Cyfoeth Naturiol Cymru
Natural Resources Wales

Water Resources
LICENCE TO
ABSTRACT
WATER

Environment Act 1995
Water Resources Act 1991 as amended by the Water Act 2003
Water Resources (Abstraction and Impounding) Regulations 2006
Natural Resources Body for Wales (Functions) Order 2012

IMPORTANT NOTES

Need for safekeeping

This licence is an important document. The permission or right to abstract water may be valuable to your landholding. So -

- **Keep the licence safe, preferably with your deeds etc.**
- **Take careful note of the comments below about "transfer and apportionment" and "death and bankruptcy".**

This is to ensure that the permission and any rights granted by the licence continue if you need to pass it on to someone else.

If you want to:

- **revoke (cancel) the licence;**
- **vary (change/amend) the licence in any way or**
- **change your contact address (but you continue to hold the licence).**

Please write to us at your local Natural Resources Wales office.

Details of this licence are placed on a register, kept by Natural Resources Wales and open for inspection by the public. The public may also obtain further details about it by virtue of the Environmental Information Information Regulations 2004 (see also Disclosure of Information) except in special cases (for advice please contact us at the address shown on the front page of the licence).

Transfer and apportionment

If you need to pass this licence or any part of it to someone else, you must contact Natural Resources Wales and obtain the appropriate application forms. Temporary licences cannot be transferred or apportioned. The licence holder remains responsible for compliance with the terms of the licence and any charges payable until the licence has been transferred or apportioned.

Death or bankruptcy of the licence holder

If a licence has been **'vested'** in you, as a result of the death or bankruptcy of the licence holder, please contact Natural Resources Wales in writing, telling us the licence number(s) and the date that the licence vested in you as a personal representative or trustee of the licence holder. This is necessary in order to enable you to subsequently transfer the licence.

'Vesting' is the transfer of responsibility and ownership of a licence when an existing licence holder is no longer able to hold the licence either through death or bankruptcy.

You do not have to complete a form, but you must notify us in writing within 15 months of the date of vesting, giving the full names of all personal representatives or trustees and a contact address.

Time limits

Your licence may be subject to a time limit (stated on the front of your licence). All new abstraction licences are legally required to include a time limit. For variations to licences, time limits are added in accordance with our policy.

The duration of a time limit is determined in accordance with our time limiting policy. The time limit is linked to the next or subsequent review of water resources within a Catchment Abstraction Management Strategy (CAMS).

There will be a presumption of renewal providing three tests are met: environmental sustainability is not in question; there is continued justification of need; and water is being used efficiently. Any application for renewal will still be subject to the normal statutory considerations.

If your licence is time limited and you wish to renew it when it expires, you will need to apply for a new licence to replace the existing one. You are advised to submit this application at least three months before it expires. To allow you to give early consideration to this, we will send you a reminder approximately 18 months before the expiry date.

If your licence cannot be renewed, we will endeavour to give at least six years notice. We will also endeavour to give at least six years notice where the licence is likely to be renewed on different terms and will significantly impact upon the use of the licence.

In exceptional circumstances, for example where there are other overriding statutory duties such as the Habitats Regulations, it may not be possible to provide six years notice.

Charges

Unless specifically exempted, we may levy an annual CHARGE for water AUTHORISED to be abstracted by this licence, in accordance with our abstraction charges scheme in force at the time.

The licence may be revoked if charges are not paid.

Quantity and quality of water

You must not abstract more than the quantity specified in the licence.

Natural Resources Wales does not, by issue of this licence or otherwise, in any way guarantee that the source of supply will produce the quantity of water authorised to be abstracted by this licence, nor that the water is fit for its intended use.

The quantity of water authorised for abstraction is given in cubic metres. One cubic metre is approximately 220 gallons.

(The precise conversion is 1 cubic metres = 219.969 gallons).

Source of supply and authorised point of abstraction

You may abstract from the point(s) specified in the licence and from no other points. If you want to add or change the authorised point(s) of abstraction, you must apply to us to vary the licence.

Land on which water is authorised to be used

Where this condition applies, you may only use the water you abstract on the area specified in the licence. You must apply to us to vary the licence if you wish to extend or alter this area or remove it.

Purpose for which water is authorised to be used

You may only use the water for the purpose(s) specified in the licence. You must apply to us to vary the licence if you wish to add to or change the purpose(s).

Offences

Under the Water Resources Act 1991 it is an offence:-

- to abstract water, or cause or permit any other person to abstract water, unless the abstraction is authorised by and in accordance with an abstraction licence, or is subject to an exemption;
- to do anything to enable abstraction, or to increase abstraction, except in accordance with an abstraction licence or exemption;
- to fail to comply with the conditions of an abstraction licence. **Note in particular that it may be a condition of the licence to maintain the meter or other measuring device etc. and failure to do so will be an offence;**
- to interfere with a meter or other device which measures quantities of water abstracted so as to prevent it from measuring correctly;
- to fail to provide information which we have reasonably required for the purpose of carrying out any of the Natural Resources Wales water resources functions;
- to knowingly make false statements for the purpose of obtaining a licence or consent or in giving required information.

The requirement for a licence is subject to some exemptions, set out in the Water Resources Act 1991 as amended. If in any doubt as to whether you need a licence, contact us at the address shown at the bottom of the front page of the licence.

Right of appeal

If you are dissatisfied with our decision on your licence application, you may appeal.

If you are in England, you should write to the Secretary of State for the Environment, Food and Rural Affairs, care of The Planning Inspectorate at:
Room 4/19 Eagle Wing,
Temple Quay House,
2 The Square,
Temple Quay,
Bristol,
BS1 6PN.

If you are in Wales, you should write to Welsh Government care of
The Planning Inspectorate at:
Crown Buildings,
Cathays Park,
Cardiff,
CF10 3NQ.

You must serve notice of appeal within 28 days of the date of receipt of this licence (although the Secretary of State and The Welsh Government have power to allow a longer period for serving notice of appeal). See Water Resources Act 1991, section 43.

Disclosure of information

Information about this licence is available in the public Register held by Natural Resources Wales. Members of the public are also entitled to ask us for other "environmental information" it holds, including any activities likely to affect "the state of any water" or any "activities or other measures designed to protect it". That would include the information additional to the licence document e.g. any related agreement or abstraction returns. In certain restricted circumstances it is possible to claim that information should be kept confidential. If you require more information about keeping this information off the public register because it is confidential, please contact us by writing to the address shown on the front page of the licence within 28 days of receiving this licence.

Licence serial number	WA/065/0001/0020/V001

Please quote the serial number in all correspondence about this licence

FULL LICENCE TO ABSTRACT WATER

The Natural Resources Body for Wales (hereafter referred to as "NRW") grants this licence to:-

Elis Llywelyn Dafydd
Dafydd Samuel Elis
Moi Elis Dafydd ("the Licence Holders")

Trading as "MED Dafydd"

4 Tai Rhos
Parc
Bala
Gwynedd
LL23 7YW

This licence authorises the Licence Holder to abstract water from the source of supply described in the Schedule of Conditions to this licence and subject to the provisions of that Schedule. The licence commences from the effective date shown below and shall remain in force until the date of expiry shown below, subject to Condition 9.9

Signed:

Ashley Lansdown
Permitting Team Leader
Permitting Service
Natural Resources Wales
Cambria House
29 Newport Road
Cardiff
CF24 0TP

Date of issue…….....02 December 2020

Date effective……02 December 2020

Date of expiry…….....31 March 2025

Date of original issue…28 September 2017

This licence should be kept safe and its existence disclosed on any sale of the property to which it relates. Please read the 'important notes' on the cover to this licence.

Note: References to "the map" are to the map which forms part of this licence.
References to "NRW" are to the Natural Resources Body for Wales or any successor body.

SCHEDULE OF CONDITIONS

1. SOURCE OF SUPPLY

1.1 Inland water (river) known as Afon Cynfal at Land near Pont yr Afon Gam, Blaenau Ffestiniog, Gwynedd.

2. POINT OF ABSTRACTION

2.1 At National Grid Reference SH 74437 41780 marked 'Point A' on the map.

3. MEANS OF ABSTRACTION

3.1 Intake works and a gravity feed pipe of an external diameter not exceeding 800 millimetres controlled by a level sensor and automated spear valve at the turbine house.

4. PURPOSE OF ABSTRACTION

4.1 Power production.

5. PERIOD OF ABSTRACTION

5.1 All year.

6. MAXIMUM QUANTITIES OF WATER TO BE ABSTRACTED

6.1 45,619.2 cubic metres per day
16,651,008 cubic metres per year
At an instantaneous rate not exceeding 528 litres per second.

Note: A day means any period of 24 consecutive hours and a year means the 12 month period beginning on 1 April and ending on 31 March.

7. MEANS OF MEASUREMENT OF WATER ABSTRACTED

7.1 (i) The Licence Holder shall determine the quantity of water abstracted by reference to the kilowatt-hours generated, as measured by a kilowatt-hours meter multiplied by the conversion factor determined using the calculation checklist attached to this licence.

(ii) The Licence Holder shall retain supporting documentation relating to details of the methodology and calculations used to convert electricity generated to the quantities abstracted and make them available to NRW on request.

8. RECORDS

8.1 (i) The Licence Holder shall record readings of the electrical output and the corresponding quantity of water abstracted at the same time each week, as determined using the calculation checklist attached to this licence or at such other intervals as may be approved by NRW in writing.

(ii) The Licence Holder shall send to NRW a copy of the records required by (i)

above within 28 days after 31 March in each year, and also within 28 days of being so requested in writing by NRW.

(iii) The Licence Holder shall keep all records for at least 6 years, and shall allow NRW to inspect them during all reasonable hours.

9. FURTHER CONDITIONS

9.1 For the purpose of this licence, references to 'hydropower scheme' shall mean all works consisting of a new reinforced concrete weir, wing walls, pre-fabricated screen with spacing no greater than 1 millimetres, sump, stilling chamber, HOF notch, plunge pool of at least 300 millimetres in depth, eel pass ramp, level sensor and 800 millimetre external diameter gravity feed penstock pipe controlled by a spear valve, a turbine and associated ancillary civil works and outfall structure.

9.2 The Licence Holder shall construct, operate and maintain the hydropower scheme in accordance with the specifications and drawings:

'CYNFAL HYDRO INTAKE LAYOUT PLAN – NRW w2235-2103, Rev P00',
'CYNFAL HYDRO INTAKE NRW PLAN & SECTION A-A + LEVELS + 'V' NOTCH DEPTH w2235-2100, Rev P00' dated 01/03/2017,
'CYNFAL HYDRO INTAKE NRW SECTION B-B, C-C & D-D + LEVELS w2235-2101, Rev P00' dated 01/03/2017,
'CYNFAL HYDRO OUTFALL – NRW w2235-2102, Rev P00' dated 01/03/2017, and
'Photomontage and micrositing image the proposed intake structure looking upstream'

copies of which are appended to this licence, or such minor amendments to those documents that are accepted in writing by NRW prior to the date of commencement of construction.

9.3 The Licence Holder shall, as far as is reasonably practicable, ensure that no water flows through the turbine if the Licence Holder is unable to generate power.

9.4 The Licence Holder shall return all of the water abstracted in pursuance of this licence to the Afon Cynfal at National Grid Reference SH 73520 41380 marked 'Point Q' on the map.

9.5 (i) No abstraction of water shall take place unless the rate of flow in the Afon Cynfal immediately downstream of the authorised point of abstraction, marked as 'Point A' as specified in Condition 2.1, is equal to or greater than 45 litres per second and the abstraction shall not cause the flow immediately downstream of said abstraction point to fall below that rate.

(ii) The quantity of water abstracted shall not exceed 70% of the available flow in the Afon Cynfal in excess of 45 litres per second.

9.6 No abstraction shall take place unless the Licence Holder has installed an intake screen with spacing no greater than 1 millimetre to prevent the entrapment, entrainment or impingement of fish at the point of abstraction.

9.7 The Licence Holder shall ensure that during construction works and any subsequent maintenance works to the hydropower scheme, the flow in the Afon Cynfal is allowed to pass downstream unchanged in quantity and quality at all times.

9.8 The Licence Holder shall notify NRW in writing within 7 calendar days after the abstraction of water for the purpose of power production first starts.

9.9 This licence shall cease to be of any effect if the abstraction it authorises has not commenced within 3 years of the licence issue date.

ADDITIONAL INFORMATION

Note: the following information is provided for information only. It does not form part of the licence.

REASONS FOR CONDITIONS

The licence is time-limited to a date to reflect the timing of a future review of the catchment resources availability.

Conditions 7 and 8: the Licence Holder is required to record readings of the electrical output and the corresponding quantity of water abstracted to demonstrate compliance with the conditions of this licence and to provide information on actual water usage for water planning purposes.

Conditions 9.1, 9.2 and 9.8: to ensure the hydropower scheme is constructed, operated and maintained in accordance with the drawings and specifications agreed by NRW during the determination of the licence.

Condition 9.3: to secure the proper and efficient use of water resources.

Condition 9.4: to ensure the abstraction can be classed as non-consumptive.

Conditions 9.5 and 9.7: to ensure a flow is maintained in the watercourse in order i) to maintain the riverine habitat for the conservation of the flora and fauna

Condition 9.6: to prevent the entrapment, entrainment and impingement of fish at the point of abstraction.

Condition 9.7: to ensure that the water environment is not impacted during construction and subsequent maintenance.

Condition 9.8: to start NRW's compliance process.

Condition 9.9: to secure the proper use of water resources and to avoid commitment of water resources to an abstraction right that cannot be exercised.

IMPORTANT NOTES

Impoundment licence serial number WA/065/0001/0021/V001 has been issued to facilitate the abstraction of water for the hydropower scheme authorised by this abstraction licence.

Condition 9.5: flows will be maintained and controlled by physical means through the design of the impoundment structure authorised by the above numbered licence.

For the purpose of Conditions 9.2 and 9.8, the Licence Holder shall contact:

Senior Officer
North West People and Places Team
Natural Resources Wales
Maes y Ffynnon
Penrhosgarnedd
Bangor
Gwynedd
LL57 2DW

Tel: 0300 065 3000
Email: nrp.northmid@cyfoethnaturiolcymru.gov.uk

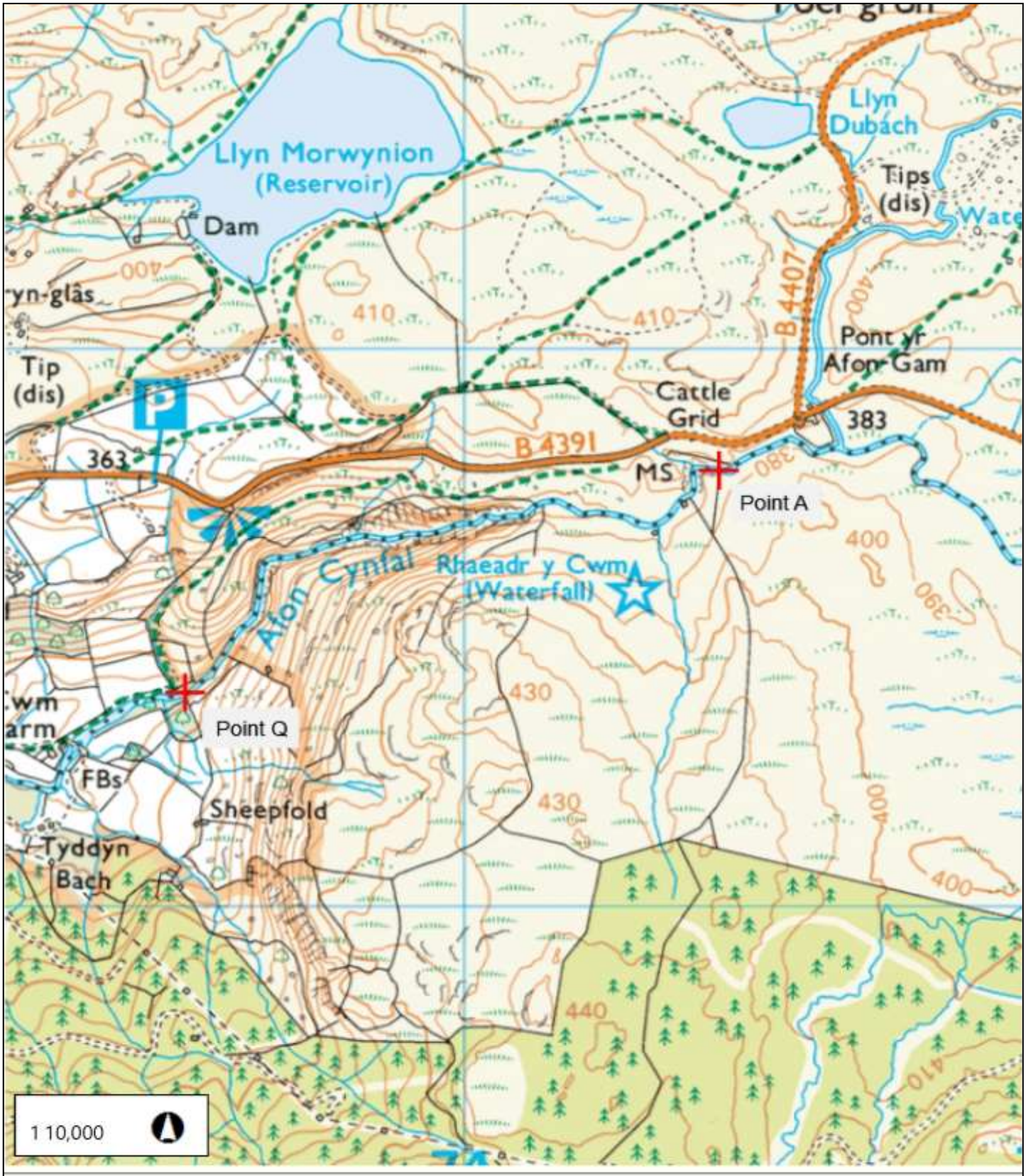
Water efficiency note
The Licence Holder should use water abstracted under the terms of this licence in an efficient manner. NRW may refer to its guidance on water efficiency (or equivalent guidance) in determining whether water is being used efficiently and may offer advice on any measures considered necessary to meet particular recommendations.

Screening
NRW will have regard to its Screening for Intakes and Outfalls: a Best Practice Guide (or equivalent guidance) in agreeing where, how and what type of fish screens should be installed and together with the results of any monitoring in determining whether the fish screens are properly effective and maintained, and in judging whether it is necessary to require repair or replacement of the fish screens.

Licence history

Licence Serial Number	Issue and Effective Date	Summary of Changes
WA/065/0001/0020	28 September 2017	Original Licence Issued
WA/065/0001/0020/V001	02 December 2020	Re-issue of licence to extend self-destruct condition.

Licence serial number	WA/065/0001/0020/V001



0.5 0 Distance / 2 0.5 Kilometers

British_National_Grid

Cyfoeth Naturiol Cymru Natural Resources Wales

MAP ACCOMPANYING LICENCE NUMBER / MAP I GYFEILIO TRWYDDED RHIF
WA/065/0001/0020/V001
Scale I Graddfa 1:10,000

N

N

EEL PASS

ESTIMATED IMPOUNDED AREA

FLOW

PLUNGE POOL

FLOW

ALL ATTEMPT TO PLACE APPROPRIATE BOULDERS TO ENSURE HOF AND FLOW OVER THE SCREENS DROP DOWN INTO THE PLUNGE POOL DOWNSTREAM OF WEIR (~300mm DEPTH)

INTAKE STRUCTURE

BURIED PIPE

PROPOSED ABSTRACTION POINT PHOTO

SCALE 1 : 100

m 1 0 10 m

NOTES

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS SHOWN OTHERWISE.
2. THE WEIR MAKES USE OF THE NATURAL STEP IN THE GROUND PROFILE, MEANING THAT THE UPSTREAM WATER LEVEL CHANGES VERY LITTLE. WEIR REPLACES EXISTING STEP IN BED LEVEL AND IS BACKFILLED WHERE NECESSARY TO ENSURE CONTINUITY/EFFECTIVE TRANSFER OF SEDIMENT THROUGH THE DEROGATED REACH TO MAINTAIN FLOW VELOCITIES THROUGH THE IMPOUNDED REACH. STRUCTURE TO BE BACKFILLED TO AVOID SCOUR AND BYPASSING AND TO RESEMBLE NATURAL FLOW CONDITIONS. WEIR ARRANGEMENT MIMICS NATURAL PROCESSES.

SITE LOCATION - ABSTRACTION POINT

GRID REFERENCE: 274437, 341780

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
P00	01-03-17	FIRST ISSUE	VJ	DRD	PMJ

SCHEME: CYNFAL HYDRO

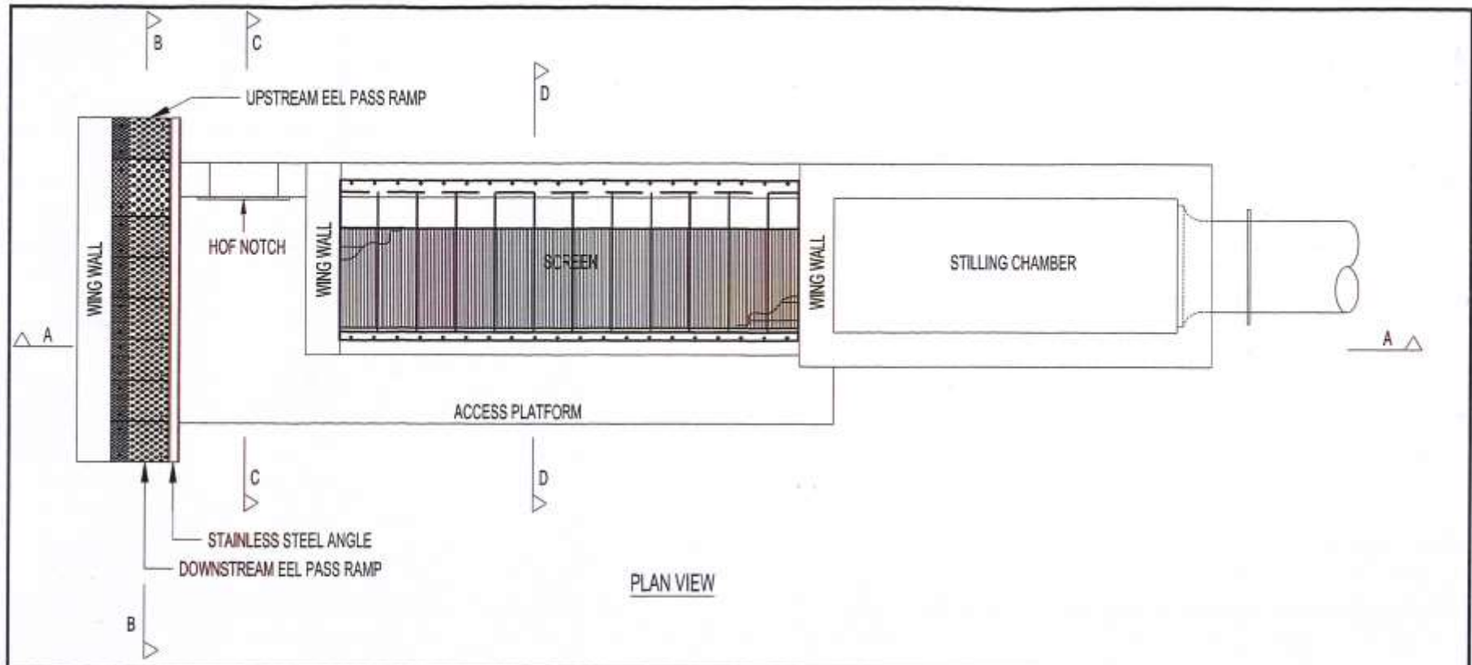
TITLE: INTAKE LAYOUT PLAN - NRW

STATUS: PRELIMINARY

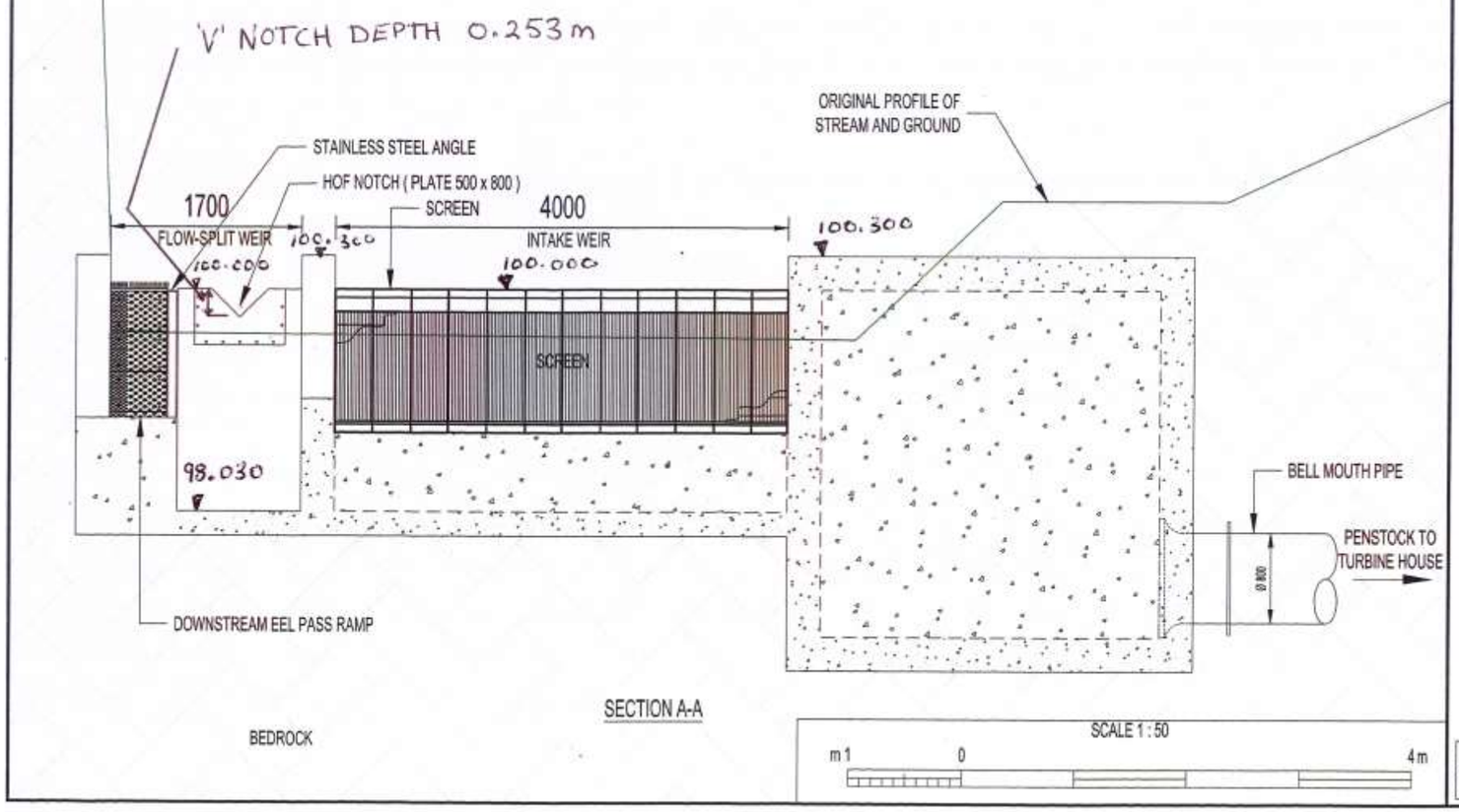
DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
VJ	DRD	PMJ	1 : 100 / A3

DRAWING NO.: w2235-2103

REV: P00



PLAN VIEW



SECTION A-A

SCALE 1 : 50

m 1 0 4 m

INTAKE SPECIFICATIONS:

- MAXIMUM ABSTRACTED FLOW RATED

  - 528 l/S

- HANDS OFF FLOW (HOF) - COMPENSATION FLOW EQUIVALENT TO Q95

  45 l/S A 'V' NOTCH (90°) IS DESIGNED TO ENSURE HOF FLOW IS LEFT IN RIVER AT ALL TIMES. BOTTOM OF 'V' NOTCH IS SITUATED 253mm BELOW CREST OF HEAD WALL. THE 'V' NOTCH IS MADE FROM STEEL PLATE AND IT CAN BE REMOVED TO CREATE A BYPASS FOR MAINTENANCE.

  'V' NOTCH IS INCLUDED IN THE RESIDUAL FLOW SPLIT PORTION SIDE OF THE WEIR AND IS FIXED TO WEIR WALL

  CALCULATION OF FLOW THROUGH V NOTCH WEIR

  $$\text{Flow through V notch} = \frac{8}{15} C_d \sqrt{2g} \tan\frac{\theta}{2} \times H^{\frac{5}{2}}$$

  CD-SHARP CRESTED WEIR COEFFICIENT = 0.593

  H-'V' NOTCH DEPTH = 0.253m

  Θ - ANGLE OF 'V' NOTCH = 90°

  $$\text{Flow through V notch} = \frac{8}{15} \times 0.593 \sqrt{2 \times 9.81} \tan\frac{90}{2} \times 0.253^{\frac{5}{2}}$$
  $$= 1.40 \times 0.253^{\frac{5}{2}} = 0.045\ m^3/s = 45\ l/s$$

- FLOW SPLIT / DIVIDE

  70% : 30% (GENERATION: RESIDUAL) ABOVE Q95 ALL YEAR (NON SEASONAL)

  FLOW SPLIT CALCULATION:

  FLOW SPLIT WEIR (INCLUDE 'V' NOTCH PLATE) (1.7m WIDTH) IS SET AT THE SAME CREST LEVEL AS THE COANDA SCREEN (4.0m WIDTH) THEREFORE THE FLOW SPLIT WILL BE THE RATIO OF THE WIDTHS:

  $$\text{Hydro flow take} = \frac{4.0}{(4.0 + 1.7)} \times 100 = 70\ \%$$

- FISH PASS UPSTREAM

  NOT REQUIRED

- FISH PASS DOWNSTREAM

  ALL ATTEMPT TO PLACE APPROPRIATE BOULDERS TO ENSURE HOF AND FLOW OVER THE SCREENS DROP DOWN INTO THE PLUNGE POOL DOWNSTREAM OF WEIR (~300mm DEPTH)

NOTES

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS SHOWN OTHERWISE.
2. FOR AVOIDANCE OF DOUBT ALL DIMENSIONS ARE APPROXIMATE AND FINAL BUILDING DIMENSIONS MAY VARY MARGINALLY AS CONDITIONS DICTATE AND DEPENDING ON FINAL MECHANICAL EQUIPMENT SELECTION.

LOCAL

CONSTRUCTION NOTES:

INTAKE STRUCTURE TO BE CONSTRUCTED OF REINFORCED CONCRETE AND WILL BE CONSTRUCTED BY CREATING SUMP, STILLING CHAMBER STRUCTURE AND THEN BOLTING ON THE PREFABRICATED SCREEN IN PLACE. THE WEIR WILL BE STONED/ SLATE FACED ON THE DOWNSTREAM EXPOSED SURFACE TO MINIMISE VISUAL IMPACT

WATER LEVEL IN SUMP STILLING CHAMBER/ TANK TO BE CONTROLLED VIA LEVEL SENSOR AND AUTOMATED SPEAR VALVE(S) AT TURBINE HOUSE. SUMP STILLING CHAMBER SIZED TO MITIGATE VORTEXING/ AIR ENTRAINMENT IN PENSTOCK. BURIED PENSTOCK OUTLET WITH A MAXIMUM PIPE DIAMETER OF 800MM.

IMPOUNDMENT CONCRETE BASE LEVEL DEPENDENT ON BEDROCK. EXCAVATION TO TAKE PLACE UNTIL FIRM, UNBROKEN GROUND IS AVAILABLE. KEYED TO BEDROCK WITH DOWELS/ROCK ANCHORS AS REQUIRED.

NOT SHOWN ON DRAWING FOR CLARITY.

- SLUICE / GATE VALVES
- ACCESS STEPS TO DOWNSTREAM SIDE OF WEIR FOR MAINTENANCE ARE NOT SHOWN ON DRAWING FOR CLARITY.
- SUMP ACCESS HATCH

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
P00	01-03-17	FIRST ISSUE	VJ	DRD	KJP

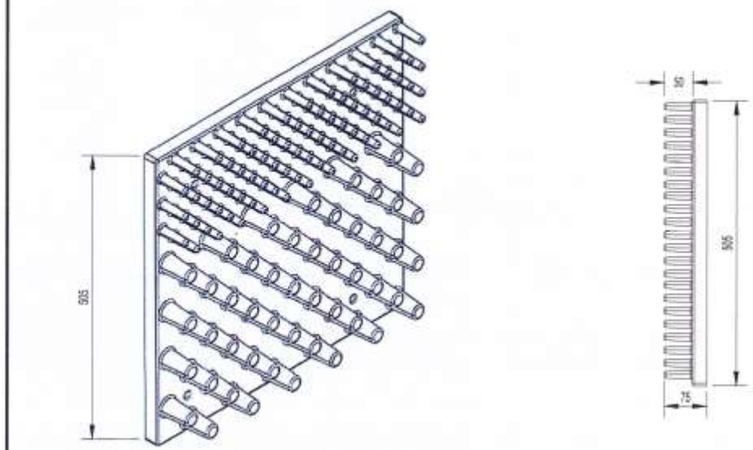
SCHEME: CYNFAL HYDRO

TITLE: INTAKE NRW
PLAN & SECTION A-A
+ LEVELS + 'V' NOTCH DEPTH

STATUS: PRELIMINARY

DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
VJ	DRD	KJP	1 : 50 / A3

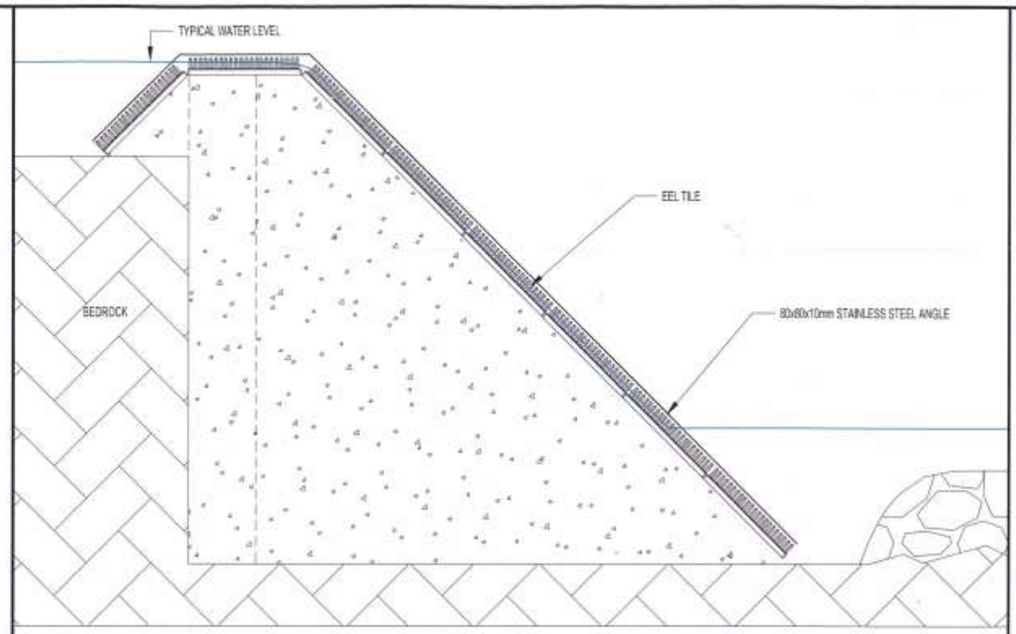
DRAWING NO. w2235-2100 REV P00



EEL TILE DETAIL

SCALE 1 : 10

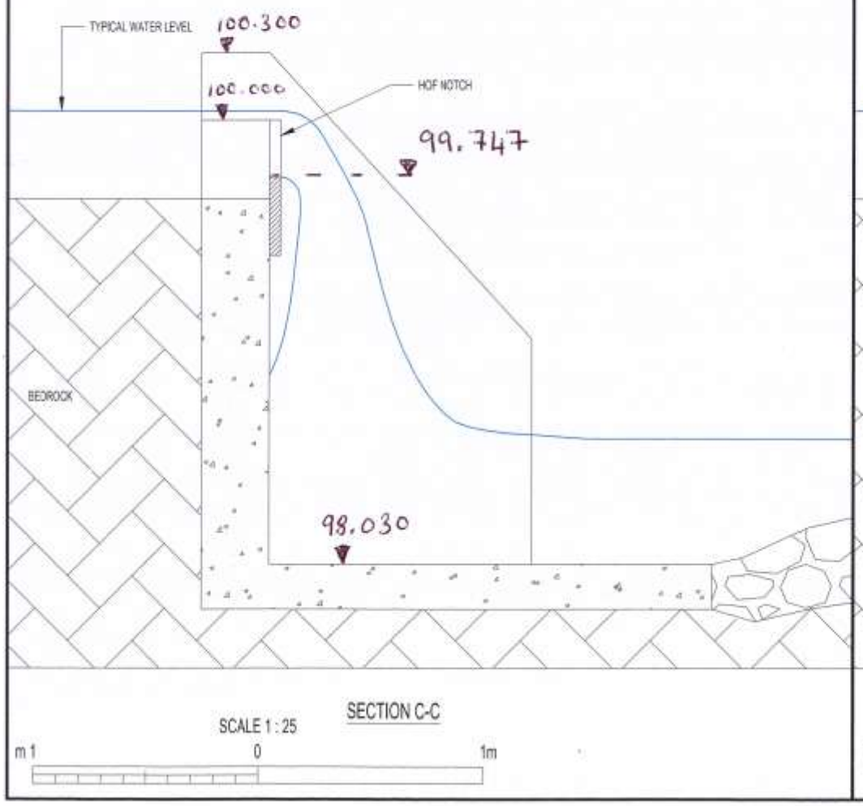
mm 100 0 1m



SECTION B-B

SCALE 1 : 25

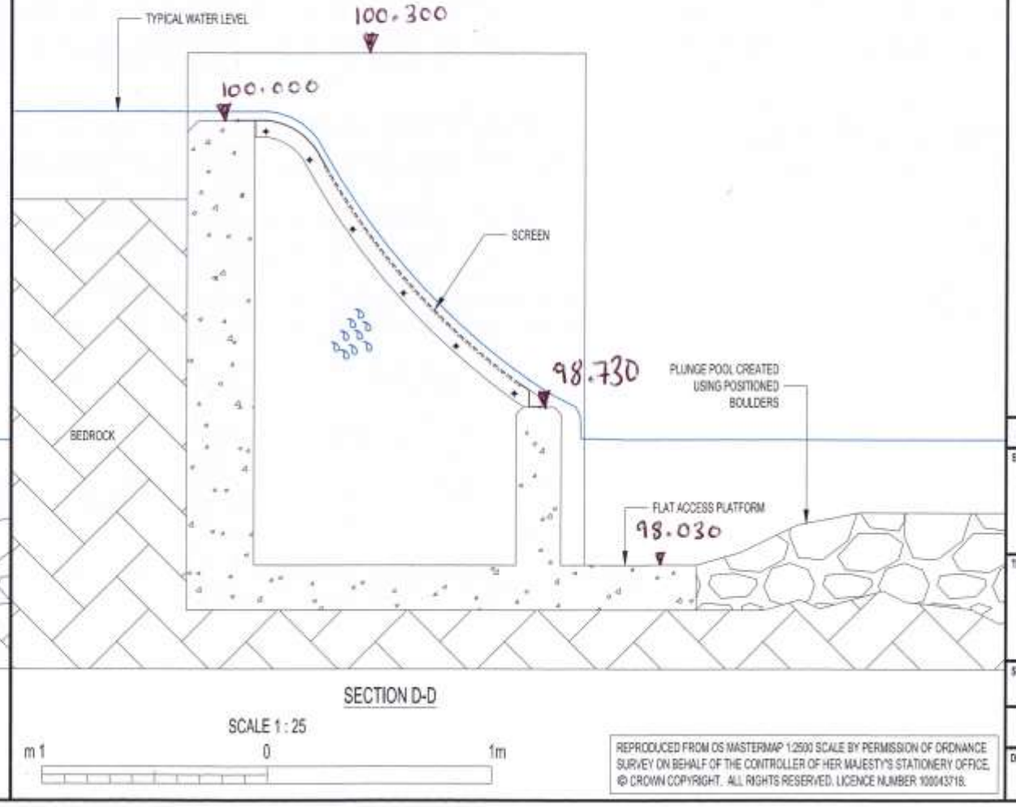
m 1 0 1m



SECTION C-C

SCALE 1 : 25

m 1 0 1m



SECTION D-D

SCALE 1 : 25

m 1 0 1m

NOTES

1. ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ~~ORDNANCE~~ LOCAL DATUM UNLESS SHOWN OTHERWISE.

TOLERANCES

FOR THE AVOIDANCE OF DOUBT ALL DIMENSIONS ARE APPROXIMATE AND FINAL BUILDING DIMENSIONS MAY VARY MARGINALLY AS CONDITIONS DICTATE AND DEPENDING ON FINAL CONSTRUCTION DESIGN.

SCREEN MANUFACTURE

AQUA SHEAR HIGH PERFORMANCE COANDA SCREENS MODEL- TYPE AB-1000 SCREEN (OR SIMILAR TYPE OF SCREEN FROM A DIFFERENT MANUFACTURER)

SCREEN SPECIFICATIONS

FLOW RATED PER SCREEN 140 L/S
SCREEN QUANTITY 4 -TYPE AB-1000 SCREEN
SCREEN AND FRAME ARE OF ONE PIECE FULLY WELDED CONSTRUCTION
SCREEN AND FRAME MADE FROM 304 STAINLESS STEEL
STANDARD SCREEN APERTURE 1.0MM
ALL MOUNTING HOLES ARE Ø13.0 MM

SCREEN INSTALLATION

COANDA SCREEN TO BE MOUNTED ON CONCRETE HEAD WALL AND FOOT WALL VIA WELDED FRAME AND STAINLESS STEEL BOLT FIXINGS. SCREEN AND FRAME TO BE SEALED TO WING WALL USING GROUT, MASTIC OR SILICONE AS APPROPRIATE.

EEL PASS

EEL TILE (505 x 505x 75mm) - MANUFACTURED / SUPPLIED BY 'BERRY AND ESCOTT ENGINEERING'. TO ACCOMODATE THE EEL TILES THE FLOW SPLIT WEIR IS RECESSED (25mm) AT WHERE THE EEL TILES ARE POSITIONED (THE MAIN BODY TOP FACE OF THE TILE IS AT THE SAME LEVEL AS THE REST OF THE SPLIT WEIR). TO ENSURE THAT THE EEL TILES ARE APPROPRIATELY WETTED A 80 x 80 x 10mm STAINLESS STEEL ANGLE IS FIXED AND SEALED NEXT TO THE EEL TILES TO CHANNEL / GUIDE THE WATER THROW THE TILES AND NOT OVER THE SIDE OF THE RAMP. THE DOWNSTREAM AND UPSTREAM EEL PASS RAMP ANGLE DEPENDING ON SITE SPECIFICS (CONFIRMED ON EXCAVATION) CAN GO TO 50° (OPTIMAL ANGLE WOULD BE 30° - 45°) THIS IS TO ENSURE THAT THE EEL TILES STARTS AT BEDROCK AND FINISH AT BEDROCK.

NOT SHOWN ON DRAWING FOR CLARITY.

- SLUICE / GATE VALVES
- ACCESS STEPS TO DOWNSTREAM SIDE OF WEIR FOR MAINTENANCE ARE NOT SHOWN ON DRAWING FOR CLARITY.
- SUMP ACCESS HATCH

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
P00	01-03-17	FIRST ISSUE	VJ	DRD	KJP

SCHEME: CYNFAL HYDRO

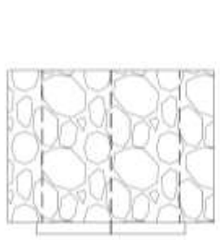
TITLE: INTAKE NRW SECTION B-B, C-C & D-D + LEVELS

STATUS: PRELIMINARY

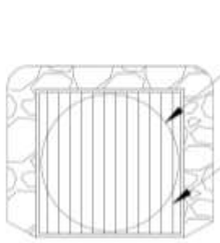
DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
VJ	DRD	KJP	As shown @ A3

DRAWING NO.: w2235-2101

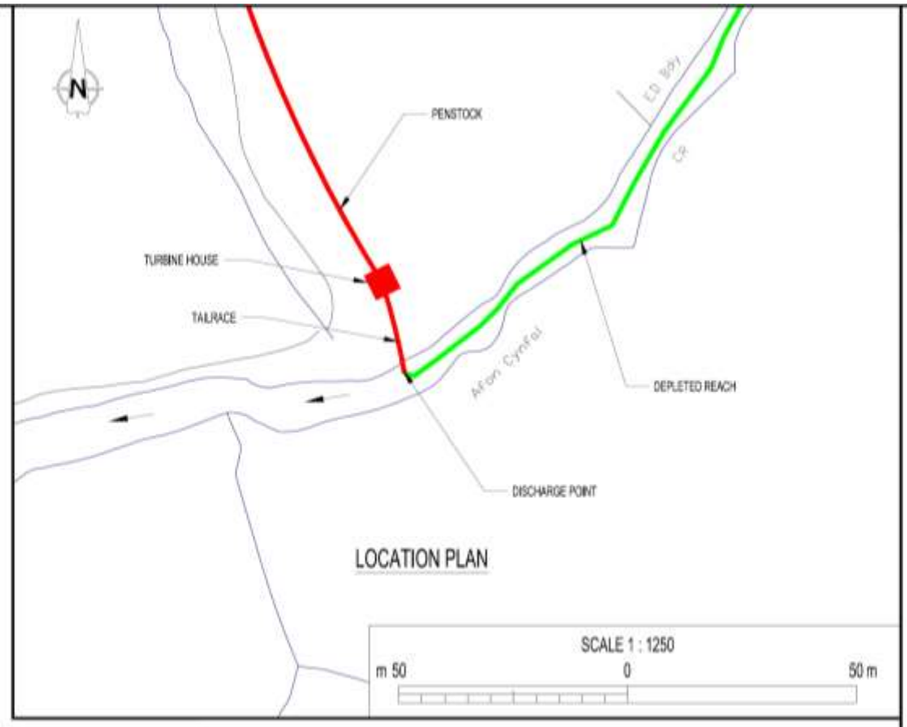
REV: P00



PLAN VIEW



FRONT ELEVATION VIEW



LOCATION PLAN

NOTES

ALL DIMENSIONS IN MILLIMETRES AND ALL LEVELS IN METRES ABOVE ORDNANCE DATUM UNLESS SHOWN OTHERWISE.

TOLERANCES

FOR THE AVOIDANCE OF DOUBT ALL DIMENSIONS ARE APPROXIMATE AND FINAL BUILDING DIMENSIONS MAY VARY MARGINALLY AS CONDITIONS DICTATE AND DEPENDING ON FINAL CONSTRUCTION DESIGN.

OUTFALL SPECIFICATIONS:

MAXIMUM DISCHARGE FLOW RATED: 528L / s

FISH SCREENING - NOT REQUIRED - AS FISH / EEL ARE UNABLE TO COME INTO CONTACT WITH TURBINE RUNNER (AIR GAP BETWEEN SUMP WATER LEVEL AND ROTATING PART OF THE TURBINE)

OUTFALL GRATE: PREVENTS ENTRANCE BY PEOPLE AND ANIMALS

DISCHARGE / TAILRACE MAXIMUM PIPE(s) DIAMETER ID: 1200mm OR MULTIPLE PIPES WITH A SIMILAR COMBINED CROSS SECTIONAL AREA. EXAMPLE : 3 PIPES AT 710mm DIAMETER. FOR CLARITY 1200mm PIPE IS SHOWN ON DRAWING.

TAILRACE CONSISTS OF A BURIED PIPE(s)EXITING POWER HOUSE BELOW GROUND LEVEL.

OUTFALL STRUCTURE TO BE CONSTRUCTED OF REINFORCED CONCRETE WILL BE STONED / SLATE FACED ON ALL EXPOSED SURFACES TO MINIMISE VISUAL IMPACT.

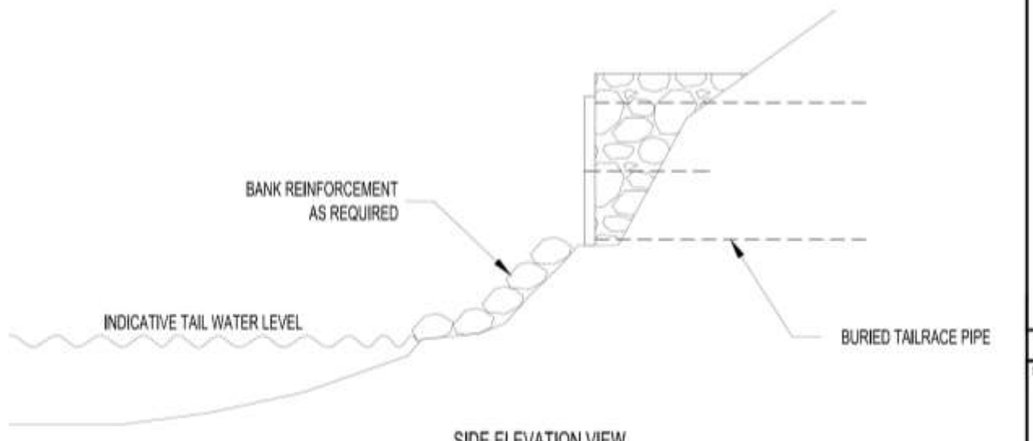
CASCADE TO BE FORMED WITH LOCALLY SOURCED BOULDERS TO PREVENT EROSION.

OUTFALL CONCRETE BASE LEVEL DEPENDENT ON BEDROCK. EXCAVATION TO TAKE PLACE UNTIL FIRM, UNBROKEN GROUND IS AVAILABLE. KEYED TO BEDROCK WITH DOWELS / ROCK ANCHORS AS REQUIRED.

SITE LOCATION / DISCHARGE POINT

GRID REFERENCE 273520, 341380

PROPOSED DISCHARGE POINT PHOTO



SIDE ELEVATION VIEW

SCALE 1 : 50

m 1 0 4 m

REV.	DATE	DESCRIPTION	DSGN'D	CHK'D	APP'D
P00	01-03-17	FIRST ISSUE	VJ	DRD	PMJ

SCHEME: CYNFAL HYDRO

TITLE: OUTFALL - NRW

STATUS: PRELIMINARY

DESIGNED	CHECKED	APPROVED	SCALE / SHEET SIZE
VJ	DRD	PMJ	AS SHOWN @ A3

DRAWING NO. w2235-2102 REV P00

Photomontage and micrositing image of the proposed intake structure looking upstream

Calculation Checklist

This checklist shall be used to record the site data and calculate the Hydro Abstraction Factor for the site (HAF_{site}) to allow conversion of electrical output to quantities abstracted. The HAF_{site} is the amount of water used in m^3 per kWhr generated for any period.

Site Data	
Site name	
Address	
Licence serial No.	
Contact name	
Contact telephone	
Contact email	
Turbine manufacturer	
Turbine type	
Turbine serial no.	
Number of jets (where relevant)	

Performance Data		
Parameter	**Value**	**How was the parameter determined?**
Net operating head of the system at maximum power output ($H_{n\ (Pmax)}$) in metres		
Turbine/water wheel efficiency at maximum power output ($e_{turbine/water\ wheel\ (Pmax)}$)		
Transmission system efficiency at maximum power output ($e_{transmission\ (Pmax)}$)		
Generator efficiency at maximum power output ($e_{generator\ (Pmax)}$)		

Calculation of overall system efficiency of the rotating parts of the hydro system, at maximum power output ($e_{system\ (Pmax)}$)

$e_{system\ (Pmax)}$ = $e_{turbine/water\ wheel\ (Pmax)}$ x $e_{transmission\ (Pmax)}$ x $e_{generator\ (Pmax)}$

= [ ] x [ ] x [ ]

$e_{system\ (Pmax)}$ = [ ]

Calculation of HAF_{site}

HAF_{site} = Hydro Abstraction Factor for the site in question

= 366.972 / ($H_{n\ (Pmax)}$ x $e_{system\ (Pmax)}$)

= 366.972 / ([ ] x [ ])

= [ ] **(m3/kWh)**

Where:

$H_{n\ (Pmax)}$ = net head at max. power.

366.972 = a constant in order to bring the final HAF into the correct unit of m3/kWhr (it is arrived at by dividing the number of seconds in an hour (3600) by gravity (9.81 m/s^2)

The volume of water abstracted for any period (**V_{period}**) can then be calculated by simply multiplying the HAF_{site} by the number of kiloWatt hours generated thus:

V_{period} (m3) = kWh_{period} (kWh) x HAF_{site} (m3/kWh)

See example:

(*kWh is a measure of energy, whilst kW is a measure of power: at full efficiency, a 50 kW*

turbine will produce 50 kWh of energy in one hour, 100 kWh in two hours, 150 kWhrs in three hours etc.).

Performance Data		
Parameter	**Value**	**How was the parameter determined?**
Net operating head of the system at maximum power output ($H_{n\ (Pmax)}$) in metres	150	Site survey
Turbine/water wheel efficiency at maximum power output ($e_{turbine/water\ wheel\ (Pmax)}$)	0.9	From manufacturer
Transmission system efficiency at maximum power output ($e_{transmission\ (Pmax)}$)	0.85	From manufacturer
Generator efficiency at maximum power output ($e_{generator\ (Pmax)}$)	0.85	From manufacturer

Calculation of overall system efficiency of the rotating parts of the hydro system, at maximum power output ($e_{system\ (Pmax)}$)

$e_{system\ (Pmax)} = e_{turbine/water\ wheel\ (Pmax)} \times e_{transmission\ (Pmax)} \times e_{generator\ (Pmax)}$

= 0.9 x 0.85 x 0.85

$e_{system\ (Pmax)}$ = 0.65

Calculation of HAF_{site}

HAF_{site} = Hydro Abstraction Factor for the site in question

= 366.972 / ($H_{n\ (Pmax)} \times e_{system\ (Pmax)}$)

= 366.972 / (150 x 0.65)

= 3.764 **(m3/kWh)**

The volume of water abstracted for any period (**V_{period}**) can then be calculated by simply multiplying the HAF_{site} by the number of kiloWatt hours generated thus:

V_{period} (m3) = kWh_{period} (kWh) x HAF_{site} (m3/kWh)

If, for example your total export of electricity for the period was 68400 kWh, then you would have abstracted a total volume of water of:

V_{period} (m3) = 68400 kWh x 3.764 m3/kWh = 257457.6 m3

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