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Our Ref: ESP.8599.3920

Wednesday, 14 June 2023

Salt Consultancy Ltd.
c/o Jonathan Salt
Business Development Centre
Main Avenue
Treforest Industrial Estate
Pontypridd
CF37 5UR

BY EMAIL

Dear Jonathan,

PENTWYN LAKE, CARDIFF
REVIEW OF CHANNEL CAPACITY

Following completion of instructed works at the above site, we are pleased to provide our report letter.

1. INTRODUCTION

1.1. Background

Cardiff County Council (hereafter known as the Client) are proposing renovation works to the weir on the Nant Glandulas and associated improvement works to a pipe that supplies the existing Pentwyn Lake, via an overflow inlet feature. The Earth Science Partnership Ltd (ESP), Consulting Engineers, Geologists and Environmental Scientists, were instructed by the Client via Salt Consultancy Ltd. to undertake a series of limited calculations in regard to the wier channel and pipe capacities.

We understand that the improvement works are aimed at improving the flow downstream in the Nant Glandulas, whilst not restricting the existing flow/feed to Pentwyn Lake, provided by an existing supply pipe (see Insert 2).

The scope of works allowed for is present in our emailed costing, dated 21st April and in summary allowed only for:

- Independent calculation of channel before top of weir.
- Independent calculation of overflow pipe capacity.

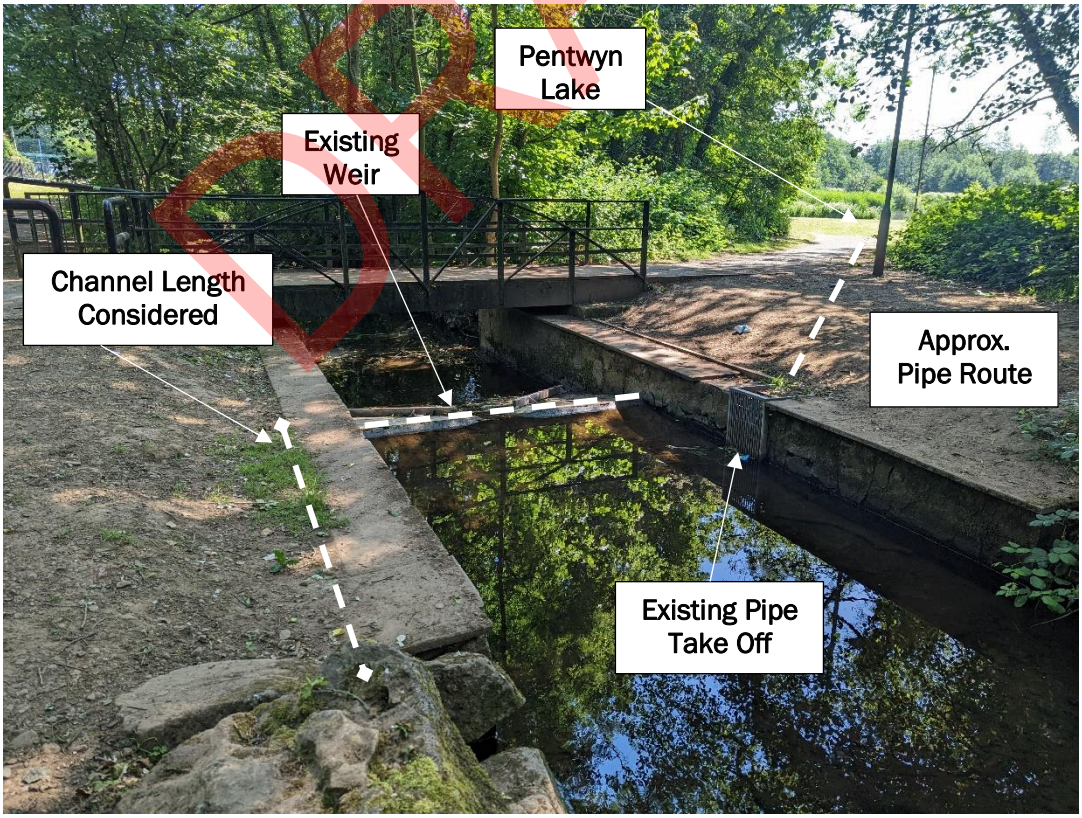
1.2. Site Setting

The site is located at Pentwyn Lake, to the rear of Pentwyn Leisure Centre, Cardiff. The National Grid Reference of the centre of the site is (ST) 320618, 180766 and the postcode for the adjacent leisure centre is CF23 7EZ. A Site Location Plan is presented as Insert 1 below.

Insert 1: Site location Plan 1:25,000 (Ordnance Survey License No.:AL100015788)

The area of assessment is shown on Insert 2 below, with the main features annotated, comprising:

- The weir.
- Existing pipe take off (150mm).
- The approximate (assumed) pipe route – no confirmation of this has been provided.
- Pentwyn Lake in the background.



Insert 2: General View Looking East (downstream) Along the Nant Glandulas

2. SITE WALKOVER

The photograph presented as Insert 2, the description of the site, and our understanding of the scheme is based on a site walkover and discussion with Jonathan Salt of Salt Consultancy on the 22nd May 2023.

An important point of note, is that ESP are only required to address the portion of the channel that is concrete lined and immediately upstream of the existing weir, measuring approximately 4m in length (see Insert 2).

3. CALCULATIONS

ESP have been instructed to simply provided calculations for three scenarios, which are summarised below and presented in Table 1.

The values presented are associated with maximum discharge capacities based on the geometry information provided to us and may not be representative of all potential events. The three sceanarios considered comprise:

- The capacity of the existing channel before the weir.
- The capacity of the same channel should a 200mm restriction be put in place.
- The capacity of the 150mm pipe currently supplying Pentwyn Lake.

Table 1: Summary of ESP Calculations

Scenario	Maximum Discharge Capacity	Comment
Existing Channel	9.09m³/sec	-
Channel with 200mm width reductions	8.40 m³/sec	Approximately equivalent to a 7.5% reduction in capacity.
Capacity of pipe at current level	0.022 m³/sec	-
Capacity of pipe once raised	0.0011 m³/sec	Reduction as lifting of pipe reduces pipe area in contact with water and associated inflow.

We trust that the above and attached is clear and provides sufficient information for your present requirements. However, should you have any queries, or require further clarification, please do not hesitate to contact us.

Yours sincerely,

Danilo Bettosi

Enc. Appendix A – ESP Calculations
Appendix B – Information Provided by Client Team
General Notes

Appendix A – ESP Calculations

Channel capacty prior to wier.

Elevation - Bottom of Channel:	10.52	mAOD
Elevation - Top Bank of Channel:	11.43	mAOD
Top of Wier:	10.99	mAOD
Water Level (prior to weir):	11.01	mAOD
Depth of Channel:	0.91	m
Width of Channel:	3.05	m
Channel material:	Smooth Concrete	
Material Coefficient of Roughness:	0.012	
Depth of water/weir:	0.49	m
Slope (DB):	0.02	
1 in	50	m

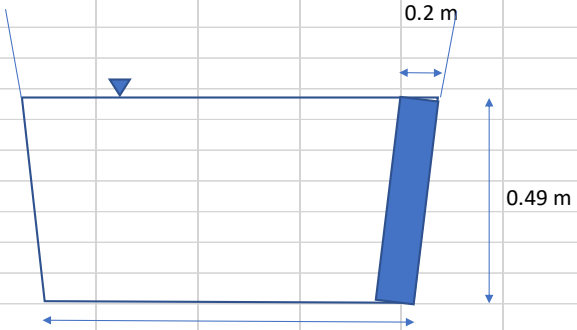
The weir results in the water filling to 10.99 AOD and the pouring over. Therefore there will be little variability in water depth.

Cross-sectional Area [A]:	1.49	m^2
Wetted Perimeter [Pw]:	4.03	m
Hydrualic Radius [Rh]:	0.371	
Velocity [V]:	6.08	m/s
Discharge Capacity [Q]:	**9.09**	**m^3/s**

Volume for 4 m of channel		
Length	4.00	m
Width	3.05	m
Depth (up to top of wier)	0.49	m
Volume (to top of wier)	**5.98**	**m^3**

Channel capacty prior to wier, after narrowing.

Elevation - Bottom of Channel:	10.52	mAOD
Elevation - Top Bank of Channel:	11.43	mAOD
Top of Wier:	10.99	mAOD
Water table (prior to Wier):	11.01	mAOD
Depth of Channel:	0.91	m
Width of Channel:	2.85	m
Channel material:	Smooth Concrete	
Material Coefficient of Roughness:	0.012	
Depth of water/weir:	0.49	m
Slope (DB):	0.02	
1 in	50	



The weir results in the water filling to 10.99 AOD and the pouring over. Therefore there will be little variability in water depth.

Cross-sectional Area [A]:	1.40	m^2
Wetted Perimeter [Pw]:	3.83	m
Hydrualic Radius [Rh]:	0.365	
Velocity [V]:	6.01	m/s
Discharge Capacity [Q]:	**8.40**	**m^3/s**

Volume for 4 m of channel		
Length	4.00	m
Width	2.85	m
Depth (up to top of wier)	0.49	m
Volume (to top of wier)	**5.59**	**m^3**

Capacity of the overflow pipe connecting to the lake.

Elevation - Entry Pipe Base:	10.51	mAOD
Elevation - Entry Pipe Top:	10.66	mAOD
Diameter of Pipe:	0.15	m
Radius of Pipe:	0.075	m
Circumference of Pipe:	0.47	m
Culvert Water Level (before wier):	11.01	mAOD
Estimated distance pipe entry to exit:	40	m
Elevation - Exit Pipe Base:	9.78	mAOD
Elevation - Exit Pipe Top:	9.93	mAOD
Lake Water Level:	10.35	mAOD
Slope of Pipe:	0.018	
or 1 m in	54.8	m
Pipe is Smooth Concrete		
n:	0.012	
100% full pipe		
Cross-sectional area of pipe:	0.018	m^2
Pw:	0.47	m
Rh:	0.0375	
V:	1.26	m/s
Q:	**0.022**	**m^3/s**

In the existing set up, the pipe is full submerged.

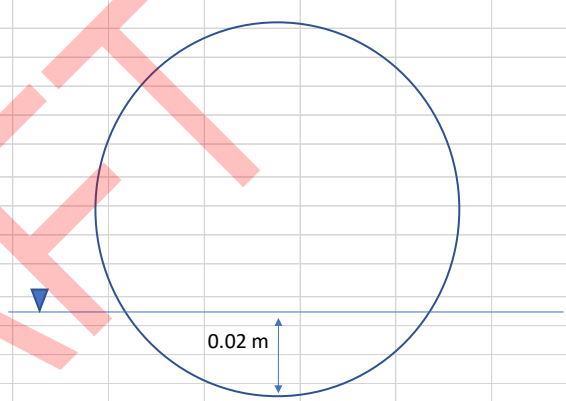
Capacity of the overflow pipe connecting to the lake, when raised.

Elevation - Entry Pipe Base:	10.99	mAOD
Elevation - Entry Pipe Top:	11.14	mAOD
Diameter of Pipe:	0.15	m
Radius of Pipe:	0.075	m
Circumference of Pipe:	0.47	m
Culvert Water Level (before wier):	11.01	mAOD
Estimated distance pipe entry to exit:	40	m
Elevation - Exit Pipe Base:	9.78	mAOD
Elevation - Exit Pipe Top:	9.93	mAOD
Lake Water Level:	10.35	mAOD
Slope of Pipe:	0.030	
or 1 m in	33.1	m
Pipe is Smooth Concrete		
n:	0.012	
100% full pipe		
Cross-sectional area of pipe:	0.018	m^2
Pw:	0.47	m
Rh:	0.0375	
V:	1.62	m/s
Q:	0.029	m^3/s

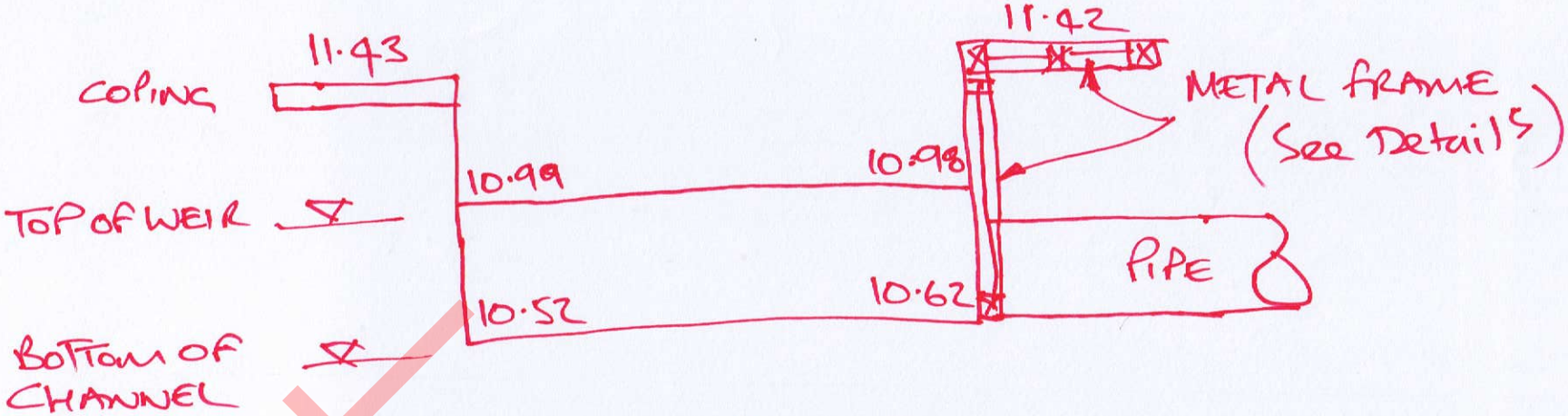
In the suggested set up the pipe will be moved so the base of the pipe is in line with the wier.
With the water level at 11.01 m AOD, the height of the water passing over th wier or into the pipe is 0.02 m.

Pipe at water height of 0.02 m		
A:	0.0014	m^2
Pw:	0.11	
Rh:	0.0125	
V:	0.78	m/s
Q:	**0.0011**	**m^3/s**

Radius (r)	0.075 m
Central angle (α)	85.67 deg
Height (h)	0.02 m
Arc length (L)	0.1121 m
Chord length (c)	0.102 m
Segment area (A)	0.0014 m^2

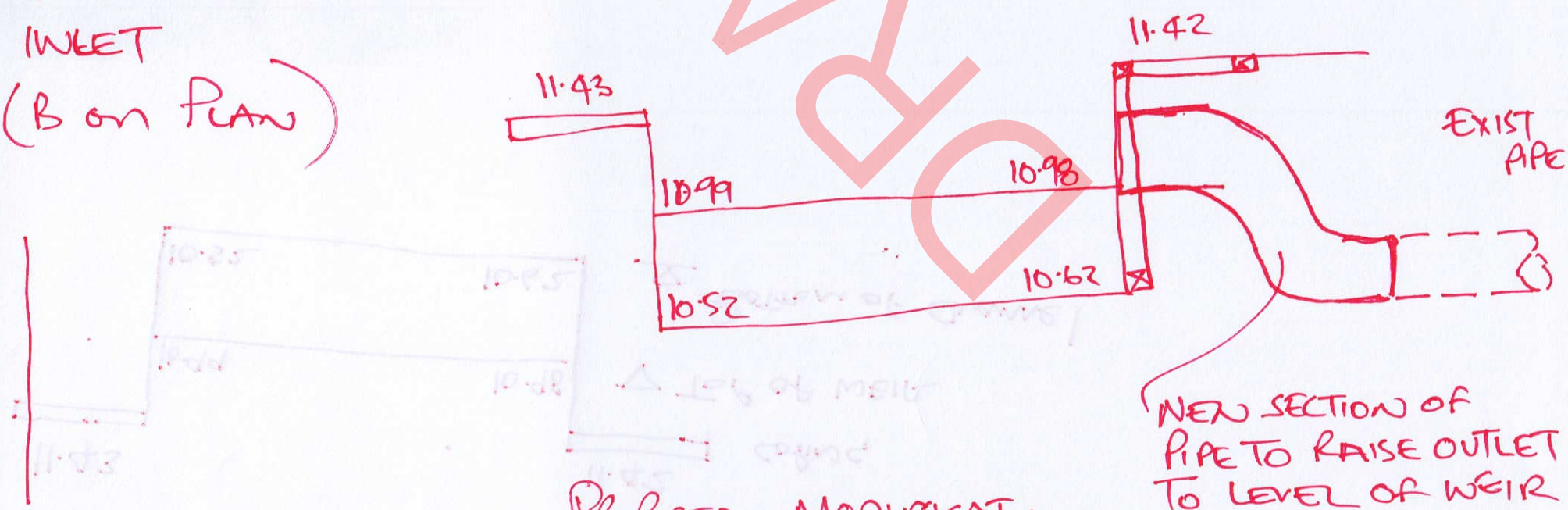


Appendix B – Client Supplied Information



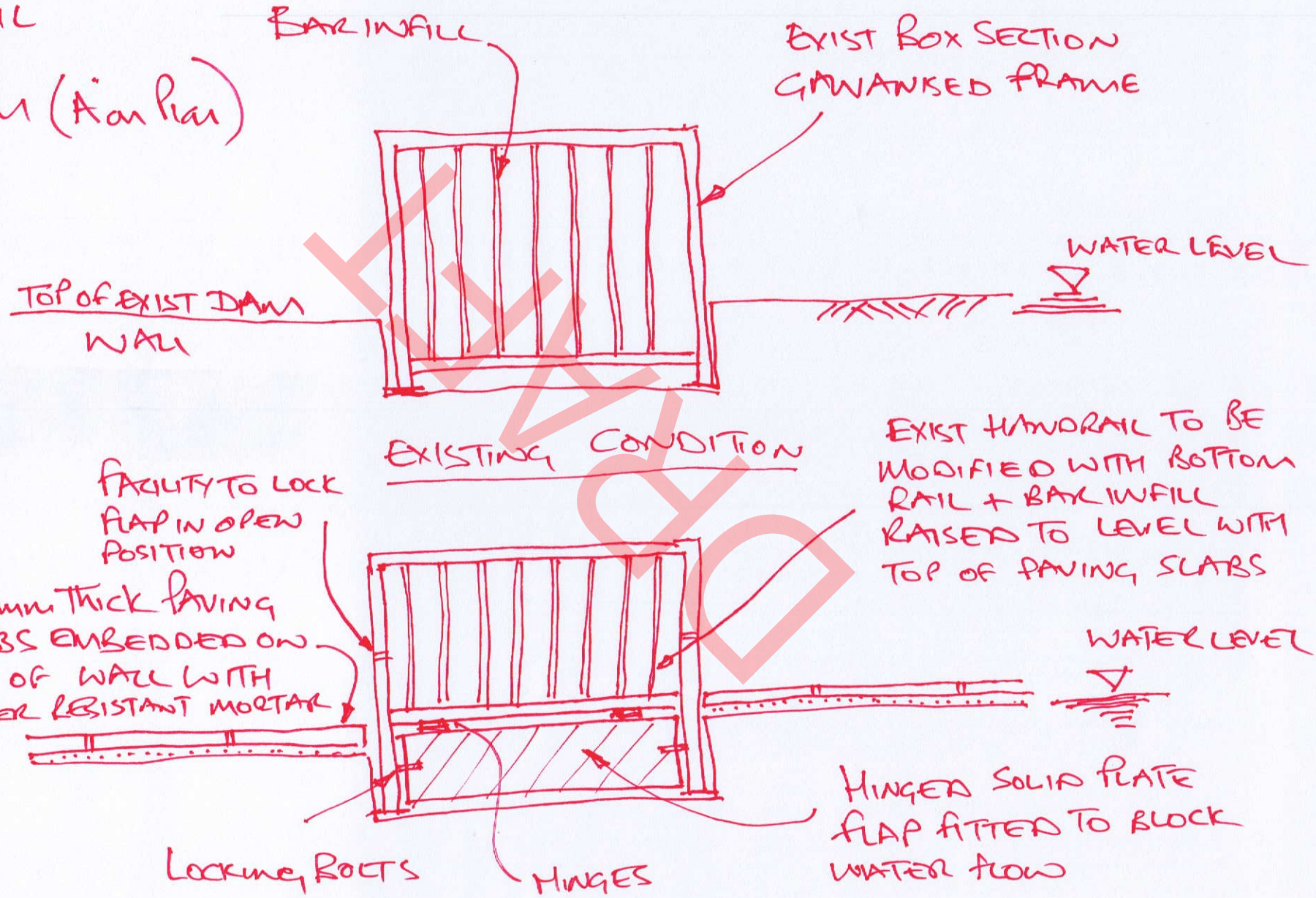
EXISTING CONDITION

DETAIL AT
INLET
(B on PLAN)

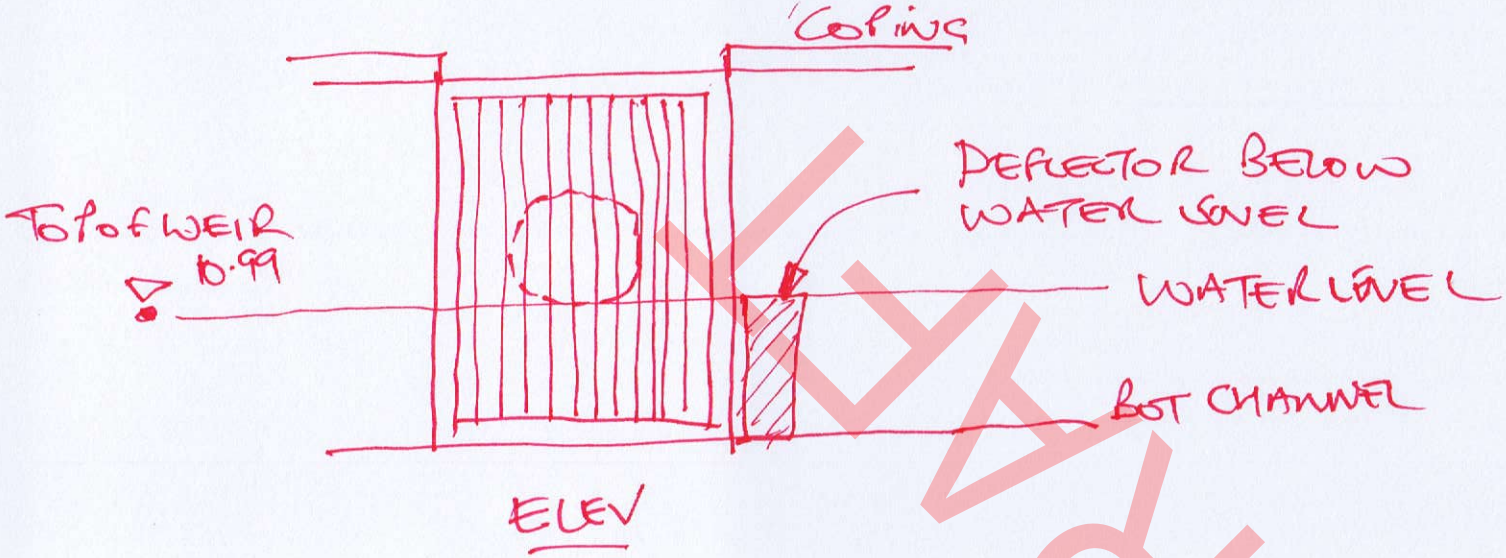


PROPOSED MODIFICATION

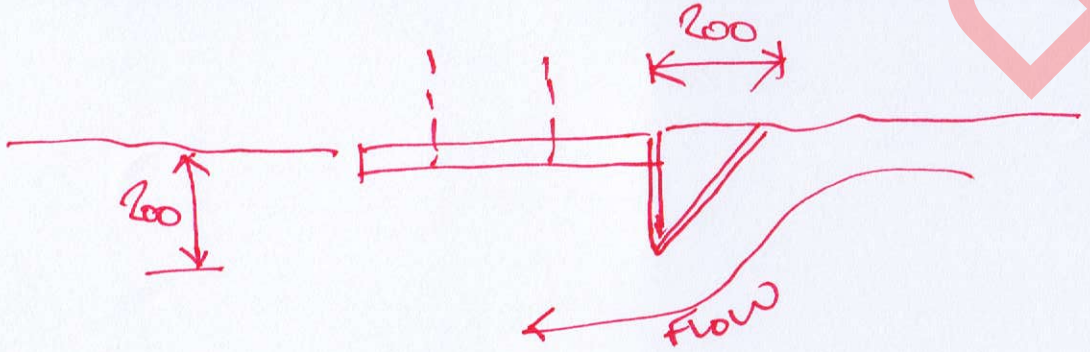
DETAIL AT DAM (Aerial Plan)



PROPOSED MODIFICATIONS

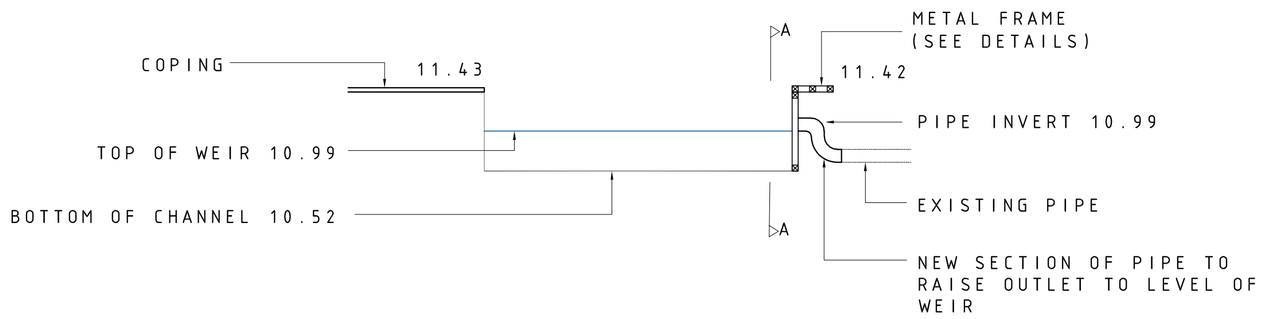


ELEV

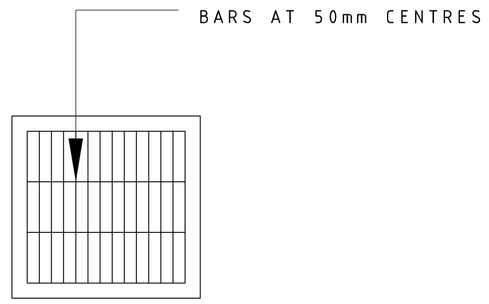


PLAN

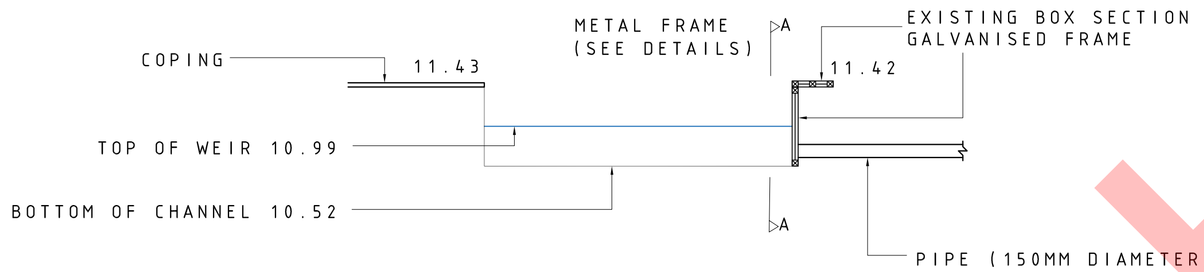
A1



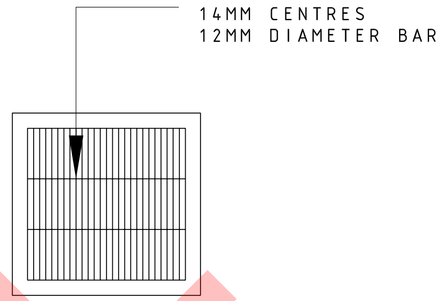
DETAIL AT INLET (B ON PLAN)
PROPOSED MODIFICATION
1:50



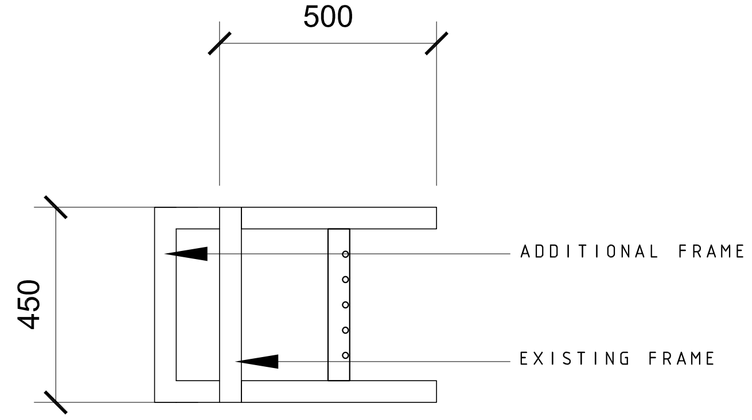
ELEVATION A-A
ADDITIONAL FRAME
1:10



DETAIL AT INLET (B ON PLAN)
EXISTING CONDITION
1:50

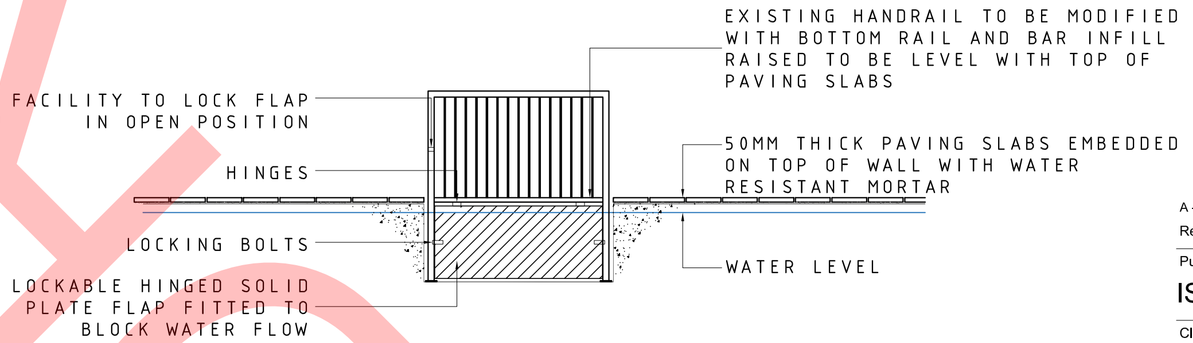


ELEVATION A-A
EXISTING FRAME
1:10

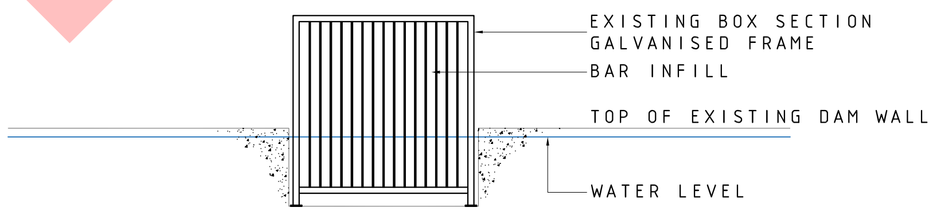


PLAN ON TOP OF FRAME
1:10

TOPOGRAPHICAL SURVEY
1:500



DETAIL AT DAM (A ON PLAN)
PROPOSED MODIFICATIONS
1:50



DETAIL AT DAM (A ON PLAN)
EXISTING CONDITION
1:50

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION

Refer to the relevant Construction (Design and Management) documentation where applicable.

It is assumed that all works on this drawing will be carried out by a competent contractor, working where appropriate to an approved method statement.

Location Key Plan (Not to Scale)

Rev	Description	Date	Check
A	ADDITIONAL FRAME INFORMATION ADDED	04/07/22	JS

Purpose of Issue

ISSUE

Client

CARDIFF CITY COUNCIL

Project

PARC Y NANT LAKE

Drawing

LOCATION OF WORKS
AND PROPOSED DETAILS

Scale @ A1	Drawn	Checked	Approved
VARIOUS	MD	HHE	JS

Project No.: 2022-17

Date: APR 2022

Drawing Number: SCL/001

Revision: A

SALT consultancy ltd

STRUCTURAL ENGINEERING : PROJECT MANAGEMENT

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GENERAL NOTES

1. Earth Science Partnership (ESP) believes that providing information about limitations is essential to help clients identify and therefore manage their risks. These risks can be mitigated through further investigation or research, but they cannot be eliminated. This report may not be used for any purpose other than that for which it was commissioned.

2. This report includes available factual data for the site as obtained only from the sources described in the text. The data are related to the site on the basis of the site location and boundary information provided by the client. The findings and opinions conveyed in this assessment are based on the information obtained from a variety of sources as detailed in the report, which ESP believe are reliable. Nevertheless, ESP cannot and does not guarantee the authenticity or reliability of the information it has relied on. It is possible that the assessment failed to indicate the existence of further sources of information on the site. Assuming such sources do exist, their information could not have been considered in the formulation of the opinions and findings in this report. It should be recognised that different conditions on site may have existed between and subsequent to the various map surveys.

3. In preparing this report it has been assumed that all past and present occupants of the site have provided all relevant and other information, especially relating to known or potential hazards. This report is not required to identify insufficiencies or mistakes in the information provided by the user/owner or from any other source, but has sought to compensate for these where obvious in the light of other information.

4. Reports are normally prepared and written in the context of a stated purpose, and should not, therefore be used in a different context. Furthermore, new information, improved practices and legislation may necessitate an alteration to the report in whole or in part after its submission.

5. The opinions presented in this report are based on the findings derived from a site inspection, investigations and a review of historical and other records. The report details any indicators that may suggest that hazardous substances exist at the site at levels likely to warrant mitigation. Not finding such indicators does not mean that hazardous substances do not exist at the site. The most recent site inspection was undertaken as detailed within the report. Circumstances on sites are subject to change and certain indicators of the presence of hazardous substances that may have been latent at the time of this inspection may subsequently have become observable.

6. The work carried out for the assessment can only investigate a small portion of the subsurface conditions. Certain indicators or evidence of hazardous substances may have been outside the limited portion of the subsurface investigated, latent at the time of the work or only partially intercepted by the works, and thus their full significance could not be appreciated. In this regard, groundwater levels are particularly susceptible to variation and it should be noted that groundwater levels are subject to diurnal, seasonal, and climatic changes and are solely dependent on the time the ground investigation was carried out and the weather before and during the investigation.

7. Accordingly, it is possible that the assessment failed to indicate the presence or significance of hazardous substances. Assuming such substances exist, their presence could not have been considered in the formulation of the report's findings and opinions. The conclusions resulting from this study and contained in this report are not necessarily indicative of future conditions or operating practices at or adjacent to the site. Where differing ground conditions or suspect materials are encountered during future site works, additional specialist advice should be sought to assess whether the new information will materially affect the recommendations currently provided herein and whether further consideration is required. Any limiting factors should be assessed by an appropriately qualified specialist.

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