

TORBAY COUNCIL

Report No: **1/2006**

Title: **Brixham Harbour Impressed Current Cathodic Protection (ICCP) System**

To: Harbour Committee on 16th January 2006

1. Purpose

- 1.1 To report the conclusions of a review of the Impressed Current Cathodic Protection (ICCP) System installed at Brixham Harbour and to set out recommendations.

2. Relationship to Corporate Priorities

- 2.1 The ongoing protection of the port infrastructure at Brixham is critical to the future of the fishing industry. It therefore impacts on the priority of 'Improving Torbay's Economy', by supporting a sustainable fishing industry.

3. Recommendation(s)

That the Council be recommended to:-

- 3.1 That, having noted the various problems identified with the existing ICCP system and having considered the recommendations contained in the independent survey undertaken by Corrosion Control Services Ltd and, having compared the alternative costs of a replacement system, that a new sacrificial anode system be installed at Brixham harbour to be funded from the Brixham Harbour Reserve Fund.
- 3.2 To vary the Capital Plan for 2006/2007 accordingly, and that the Director of Finance be asked to approve the use of the Brixham Harbour Reserve to fund these works

4. Reason for Recommendation(s)

- 4.1 Brixham harbour's impressed current cathodic protection system is not fully functional and a decision is therefore needed as to the best way forward to ensure that the harbour's steel structures are adequately protected against the effects of accelerated low water corrosion.

5. Key Risks associated with the Recommendation(s)

- 5.1 The key risks associated with the recommendations and therefore proceeding with the capital works, relate to finance and harbour operations.
- 5.2 Financially the cost of the various works will inevitably lead to a reduced Brixham harbour reserve fund. The reserve fund balance at the end March 2005 was £924,000 and the outline costs associated with the capital works detailed within this report will clearly impact upon this balance. A Reserve Account contingency of £144,000 (based on 20% of turnover) together with a cash figure of £250,000 is required to provide financial cover to fund repairs and trading deficits without the need to call on the Council's General Fund. The target range of this reserve account based on the understanding of needs and risks is £394,000 to £1,000,000. Likelihood = 4. Impact = 3.
- 5.3 Undertaking any repair work or modification to the ICCP system will clearly have some impact on the operational efficiency of the harbour. However, this impact can be mitigated with careful planning and contract management. Likelihood = 2. Impact = 2.

- 5.4 There is therefore an intermediate risk associated with proceeding with this work, as can be seen in the table below. (4 x 3 = 12)

Likelihood	6	6	12	18	24
	5	5	10	15	20
	4	4	8	x12	16
	3	3	6	9	12
	2	2	4	6	8
	1	1	2	3	4
		1	2	3	4
		Impact			

	Low risk		Intermediate risk		High risk
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The "x" in the above matrix denotes where the author has assessed the level of final risk to fall.

- 5.5 There are also key risks associated with not proceeding with the recommendations in this report. These risks relate to health & safety, infrastructure serviceability and the general port business. In summary they have been assessed as having a likelihood score of 5 and an impact score of 3.

- 5.6 There is therefore a high risk associated with not proceeding with this work, as can be seen in the table below. (5 x 3 = 15)

Likelihood	6	6	12	18	24
	5	5	10	x15	20
	4	4	8	12	16
	3	3	6	9	12
	2	2	4	6	8
	1	1	2	3	4
		1	2	3	4
		Impact			

	Low risk		Intermediate risk		High risk
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The "x" in the above matrix denotes where the author has assessed the level of final risk to fall.

6. Alternative Options (if any)

- 6.1 Modification and repair of the existing ICCP system, under warranty, by the original contractor is not possible due to a contractual dispute.
- 6.2 Modification and repair of the existing ICCP system by a new contractor can be seen to be more expensive than the installation of sacrificial anodes. The cost difference expected to an additional £91,000 over a 20-year life or £45,000 over a 10-year life.
- 6.3 The do nothing option would result in further degradation of the system and a growing reduction in the level of cathodic protection provided to the steelwork in the harbour. This would result in further corrosion of the steel structures leading to loss of fill, subsidence and ultimately to complete structural failure and collapse of the quay wall or slab.

7. **Background**

- 7.1 Brixham harbour has an ICCP system that was designed and installed by Corrintec Limited in 2001. The ICCP system was installed following the identification of problems associated with accelerated low water corrosion. This corrosion had caused holes to appear in structural steelwork at various locations around the fishing vessel basin. The ICCP system was installed in 2001 following a schedule of repairs to the affected steelwork. Both the steel repair work and ICCP system received 50% funding from Defra. At the time, the decision to proceed with an ICCP system received considerable scrutiny from the Harbours Sub-Committee and Strategic Services Committee.
- 7.2 In April 2005 Corrosion Control Services Ltd were appointed to investigate and review the existing ICCP system located within the fishing vessel basin at Brixham harbour.

The fishing vessel basin lies within the main harbour in Brixham, being built around thirty years ago and it includes the following areas to be protected by the ICCP system.

Area	Construction
East Quay & east end of South Quay	Sheet steel piled, using Larssen section piles
West end of South Quay	Older section on concrete piles, with extension on Larssen box piles
Fish Market	Older Section on concrete piles with extension on Larssen box piles
Ice Plant	Circular web piling using Larssen section piles
Wave Screen	Outer north side of fish quay, using Frodingham piles

All piles which make up the quay structure were originally installed without a protective coating or indeed any form of corrosion protection system. Repairs to the piles of the quay structure were carried out in 2000 after it was discovered that steel pile thicknesses around the basin had been severely reduced due to a phenomenon known as accelerated low water corrosion (ALWC). The ICCP System was installed shortly afterwards with the intention of preventing any further ALWC.

Corrintec Ltd installed the ICCP system in 2001 based on a design & build contract. The system consists of three (250A/20v) transformer rectifiers (TR) which provide power to a total of 20 anodes. Each anode is rated at 50A and consists of flat lead/silver elements on dielectric shields, which are then welded to the pile structure in the area known as the splash zone. 14 of the anodes are mounted on the in-pans of the sheet steel piling and the remainder on box piles. Connection to the structure is made at ten locations. The system is designed for automatic control using 6 zinc reference electrodes (2 per TR). Soon after the system was installed it became apparent through discussions with Corrintec and through an independent survey conducted by Griffin Technology that the system was not functioning correctly.

Corrintec Ltd were insistent that in order for more investigative work to be undertaken to ascertain why the system was not functioning correctly a further fee would be payable. A series of further unproductive discussions and meetings then took place with Corrintec Ltd resulting in a contractual dispute and eventually the contract was terminated. Consideration was given to taking legal action against Corrintec Ltd but after discussions with the Director of Environmental Services and after taking internal legal advice it was decided not to adopt this course of action. This decision was reached because of the expectation of high external legal costs, considered against the likelihood of success and the likely ability of Corrintec to meet the costs of any successful claim.

7.3 Griffin Technology survey 2001

Soon after installation of the ICCP system by Corrintec a survey was carried out to confirm the quality of the installation and to record initial protection potentials. Most components had been installed satisfactorily with some concerns in respect of detached junction boxes under the fish quay and the possible effect of settlement of the quay, which might adversely affect the integrity of the cables. The survey found sheet steel piling on the East Quay, ice plant and wave screen was largely under-protected with only areas close to the installed anodes reaching adequate protection. This was despite all the TRs operating at close to their maximum output. Some areas were at the expected free-corrosion potential of steel in aerated seawater, indicating that they were receiving no protection current. Better protection was being conferred to the cylindrical and box piles of the fish quay, but only reaching full protection close to the installed anodes.

7.4 Millennium Marine Contractors 2002 Survey

Potentials measured during this survey confirmed that protection was only being achieved close to the installed anodes. Large areas of the sheet steel piling were still prone to corrosion, and the situation on the box piles had worsened.

The TRs were all operating at currents close to their the maximum, and the survey report noted signs of overheating, notably melting of the plastic bezels around the meters.

7.5 Corrosion Control Services Ltd Survey April 2005

The most recent survey carried out by Corrosion Control Services Ltd states that the ICCP system appears to be under designed in respect of the installed capacity.

The survey's conclusions are summarised as follows: -

1. Corrintec Ltd had under-designed the ICCP system.
2. The TR enclosures were inadequately sized and ventilated leading to damage by overheating.
3. The distribution of anodes was poor.
4. Some of the lead/silver anodes have failed for unknown reasons. Alternative anodes made from titanium may have been a better choice.
5. The material chosen for the dielectric shields was insufficiently resistant to the aggressive saltwater conditions around the anodes. The shields may also have been too small.
6. The failure to ensure electrical continuity has been a major contributor to poor current distribution.
7. Anodes are not ideally distributed and continuity may not have been provided.
8. Since key components of the present system must be regarded as suspect as well as inadequate in number and location, there seems little prospect of a satisfactory upgrade. A complete new system design is required.
9. Given the busy nature of the port, and the resultant possibility of stray current corrosion, the use of a sacrificial system should not be ruled out.
10. If ICCP is chosen again it would be prudent to offer advice on bonding to the operators of all steel hulled vessels using the basin.

8 Costs of ICCP capital works

Refer to Annex 1 an exempt item by virtue of paragraphs 7 & 9 of Part 1 of Schedule 12a of the Local Government Act 1972.

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IMPLICATIONS, CONSULTATION AND OTHER INFORMATION

Part 1

These sections may have been completed by the Report author but must have been agreed by the named officers in the Legal, Finance, Human Resources, Estates and Property and Procurement.

Does the proposal have implications for the following issues? If "Yes" - give details. <i>delete as appropriate</i>		Name of responsible officer
Legal	No	Bill Norman
Financial – Revenue	No	Pete Trueman
Financial – Capital Plan	Yes. Subject to approval the scheme will be funded from the Brixham Harbour Reserve, in competition with other projects at the Harbour.	Steve Warren
Human resources	No	Sue Wiltshire
Property	No	Sam Partridge
Procurement and Efficiency	No	Robert Valentine

Part 2

The author of the report must complete these sections.

Could this proposal realistically be achieved in a manner that would more effectively: <i>delete as appropriate</i>		
(i)	promote environmental sustainability?	No
(ii)	reduce crime and disorder?	No
(iii)	promote good community relations?	No
(iv)	promote equality of opportunity on grounds of race, gender, disability, age, sexual orientation, religion or belief?	No
(v)	reduce (or eliminate) unlawful discrimination (including indirect discrimination)?	No

If the answer to any of the above questions is "Yes" the author must have addressed the relevant issue/s in the main report and have included a full justification and, where appropriate, an impact assessment.

Part 3

The author of the report must complete this section.

	<i>delete as appropriate</i>	If "Yes", give details
Does the proposal have implications for any other Business Units?	No	

Part 4

Is this proposal in accordance with (i.e. not contrary to) the Council's budget or its Policy Framework?		<i>delete as appropriate</i>
		No
1.	If "No" - give details of the nature and extent of consultation with stakeholders and the relevant overview and scrutiny body. The repairs proposed in this report require a variation to the Council's approved Capital Plan. These works have been the subject of considerable discussion and consultation with the Brixham Harbour Liaison Forum.	
2.	If "Yes" - details and outcome of consultation, if appropriate.	

Part 5

Is the proposal a Key Decision?	<i>delete as appropriate</i>	If "Yes" - give Reference Number
	No	

Part 6

Wards

Berry Head with Furzeham Ward

Appendices

Appendix 1 Costs of ICCP capital works (exempt)

Documents available in Members' Room

Background Papers:

The following documents/files were used to compile this report:

- Corrintec Tender Document – 'Cathodic Protection, Work Proposals & Drawings' (undated)
- Griffin Technology Report – 'Inspection of Impressed Current Cathodic Protection System', 30th June 2001.
- Millennium Marine Report – 'Effectiveness of Cathodic Protection System as installed in Brixham MFV Basin', 21st January 2003.
- Corrosion Control Services Ltd - Cathodic Protection System Review Report (April 2005).