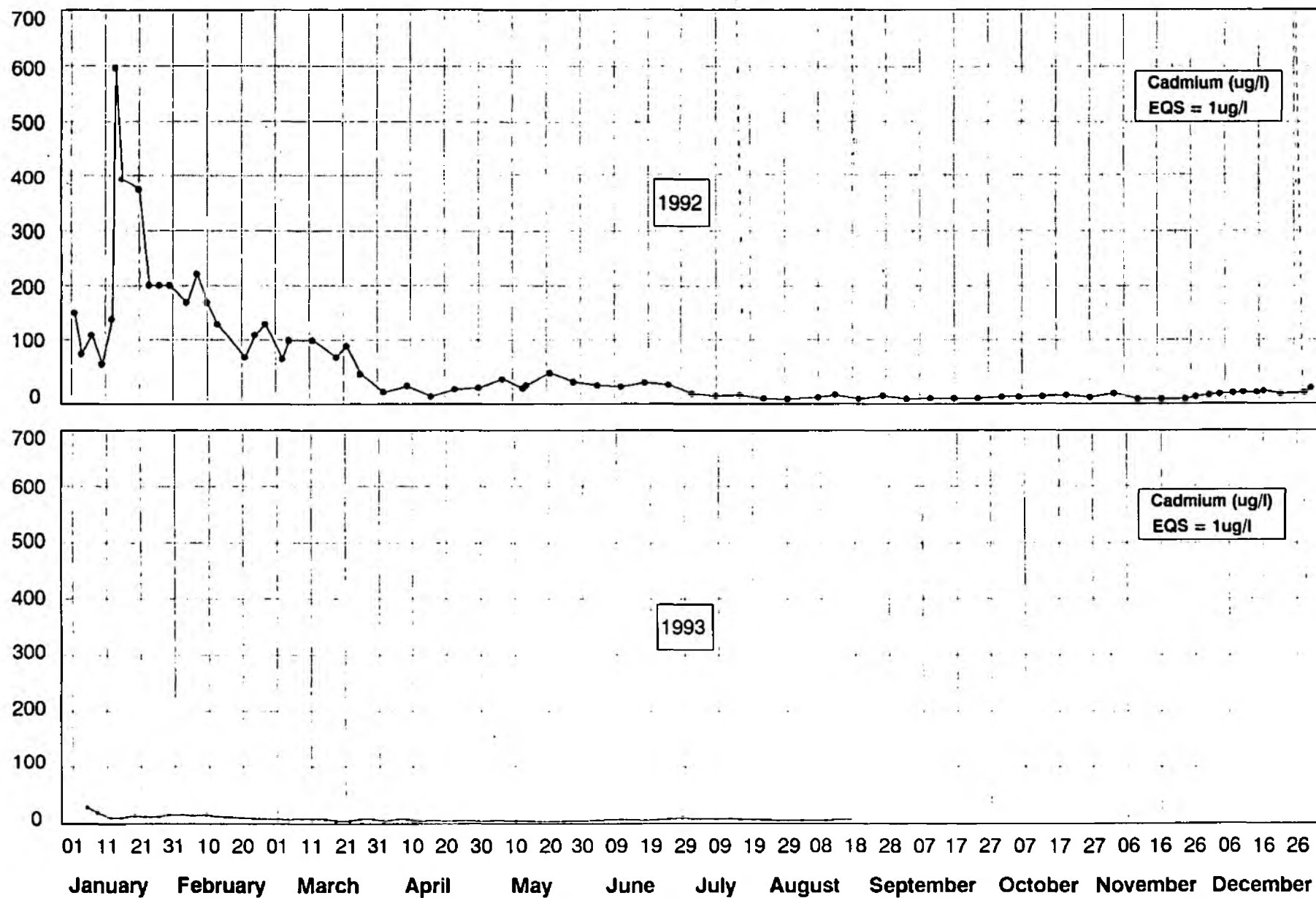
This sheet shows the latest results for zinc concentrations at Devoran Bridge.



27 August 1993

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for cadmium concentrations at Devoran Bridge



Carnon Valley Update



NRA

*National Rivers Authority
South Western Region*

DATE: 24 SEPTEMBER 1993

WATER QUALITY NEWS

Water quality in the Carnon River remains consistent, with concentrations of cadmium ranging between 6 and 12 microgrammes per litre ($\mu\text{g/l}$) over the last month.

The minor peak to 12 $\mu\text{g/l}$ was due to run-off following heavy rainfall on the 6 and 7 September.

The most recent sample result available (taken on 14 September) produced a cadmium concentration at Devoran Bridge of 3 $\mu\text{g/l}$. Other readings were 12 $\mu\text{g/l}$ on 7 September, 3 $\mu\text{g/l}$ on 31 August and 6 $\mu\text{g/l}$ on 24 August.

The total flow of minewater from the disused Wheal Jane mine is currently being treated and there is no discharge of untreated minewater from the Nangiles adit.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is working to its full capacity of up to 3.3 million gallons a day.

The new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

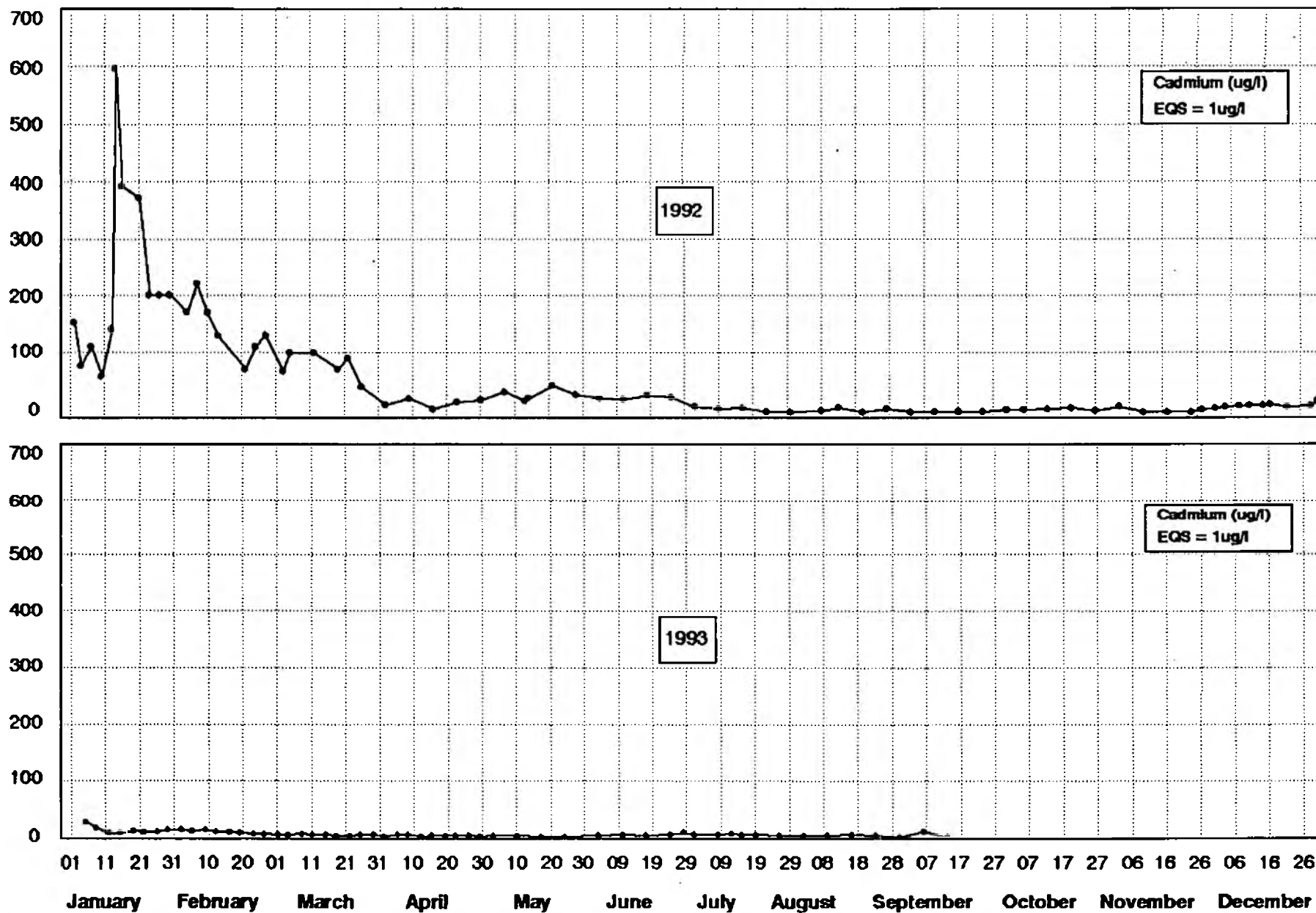
The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

For further information please contact Public Relations,
Manley House, Kestrel Way, Exeter, Devon, EX2 7LO.
Tel: Exeter (0392) 444000
Direct Line: Exeter (0392) 442008
Fax: (0392) 444238

24 September 1993

WATER QUALITY IN THE CARNON RIVER

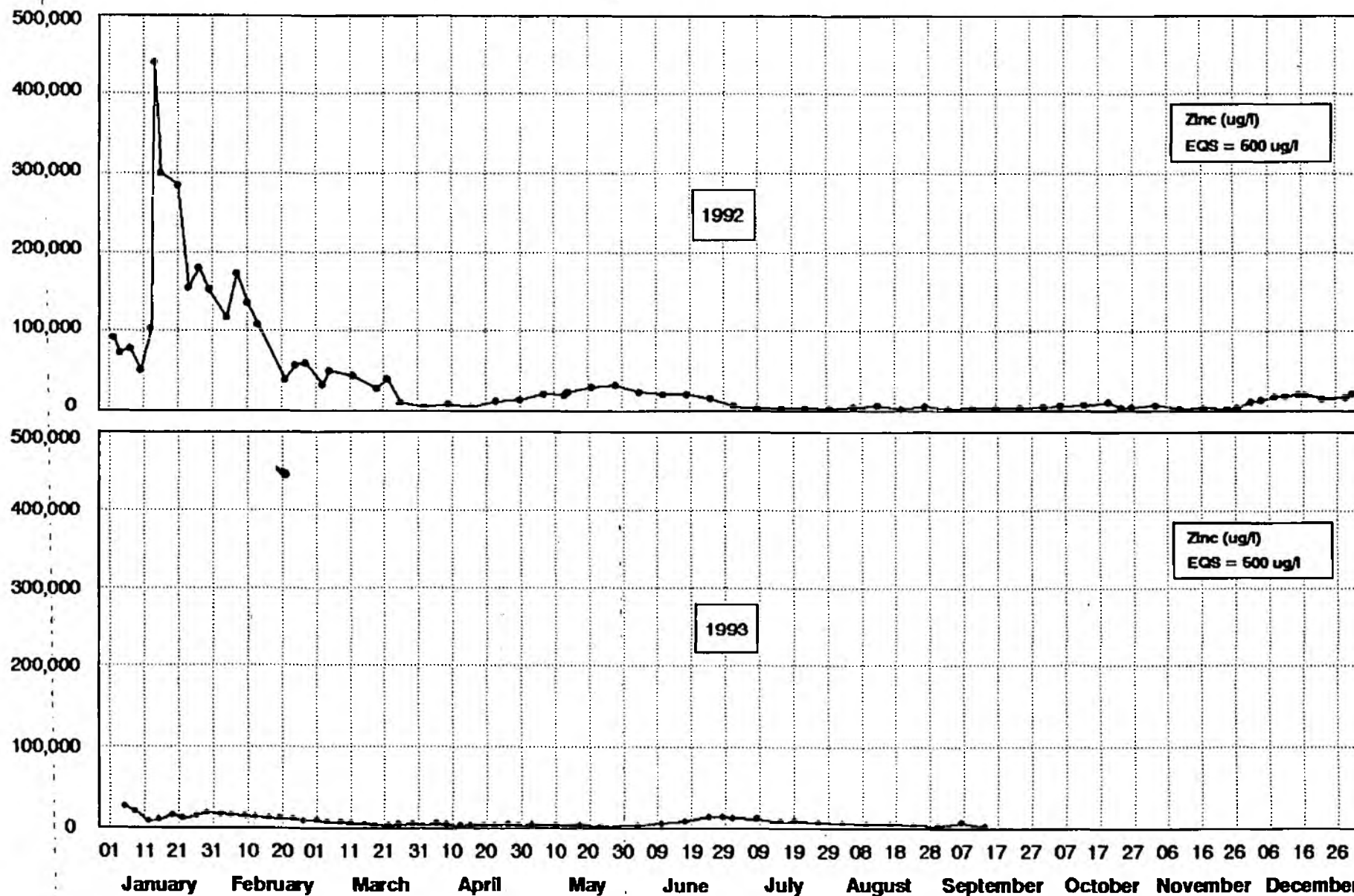
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



24 September 1993

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority

South Western Region

DATE: 22 OCTOBER 1993

WATER QUALITY NEWS

Water quality in the Carnon River remains consistent, with concentrations of cadmium ranging between 3 and 7 microgrammes per litre ($\mu\text{g/l}$) over the last month.

The most recent sample result available (taken on 15 October) produced a cadmium concentration at Devoran Bridge of 5 $\mu\text{g/l}$. Other readings were 4 mg/l on 12 October, 4 $\mu\text{g/l}$ on 5 October, 4 $\mu\text{g/l}$ on 28 September and 6 $\mu\text{g/l}$ on 21 September.

Following above average rainfall in September and early October untreated water recommenced flowing from the Nangiles Adit on October 12. The discharge is currently approximately 1.6 million gallons per day. However, because of high flows in the Carnon River the mine discharge is having little effect on overall water quality.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA, is working to its full capacity of up to 3.3 million gallons a day.

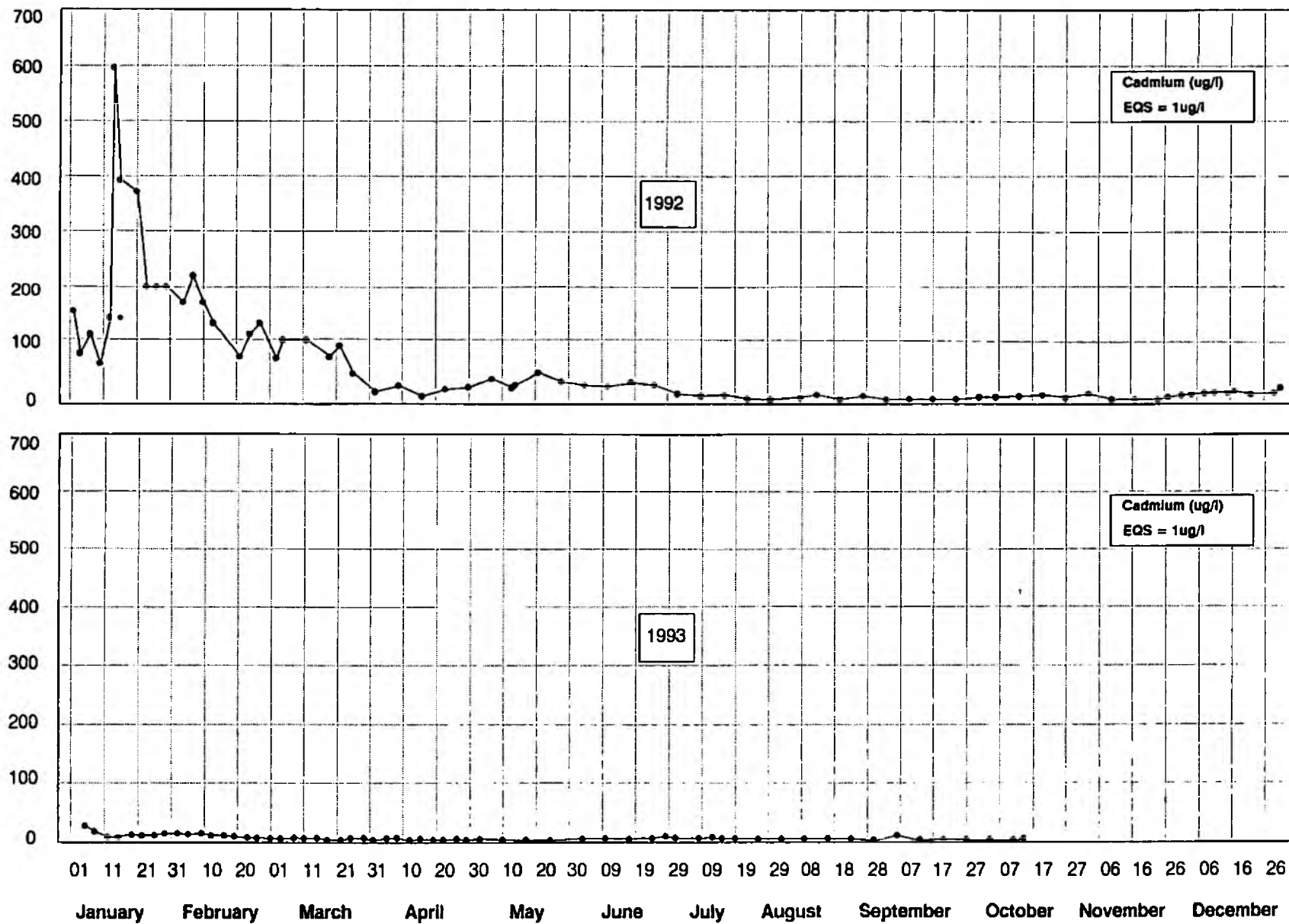
The new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The NRA stressed, once again, that the current treatment system remains vulnerable to adverse weather and pump failures.

22 October 1993

WATER QUALITY IN THE CARNON RIVER

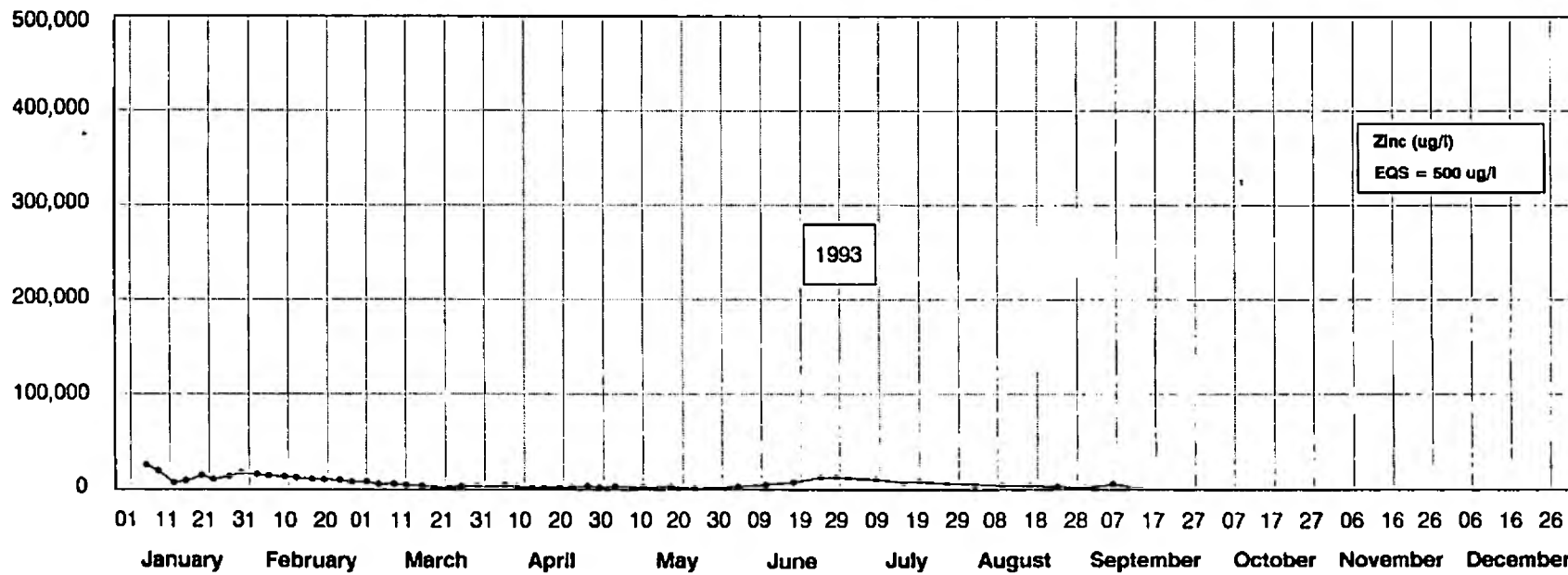
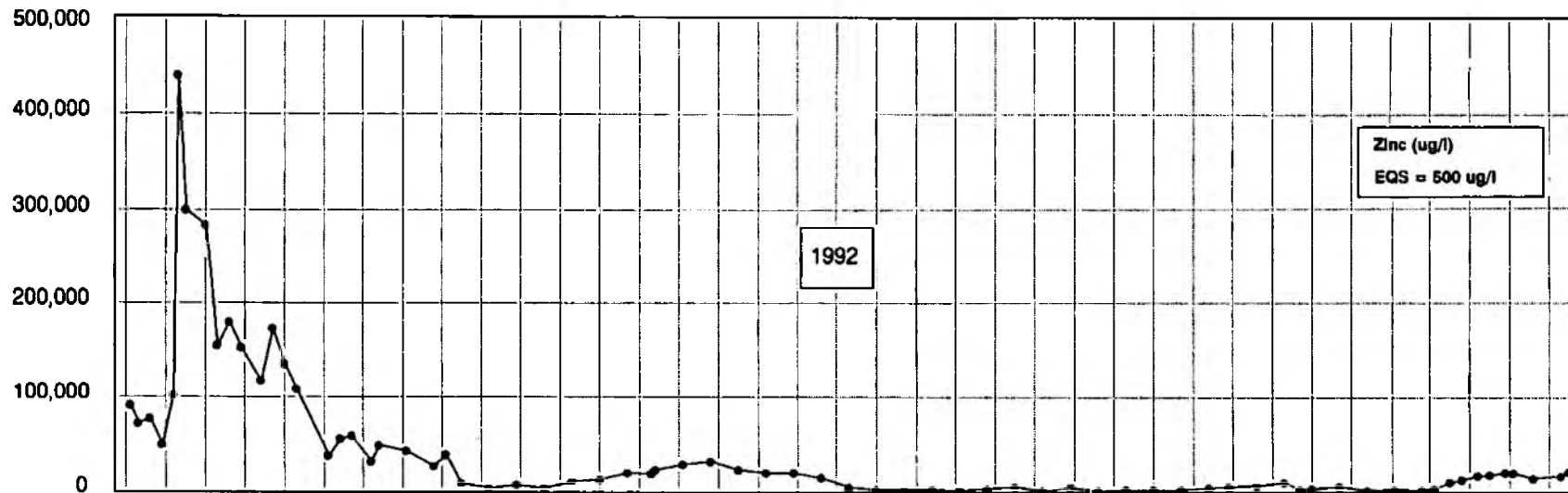
This sheet shows the latest results for cadmium concentrations at Devoran Bridge



22 October 1993

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



Carnon Valley Update



NRA

National Rivers Authority

South Western Region

DATE: 19 NOVEMBER 1993

WATER QUALITY NEWS

Water quality in the Carnon River remains consistent. The most recent sample results, taken on 19 and 26 October and 5, 11 and 13 of November (see attached graphs), all produced cadmium concentrations of 6 microgrammes per litre.

The new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA is continuing to work to its full capacity of up to 3.3 million gallons a day.

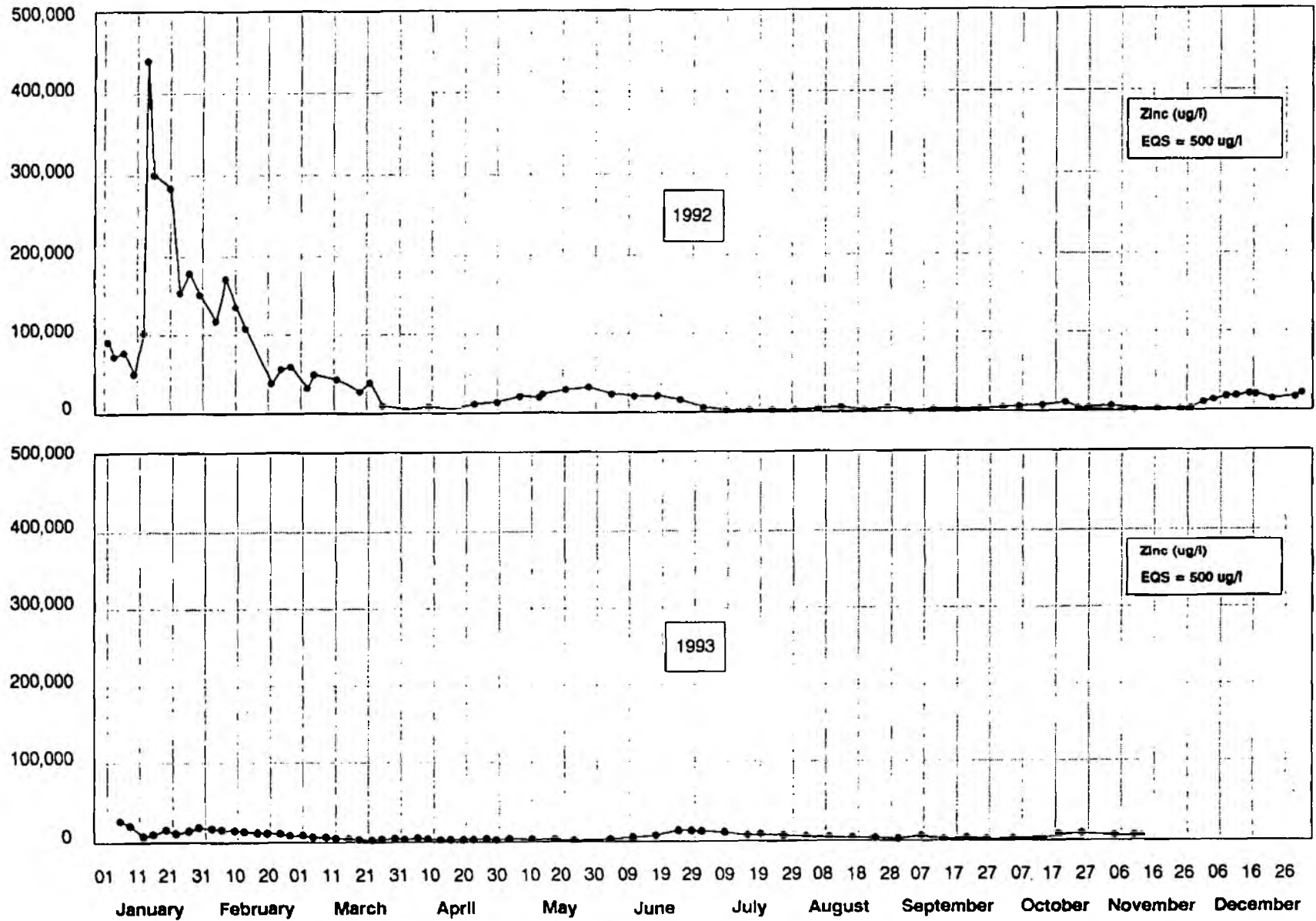
The recent drier weather has led to a reduction in the amount of untreated water flowing out of Nangiles Adit. The current discharge is under half a million gallons a day and falling.

The NRA stressed, once again, that the system remains vulnerable to adverse weather and pump failures.

WATER QUALITY IN THE CARNON RIVER

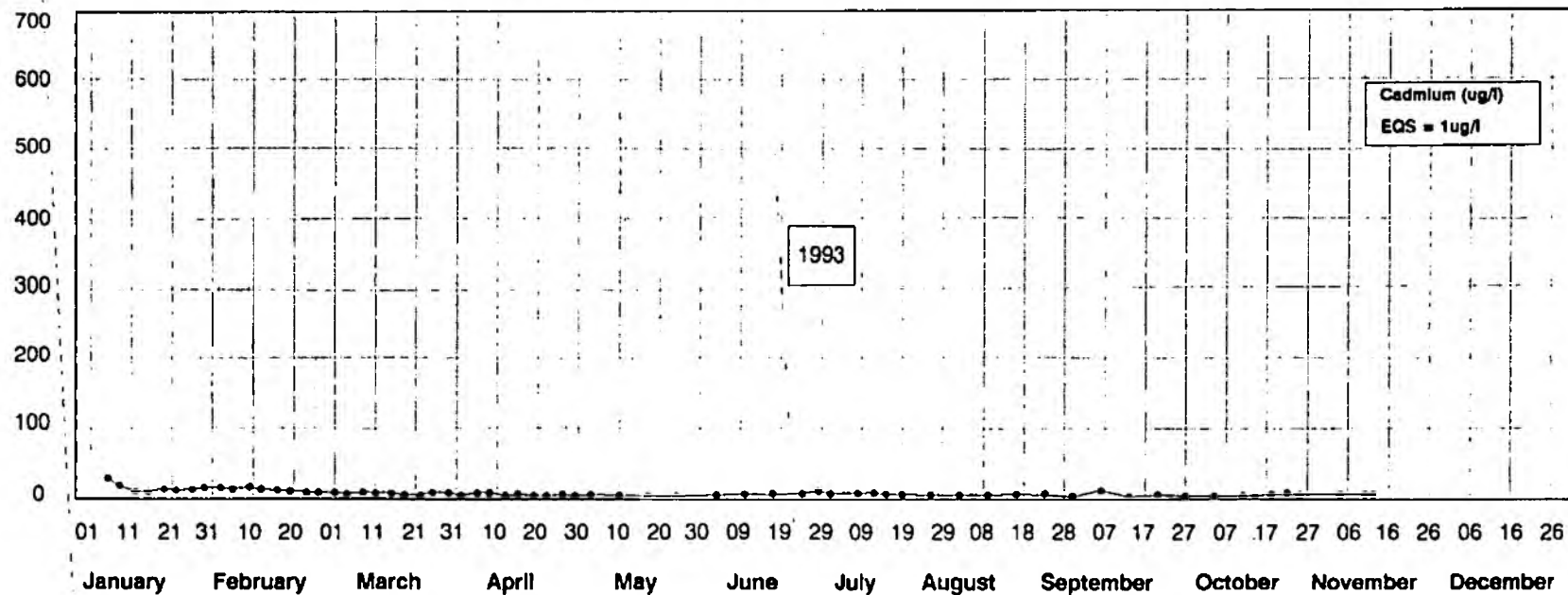
19 November 1993.

This sheet shows the latest results for zinc concentrations at Devoran Bridge.



WATER QUALITY IN THE CARNON RIVER

The graph displays the annual average cadmium concentration in the River Mersey from 1989 to 1992. The y-axis represents concentration in $\mu\text{g/l}$, ranging from 0 to 700. The x-axis represents time, with labels for 1989, 1990, 1991, and 1992. A box labeled '1992' is positioned above the data line in the latter half of the graph. A legend box in the top right corner specifies 'Cadmium ($\mu\text{g/l}$)' and 'EQS = $1\mu\text{g/l}$ '. The data shows a sharp peak in early 1989, followed by a rapid decline and subsequent fluctuations at lower levels, generally remaining below the EQS level after mid-1990.



Carnon Valley Update



NRA

National Rivers Authority
South Western Region

DATE: 17 DECEMBER 1993

WATER QUALITY NEWS

Water quality in the Carnon River remains consistent with concentrations of cadmium ranging between 4 and 6 microgrammes per litre ($\mu\text{g/l}$) during the last month.

The most recent sample result (taken on 10 December at Devoran Bridge) produced a cadmium concentration of 5 $\mu\text{g/l}$. Other readings were 4 $\mu\text{g/l}$ on 16 November, 6 $\mu\text{g/l}$ on 23 November, 4 $\mu\text{g/l}$ on 30 November and 5 $\mu\text{g/l}$ on 7 December.

The new cadmium figures compare with 600 $\mu\text{g/l}$ at the height of the discharge (14 January 1992). Although the Environmental Quality Standard (EQS) for cadmium is 1 $\mu\text{g/l}$ (as an annual average), background levels at Devoran prior to the current discharges regularly exceeded the standard, sometimes by more than 30 $\mu\text{g/l}$.

Following heavy rainfall during November and early December untreated minewater has recommenced flowing from the Nangiles Adit. The discharge is currently around 2 million gallons per day. This flow is not having a significant effect on the overall water quality due to high flows in the Carnon River.

The pumping and treatment operation carried out by Carnon Consolidated Ltd, and funded by the NRA is continuing to work to its full capacity of up to 3.3 million gallons a day.

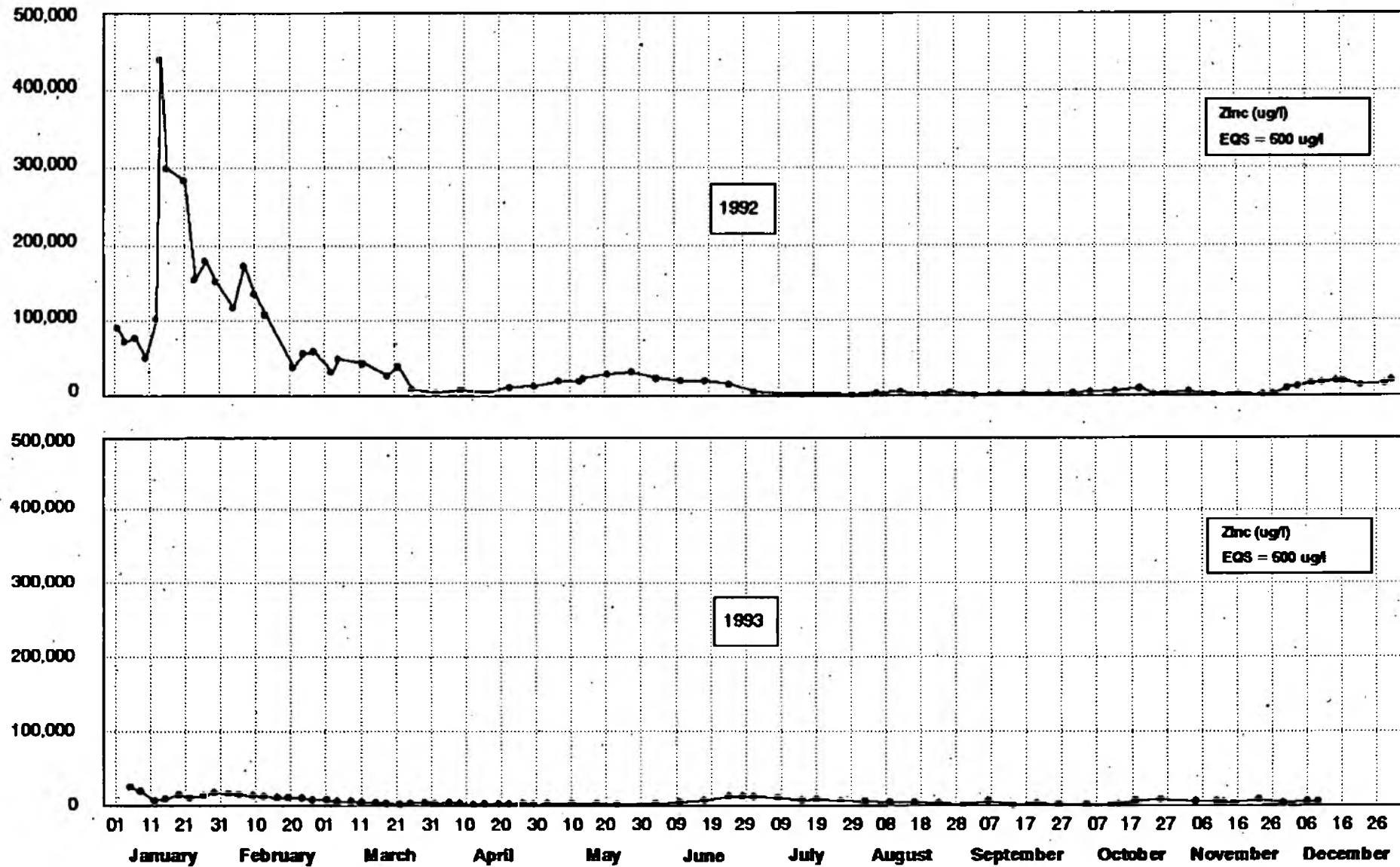
The NRA stressed, once again, that the system remains vulnerable to adverse weather and pump failures.

For further information please contact Public Relations,
Manley House, Kestrel Way, Exeter, Devon, EX2 7LQ.
Tel: Exeter (0392) 444000
Direct Line: Exeter (0392) 442008
Fax: (0392) 444238

WATER QUALITY IN THE CARNON RIVER

17 December 1993.

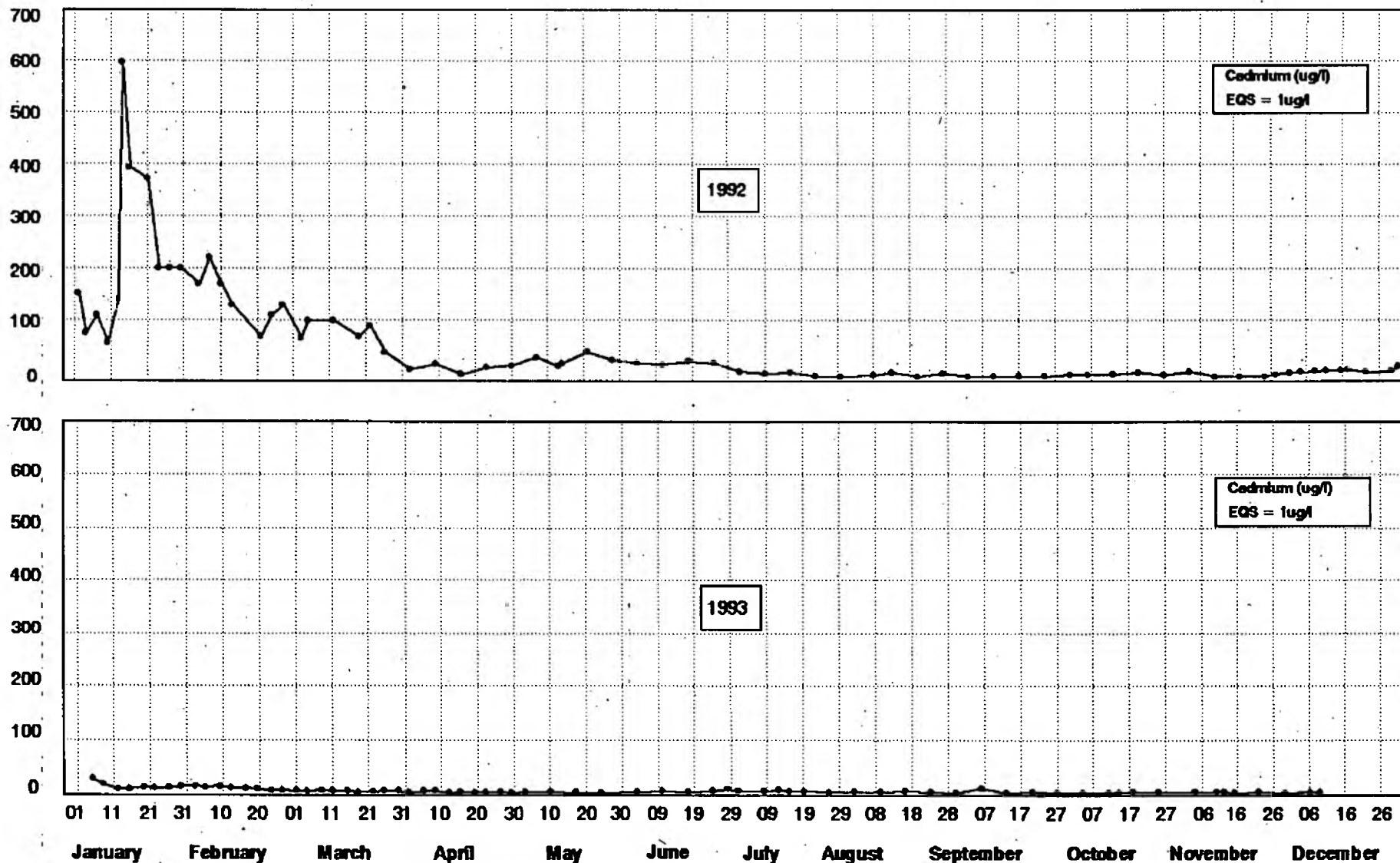
This sheet shows the latest results for zinc concentrations at Devoran Bridge.



17 December 1993.

WATER QUALITY IN THE CARNON RIVER

This sheet shows the latest results for cadmium concentrations at Devoran Bridge



Rivers Information



NRA

National Rivers Authority
South Western Region

VIDEOS

The National Rivers Authority (NRA) is a major environmental protection agency responsible for safeguarding and improving the natural water environment.

The South Western Region of the NRA is responsible for protecting the magnificent rivers, estuaries and coastal waters in an area covering 20,802 square kilometres including Avon, Cornwall, Devon, Dorset, Somerset and parts of Gloucestershire, Hampshire and Wiltshire.

The main tasks of the NRA are flood defence, water quality regulation, pollution control, water resource planning and control, environmental monitoring, fisheries, recreation and conservation.

To help you gain an insight into the work of the NRA there are the following videos available for hire.

GUARDIANS OF THE WATER ENVIRONMENT: A comprehensive guide to the NRA.
Format: VHS. Running Time: 10 minutes approx.

FARM POLLUTION - TOGETHER WE CAN BEAT IT: Explains the NRA's campaign against farm pollution.
Format: VHS. Running Time: 9 minutes approx.

WHEAL JANE - 'A CLEAR WAY FORWARD': The future plans for the Cornish tin mine.
Format: VHS. Running time 11 minutes approx.

GROUNDWATER - OUT OF SIGHT BUT NOT OUT OF MIND: An explanation of the problems concerning groundwater contamination.
Format: VHS. Running Time: 10 minutes approx.

FLOOD DEFENCE VIDEO: An explanation of the NRA's role in protecting people and property from flooding.
Format: VHS. Running Time: 20 minutes approx.

These videos can be hired free of charge from Support Services, National Rivers Authority, South Western Region, Manley House, Kestrel Way, Exeter EX2 7LQ. Tel: Exeter (0392) 444000.

Dec 93