

PROPOSED RIVER USK BARRAGE

POSITION STATEMENT OF NATIONAL RIVERS AUTHORITY

4 AUGUST 1993



ASiantaeth yr Amgylchedd Cymru
ENVIRONMENT AGENCY WALES

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1. INTRODUCTION

Newport Borough Council and Gwent County Council propose to construct a barrage across the river Usk Estuary at Newport thereby creating a large body of impounded water with a minimum retained water level of 3.5m ODN.

The existing estuary is a highly dynamic system throughout its entire length, from the tidal limit near Newbridge-on-Usk to the confluence with the Severn Estuary at Newport. Because of the high tidal range and the fast tidal currents the Usk Estuary is a well mixed, non-stratified body of water displaying a gradual change in salinity from the saline water of the Severn to the fresh water of the Usk river. Following construction of the barrage, the impounded waters would be transformed into a lake which will be affected by freshwater river flow and the controlled intrusion of saline water.

Throughout the promotion of two earlier private Parliamentary Bills, both of which were withdrawn, and the subsequent application for an Order under the Transport and Works Act 1992, the NRA has examined the environmental assessment reports produced by the applicants. The NRA has also maintained a dialogue with their consultants aimed at minimising the impact of the proposed development on the aquatic environment, the protection of which is the NRAs statutory responsibility.

Following the Parliamentary withdrawal of a second River Usk Barrage Bill on 24 September 1992, at meetings of Newport Borough Council and Gwent County Council on 27 and 28 April 1993 respectively, it was resolved that the Councils, as joint applicants, would use the Transport and Works Act 1992 procedure to promote a barrage across the River Usk.

This position statement outlines the matters of concern to the National Rivers Authority on the subjects of Flood Defence, Fisheries, Conservation and Water Quality.

2. FLOOD DEFENCE

The NRA has a statutory duty to ensure that the proposed barrage will neither exacerbate the incidence of flooding in the river upstream, nor result in any reduction in the existing level of flood defence provided.

2.1 Standards

To ensure that flooding risk is minimised the NRA has stipulated barrage design criteria. The criteria are based upon a combination of tide and hydrological events which comprise firstly, a mean annual high tide coinciding with a 1 in 100 year peak river flood and secondly, a 1 in 100 year peak high tide coinciding with a mean annual river flood.

During high tides, when moderate river flows are unable to discharge through the barrage, storage upstream would contain the river flows until the tide falls and discharge through the barrage could take place. At higher river flows discharge over the barrage would occur when the available storage has been used and through the barrage when tide levels allow.

The Barrage must also allow for limited tidal intrusion to occur for flushing to remove downstream sedimentation, and for water quality purposes. Precise details of the management of these operations require clarification and the Authority is at present seeking further details regarding the Barrage management and operation control systems.

The Authority is generally satisfied that the barrage can meet its Flood Defence requirements during extreme events whilst operating in a tidal exclusion mode. However, it requires further clarification on various aspects of the operating procedures with respect to the management of limited tidal intrusion and sedimentation flushing to ensure that these operations are compatible with flood control.

Details are also being sought on the operation and control systems for the outfalls from Liswerry Pill and Great Spyttly Reen, together with details of the design of the culverting of these watercourses.

2.2 Sediments

The accumulation of river sediments in the impoundment would reduce the hydraulic capacity of the river and its tributaries, exacerbating the incidence of flooding. The applicants have undertaken a study which has enabled predictions to be made on the rate of accumulation in the impoundment.

The NRA's requirement for the applicants to carry out a long term monitoring programme into the sediment/gravel build up and to remove this material in an acceptable manner, at their expense, has been incorporated into the proposed Order.

2.3 NRA View on Flood Defence Issues

Subject to additional clarification on aspects of the operating procedures the Authority is satisfied that the proposed barrage can meet its flood defence requirements.

3. FISHERIES

The NRA has a statutory responsibility to maintain, improve, and develop salmon, trout, coarse and eel fisheries, and also has a sea fisheries responsibility in the Severn and Usk estuaries off Newport.

The stocks of salmon, and to a lesser extent sea trout, in the Usk support a valuable rod fishery and also contribute to commercial fisheries in the Severn Estuary. Despite a decline in anglers' catches in recent years the Usk remains one of the five most prolific salmon angling rivers in the Welsh Region. In addition Usk salmon stocks are heavily exploited in the Severn Estuary, contributing approximately 33% of the catch of local commercial fisheries and about 5% of the total commercial catch of English and Welsh salmon in home waters. There is also a small commercial fishery for eels, both as elvers and adults, associated with the river. In addition, the estuary is inhabited by a variety of estuarine and coastal marine species, some of which are exploited.

3.1 Passage of migratory fish.

The barrage would constitute a major obstruction both to the upstream and downstream passage of migratory fish, including salmon, sea trout, shad and eels. Migrating fish would have to pass through the altered tidal zone downstream, negotiate the barrage itself and pass through an 18 kilometre stretch of impounded water upstream.

The success of fish passage would be determined in part by the water quality achieved both up and downstream of the barrage. In addition alterations in the flow regime may affect migration rates. There may therefore be adverse consequences for both fish survival and the availability to the rod fishery.

3.1.1 Salmon and sea trout

Adult salmon and sea trout migrate from the sea into the river to spawn, and the juveniles (smolts) and spawned adults (kelts) migrate from the river to the sea for their marine feeding phase.

3.1.1.1 Upstream migration

In order that fish can pass upstream across the barrage the NRA has stipulated that fish passage facilities approved by the Secretary of State must be incorporated in the structure. Such approval would be conditional only until such time as evidence of passage success is collected, whereupon approval could become final. In both cases, approval should not be interpreted as a measure of success or efficiency of the pass. The applicants have, after consultation with the NRA, produced a design of fish lock based upon the best available knowledge. Nevertheless there are very few precedents for pass design in such situations, and the proposed design is unproven. There remain concerns that salmonids and other species will be significantly hindered.

The NRA is not satisfied that the proposed fish passage facilities would provide unhindered access for migratory salmonids, shad and eels to the river.

Even if the upstream passage of fish past the barrage were completely unhindered, the applicants have indicated that salmon would be delayed in the impoundment upstream. The

NRA considers that the rod fisheries throughout the river would be detrimentally affected because fewer fish would move into the fishing reaches during the rod fishing season.

The NRA cannot accept the delay in the upstream migration of salmon and sea trout which is expected to result from the barrage and the impoundment.

3.1.1.2 Downstream migration

The NRA expects that a stock of large trout and pike would develop in the impoundment which would prey upon smolts migrating downstream. At the barrage, downstream migrating fish would have to pass via the fish lock, sluices or navigation lock. The NRA has stipulated that, as for upstream migrants, fish passage facilities would be required and would have to be approved by the Secretary of State. The applicants have altered the design of one sluice to alleviate the NRA's concerns over the effects on juveniles of the height of the fall over the barrage. Nevertheless the NRA is not convinced that fish survival would not be jeopardised by downstream passage past the barrage.

The NRA remains concerned that increased mortality of salmon and sea trout migrating downstream would result from the presence of the barrage.

3.1.2 Eels

The applicants have indicated that the barrage would reduce by about 30% the number of elvers entering the Usk due to the reduced tidal flow on the flood tide. They contend, without any supporting evidence, that even reduced elver runs would fully populate the Usk with eels but the NRA remains to be convinced that stocks within the river would not be significantly affected. However, the Authority recognises the applicants' provision for a fish pass for elvers on the barrage designed to the best available knowledge.

The NRA is concerned that the barrage could significantly reduce eel stocks within the Usk.

3.2 Estuarine and marine fish species

Comparatively little is known about the estuarine and marine fish utilising the Usk estuary and consequently the NRA has asked the applicants to commission a baseline survey to determine their diversity and significance in the area to be affected by the barrage. The applicants have undertaken a preliminary assessment but have not demonstrated the significance of the species found. Whilst they have proposed further survey work it will not be possible, as a consequence of the proposed timescale, to judge the result until after construction is complete.

Until the results of such surveys are known it is not possible to judge the effect of the barrage on estuarine and marine fish populations nor whether such effects could be mitigated for.

3.3 Monitoring

Even if the NRA's concerns could be satisfied there would remain an element of uncertainty regarding the future success of fish migration. Should the barrage proceed it is essential that a comprehensive monitoring programme is instigated to determine :-

- a) the effectiveness of any measures designed to assist the passage of migratory fish;
- b) the extent to which both fish stocks and their associated fisheries are affected by the construction and operation of the barrage, and hence the scale of the mitigation required;
- c) the mechanism of any detrimental effects on the fisheries and consequently any remedial measures that may be required;

3.3.1 The Impact on Salmon Rod Catches

The NRA has examined the relationship between reported catches of salmon on the Usk relative to the Wye to try and predict future rod catches in the absence of the barrage. The Authority concluded that this approach could not be relied upon because of the changing assumptions on which the statistical relationship is based and informed the applicants accordingly. Notwithstanding the NRA's rejection of the use of past relationships to predict future catches, the applicants have claimed that this approach is reliable.

Whilst the applicants have used reported salmon catch data to determine a predictive relationship between the Rivers Wye and Usk the NRA does not accept that such a relationship can be relied upon to demonstrate the level of impact on catches of the proposed barrage.

3.3.2 The Impact on Salmon Stocks

The applicants have indicated that the fish counter at Trostrey could be upgraded to compare salmon movements pre and post barrage construction. The NRA accepts that this approach could potentially provide useful data on the timing of salmon runs particularly given several years data preconstruction. However, the applicants have not shown how this might be achieved nor how the impact of the barrage on salmon numbers could be assessed by the counter.

Due to the large annual fluctuations and expected improvement in Usk salmon stocks in the absence of the barrage, the Authority does not accept that the counter could be relied upon to identify the impact of the barrage on stocks.

3.3.3 The Mechanism of impact

The NRA agrees with the applicants that the tracking of salmon, both adults and juveniles, using radio and acoustic tags provides the best known method of assessing the likely mechanisms of impact of the barrage on salmon stocks. It does not accept that such studies could quantify the impact of the barrage.

3.4 Mitigation

Regardless of the absence of a satisfactory method for measuring adverse effects upon fish stocks the NRA is concerned as to how any effect might be mitigated for. The nature and size of the natural salmon run and fishery, in the river in particular, is such that even a small reduction caused by the barrage would be most difficult, expensive and probably impactable to mitigate by re-stocking. Any restocking programme would require strict management to ensure that the unique genetic composition of native stocks was not adversely affected.

In relation to damage to the river Usk fishery, the NRA is particularly concerned about the effect on fish stocks during the period when the extent of any damage was being assessed, and also during the subsequent period during which the barrage structures or modes of operation might be altered to try to reduce identified damage.

The applicants have not demonstrated to the satisfaction of the NRA that effective mitigation measures could be employed to compensate for any effect of the barrage on fish stocks.

3.5 NRA View on Fisheries Issues

Despite the provision of facilities for fish passage the NRA fears that the construction of the barrage will:

- (a) delay and obstruct fish passage;
- (b) increase mortality of young salmon and sea trout;

(c) adversely affect salmon stocks and the rod and commercial fisheries which depend on them.

(d) reduce the numbers of eels within the river.

Furthermore, the provisions for monitoring fish stocks and fisheries and mitigating the anticipated damage are wholly inadequate.

4. CONSERVATION

Under the Water Resources Act 1991, the NRA has the responsibility to further conservation in the riverine environment. The major conservation impact of the barrage proposals is upon fish species and those fish-eating birds and mammals, particularly otters, which feed upon migratory fish in the river.

In addition to those fish species which support fisheries, the Usk is also used by other migratory species including the lamprey. Twait shad, a fish species of special conservation interest, enter the river in significant numbers to spawn, and are likely to be severely impeded with consequent effects upon the spawning stock.

4.1 General Aquatic Flora and Fauna

The diversity of the general aquatic flora and fauna of the Usk Estuary is presently restricted by its rigorous physical and chemical characteristics. The NRA accepts that the proposed barrage operation, with regular tidal intrusion to maintain variable salinity conditions over much of the benthic habitat, should allow the maintenance of the existing fauna and flora, but the naturalness of the estuary will be affected.

4.2 NRA View on Conservation Issues

Unless the applicants fully address the above issues, formulate a satisfactory monitoring programme and identify acceptable mitigation measures, the NRA will not be satisfied that the conservation interests in the river upstream of the impoundment have been adequately protected.

5. WATER QUALITY

The NRA has a responsibility to maintain and improve the quality of the aquatic environment and has stipulated appropriate standards to protect the water quality in both the estuary downstream of the barrage and in the impounded water behind the barrage.

These quality standards are applied to ensure that the waters are visually acceptable, that conditions are such that an ecological balance can be achieved and that water quality and flow conditions are maintained to protect the health of fish and their free migration.

5.1 Water Quality Criteria

There are many interacting processes which would affect water quality both in the existing estuary and in the changed water regime after barrage construction.

These processes and related water quality criteria are summarised below:-

5.1.1 Sedimentation

If the barrage is constructed the smaller volume of water flowing in and out of the estuary downstream would result in reduced scouring and increase the potential for a build-up of mud. To prevent this becoming a problem, the Applicants have proposed that sea water be allowed to intrude into the barrage with subsequent release to effect the scouring of accumulated silt.

The NRA has required the applicants to study the effect of the resuspended sediments on water quality below the barrage and to show that stipulated standards in the estuary can be maintained.

5.1.2 Dissolved Oxygen

Oxygen must be maintained above a certain critical level to support the passage of migratory fish and to sustain both the resident fish populations and benthic flora and fauna. At very low oxygen levels an estuary would support few living organisms and could even become a nuisance because of smell.

The degradation of organic substances, originating mainly from the sewage effluent inputs and resuspended muds, exerts a demand on the dissolved oxygen content of the waters.

If the barrage were to be built, the reduced mixing and increased residence time within the impoundment could result in reduced oxygen levels. In addition, even though the crude sewage discharges will be removed, oxygen demands may still be high because of remaining organic inputs and from the effect of algae decaying in bottom waters and respiring in surface waters.

The proposal to introduce saline waters into the impoundment which would lead to stratification could also result in the depletion of dissolved oxygen in the bottom water layers. However, the applicants plan to control this effect and flush out accumulated sediments from the downstream channel by regular releases from this layer.

To ensure that unacceptable conditions do not develop and that the releases from the impoundment do not impinge upon the survival of salmonids below the barrage, the NRA has stipulated minimum dissolved oxygen levels of 5 mg/l throughout the impounded water body and 3 mg/l in the estuary downstream of the barrage. The applicants would have to satisfy the NRA that these standards would be maintained at all times, if necessary by the use of artificial oxygen injection.

5.1.3 Salinity

The existing estuary is well mixed with a gradual change from saltwater to freshwater conditions. If the barrage were to be constructed, an abrupt change from salt to freshwater would be modified by the intrusion of sea water to facilitate flushing and when the lock gates are operated. Saltwater would tend to sink to the bottom upstream of the barrage and, as mentioned earlier, result in stratification.

Sudden, intermittent changes in salinity would be fatal to a benthic fauna dominated by freshwater species. If saltwater intrusion is to occur it must be on a sufficiently regular basis and operate in a way that would allow development of a stable, balanced benthic ecosystem above the barrage.

This matter has been acknowledged by the developers who have proposed a procedure to maintain a stable ecology.

5.1.4 Algae

Reduced turbidity upstream of the barrage would allow greater light penetration and, with increased retention time and a supply of nutrients there might be the opportunity for planktonic and benthic algal blooms to develop.

The applicants have undertaken modelling of the potential for growth of planktonic algae in the impoundment.

5.1.5 Microbiological Quality

Bacteria and other microbiological organisms of natural and sewage origin exist in the river, estuary and seawater. They will survive longer in freshwater but the increased penetration of sunlight expected upstream of the barrage could offset this. The bacteriological quality of the waters behind the barrage would partly determine the recreational uses to which these waters can be put. It is concluded by the applicants that contact recreation would not be possible.

The NRA has no statutory responsibility in matters relating to public health and it will be for the Environmental Health Department of Newport Borough Council and other relevant Authorities to assess the risk and to decide on what recreational activities should be permitted.

5.1.6 Other Water Quality Parameters

The NRA has set quality standards for ammoniacal nitrogen and temperature in both the impounded waters and in the estuary downstream of the barrage.

5.2 Predictive Modelling Studies

- 5.2.1 Computer models have been developed by the applicants to predict what are likely to be the water quality conditions after the barrage is constructed. Measures can then be identified to address any problems.

The appropriate modelling techniques and the type of mathematical model that has been used by the applicants and their consultants have been approved by the NRA.

The models must be correctly calibrated and properly validated so that they accurately describe the existing situation before they can be used to predict conditions for post-barrage scenarios.

- 5.2.2 The NRA is satisfied that the applicants have undertaken all reasonable calibration and validation studies and have presented modelling results fit for the purpose of predicting post-barrage conditions.

The NRA are reasonably satisfied that the water quality standards as stipulated can be achieved by the proposed barrage operating regime.

- 5.2.3 The stipulated water quality standards are intended to protect the health of fish and their free migration. However, concern remains as to whether the change in water quality conditions will be detrimental to normal fish behaviour and successful migration particularly in the vicinity of the barrage.

5.2.4 With respect to algal problems upstream of the barrage, predictions indicate that blue-green algae should not be a problem but that substantial blooms of other, less problematic planktonic algal species may occur. Also the potential for growth of filamentous benthic algae (e.g. Cladophora) on the sediments of the impoundment is considered to be substantial, particularly during the early years of impoundment.

5.2.5 To have further confidence in protecting water quality the NRA has secured in the proposed Order inclusion of mitigating measures such as the removal of algal growth and oxygenation of waters.

5.3 Sewage

The NRA has insisted that the existing crude sewage discharges above and below the proposed barrage will have to be removed to prevent aesthetic and water quality problems developing. The current proposal involves collecting these discharges and treating them prior to discharge outside the impoundment. The NRA will stipulate consent conditions such that the quality of the receiving waters are safeguarded.

The existing sewage effluent discharges from Ponthir and Caerleon sewage works continue but Caerleon will, and Ponthir may, require additional treatment.

Storm sewage outlets may remain upstream and downstream of the barrage but these discharges will occur infrequently. The applicants have indicated that full hydraulic modelling studies will be completed at the design stage. The NRA will be controlling such overflow volumes and frequency of occurrence by issuing discharge consents in full consideration of this information.

5.4 Other Effluents

Other effluents discharge downstream of the proposed barrage and because of the reduced volume of seawater in the estuary, the NRA insisted that the applicants investigate the need for improved treatment. The NRA has been shown that additional treatment would not be required as a result of the barrage construction.

5.5 NRA View on Water Quality

The NRA is reasonably satisfied that the water quality standards it has stipulated can be achieved. However, it has reservations with regard to:

- (a) whether the change in water quality conditions as a result of the proposed barrage will be detrimental to normal fish behaviour and successful migration, particularly in the vicinity of the proposed barrage
- (b) provisions for the removal of continuous and intermittent crude sewage discharges into the river above and below the proposed barrage
- (c) the impact of rising groundwater levels on the potential for mobilisation of contaminants and their entry to both groundwaters and the waters of the proposed impoundment (see also section 6 below).

6. GROUNDWATER

Under the Water Resources Act 1991 and associated legislation, the NRA does not have primary responsibility for groundwater levels. However in view of the potential effects which a rise in groundwater levels could have on flood defence, water quality and conservation the Authority is considering the hydrogeological reports provided by Newport Borough Council.

At this stage the Authority is not satisfied that the applicants have fully addressed these concerns, and it has told the Council that further studies are required.

7. CONCLUSIONS

The applicants have so far failed to demonstrate to the NRA's satisfaction that the construction of a barrage across the Usk estuary would not adversely affect its statutory responsibilities in respect of both the protection of the environment and the uses made of the waters affected by the proposals.

Notwithstanding detailed considerations and discussions with the applicants, their experts and advisors, the NRA remains of the view that if the Usk Barrage were to be constructed, it would create an unacceptable risk to the fish stocks and fisheries of the river, particularly in view of their high conservation, sporting and commercial value. The Environmental Statement relied upon in support of the proposed Order does not adequately address these concerns or provide acceptable proposals for mitigating the damage which we believe will be caused if Ministerial approval is granted.

Accordingly the NRA is lodging an objection to the Proposed Order with the Secretary of State for Wales. If a Public Inquiry is called to consider the application and objections to it the NRA will present evidence on the above matters.