FISHTEK CONSULTING

Flood Risk Assessment

Staverton Hydropower Scheme and Fish Pass

Client:	TRESOC / Staverton Hydro Community Benefit Society
Date:	August 2018
Author(s):	Adam Fryer *BSc MSc MIFM* *Pete Kibel BSc MSC MIFM*

tresoc TOTNES RENEWABLE ENERGY SOCIETY

Fishtek Consulting Ltd

Unit 1a Webber's Way
Dartington
Totnes
TQ9 6JY

Phone: 01803 866680
E-mail: info@fishtek-consulting.co.uk
Web: www.fishtek-consulting.co.uk

Project Title	Staverton Hydropower Scheme Flood Risk Assessment
Date	02nd August 2018
Client	TRESOC / SHCBS

Revision Record

Revision	Date	Author	Checked by
Final	02nd August 2018	A Fryer	P Kibel

CONTENTS

Figures

Tables

1. INTRODUCTION

Staverton Hydro Community Benefit Society (SHCBS) is proposing to install a hydropower scheme at Staverton on the River Dart that utilises the old mill leat. The 100-kW scheme will comprise a single Archimedean screw turbine located at the downstream end of the existing leat channel. Water will be abstracted via the upstream end of the leat at Staverton weir, resulting in a 660 m long deprived reach between the weir and discharge point, as labelled in Figure 1-1.

The leat previously provided flow to a hydropower scheme that was decommissioned in the 1960's and is no longer in use. At present large sluice gates at the upstream end of the leat currently prevent all but a small sweetening flow of a few litres from entering the channel. It is proposed to open the sluices and reinstate the leat to supply flow to the new hydropower scheme.

As part of the works it is planned to repair the existing weir and update the fish pass. The weir has recently failed, and large sections of sheet piling have been undermined and collapsed (see Figure 1-2), resulting in a reduction in upstream water levels and some erosion of the upstream banks. It is proposed to reinstate the weir crest at 7.6 m OD, which was the mean level prior to collapse (AP Land Survey's topographic survey undertaken in 2014). The existing fish pass notch is 1500 mm wide with an invert level that is 400 mm below the weir crest (thus 7.2 m OD). The developers plan to replace the informal fish pass with a best practice Larinier fish pass that is 1.8 m wide.

The following FRA (Flood Risk Assessment) assesses the potential impact of the proposed Staverton hydropower scheme and fish pass on flood risk at the site.

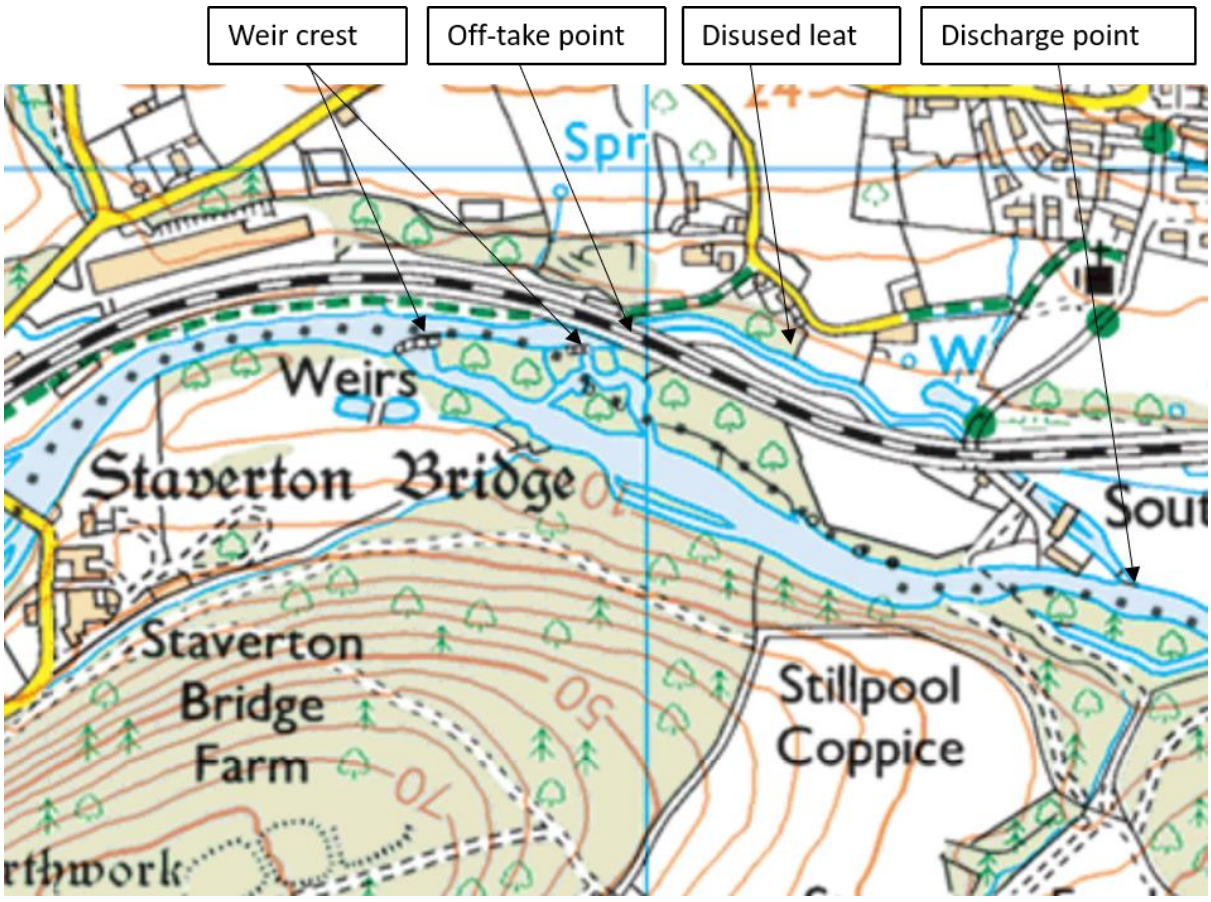


Figure 1-1 Map displaying the key locations relevant to this report

Figure 1-2 Image of the recently failed sheet piled weir (left) and large sluice gates preventing flow into the leat (right)

1.1. Flood Zone

A flood map for planning purposes was obtained for NGR SX 78914 63858 (approximately the centre of the weir). The site including the whole of the leat falls within Flood Zone three meaning it has a high probability of flooding. Development in this area requires a FRA.

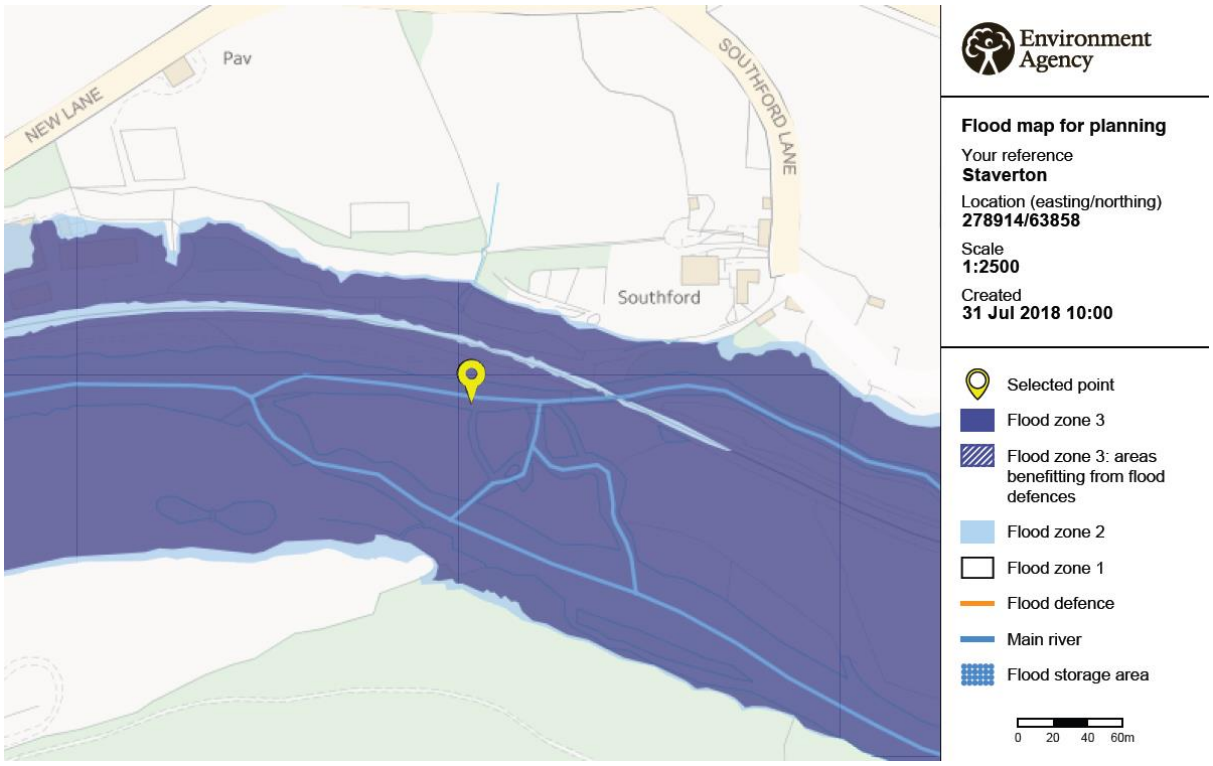


Figure 1-3 The Environment Agencies Flood Map for Planning at Staverton weir.

2. METHODS

2.1. Modelled scenarios

The potential impacts on flood risk were modelled under three different scenarios:

1. Baseline – Existing unmodified site (pre-weir collapse)

2. Post flowing – Post installation scenario with the fish pass 'flowing'. The hydropower scheme will not be operating, and sluice gates closed.

3. Post blocked - Post installation scenario with a blocked 'non-flowing' fish pass. The hydropower scheme will not be operating, and sluice gates closed.

The weir profile for each scenario is given in Figure 2-1

High-level modelling was undertaken using relevant hydraulic formula including the broad-crested weir equation (coefficient of discharge = 1.7), Francis equation for flow in a free-flowing notch and the equation for discharge in a Larinier fish pass. The model assumes the sluice gates are closed under all scenarios and there will be no flow discharging down the leat. This is because the sluice gates are currently closed, and should the hydro scheme be built the sluice gates would automatically close during high flow events. As such there will be no variation in flow at the weir between the three scenarios and only fish pass discharge will vary.

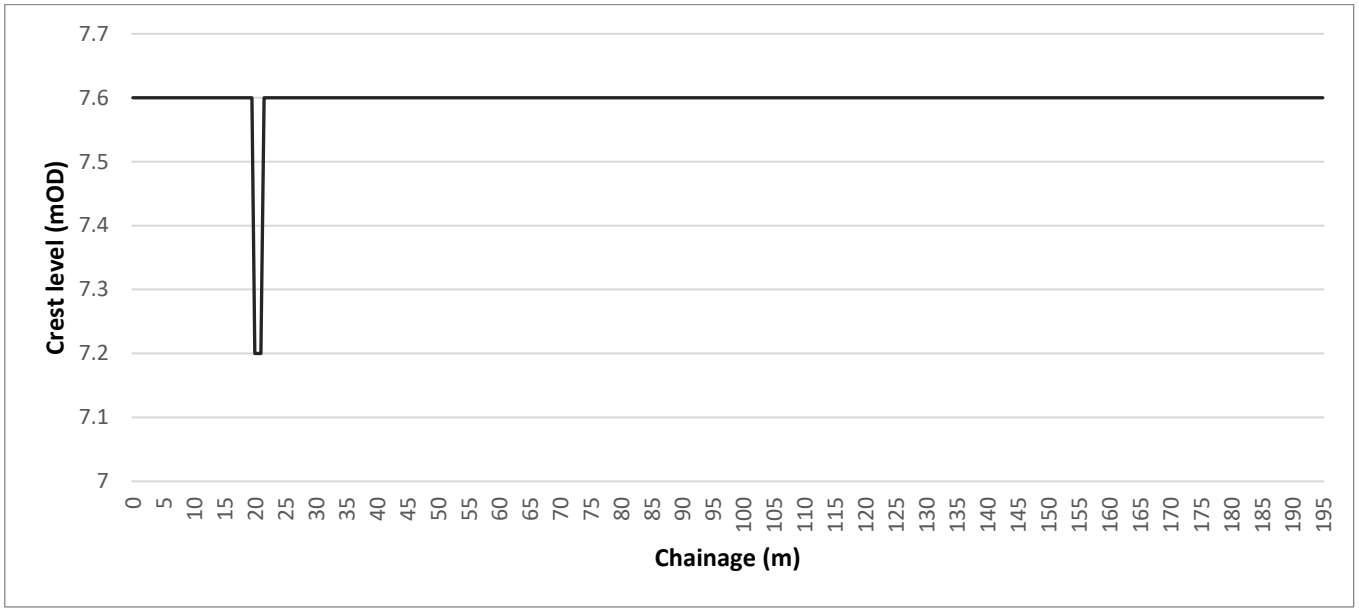
2.2. Modelled flows

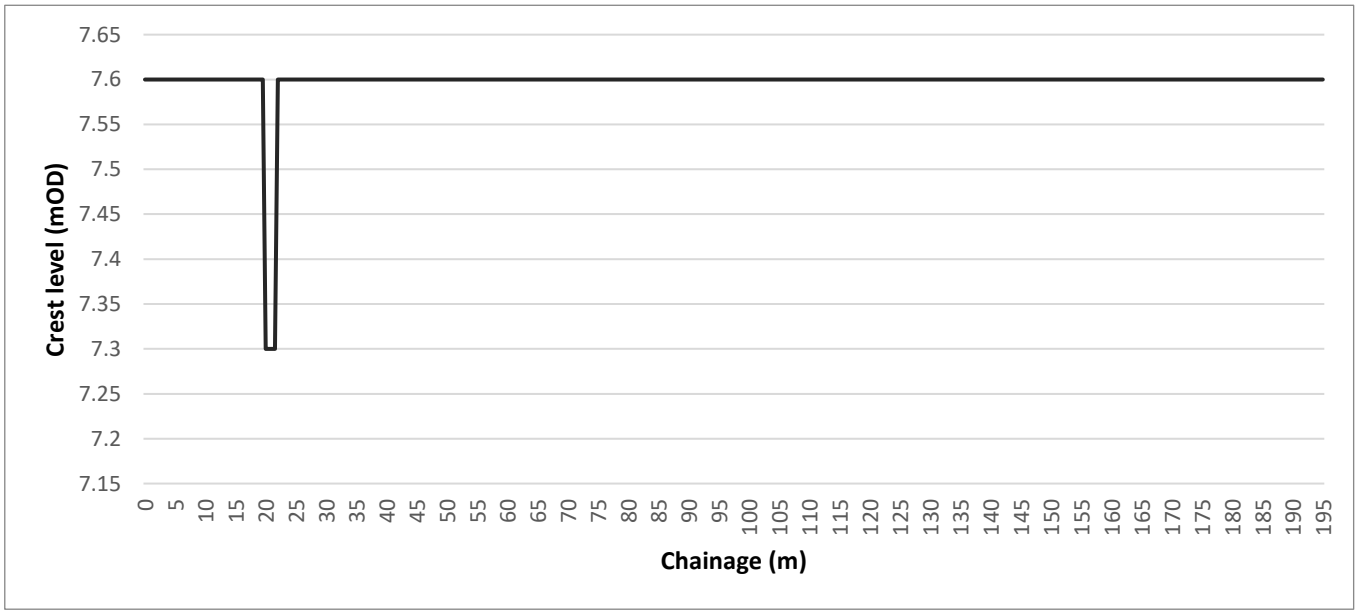
The potential impact to flood risk under scenarios 1-3 was modelled for two different flows:

a) 1 in 100-year flood event: 646.3 m^3/s

b) 1 in 100-year flood event + a 20% uplift for climate change (CC): 775.6 m^3/s

Flow estimates were obtained from On-stream Energy using gauged data from Austin's Bridge with a 12% uplift to account for minor tributaries and run-off from between Austin's Bridge to Staverton Weir.


7.7
7.6
7.5
7.4
7.3
7.2
7.1
7
Crest level (mOD)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195
Chainage (m)


7.65
7.6
7.55
7.5
7.45
7.4
7.35
7.3
7.25
7.2
7.15
Crest level (mOD)
0 5 10 15 20 25 30 35 40 45 50 55 60 65 70 75 80 85 90 95 100 105 110 115 120 125 130 135 140 145 150 155 160 165 170 175 180 185 190 195
Chainage (m)

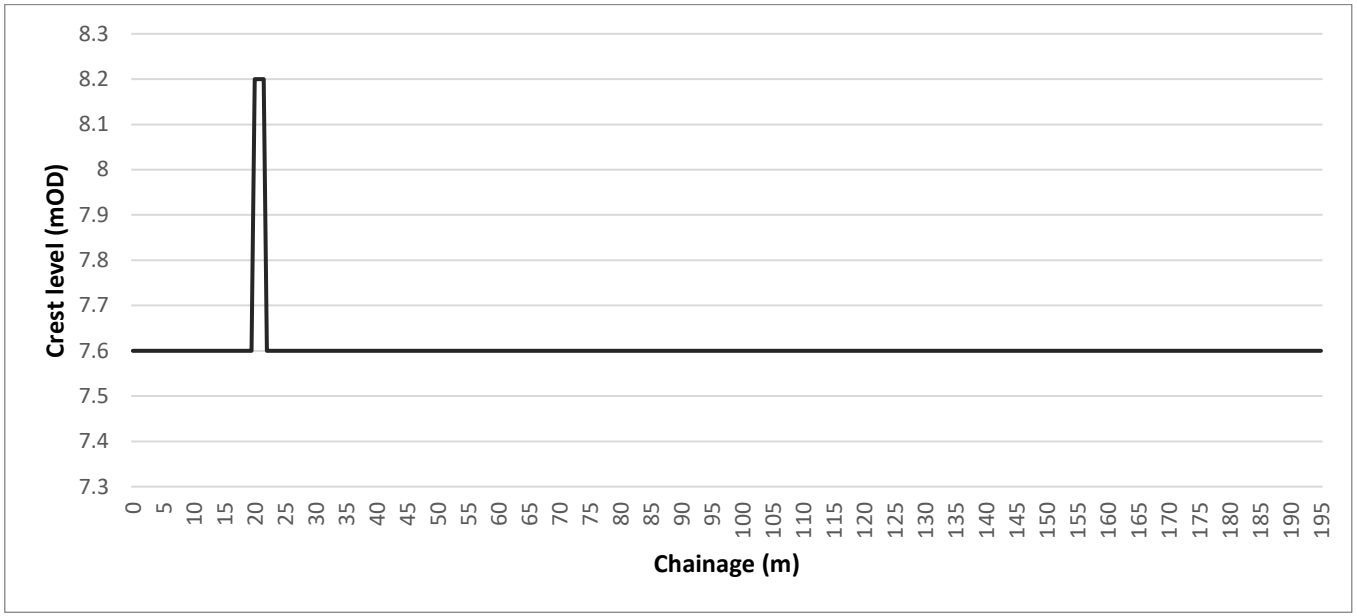


Figure 2-1 The three weir profiles inputted into the model - Baseline with existing 1.5 m wide fish pass notch (top), post flowing with a free-flowing 1.8 m wide Larinier (middle) and post blocked with a 1.8 m wide Larinier within a 0.9 m high channel that is fully blocked (bottom).

3. RESULTS

The model outputs for the *baseline, post flowing* and *post blocked* scenarios during a 1 in 100-year flood event are given in Table 3-1. The *post flowing* and *post blocked* scenarios result in a 4 mm reduction and 1 mm increase in water level respectively compared to the baseline scenario.

Table 3-1 Model output for a 1 in 100-year flood event under the three different weir configurations.

Scenario	Water elevation (m OD)	Variation from baseline
Baseline	9.160	0 mm
Post flowing	9.156	- 4 mm
Post blocked	9.161	+1 mm

The model outputs for the *baseline, post flowing* and *post blocked* scenarios during a 1 in 100-year+CC flood event are given in Table 3-1. The *post flowing* and *post blocked* scenario result in a 3 mm reduction and 1 mm increase in water level respectively compared to the baseline scenario.

Table 3-2 Model output for a 1 in 100-year + CC flood event under the three different weir configurations.

Scenario	Water elevation (m OD)	Variation from baseline
Baseline	9.361	0 mm
Post flowing	9.358	- 3 mm
Post blocked	9.362	+ 1mm

4. CONCLUSIONS

Under the worst-case scenario, the model predicts a 1 mm increase in water levels for the 1 in 100 year and 1 in 100 year+CC flood events. In reality this is unlikely to happen as even when blocked the fish pass will discharge some flow. Under the *post flowing* scenario there is a reduction in flood risk for both the 1 in 100 year and 1 in 100 year+CC flood events.

The hydro scheme has no impact on flood risk at the weir, as under all flooding scenarios the sluice gates will be closed preventing flow down the leat. As such it can be concluded that the proposed Staverton hydropower scheme would have no impact on flood risk at the site.