TEDDINGTON & HAM HYDRO PLANNING APPLICATION
DESIGN & ACCESS STATEMENT

Contents

1 Introduction

The Design and Access Statement is part of a suite of documents relating to the application to construct a turbine to generate electricity at Teddington. This document sets out the design rationale of the Teddington & Ham Hydro team and provides information about how the designs have evolved to meet aesthetic considerations within the historic context of the original and recent structures at this location. It also sets out how the requirements of noise management, environmental considerations, flood management and safety of river users has been achieved, within the context of a proven and reliable technology.

2 Sustainability and Energy

The whole purpose of the development is to generate electricity from renewable energy sources currently estimated between 1.5-1.9GWh annually – approximately equivalent to the electricity demand of 5-600 homes. The project aims to avoid CO_2 emissions amounting to 1,000 tonnes per annum at the upper end. The scheme will be community owned, with 90% of free cash flow (after operating & financing costs, and provisions for capital expenditure) being allocated to interest payments for local members and the remaining 10% will be paid to the Teddington & Ham Hydro Foundation. This will "promote and develop projects in the local area which encourage sustainable development, environmental improvement and the low carbon economy, together with any activities related thereto" (extract from Company Objects registered with Companies House and Community Interest Companies Regulator).

In addition, the National Physical Laboratory (NPL) has carried out a sustainability life cycle analysis which shows the carbon payback of the scheme as nine months.

3 Historical Background

Teddington Weir is a man-made structure which has changed enormously over time (Figs. 1a and 1b). In our designs we have sought to capture and improve upon the essence of the weir. We hope that, over time, our hydro scheme will become as familiar and loved as Teddington footbridge is today.

A weir was in place on the Thames at Teddington by 1345, although it was destroyed about 1535. A new lock was opened in 1811. Since 1811, the weir has marked the end of the tidal reach of the river. Prior to 1811, the tide used to go as far upriver as Walton, and occasionally even to Staines.

Teddington Lock is a complex of three locks and a weir on the River Thames, and consists of a conventional launch lock, a very large barge lock and a small skiff lock.

The lock was rebuilt in 1858, and the barge lock added in 1904. The weir itself has had to be rebuilt several times following floods. The section nearest the Middlesex bank (the proposed location of the hydro scheme) used to have a roof over the walkway, as seen in Fig. 2 (photo circa 1960) and Fig. 3 (the engineering drawing of that section of the weir prior to its demolition and reconstruction in 1991/2). Teddington footbridge was built in 1889: the funds for its construction were raised by public subscription – a very similar mechanism to the financing plan for our scheme.

Fig 1a. Postcard of the weir from 1902

Fig. 1b The weir as it is today

Fig 2. View of the relevant section of the weir, showing the former roofed walkway and overspill

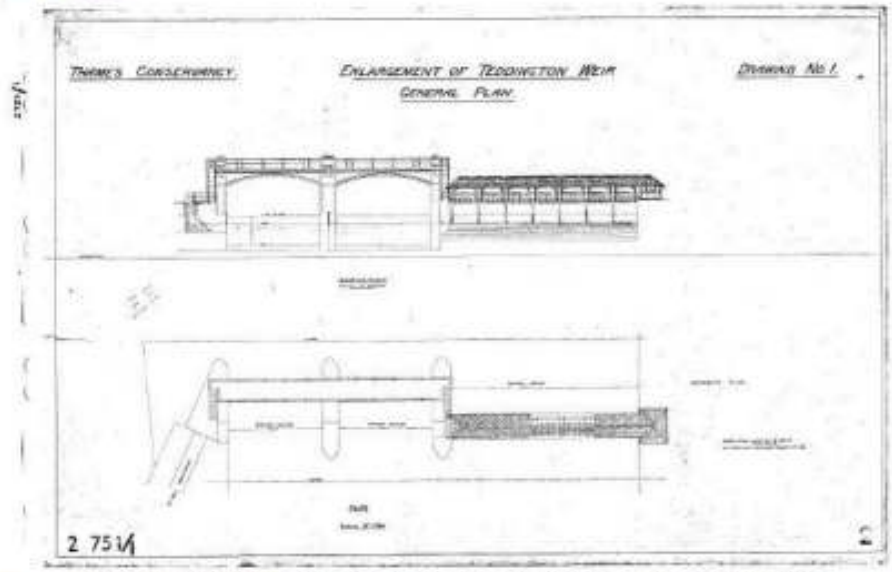


Fig. 3: Engineering drawing for construction of roller sluices, dated August 1931.

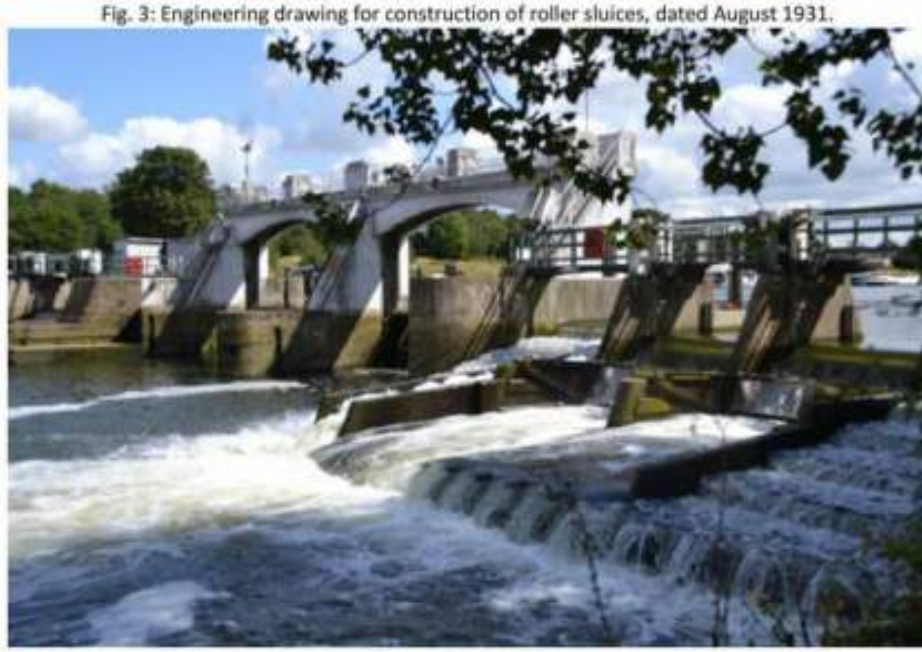


Fig. 4 Current view of the relevant section of the weir from the Teddington bank

The section of the weir to be used for the hydroelectric scheme was reconstructed in 1991-92 (Fig. 5) and now incorporates two sluice gates, two overspills and two fish passes between the roller sluices and the river wall. The small brick and pitched roof gauge house on the bank, adjacent to the Lensbury Club, was built at the same time. Demolition of this section of weir and the introduction of the hydro power scheme and replacement fish pass and sluice should be seen as the latest *incremental* change at this site. The proposal effectively replaces one engineering structure with another, of appropriate scale and enhanced appearance.

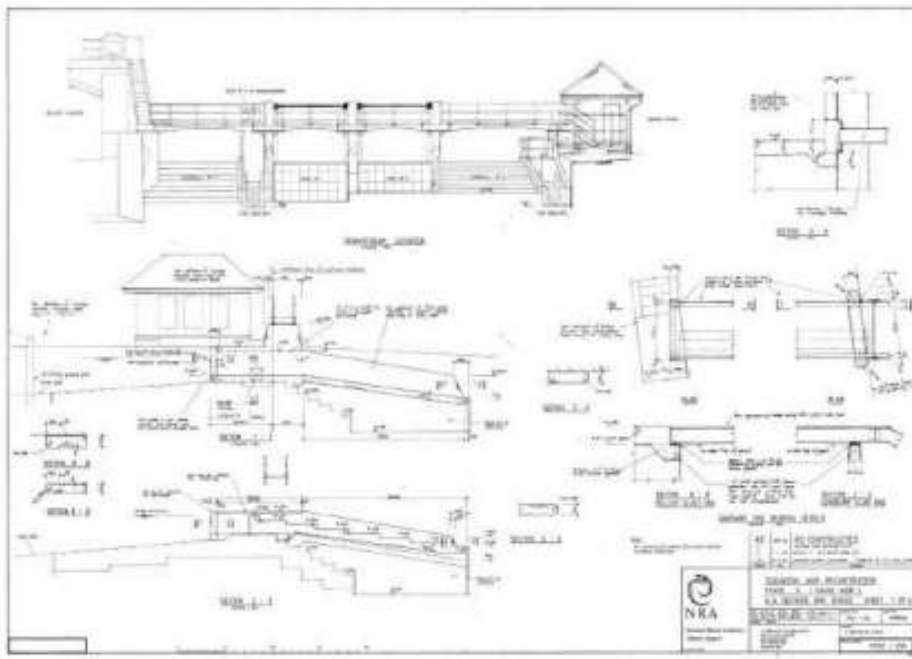


Fig. 5 – reconstruction of the relevant section of the weir in 1991-2

The scheme is designed to keep it consistent with the range of existing engineering structures forming Teddington Weir. The overall scale of the structure is comparable with the adjoining large roller sluice gates. Three 4 metre wide Archimedian screws will be mainly below the top of the river wall, although the shafts will extend up to a higher generator platform (above the projected maximum flood level) and maintenance walkway. These are flanked on one side by a wider fish pass next to the river wall and a new sluice gate on the other. A small plant room for inverters and electrical switchgear is located on this platform above the sluice. None of the components of the scheme exceed the height of the existing roller sluice structure.

4 Visual Impact

A dedicated document with visuals of before and after (using computer generated graphics) is included within this application. Below are a selction of visuals of how the weir will look pre and post the construction of the scheme. Our design team have worked hard to capture the essence of the weir and feel that we have adhered to the spirit and letter of the rules for sustainable development taking into account suurounding assets and views.

Design features

The design of the scheme incorporates features which harmonise with the aesthetic of the current weir structures and also echo another major feature of the river Thames. The design also reinstates some character to this section of the weir which was lost when the former roofed walkway was demolished to make way for the current structure.

- the wall of the structure facing the Lensbury grounds will be faced with blue engineering brick to echo the brickwork of the gauge house. The blue brick is associated with the inland waterways, especially canals. The podium or base of the gauge house is construction from blue brick as are all the decorative stripes and corners. The blue brick is a neutral tone that goes best with the white painted and raw concrete of the rest of the structure, and the grey/silver of the various fittings /railings/generator housings in metal. It also blends well with the shadows cast by the fringe of trees;
- turbine channel sluice gates and intakes will be arched to harmonise with the roller sluices;
- the plant room structure will harmonise with the roller sluices;
- the shape of the generator housings echoes the Thames Barrier, thus "book-ending" the tidal stretch of the river.
- The proposed structure is smaller than many elements of the current weir structure.

View from the Ham Bank: Before construction

View from the Ham Bank: After Construction

View from Teddington Bridge: Before construction

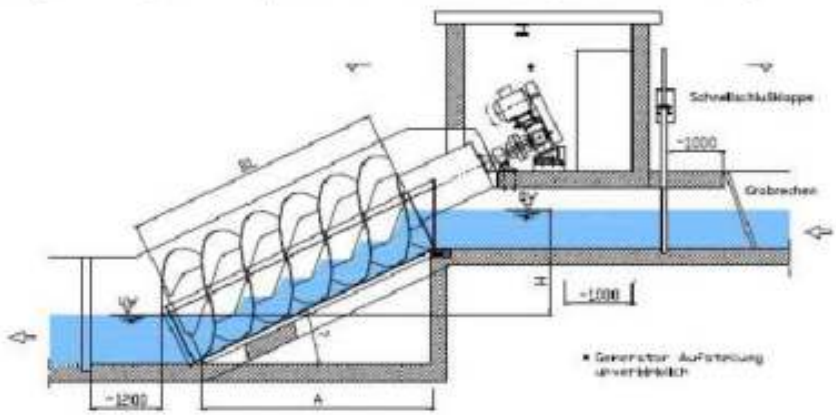
View from Teddington Bridge: After Construction

View from the Lensbury Terrace: After Construction

5 Noise mitigation

Detailed analysis of the projected sound of the scheme and the mitigation measures are given in the documentation on noise contained within this application. In brief, the turbines themselves will each be enclosed in a transparent, semi-circular tube: this will mitigate any hydrodynamic noise (possible splashing sounds); in addition, the generators housings will be equipped with sufficient noise muffling to enable the scheme to be operated within the constraints placed upon it by LBRuT planning department.

Peter Brett, noise consultants conculded: *"A noise impact assessment has been undertaken for the proposed hydropower scheme at Teddington Weir. The results of the assessment indicate that the requirements of the Local Authority should be achieved when the various noise sources are placed inside suitable acoustic enclosures. An acoustic specification for these enclosures has been provided alongside a list of suitable suppliers."* These have been incorporated into our designs.



6 Proven Technology

Archimedean screws have been shown to be the most ecologically safe hydro power technology and are the preferred technology of the UK Environment Agency.

Archimedean Screws have been used for thousands of years but until recently their purpose has always been to raise water. Recent developments in turbine technology have enabled hydro power schemes to be developed at "low-head" locations (where the drop in water level from above the scheme to below it is relatively low). By "reverse-engineering" Archimedean screws it is possible to utilise the energy generated by river flow and head (drop). Water passes from upstream of the installation into the screw channel. It then passes through the screw and the force from the flow turns the screw. The turning of the screw is used to generate clean electricity which can then be used or sold on. The application of this technology is not new though with many working schemes currently operating in the UK. The only nuance is that the weir is tidal for 8 of the 24 hours each day. The only impact this has is that the head (or drop) is variable for these hours and so production of electricity may be reduced during this time. This is a financial consideration and has been built in to the financial forecasts. The technology used is in no way experimental. Moreover, there is no impact on noise, environmental or other sustainability issues resulting from siting the scheme at a semi-tidal section.

7 Development constraints

The specific location of the scheme has been determined by the Environment Agency statutory requirements for fish passage and flood relief. The flow capacity of the section of the weir to be replaced must be replicated by the scheme without any adverse impact on flow management or flood relief, or diminishment of habitats.

Fish Passage

The turbines must co-terminate with the new fish pass to be installed as part of the scheme. The key reason for this position is this gives fish the best chance to find it and use it to pass upstream. The section of weir adjacent to the Middlesex bank is the highest point in the weir pool and is the point fish will move towards as they look for a place to pass over the weir. This is because the flow out of the turbines creates an attraction to fish. This arrangement is a licensing requirement based on best practice design guidelines produced by EA for developers, which our design adheres to.

Flood Relief

The amount of water flowing into the weir pool must be unchanged following the construction of the scheme. If the scheme were sited elsewhere, potentially two non-adjacent sections of weir would need to be demolished, which would increase risk, costs and disturbance during the construction process.

Other considerations

The scheme will also be placed away from the main navigation route and will mean least disruption for river users during construction and operation of the scheme – Health and Safety issues have played a big part in the siting of the scheme.

Furthermore, The Environment Agency does not want to demolish any of the "Zig Zag" section of the weir as this could affect its overall integrity. The section chosen has the advantage of being able to be treated as a single, unitary section.

8 Access

There is no road or vehicular access.

Maintenance access will be, as currently, from the lock island (Swan Ait) end via the continuous existing walkway above the weirs. Because the height of the walkway over the hydro scheme will be increased by approximately 1.5 metres there will also be minor changes to the existing metal steps providing access to the gauge house. As an operational engineering structure and power facility there will be no access for those with disabilities under the Disability Discrimination Act.

Delivery of any major replacement components required during the life of the project will be waterborne, in the same way as the initial construction (see Construction Methodology Statement).

Construction issues

T&HH is in negotiations with a number of parties to use a portion of their grounds during the construction phase for the purpose of taking deliveries of building materials and effecting some of the works therefrom. These parties will continue these negotiations once planning approval has been granted.

Cable route

The export elctricity cable will run underwater pinned to the bank or the river bed to the slipway at the bottom of Ferry Road. From there, the cable will be buried under the road/pavement surface and be conducted to the nearest sub-station in Broom Road.

Stephen Jarvis, Managing Director – Teddington and Ham Hydro Cooperative Limited

[redacted]

London, 1st September, 2014


HYDRO

TEDDINGTON & HAM HYDRO PLANNING APPLICATION
DESIGN & ACCESS STATEMENT

Contents

1 Introduction

The Design and Access Statement is part of a suite of documents relating to the application to construct a turbine to generate electricity at Teddington. This document sets out the design rationale of the Teddington & Ham Hydro team and provides information about how the designs have evolved to meet aesthetic considerations within the historic context of the original and recent structures at this location. It also sets out how the requirements of noise management, environmental considerations, flood management and safety of river users has been achieved, within the context of a proven and reliable technology.

2 Sustainability and Energy

The whole purpose of the development is to generate electricity from renewable energy sources currently estimated between 1.5-1.9GWh annually – approximately equivalent to the electricity demand of 5-600 homes. The project aims to avoid CO_2 emissions amounting to 1,000 tonnes per annum at the upper end. The scheme will be community owned, with 90% of free cash flow (after operating & financing costs, and provisions for capital expenditure) being allocated to interest payments for local members and the remaining 10% will be paid to the Teddington & Ham Hydro Foundation. This will "promote and develop projects in the local area which encourage sustainable development, environmental improvement and the low carbon economy, together with any activities related thereto" (extract from Company Objects registered with Companies House and Community Interest Companies Regulator).

In addition, the National Physical Laboratory (NPL) has carried out a sustainability life cycle analysis which shows the carbon payback of the scheme as nine months.

3 Historical Background

Teddington Weir is a man-made structure which has changed enormously over time (Figs. 1a and 1b). In our designs we have sought to capture and improve upon the essence of the weir. We hope that, over time, our hydro scheme will become as familiar and loved as Teddington footbridge is today.

A weir was in place on the Thames at Teddington by 1345, although it was destroyed about 1535. A new lock was opened in 1811. Since 1811, the weir has marked the end of the tidal reach of the river. Prior to 1811, the tide used to go as far upriver as Walton, and occasionally even to Staines.

Teddington Lock is a complex of three locks and a weir on the River Thames, and consists of a conventional launch lock, a very large barge lock and a small skiff lock.

The lock was rebuilt in 1858, and the barge lock added in 1904. The weir itself has had to be rebuilt several times following floods. The section nearest the Middlesex bank (the proposed location of the hydro scheme) used to have a roof over the walkway, as seen in Fig. 2 (photo circa 1960) and Fig. 3 (the engineering drawing of that section of the weir prior to its demolition and reconstruction in 1991/2). Teddington footbridge was built in 1889: the funds for its construction were raised by public subscription – a very similar mechanism to the financing plan for our scheme.

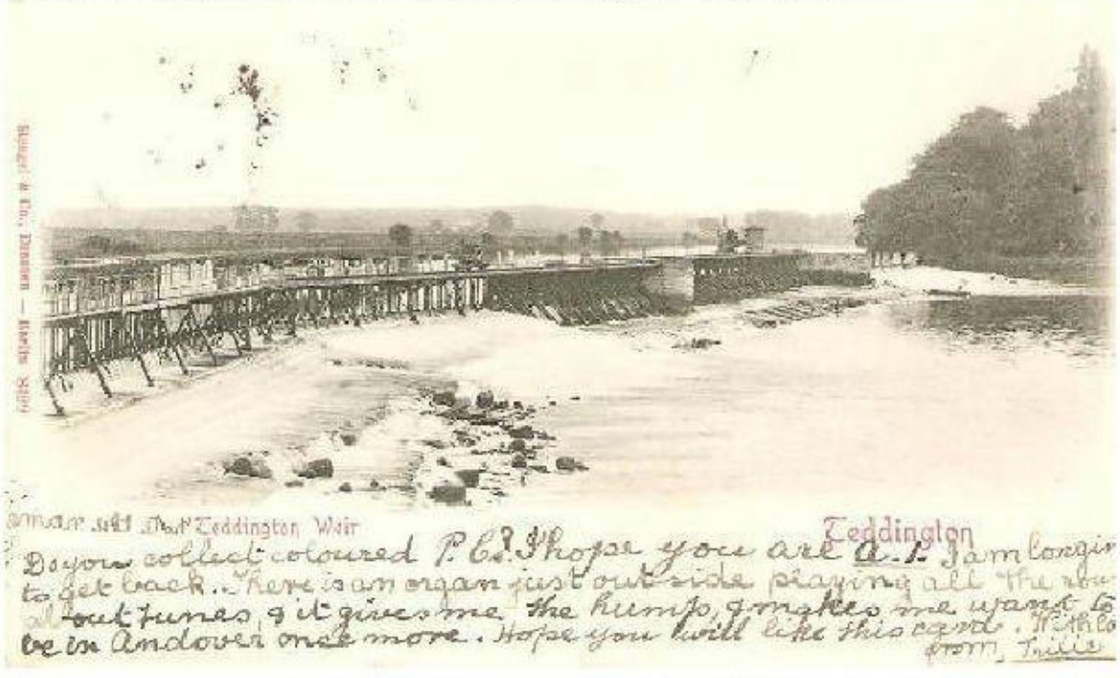


Fig 1a. Postcard of the weir from 1902

Fig. 1b The weir as it is today

Fig 2. View of the relevant section of the weir, showing the former roofed walkway and overspill

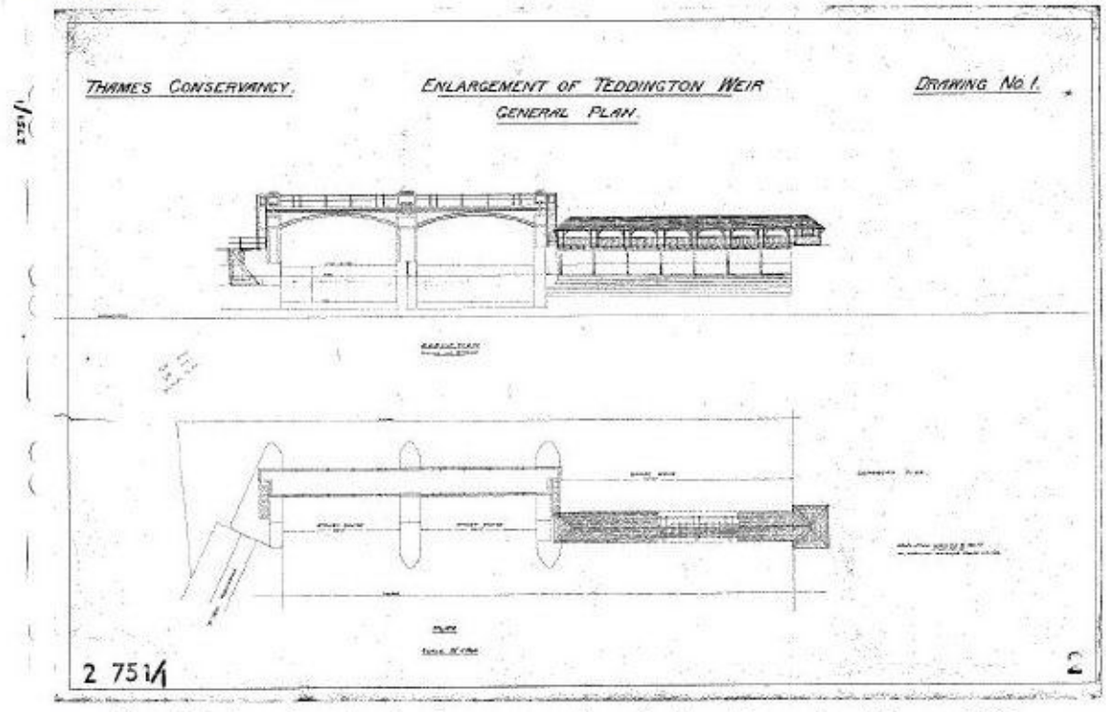


Fig. 3: Engineering drawing for construction of roller sluices, dated August 1931.

Fig. 4 Current view of the relevant section of the weir from the Teddington bank

The section of the weir to be used for the hydroelectric scheme was reconstructed in 1991-92 (Fig. 5) and now incorporates two sluice gates, two overspills and two fish passes between the roller sluices and the river wall. The small brick and pitched roof gauge house on the bank, adjacent to the Lensbury Club, was built at the same time. Demolition of this section of weir and the introduction of the hydro power scheme and replacement fish pass and sluice should be seen as the latest *incremental* change at this site. The proposal effectively replaces one engineering structure with another, of appropriate scale and enhanced appearance.

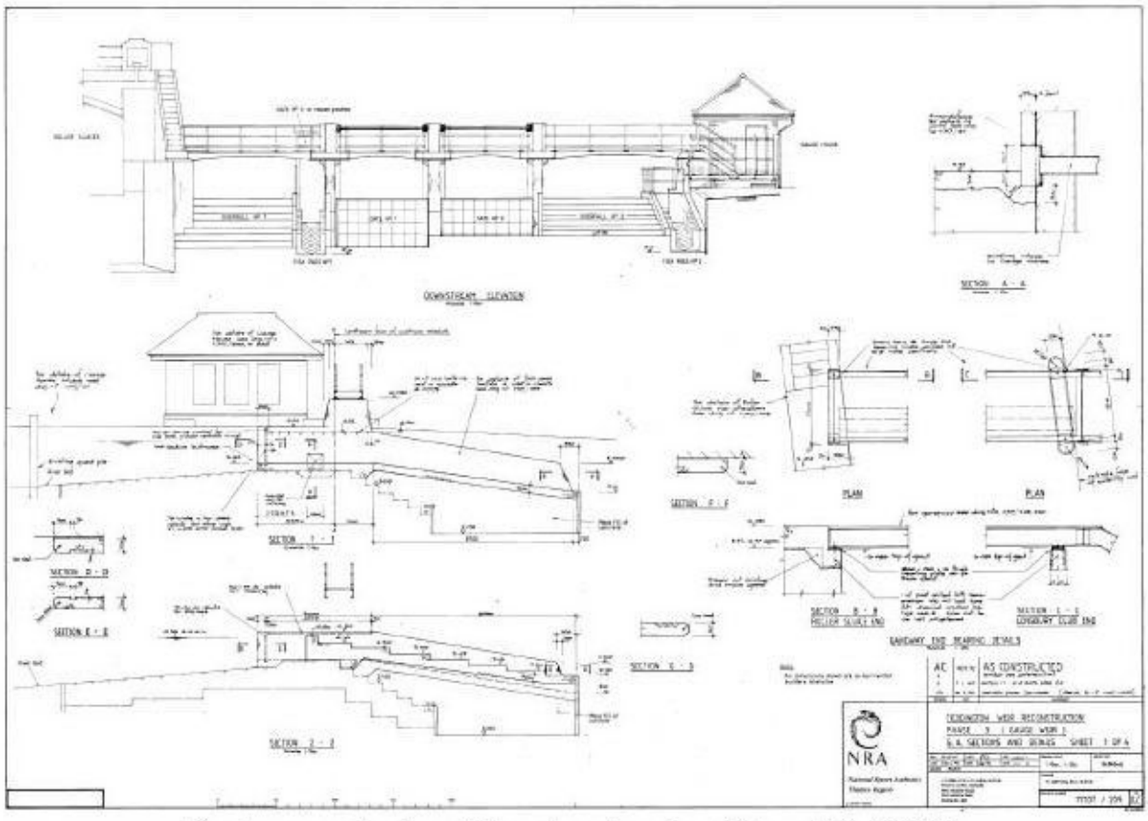


Fig. 5 – reconstruction of the relevant section of the weir in 1991-2

The scheme is designed to keep it consistent with the range of existing engineering structures forming Teddington Weir. The overall scale of the structure is comparable with the adjoining large roller sluice gates. Three 4 metre wide Archimedian screws will be mainly below the top of the river wall, although the shafts will extend up to a higher generator platform (above the projected maximum flood level) and maintenance walkway. These are flanked on one side by a wider fish pass next to the river wall and a new sluice gate on the other. A small plant room for inverters and electrical switchgear is located on this platform above the sluice. None of the components of the scheme exceed the height of the existing roller sluice structure.

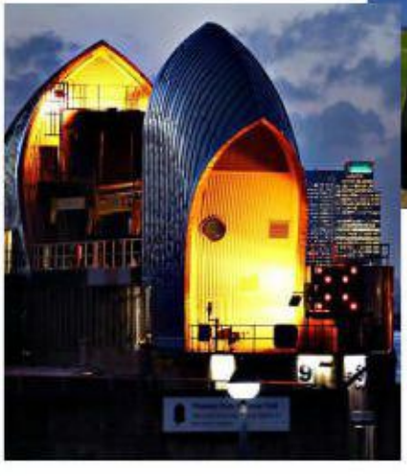
4 Visual Impact

A dedicated document with visuals of before and after (using computer generated graphics) is included within this application. Below are a selction of visuals of how the weir will look pre and post the construction of the scheme. Our design team have worked hard to capture the essence of the weir and feel that we have adhered to the spirit and letter of the rules for sustainable development taking into account suurounding assets and views.

Design features

The design of the scheme incorporates features which harmonise with the aesthetic of the current weir structures and also echo another major feature of the river Thames. The design also reinstates some character to this section of the weir which was lost when the former roofed walkway was demolished to make way for the current structure.

- the wall of the structure facing the Lensbury grounds will be faced with blue engineering brick to echo the brickwork of the gauge house. The blue brick is associated with the inland waterways, especially canals. The podium or base of the gauge house is construction from blue brick as are all the decorative stripes and corners. The blue brick is a neutral tone that goes best with the white painted and raw concrete of the rest of the structure, and the grey/silver of the various fittings /railings/generator housings in metal. It also blends well with the shadows cast by the fringe of trees;
- turbine channel sluice gates and intakes will be arched to harmonise with the roller sluices;
- the plant room structure will harmonise with the roller sluices;
- the shape of the generator housings echoes the Thames Barrier, thus "book-ending" the tidal stretch of the river.
- The proposed structure is smaller than many elements of the current weir structure.



View from the Ham Bank: Before construction

View from the Ham Bank: After Construction

View from Teddington Bridge: Before construction

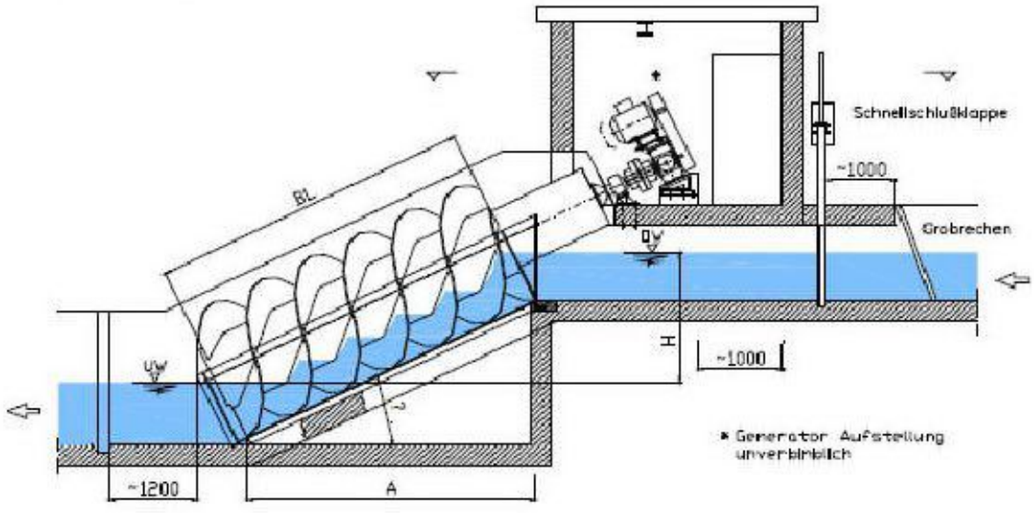
View from Teddington Bridge: After Construction

View from the Lensbury Terrace: After Construction

5 Noise mitigation

Detailed analysis of the projected sound of the scheme and the mitigation measures are given in the documentation on noise contained within this application. In brief, the turbines themselves will each be enclosed in a transparent, semi-circular tube: this will mitigate any hydrodynamic noise (possible splashing sounds); in addition, the generators housings will be equipped with sufficient noise muffling to enable the scheme to be operated within the constraints placed upon it by LBRuT planning department.

Peter Brett, noise consultants conculded: *"A noise impact assessment has been undertaken for the proposed hydropower scheme at Teddington Weir. The results of the assessment indicate that the requirements of the Local Authority should be achieved when the various noise sources are placed inside suitable acoustic enclosures. An acoustic specification for these enclosures has been provided alongside a list of suitable suppliers."* These have been incorporated into our designs.



6 Proven Technology

Archimedean screws have been shown to be the most ecologically safe hydro power technology and are the preferred technology of the UK Environment Agency.

Archimedean Screws have been used for thousands of years but until recently their purpose has always been to raise water. Recent developments in turbine technology have enabled hydro power schemes to be developed at "low-head" locations (where the drop in water level from above the scheme to below it is relatively low). By "reverse-engineering" Archimedean screws it is possible to utilise the energy generated by river flow and head (drop). Water passes from upstream of the installation into the screw channel. It then passes through the screw and the force from the flow turns the screw. The turning of the screw is used to generate clean electricity which can then be used or sold on. The application of this technology is not new though with many working schemes currently operating in the UK. The only nuance is that the weir is tidal for 8 of the 24 hours each day. The only impact this has is that the head (or drop) is variable for these hours and so production of electricity may be reduced during this time. This is a financial consideration and has been built in to the financial forecasts. The technology used is in no way experimental. Moreover, there is no impact on noise, environmental or other sustainability issues resulting from siting the scheme at a semi-tidal section.

7 Development constraints

The specific location of the scheme has been determined by the Environment Agency statutory requirements for fish passage and flood relief. The flow capacity of the section of the weir to be replaced must be replicated by the scheme without any adverse impact on flow management or flood relief, or diminishment of habitats.

Fish Passage

The turbines must co-terminate with the new fish pass to be installed as part of the scheme. The key reason for this position is this gives fish the best chance to find it and use it to pass upstream. The section of weir adjacent to the Middlesex bank is the highest point in the weir pool and is the point fish will move towards as they look for a place to pass over the weir. This is because the flow out of the turbines creates an attraction to fish. This arrangement is a licensing requirement based on best practice design guidelines produced by EA for developers, which our design adheres to.

Flood Relief

The amount of water flowing into the weir pool must be unchanged following the construction of the scheme. If the scheme were sited elsewhere, potentially two non-adjacent sections of weir would need to be demolished, which would increase risk, costs and disturbance during the construction process.

Other considerations

The scheme will also be placed away from the main navigation route and will mean least disruption for river users during construction and operation of the scheme – Health and Safety issues have played a big part in the siting of the scheme.

Furthermore, The Environment Agency does not want to demolish any of the "Zig Zag" section of the weir as this could affect its overall integrity. The section chosen has the advantage of being able to be treated as a single, unitary section.

8 Access

There is no road or vehicular access.

Maintenance access will be, as currently, from the lock island (Swan Ait) end via the continuous existing walkway above the weirs. Because the height of the walkway over the hydro scheme will be increased by approximately 1.5 metres there will also be minor changes to the existing metal steps providing access to the gauge house. As an operational engineering structure and power facility there will be no access for those with disabilities under the Disability Discrimination Act.

Delivery of any major replacement components required during the life of the project will be waterborne, in the same way as the initial construction (see Construction Methodology Statement).

Construction issues

T&HH is in negotiations with a number of parties to use a portion of their grounds during the construction phase for the purpose of taking deliveries of building materials and effecting some of the works therefrom. These parties will continue these negotiations once planning approval has been granted.

Cable route

The export elctricity cable will run underwater pinned to the bank or the river bed to the slipway at the bottom of Ferry Road. From there, the cable will be buried under the road/pavement surface and be conducted to the nearest sub-station in Broom Road.

Stephen Jarvis, Managing Director – Teddington and Ham Hydro Cooperative Limited

[redacted]

London, 1st September, 2014