WRH Supporting Documentation for
CRT263 Mill Turn

Documents included are:

- 7.1 CRT263_Mill Turn Location Map
- Canal & River Trust Generic Map Key
- 8.4 CRT263_Mill Turn Abstraction Details
- 8.5 CRT263_Mill Turn Evidence of Abstraction
- 13.1 CRT263_Mill Turn - Other Abstractions

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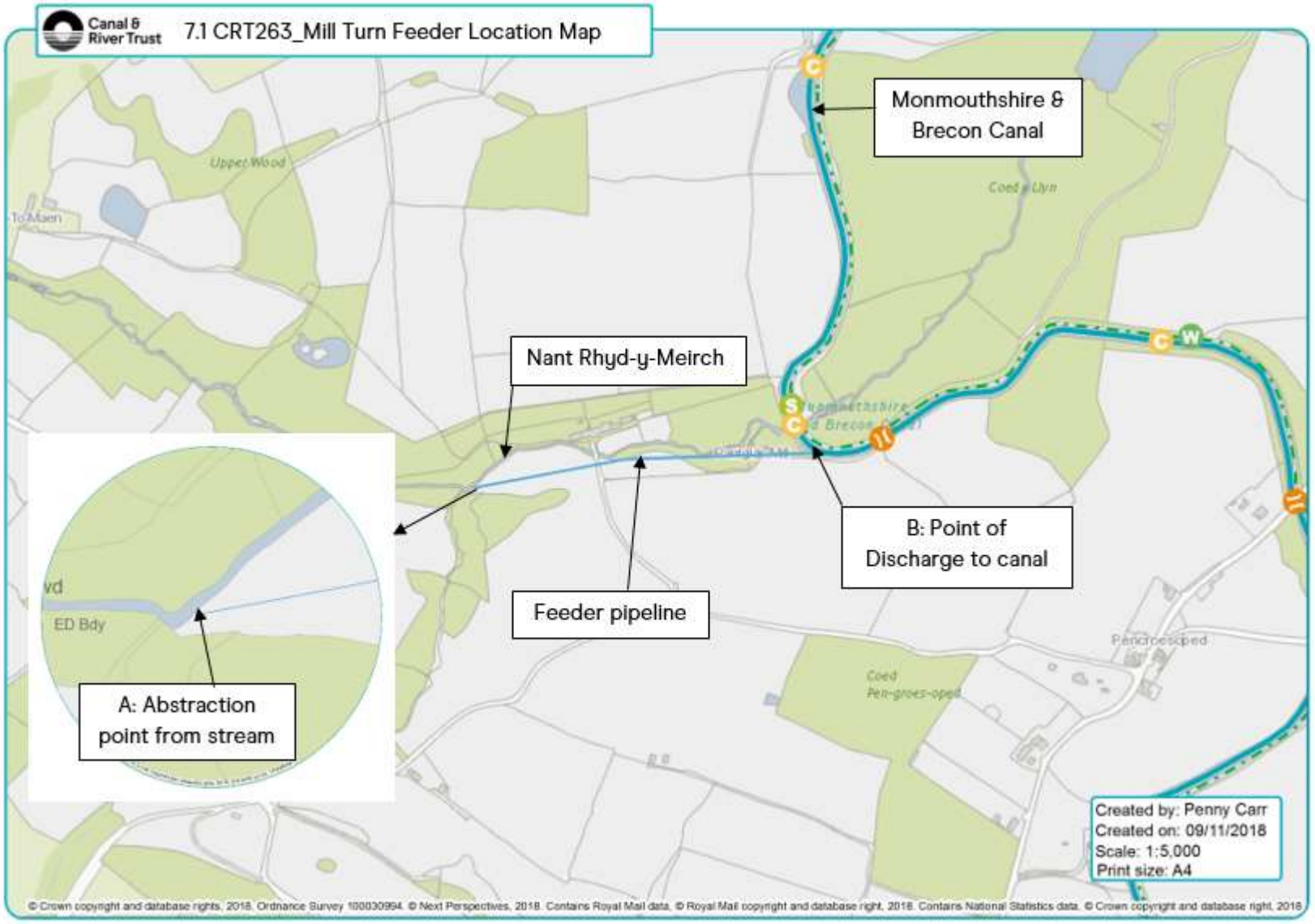
Canal & River Trust
7.1 CRT263_Mill Turn Feeder Location Map
Monmouthshire & Brecon Canal
Nant Rhyd-y-Meirch
B: Point of Discharge to canal
Feeder pipeline
A: Abstraction point from stream
ED Bdy
Upper Wood
Coed y Llyn
Coed Pen-groes-oped
Created by: Penny Carr
Created on: 09/11/2018
Scale: 1:5,000
Print size: A4
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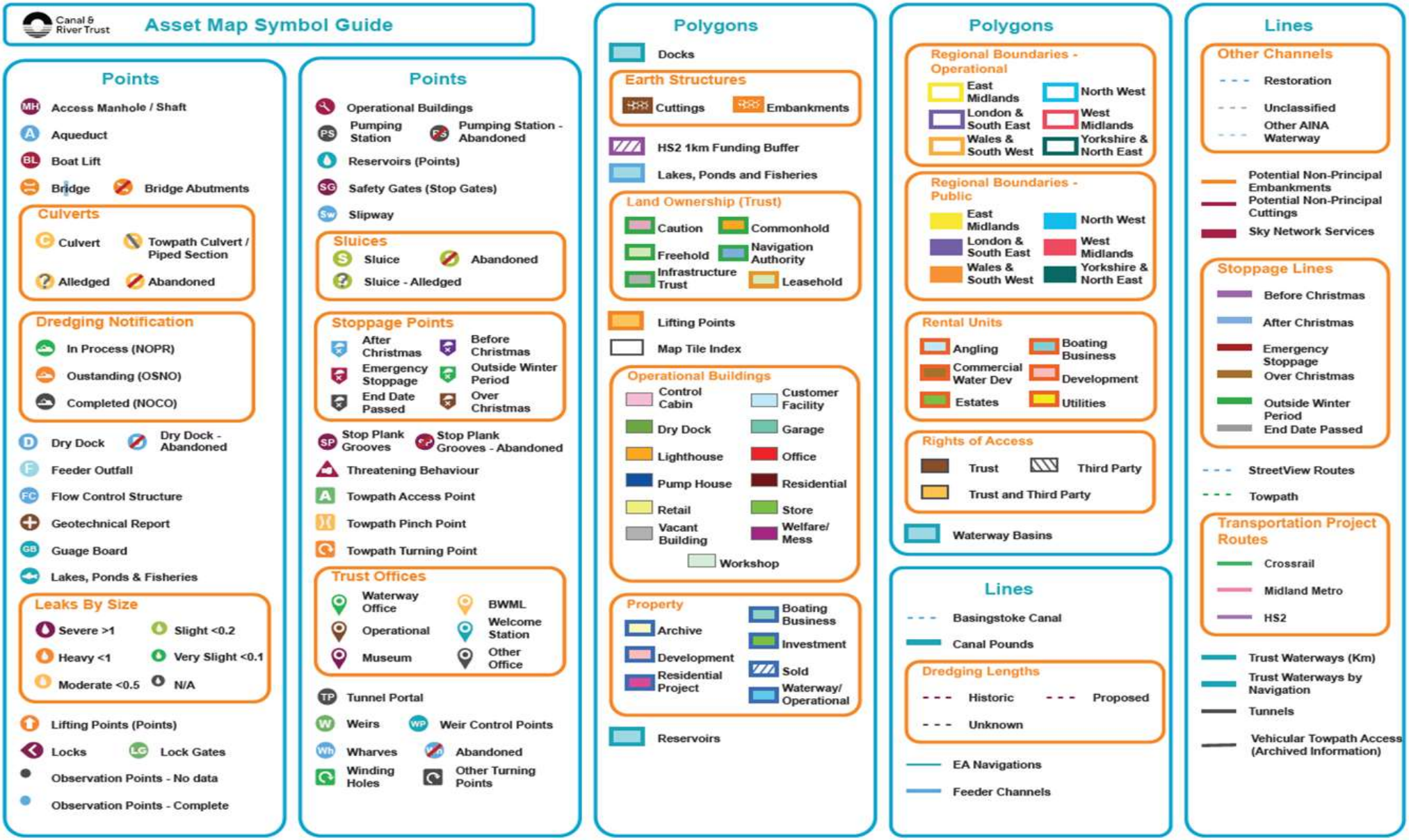
Canal & River Trust Generic Map Key:

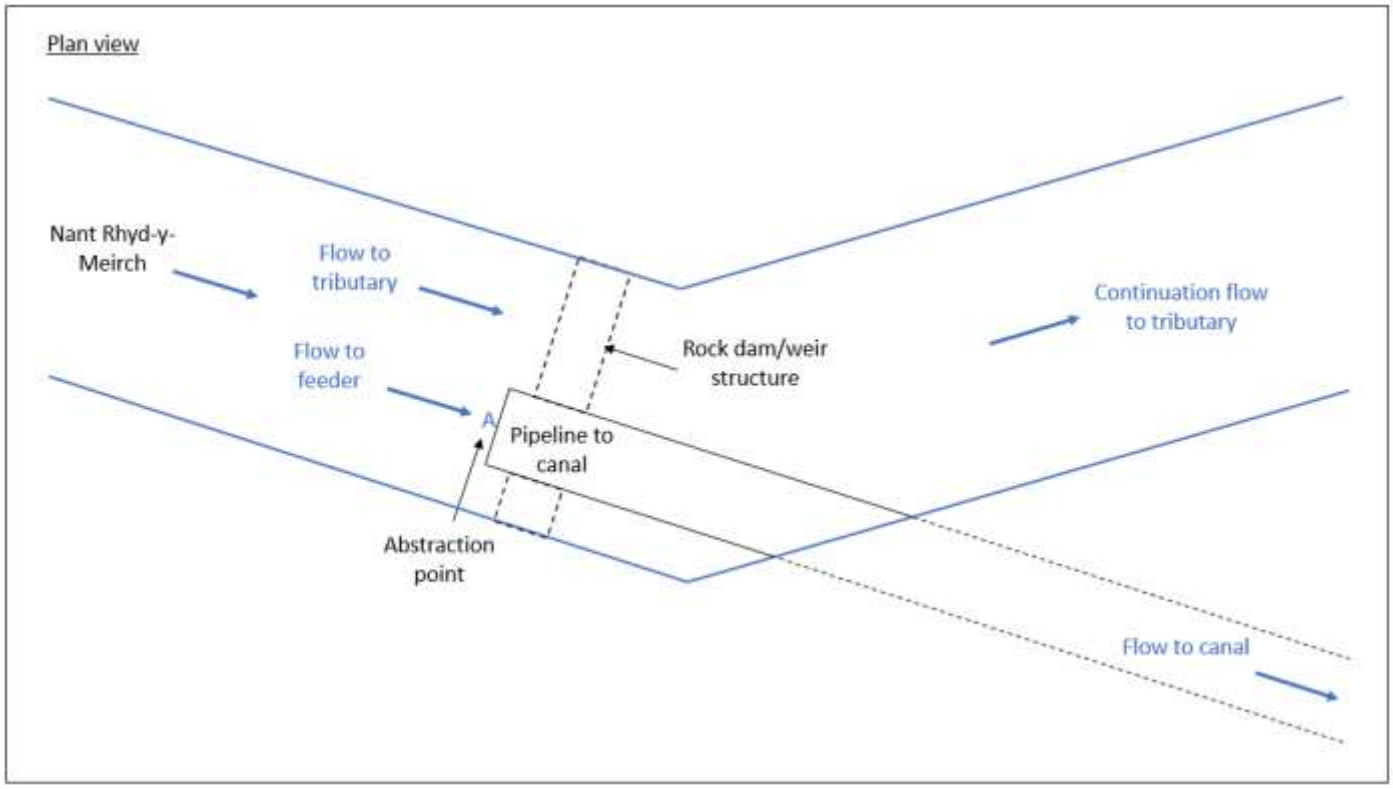


8.4 CRT263_Mill Turn Abstraction Details

General Description:

Mill Turn is a Scenario 1b feeder (as detailed in Navigation Scenario Workbook), with fixed structures. The abstraction is from Nant Rhyd-y-Meirch which is diverted into a feeder pipeline via a rock dam/weir structure. Flow continues through the pipeline for approx. 380m, before discharging to the Monmouthshire & Brecon (M&B) Canal. Please see schematic of abstraction arrangement.

Schematic of Abstraction Arrangement:



Details of the Structures:

Flow is diverted into a feeder pipeline via an approx. 3m wide rock dam/weir structure. Flow continues through a 0.300m diameter plastic pipeline for approx. 380m, before discharging by gravity to the M&B Canal. Please refer to photographic record in section 8.5 CRT263_Mill Turn Evidence of Abstraction below for photographs of the abstraction arrangement.

Means of Measurement/Assessment of Abstraction Quantities Method:

The abstraction at this location is not monitored. Abstraction quantities were therefore estimated from derived inflows at MIll Turn and the hydraulic capacities of the abstraction structures at this location.

Derived inflows at Mill Turn
Inflows at Mill Turn were derived using gauged flows from the River Senni at Pont-Hen-Hafod which were scaled *pro rata* by catchment area. The River Senni at Pont-Hen-Hafod was found to be the most hydrologically similar catchment based on review of catchment characteristics: SAAR; BFI Host; SPR Host; and URBEXT2000. Inflows were estimated using the following formula:

$$I = Q_1 \times A_2 / A_1$$

where I is the derived inflow in m^3/s, Q_1 is the gauged catchment flow in m^3/s, A_1 is the gauged catchment area in km^2 and A_2 is the catchment area of the abstraction point at Mill Turn in km^2.

Hydraulics of the abstraction structures

The capacity of the abstraction structure and derived flows through the pipe were then estimated using the following standard equations for unsubmerged inlet controlled culverts/pipes and broad crested weirs (to represent the rock dam/weir structure) as follows:

$$Q_P = \sqrt{(A^3 \times g)/T}$$

where Q_P is the culvert/pipe flow in m^3/s, A is the area of flow in m^2, g is acceleration due to gravity in m/s and T is the channel water surface width in m; and

$$Q_W = Cd \times b \times (h^{3/2})$$

where Qw is the flow over the weir in m^3/s, Cd is the coefficient of discharge, b is the breadth of the weir in m and h is the upstream head in m. See section 8.5 CRT263_Mill Turn Evidence of Abstraction below for further details.

General principles of maintaining a level on Canal & River Trust Navigations:

The purpose of water control at the Canal & River Trust (the Trust) is to keep the water level within a Normal Operating Zone (NOZ) to minimise business risks. The business risks associated with high water levels include overtopping, which could lead to canal infrastructure damage ranging from towpath surfacing to catastrophic embankment failure or breach. Low levels can lead to damage to canal lining and in cases of rapid drawdown collapse of canal bank, in addition to insufficient navigable depth which can lead to disruption and inconvenience to our customers, damage to reputation, loss of income and/or environmental/ ecological damage such as algal blooms, fish distress, kills etc. and/or impact on water sales (hands off flows, commercial agreements, intake structures exposed).

Generally, canals operate within the NOZ (Figure 8.41 below), which is a zone of tolerance around a Normal Water Level (NWL); NWL is usually determined by refining a given level based on unobstructed passage for navigation and efficient use of available resources (water and manpower).

Across the Trust's canal network, NWL may or may not be the same as 'level', 'pound datum' or 'zero' and slight variations between NWL and 'level' exist across the network i.e. in some areas NWL is equivalent to 'level', whereas in other areas 'level' maybe the bywash cill and NWL is 25 to 50mm above this to maintain a flow and level throughout the lower pounds in the canal.

The lower limit of the NOZ is generally governed by the minimal navigable depth of the section of canal in question, below NWL. Assuming pound datum and NWL are the same, then typical values of the lower limit of NOZ are in the region of - 200mm from pound datum. Depending on location, this can vary between -450mm and -100mm.

The upper limit of the NOZ is generally governed by the available freeboard of the section of canal and then subtracting a 'margin' from this. The freeboard enables the canal to have a degree of passive control, by the waste and bywash weirs (and in some areas the top beam of the lock gates), before requiring active intervention/flood control activities to avoid overtopping of the canal. In some locations on the network, the upper limits of NOZ is governed by the air draft under a bridge, i.e. the point below NWL beyond which navigational issues occur due to restricted head room.

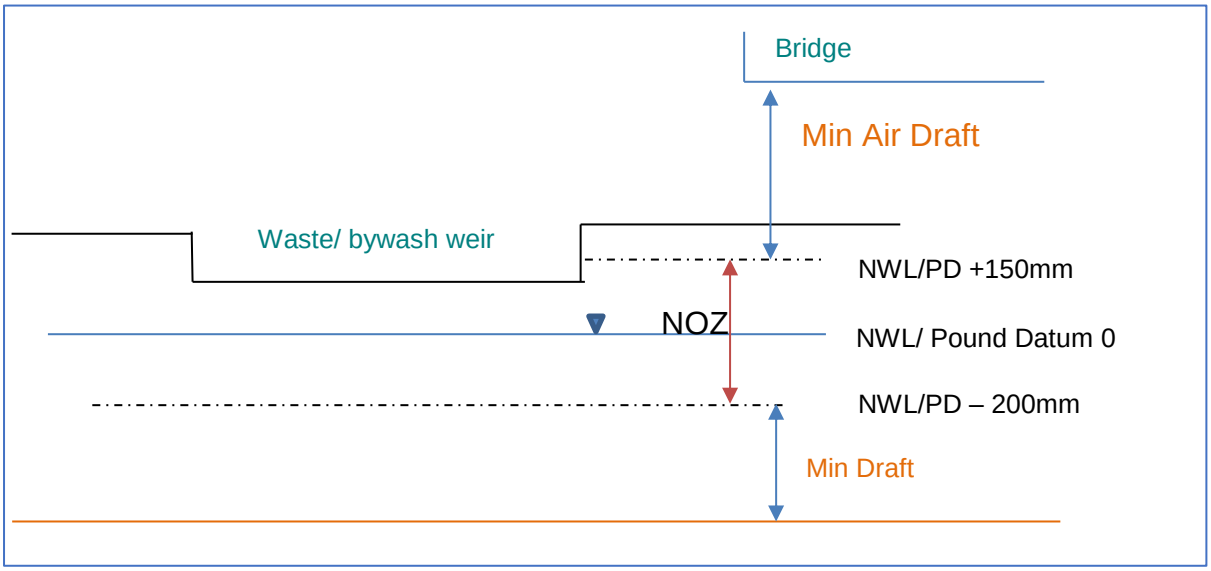


Figure 8.41: Example of Normal Operating Level on Canal & River Trust Navigations

8.5 CRT263_Mill Turn Evidence of Abstraction

Estimated Abstraction Quantities:

The abstraction at this location is not monitored. Abstraction quantities were therefore estimated from derived inflows at Mill Turn and the hydraulic capacities of the abstraction structures at this location. Figure 8.51 below shows the estimated daily mean abstraction quantities for the period 2011-2017 inclusive.

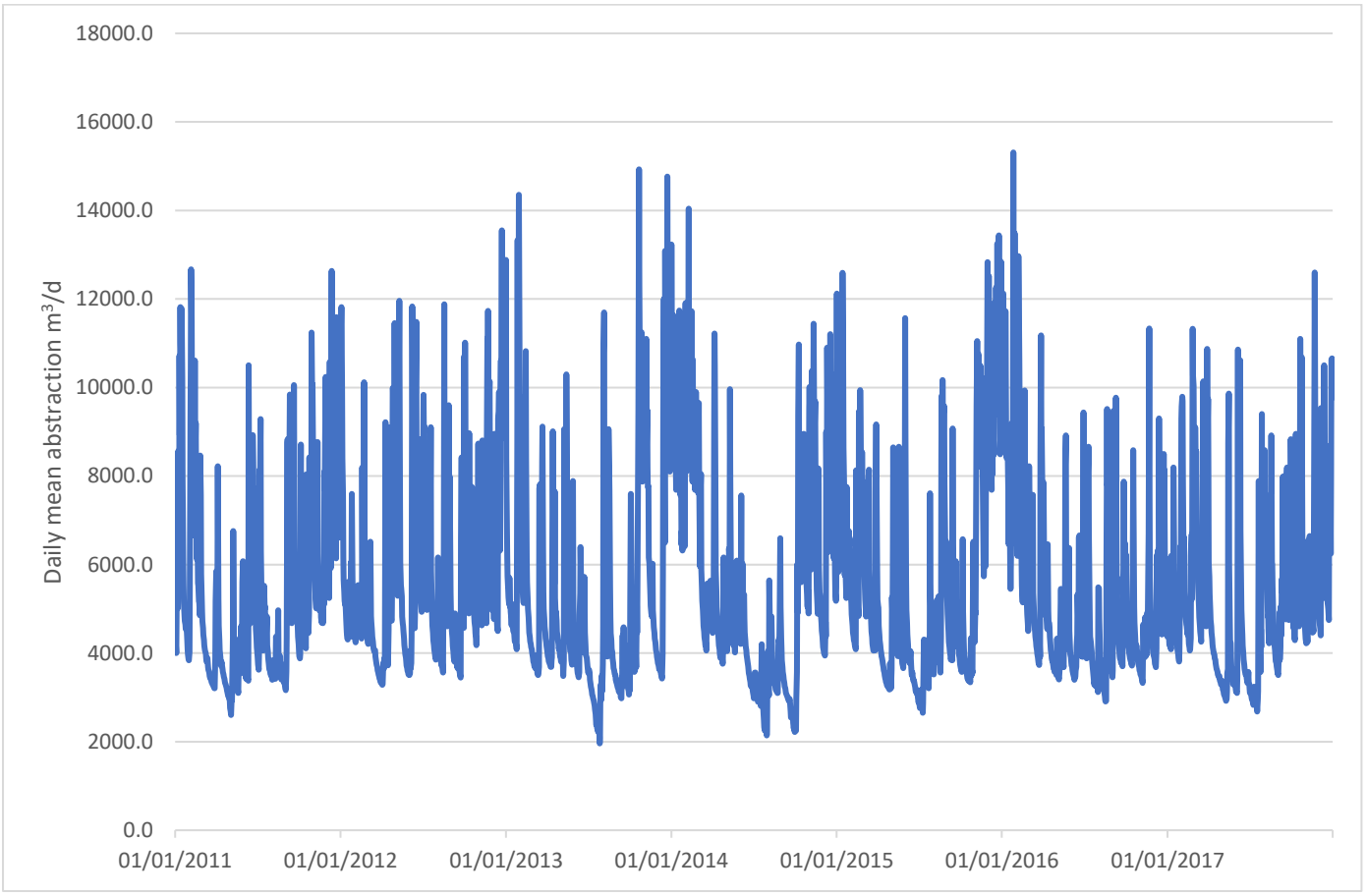


Figure 8.51 Estimated daily mean abstraction 2011-2017

Photographic Record:

Photo 1: Abstraction to pipeline 23.10.13

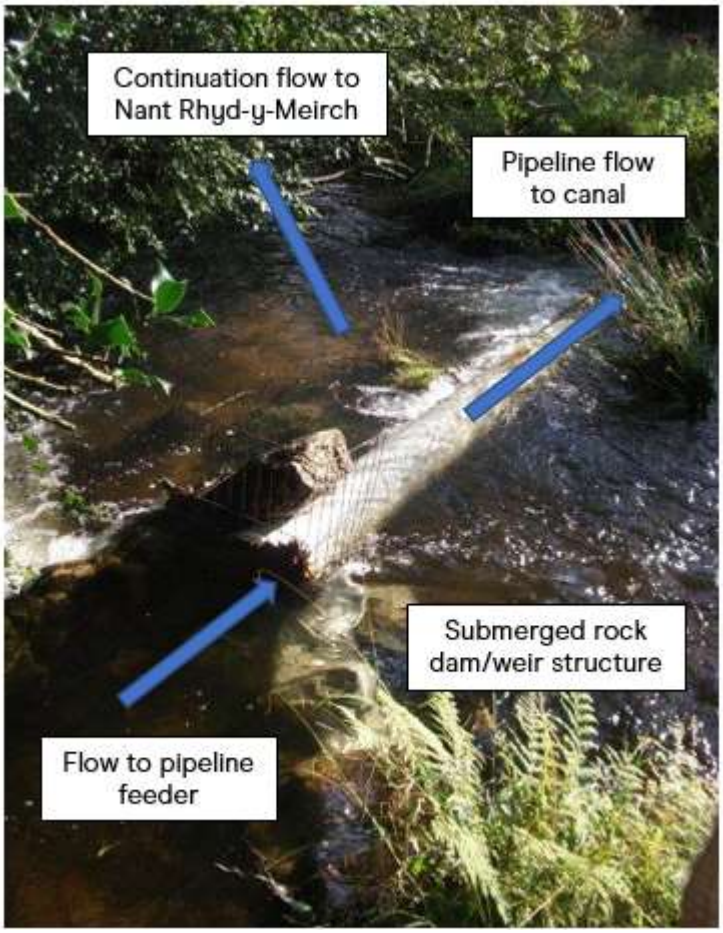
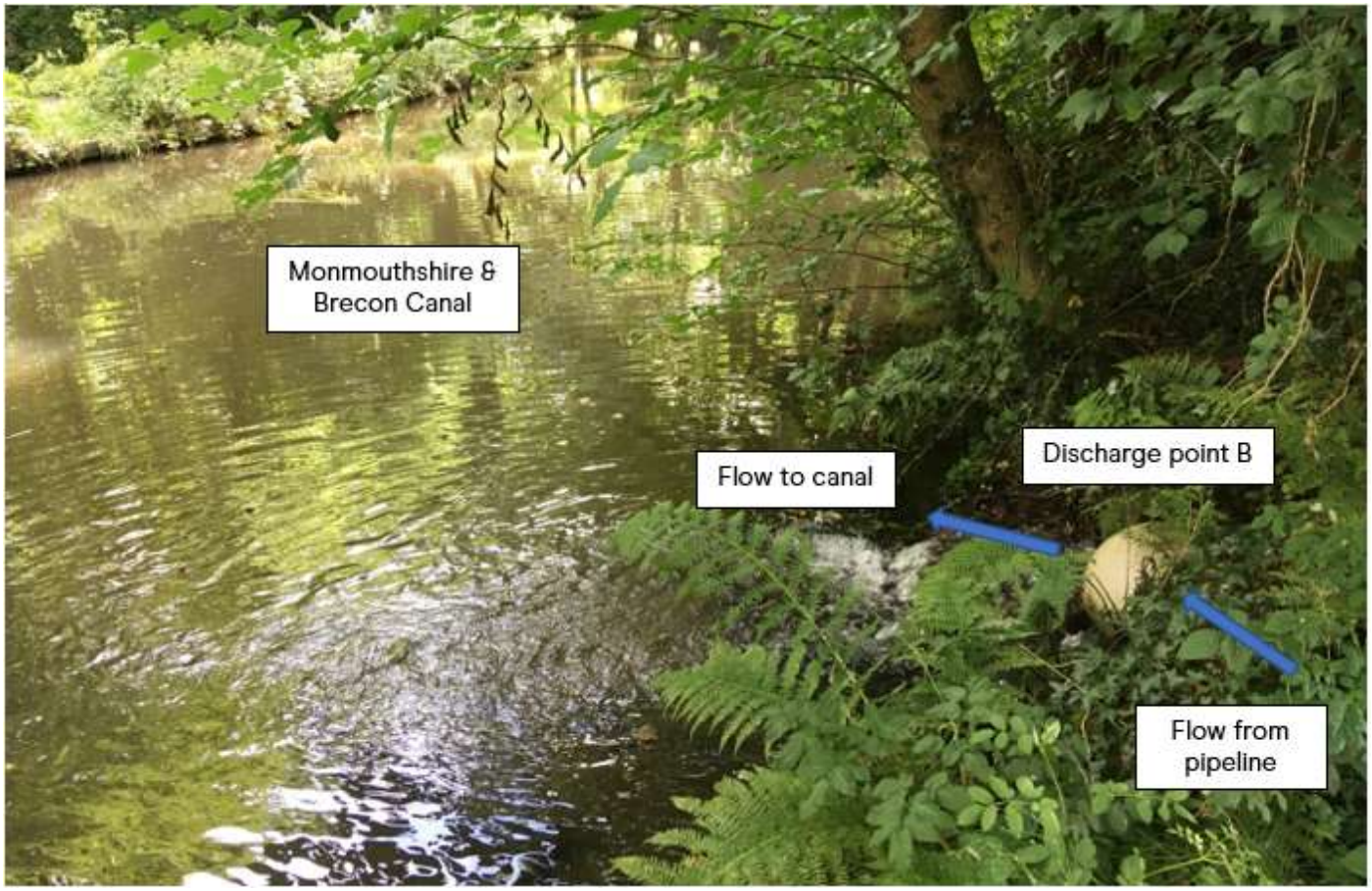


Photo 2: Current abstraction arrangement 07.08.18

Photo 3: Abstraction point A, looking upstream 07.08.18

Photo 4: Pipeline to canal, downstream of abstraction point A 17.08.11

Photo 5: Discharge point B to canal 07.08.18



13.1 CRT263_Mill Turn - Other Abstractions

Table 13.1 – Details of any other abstraction(s) (licensed or exempt) that are associated with this application					
National Grid Reference (12 digit) of where you abstract water	Source name and type	Purpose of abstraction	Where do you use the water?	When do you abstract the water	Is this a pending application, or already licensed? Please provide the application or licence number as appropriate
SO 29207 11704	Tributary of River Usk – Single point	Transfer from one source of supply to another	Monmouthshire & Brecon Canal	All year	Pending application CRT_61 Castle Turn
SO 14327 19473	Afon Crawnon – Single point	Transfer from one source of supply to another	Monmouthshire & Brecon Canal	All year	Pending application CRT91_Cwm Crawnon
SO 20844 16956	Nant Onnau-fach – Single point	Transfer from one source of supply to another	Monmouthshire & Brecon Canal	All year	Pending application CRT234_Llangattock
SO 29704 09116	Tributary of Ochram Brook – Single point	Transfer from one source of supply to another	Monmouthshire & Brecon Canal	All year	Pending application CRT276_Ochran Turn
SO 03975 28882	River Usk – Single point	Transfer from one source of supply to another	Monmouthshire & Brecon Canal	All year	Pending application CRT327_River Usk at Brecon
SO 28609 00570	Trosnant Brook – Single point	Transfer from one source of supply to another	Monmouthshire & Brecon Canal	All year	Pending application CRT438_Trosnant Spring

Mill Turn is one of seven feeders to the M&B Canal. There are six additional feeders that support navigation on the canal. These are shown in Table 13.1 above and separate applications have been submitted for each.

The River Usk and its tributaries are designated a Special Area of Conservation (SAC) under the Habitats Directive. To comply with this directive, Natural Resources Wales (NRW) have indicated that for each of these feeders, conditions will need to be applied to licences. This will most likely result in a reduction in supply to the canal, once these licences are determined and lead to the canal being closed for significant periods every year.

The Trust has therefore been working with Natural Resources Wales, together with Dwr Cymru Welsh Water and the Wye & Usk Foundation as part of the UWAG (Usk & Wye Abstraction Group), to come up with an agreed solution to secure the long-term resources to the canal. In addition to improvements to existing feeders, this solution may also include abandoning some and establishing new, alternative sources of supply.

Please note however, that this work is still ongoing and an agreed and funded solution has not yet been reached. Separate applications have therefore been submitted for each existing feeder to the M&B Canal.