

Technical Note

Project: Coed Darcy

Subject: North Site Reservoir - Baseline Flood Risk & Hydrology Conditions
Summary

Client:	St Modwen Developments	Revision:	1
Document Reference:	04020-PJA-22-XX-TN-R-006	Author:	Andrea Nelmes
Date:	11/01/2023	Approved:	Alison Caldwell

I Introduction

I.1 Purpose of Technical Note

- 1.1.1 This technical note has been prepared on behalf of St. Modwen to support the Environmental Impact Assessment (EIA) screening process for the proposed discontinuance of the North Site Reservoir (NSR) located in Coed Darcy, Neath Port Talbot. This technical note provides an overview of the current status of the NSR in terms of its current operation, hydrology and flood risk with the aim of setting out the baseline conditions of the reservoir, enabling a review of the potential impacts the discontinuance of the NSR will have on local flood risk and the hydrological condition of the receiving downstream Crymlyn Bog.
- 1.1.2 This note also sets out additional documents that will assess the impacts of discontinuing the NSR, within a hydrological and flood risk context, and any necessary mitigation measures required that will be prepared and submitted to support any future planning application of the site and works to the reservoir.

2 Background

- 2.1.1 The NSR lies within the northern part of the North Site area of Coed Darcy at the former BP Llandarcy Oil Refinery.
- 2.1.2 The NSR occupies an area of approximately 7 hectares and is approximately 575m long by 150m wide. The NSR is orientated ENE – WSW and was formed in a valley by the retainment of water behind a dam which was constructed at the western end of the reservoir. During operation of the Llandarcy Oil Refinery, the NSR is believed to have been used for storing process water and for use in firefighting. A spillway at the north western end of the NSR provided a direct point of

discharge to downstream drainage network, including the Crymlyn Bog networks. The location of the NSE is shown on Figure 1 below.



Figure 1: North Site Reservoir Location Plan

- 2.1.3 At the eastern end of the NSR is a second body of water, East Bay, which is approximately 80m by 90m and covers an area of approximately 0.6 hectares. East Bay is separated from the NSR by an earth causeway, and is in linked hydraulically with the NSR by a culvert.
- 2.1.4 The land on which the NSR is located is owned by Coombe Tennant Estate and was leased to BP for construction of the reservoir. The tenancy agreement, between BP and Coombe Tennant Estate, was passed to St. Modwen with the purchase of the wider Llandarcy Oil Refinery Site.
- 2.1.5 Over the last two decades, since the refinery closed, the NSR has become redundant. The reservoir infrastructure has become dilapidated and this has prompted the decision to decommission the NSR as part of a formal discontinuance programme with the aim of re-establishing a shallow valley feature.

2.2 Development Proposals

2.2.1 It is proposed to return the land back to the landowner with a similar landform as it was prior to the construction of Llandarcy Oil Refinery. This is understood to have comprised marshland with a stream flowing along the base of the valley.

2.2.2 Figure 2 shows a historic land registry drawing (overlain onto a current OS map) showing the original flow of the stream prior to the formation of the reservoir. This historic map (pre 1920's) shows the original route of the stream flowing from east to west and flowing through the culvert beneath the railway embankment prior to eventual discharge into the Crymlyn Bog.

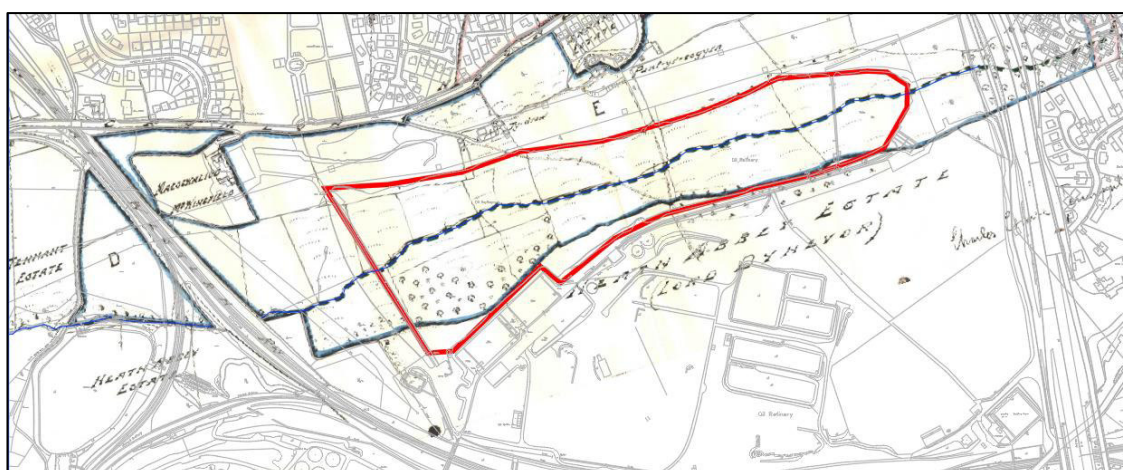


Figure 2: Historic Plan Showing the Original Route of the Stream Prior to the Construction of the North Site Reservoir

2.2.3 The works intend to re-form the shallow valley and create a central stream feeding a pond at the western end of the previous NSR. The earth dam will be removed and re-formed with a safe shallow earthwork. Any features retaining water will be designed such that its capacity remains permanently below that of a designated reservoir.

2.2.4 The re-formed valley will drain via an existing historic culvert to the west, which allows water to flow through the adjacent railway embankment, via the Tal-y-Wedu outfall into Crymlyn Bog. The culvert through the embankment pre-dates the NSR. Once any remedial activities have been undertaken the re-profiled landscape will be allowed to vegetate naturally.

2.2.5 A schematic of the proposed pond and stream layout are presented in Figure 3.

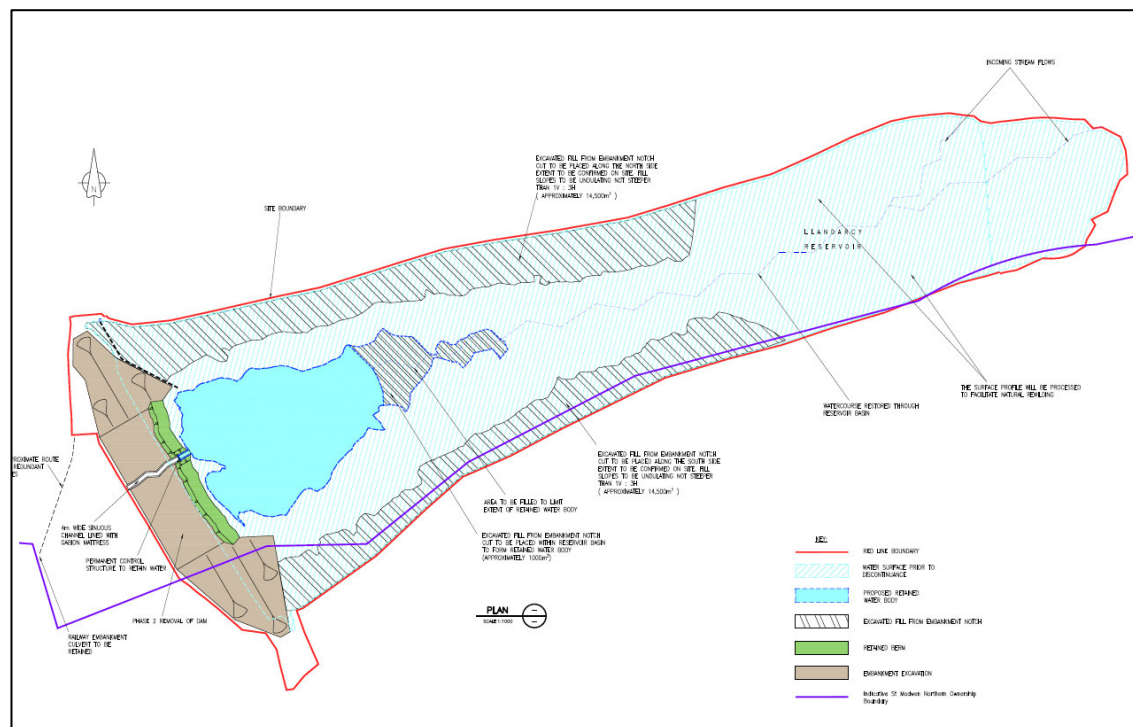


Figure 3: Schematic of Landform Proposals including Reduced Pond at Western End.

2.3 Outline Phasing of Works

The following section outlines the likely phasing of works that are proposed for the removal of the reservoir:

1. Dewater reservoir via pumping through existing drainage routes (via River Neath).
2. Partial removal of dam to reduce the capacity of the water retained to below 'reservoir status'.
3. Continuance of water level management through existing pumped drainage routes.
4. Creation of pond and proposed landform. Remediation of any contaminated soils following reservoir decommissioning.
5. Environmental monitoring of water inputs and pumped outputs.
6. Following a period of monitoring, removal of active pumping and a return to natural drainage through historic routes into the Crymlyn Bog drainage system.

3 Summary of Baseline Data

NSR Hydrology & Operation

- 3.1.1 Several sources of historical and current information, including a site visit undertaken by PJA in September 2021, have been relied upon to understand the NSR's current hydrological regime and operational processes as listed in Section 1.3.

Capacity

- 3.1.2 The NSR can hold around 300,000 cubic metres of impounded water and as such is registered as a reservoir within the control of the Reservoirs Act 1975 (RA).

Contributing Catchment

- 3.1.3 Based on a site walkover and a review of available site plans and information, the NSR has four 'major' hydrological inputs:
- 1 Drainage from the wider Coed Darcy site via the north site culvert or the 'Nullah,' which also receives unattenuated surface water runoff from the existing development to the south of the NSR. Water flows around the southern edge of the redundant oil interceptor tanks and reservoir via a concrete lined channel to a stepped concrete spillway in the far south-eastern corner of the NSR.
 - 2 The original watercourse, which springs to the east of the NSR and M4 motorway. The watercourse flows in a westerly direction under the M4. via a 450mm diameter pipe, and discharges into the East Bay of the NSR. Refer to Figure 4.
 - 3 There is another watercourse to the northeast corner of the NSR, which is captured both on URS's drawing and Stillwater's Llandarcy NSR Flood Assessment Report (Sept 2021) which flows into the NSR via a 600mm diameter pipe under the M4 motorway.
- 3.1.4 During a site visit undertaken by PJA in Sept 2021, watercourse (3) was observed to continually flow (providing a greater baseflow than that emanating from the 450mm pipe) and cut its own path in a southerly direction to join the watercourse from the 450mm pipe before discharging into the East Bay of the NSR. This arrangement and site observations are recorded in Appendix A.



Figure 4: Original Watercourse Emanating from 450mm diameter Pipe under M4

3.1.5 The NSR also receives other inputs from several other sources including:

- 1 Direct rainfall onto the reservoir;
- 2 Surface water runoff from the immediate surrounding land/catchment;
- 3 Highway runoff from the M4 motorway; and
- 4 Intermittent sewage discharges from DCWW's combined pumping station overflow.

Historical NSR Outlets & Water Level Maintenance

3.1.6 Historically during the operation of the BP Llandarcy Oil Refinery, the NSR is believed to have been used for storing operational storm runoff, process water, and firefighting water. In the event of high water levels within the reservoir, an emergency spillway located within the north-western corner of the NSR, consisting of a reinforced concrete headwall and outlet pipe, would operate and enable excess water to be conveyed directly to the Crymlyn Bog. Anecdotal evidence indicates that this overflow rarely operated during BP's time of ownership.

3.1.7 Spill water from the NSR would have designed to flow in a westerly direction to the bottom of the NSR's dam embankment. It then passed under Network Rail's embankment via a 1.5m diameter brick culvert. Downstream of this, it passed through another culvert (which is throttled via several openings varying in diameter as shown in Figure 7) under a private railway siding and out toward the South Site Reservoir. Historical BP records in Appendix B show the arrangement of the spillway as well as the culvert under Network Rail's embankment. These drawings also

show the presence of a watercourse between Network Rail's embankment and the railway siding. A site visit carried out in September 2021 identified the presence of both culverts and identified this watercourse still conveys a baseflow, the source of which is unknown (Figure 5, Figure 6 and Figure 7).



Figure 5: Network Rail 1.5m diameter Culvert & Watercourse looking East

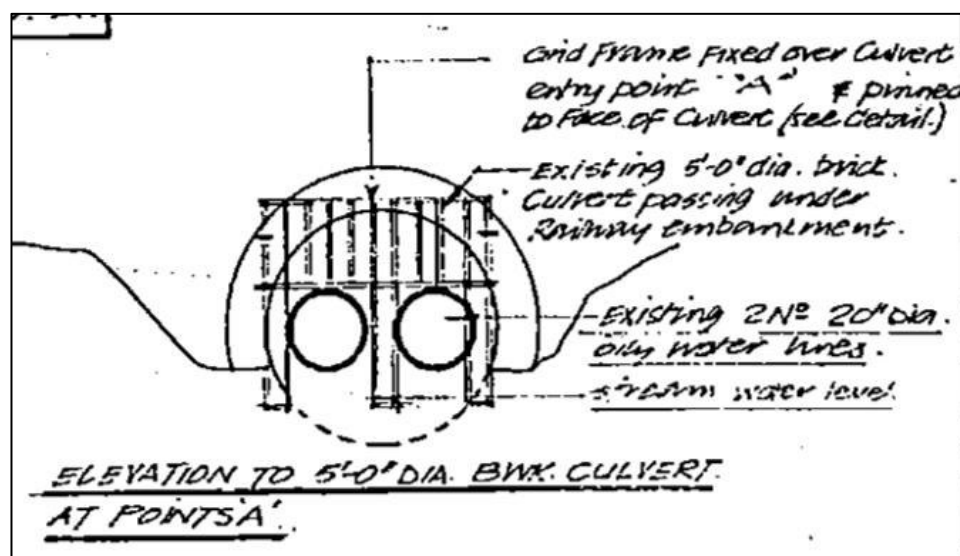


Figure 6: Original BP For Construction Drawing (1951) – showing detail of culvert under Network Rail line



Figure 7: Culvert & Internal Pipe Arrangement Under Private Railway Siding looking West

- 3.1.8 This watercourse continues to flow in a westerly direction to become the Tal-y-Wedu, where it picks up flows from the South Site Reservoir and Crymlyn Brook before discharging into the Crymlyn Bog. Refer to Appendix B for a plan showing the drainage arrangement around the existing railway embankments.

NSR Pumping Station Arrangement & Water Level Management

- 3.1.9 Water levels within the NSR are currently maintained by a pumping station which is located within the southwestern corner of the reservoir. The pumping station compound measures approximately 450m², housing three pumps which pump water across the railway cutting to a discharge point in the northwest corner of the main Coed Darcy site. This system outfalls to DCWW's public sewer system (referred to as the Bridge House Outfall) and the River Neath further east.
- 3.1.10 Based on discussions with the contractor responsible for operating and maintaining the pumps, only two of the three pumps are operational at one time. Based on this anecdotal evidence it is assumed that the pumps are arranged on a Duty, Assist, Standby arrangement, where the duty pump is capable of pumping at an estimated flow rate of 650l/hr; and the second assist pump can pump at approximately 700l/hr. The standby pump serves only as a backup should either the duty or assist pumps fail. When both duty and assist pumps are operational, they are together capable of pumping an estimated 1000l/hr, which is restricted by the diameter of the rising main.

- 3.1.11 Currently water within the NSR is being continually pumped out to keep water levels to a minimum as an interim measure until works are carried out to discontinue and deregulate the reservoir.

Flood Risk

- 3.1.12 The NSR is identified not to lie within a Flood Zone according to the publicly available Development Advice Map. Furthermore, the publicly available Flood Map for Planning, identifies the NSR to lie outside of the Flood Zone extents associated with Rivers and Seas. Refer to Figure 8

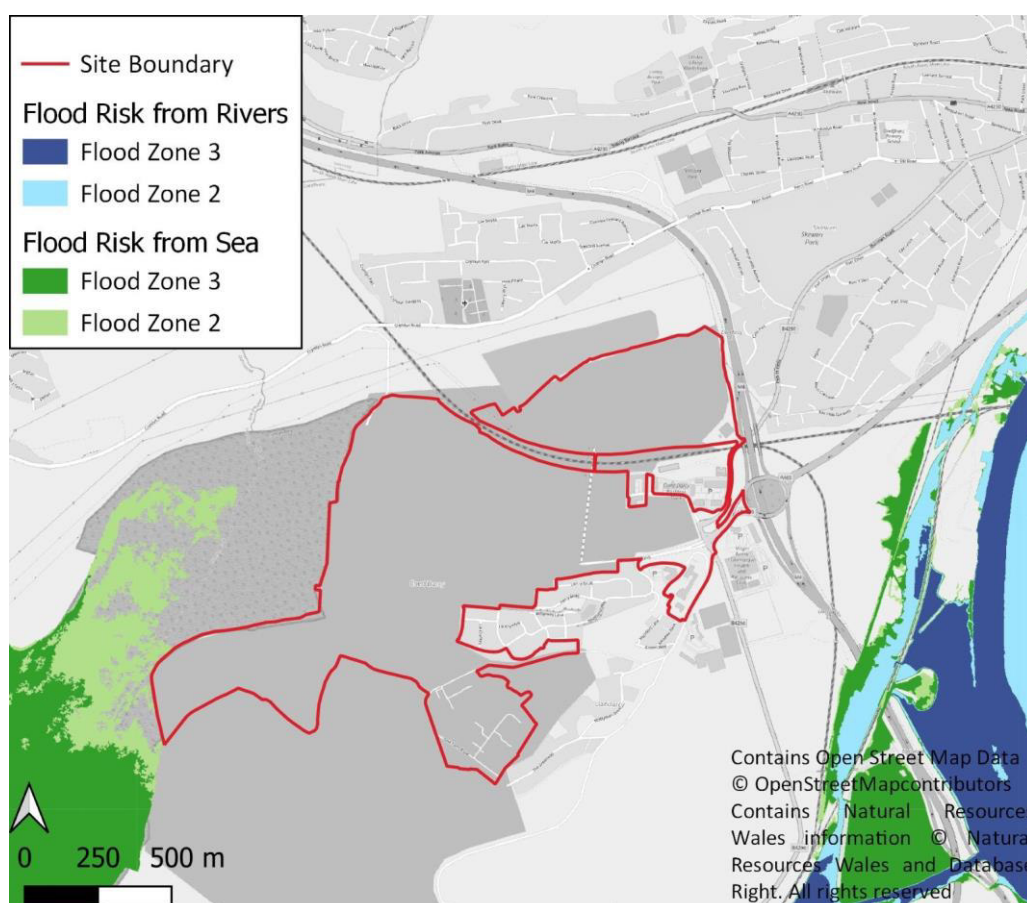


Figure 8: Flood Map for Planning Rivers and Seas Mapping Extract

- 3.1.13 With regard to surface water and small watercourses, the NSR is identified to be located entirely within Flood Zone 3, most likely associated with existing landform and the topographical depression containing the NSR itself.

3.1.14 In its current form, the NSR itself is however identified to present a potential flood risk should the dam fail, refer to Figure 9. In the unlikely event that the NSR does fail, the flood extents shown on Figure 9 represent the worst-case scenario for the area. However it is anticipated that in reality this flood extents is very unlikely to occur firstly as the NSR is continually being drained and as such is storing a minimal quantum of water and secondly the network rail embankment located just to the south west of the NSR presents a substantial physical obstruction to any flood flows being conveyed toward the Crymlyn Bog.

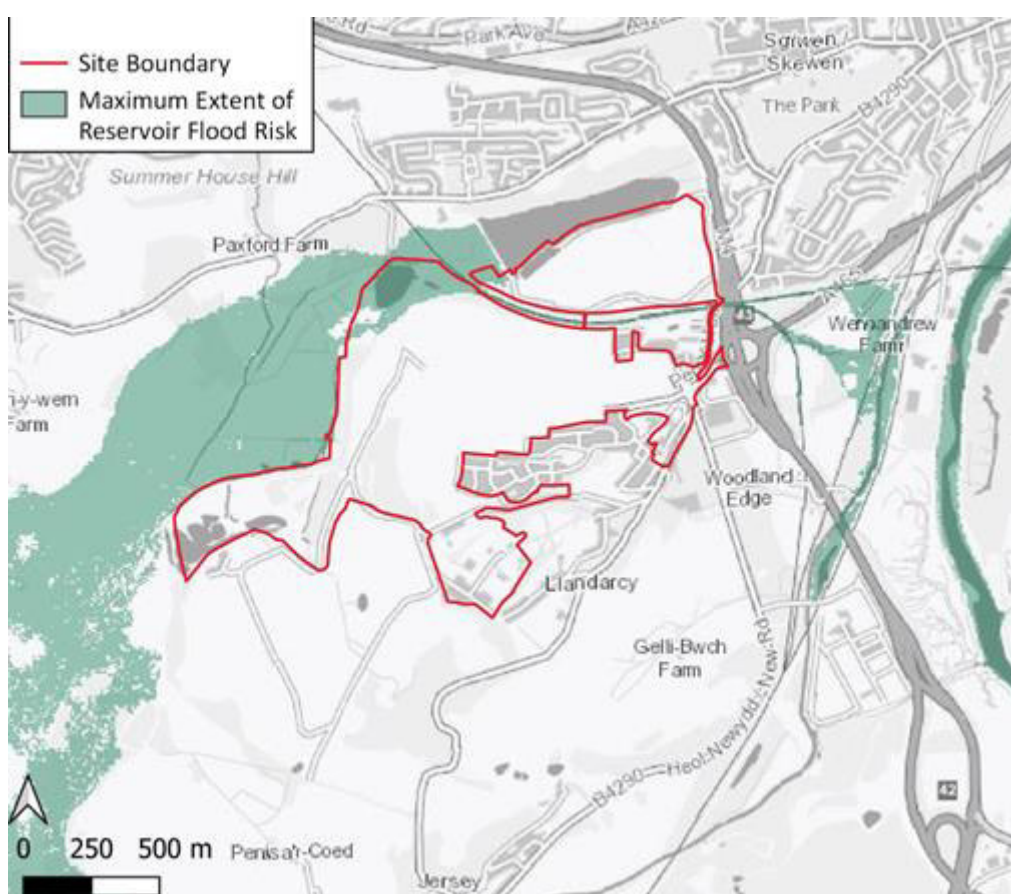


Figure 9: Reservoir Flood Risk Map Extract

3.1.15 To understand the long terms impacts of discontinuing the NSR and naturalising the reservoir back to its watercourse form, a Flood Risk Assessment was prepared by Stillwater Associates Limited in September 2021. This assessment considered hydraulic modelling of the contributing catchments draining to the NSR and the associated potential impact of discontinuance of the NSR resulting in an increase of peak flood levels at the downstream railway embankment and peak discharge rates through the downstream railway culvert.

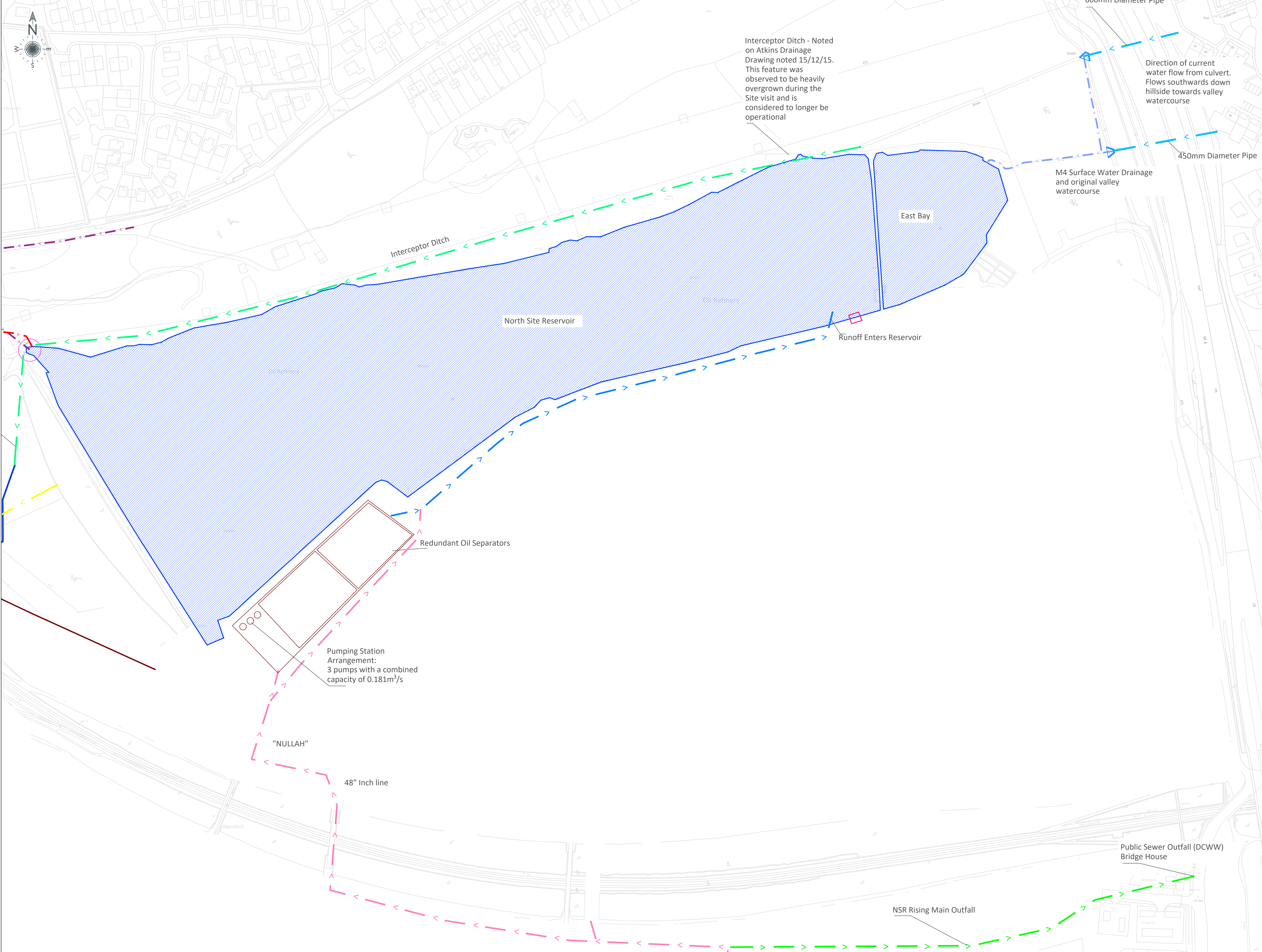
4 Planning System Proposals

It is considered that there is already a very good understanding of the NSR network, inputs and influences on flood risk. It is considered that the standard planning control will be sufficient to ensure risks are managed and appropriate designs are submitted for approval. The following stages are anticipated to support the respective planning application:

- Further quantification of potential adverse downstream impacts and implementation of mitigation measures. Where required, mitigation will be proposed within the existing NSR footprint and where it is considered feasible.
- An assessment of the potential flood risk and associated consequences in accordance with Planning Policy Wales Technical Advice Note 15 (TAN 15)
- An appraisal of the potential impacts on the hydrology of the Crymlyn Bog.

Any necessary mitigation measures identified will be delivered in a collaborative approach with other disciplines to ensure that the water availability and quality of sensitive receptors within the local area are also not adversely impacted on as part of an integrated managed approach to the discontinuance of the NSR and the restoration of the original landform.

Appendix A NSR Local Water Features and Flow Routes



NOTES

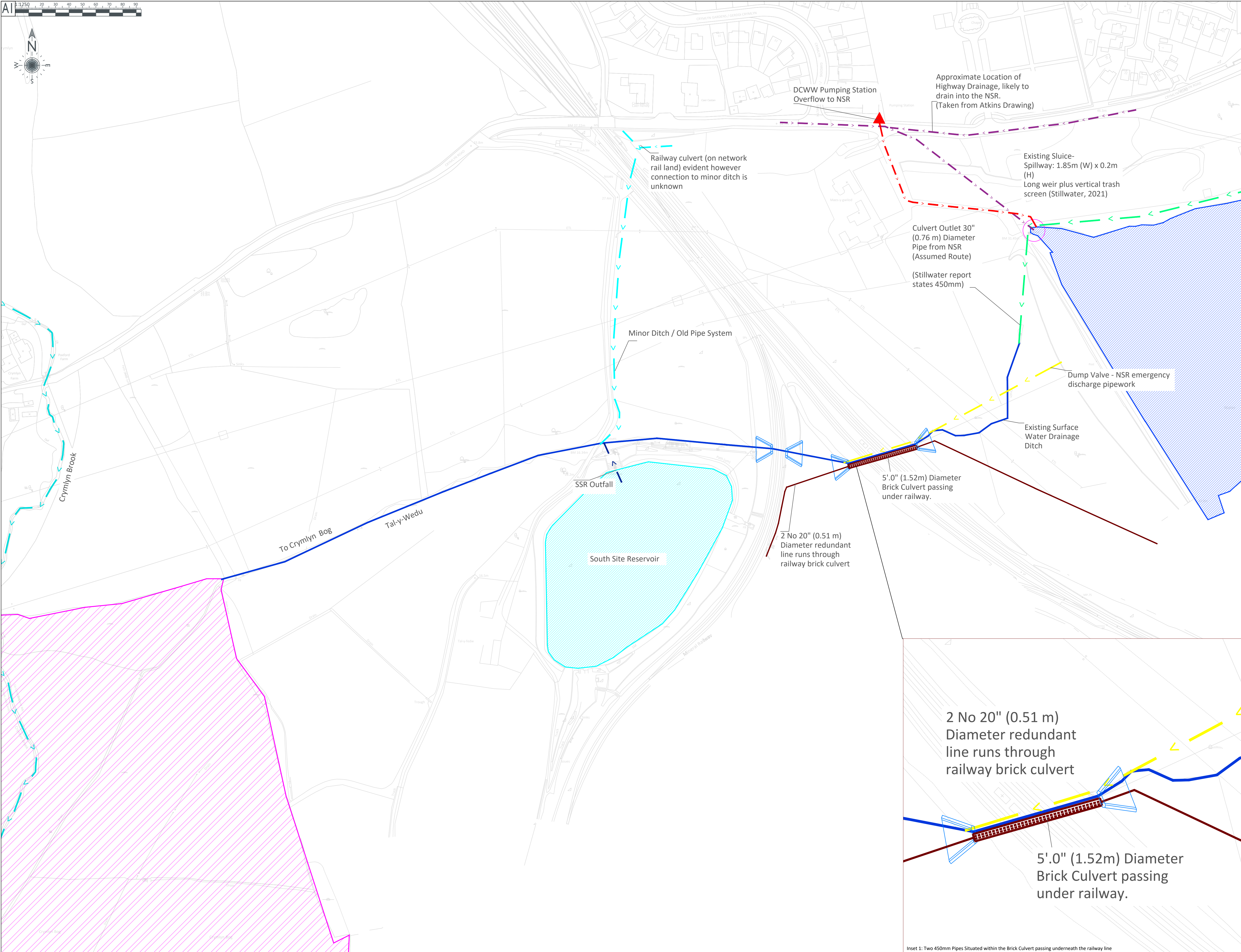
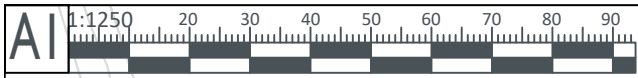
These drawings have been produced with reference to the CDM Regulations 2015. Please note that these are pre-construction phase drawings and should be subject to further design risk management as required in accordance with Regulation 9

1. This Drawing is not to be reproduced in any part or form without the consent of PJA Civil Engineering Ltd. All copyright reserved.
2. No assessment of earthworks has been undertaken at this stage.
3. Drawing should be read in conjunction with all other relevant scheme drawings.
4. DWG has been produced based on information provided in:
 - 4.1. Atkins Existing Drainage Data provided in July 2010 and December 2015 (5041216-ATK-DR-C-ENG-0002146)
 - 4.2. URS Map of Local Features of Existing Water flows
 - 4.3. BP Oil NSR Facility for Construction (DWG Ref: 90-04-51 1984)
 - 4.4. DCWW Sewer Records provided in September 2021
 - 4.5. PJA Site Visit (September 2021)

Key

- North Site Reservoir
- South Site Reservoir (Lagoon)
- Crymlyn Bog
- Existing Sluices
- Existing Water Drainage Routes
- Reservoir Outfalls
- Interception Ditch
- Nullah Channel
- NSR Rising Main
- Ditch Course
- Minor Ditch / Old Pipe System
- Highway Drainage
- Crymlyn Brook
- Pumping Station (NSR)
- DWCC Pumping Station (Combined)
- Combined Sewer

PI	15/06/2022	DRAFT FOR COMMENT	CT
REV	DATE	REVISION NOTE	BY
PJA Seven House - High Street Longbridge - Birmingham B31 2UQ - Tel: 0121 475 0234 Birmingham - Bristol Exeter - London - Reading pja.co.uk CLIENT PROJECT NSR Mass Water Balance Study DRAWING TITLE Data Collection - NSR Sheet 1 DRAWING ISSUE STATUS INFORMATION PJA JOB No. SUB-CODE DRAWING NO. REVISION 04020 -WR - 0100 - PI Revision Letter / P - Prelim / A - Approval / T - Tender / C - Construction REVISION REFERENCE SCALE DRAWN REVIEWED DATE AI @ 1:250 CT AN JUN 2022			



NOTES

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Longbridge - Birmingham
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Birmingham - Bristol
Exeter - London - Reading
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CLIENT: **St. Modwen**

PROJECT: **NSR Mass Water Balance Study**

DRAWING TITLE: **Data Collection - NSR Sheet 2**

DRAWING ISSUE STATUS: **INFORMATION**

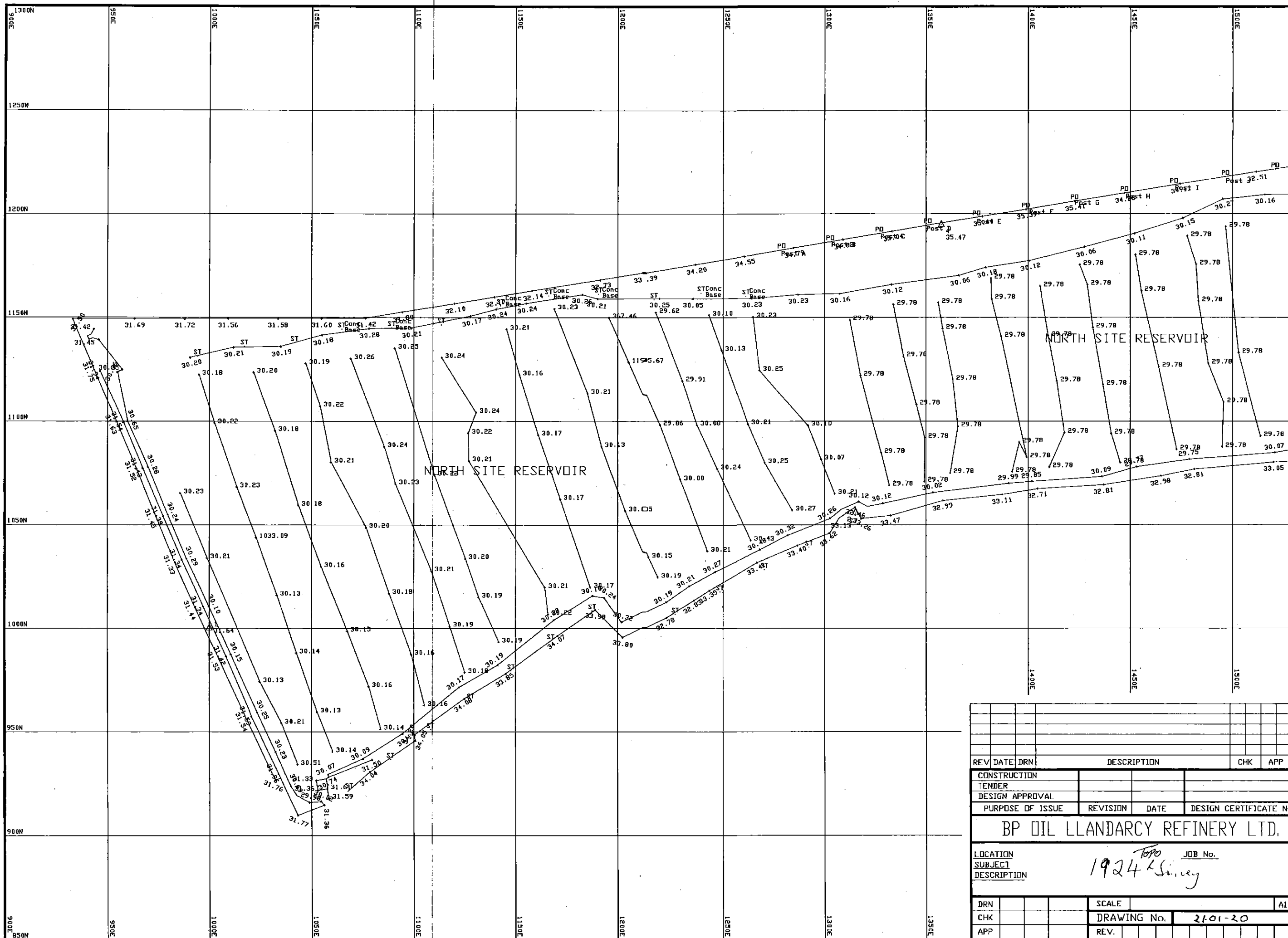
PJA JOB No. SUB-CODE DRAWING NO. REVISION
04020 - WR - 0101 - PI

Revision Letter: P - Prelim / A - Approval / T - Tender / C - Construction
BIM DRAWING REFERENCE:

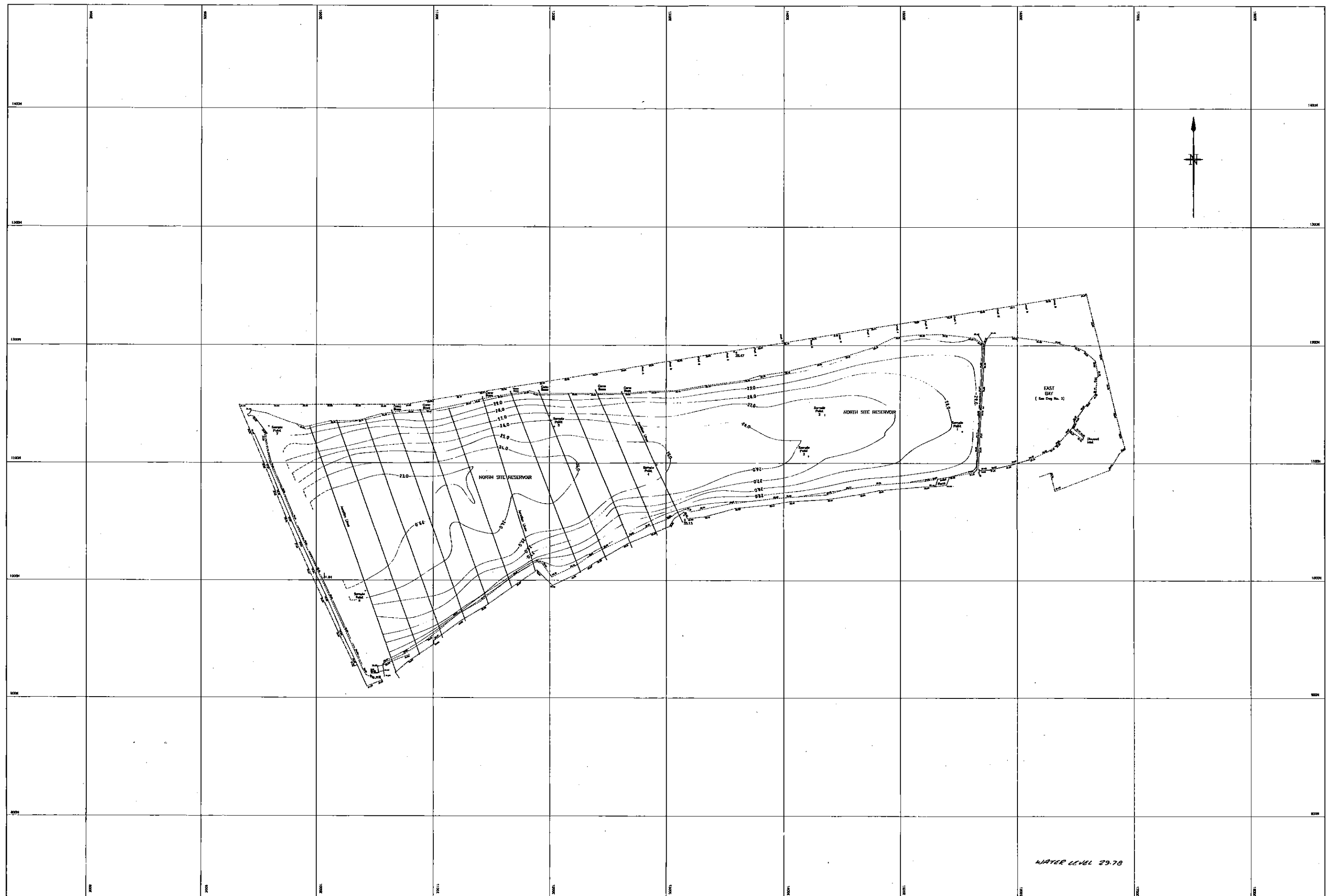
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Inset 1: Two 450mm Pipes Situated within the Brick Culvert passing underneath the railway line

Appendix B BP Historical NSR Records

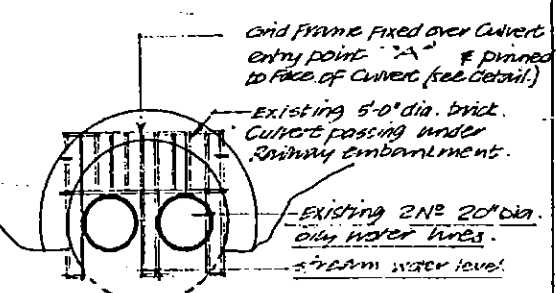
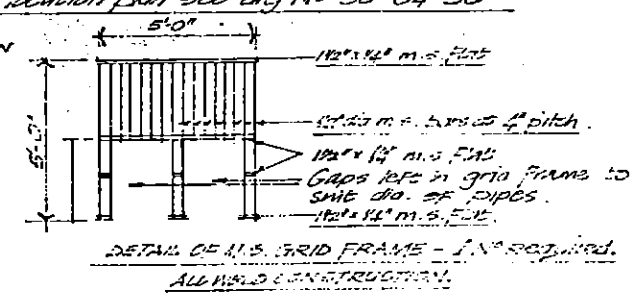
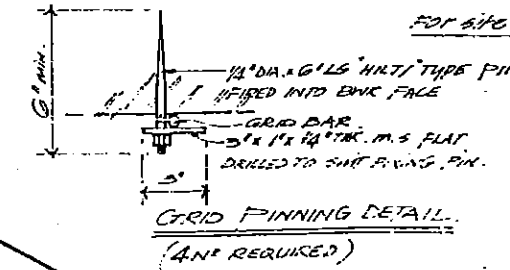
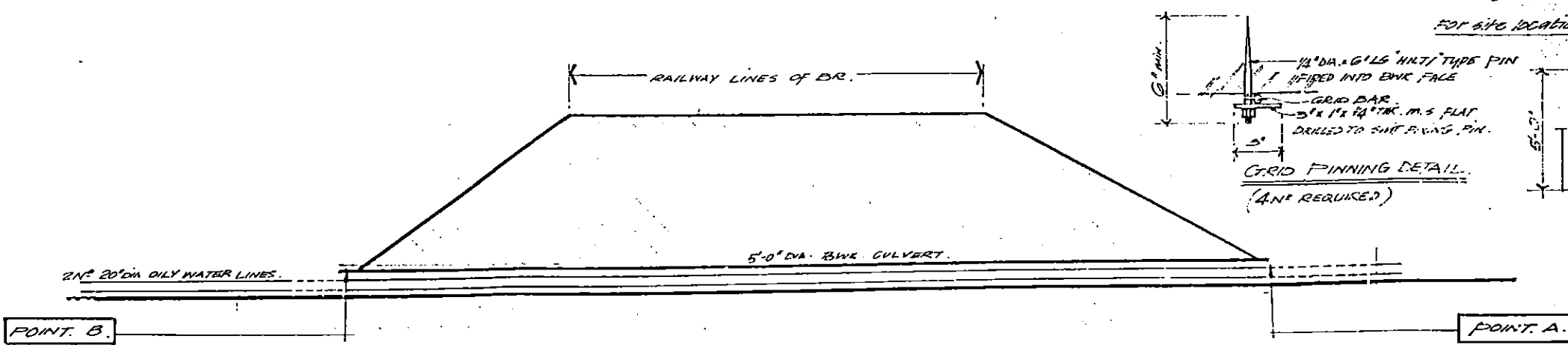


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			TENDER		
			DESIGN APPROVAL		
			PURPOSE OF ISSUE	REVISION	DATE
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LOCATION			JOB No.		
SUBJECT			1924 Survey		
DESCRIPTION					
DRN			SCALE		A1
CHK			DRAWING No.	21-01-20	
APP			REV.		

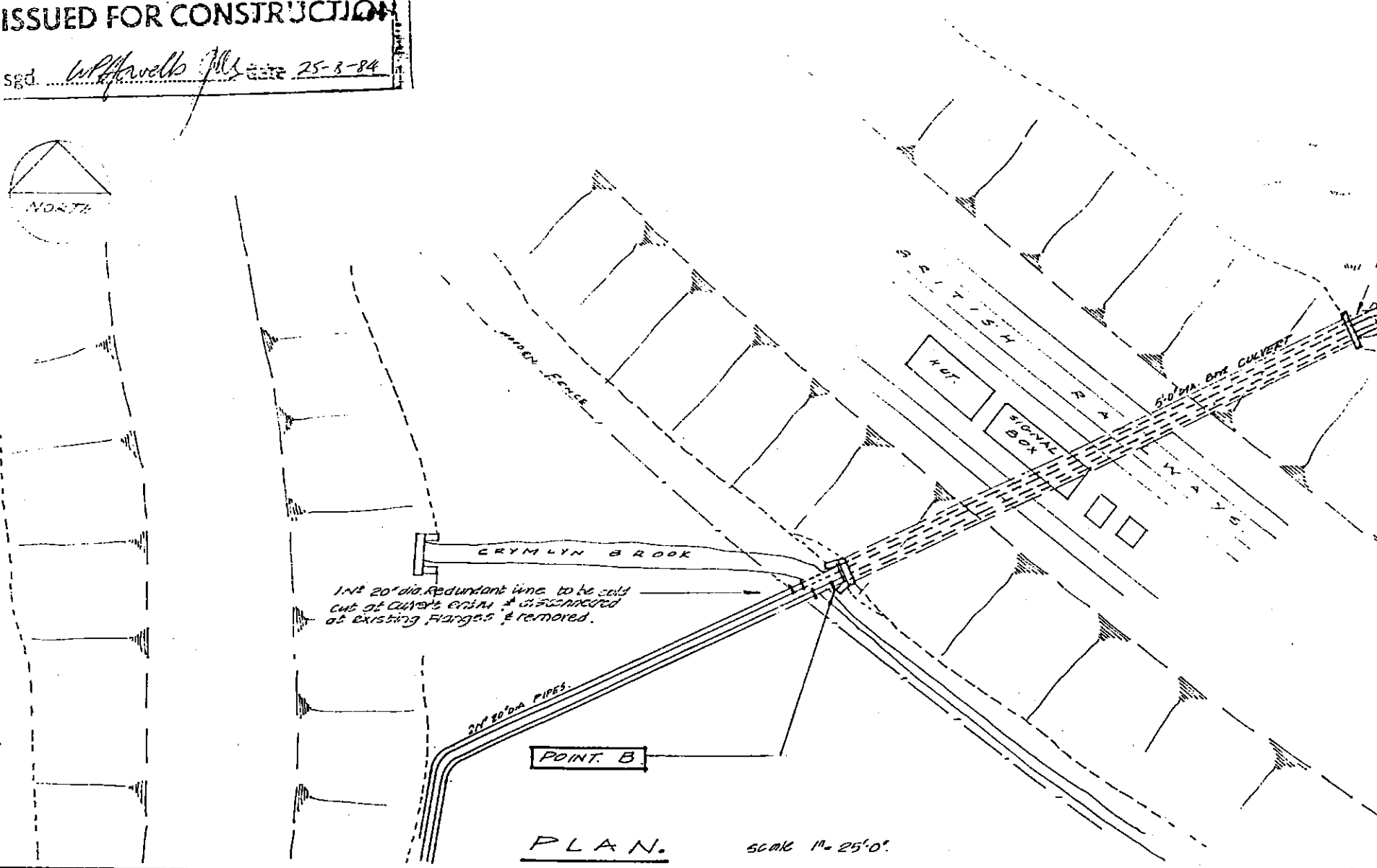
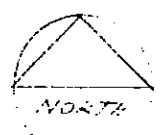


LINE TYPES Buildings Banks Fences Top of banks Bottom of banks Centre of banks Overhead wires Surface change	NOTES 1. LOCAL GRID 2. NORTH ARROW SHOWS APPROXIMATE TRUE NORTH 3. D.S. DATA 4. SP. INTERPOLATED AL. ON INTERPOLATED BOUNDARY P. (21.01-13) 5. BASED ON SURV. NO. 2 (21.01-13)	CLIENT BP. LANDWORTH BUTTING HOUSE LANDWORTH NORTH WILSON SITE 101	NORTH SITE RESERVOIR topographic survey	SHEET DIAGRAM	SCALE 1:1000 SHEET 1 OF 2 SHEET SET JOB NUMBER 2007 DRAWN BY CHECKED BY APPROVED BY DATE June 1983	12 London Rd., North, West Glamorgan. SA11 1HB tel (0639)637801/630832 fax (0639)637844  CONTRACT SURVEYS LTD. LAND AND ENGINEERING SURVEYORS Member of U.K. Land and Hydrographic Survey Association BP.DRG. 21-01-13
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NOTES/AMENDMENTS
 IN EXISTING REDUNDANT 20" DIA. TO BE DISCONNECTED AS EXISTING FLANGES & CUT OUT AT CURVE ENTRY POINTS 'A' & 'B' & PULLED AWAY TO SUIT.
 12" DIA. BRICK CULVERT TO BE FIXED OVER CURVE ENTRY POINT 'A' TO SUIT.
 FOR SITE LOCATION PLAN SEE DRY NO 90-04-30



ISSUED FOR CONSTRUCTION
 Sgd. *W. H. H. H. H.* 25-8-84



EXISTING 12" DIA. PIPE SEWERS TO BE DISCONNECTED AT EXISTING FLANGES AND CUT OUT AT CURVE ENTRY POINT 'A' & REMOVED.
 EXISTING 20" DIA. PIPE TO REMAIN.

ISSUE	DATE	DRAWN	PURPOSE OF ISSUE	CHECKED	APPROVED
3	25/8/84	OC	FOR CONSTRUCTION.		
2	12/8/84	BC	FOR FINAL APPROVAL.		
1	10/8/84	OC	FOR COMMENTS & APPROVAL.		

BP OIL LLANDARCY REFINERY LTD.

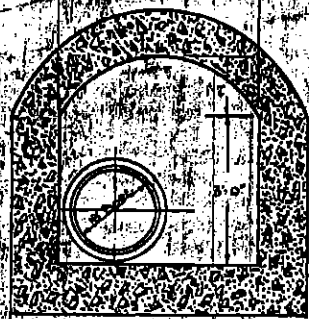
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LOCATION: NORTH SITE

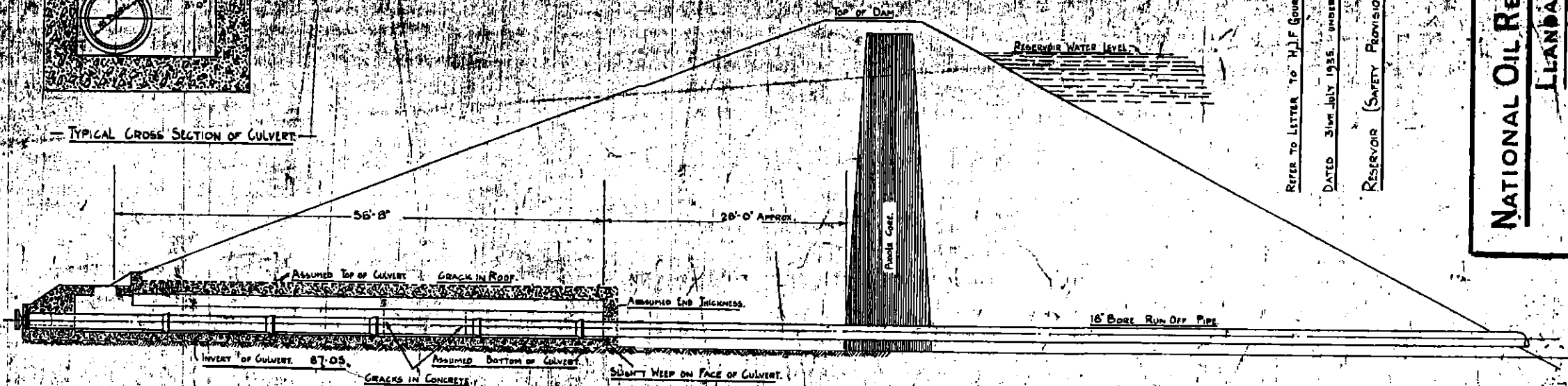
SUBJECT: SEWERS, DRAINS & UNDERGROUND PIPEWORK.

DESCRIPTION: PROPOSED DB-BOTTLENECKING OF CULVERT UNDER THE B.R. EMBANKMENT, S.W. OF THE RESERVOIR.

SCALE: 1/8" = 1'-0" & 1" = 25'-0". DRAWING NUMBER: 90-04-31



TYPICAL CROSS SECTION OF CULVERT



SECTIONAL ELEVATION OF DAM.

REFER TO LETTER TO H.J.F. GOSSETT, LEE, M'COMB, DUNCAN, P.C.

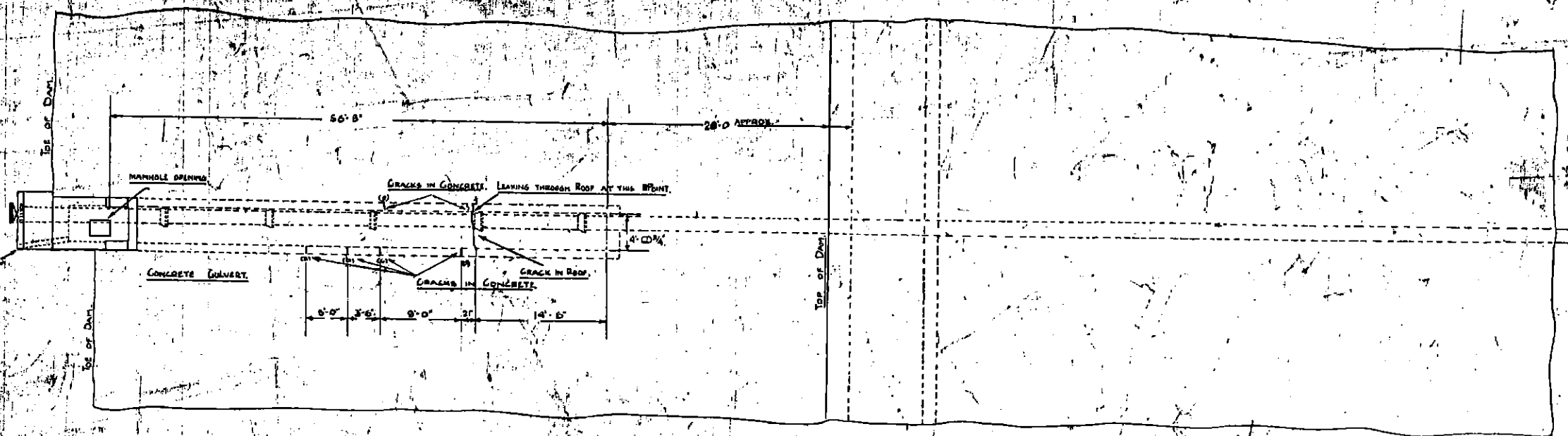
DATED 31st JULY 1935. UNDER HEADINGS

RESERVOIR (SAFETY PROVISIONS ACT) 1930.

NATIONAL OIL REFINERIES, LTD.
LIANDRAC

WATER SERVICE
CULVERT AND RUN OFF PIPE AT N'S RESERVOIR

SCALE 1/4" = 1'-0"
DATE 31st JULY 1935
DRAWING NO. 100/100



PLAN.

HERMANN ROAD DEVL - EARNITC'S

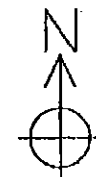
NO PUBLIC SURFACE WATER SEWERS

SHOWN ON OSNW STATUTORY MAP.

POSSIBLY ROOF & YARD WATER AND

HIGHWAY WATER DRAINS THUSWAY. FROM

THIS PRIVATE ESTATE - HIGHWAYS ADJUTED - SEE ATTACHED EXTRACT



Oct 17 2003

SOUTHALL AVE.

DEVELOPMENT

KEYWORKERS

HOUSING DEVL.

FOR B.P.

DUE TO THE

TOPOGRAPHY

COULD POSSIBLY

BE DRAINING

S.WATER (HIGHWAY

ETC.) INTO

MOTORWAY

CULVERT.

- NO PUBLIC

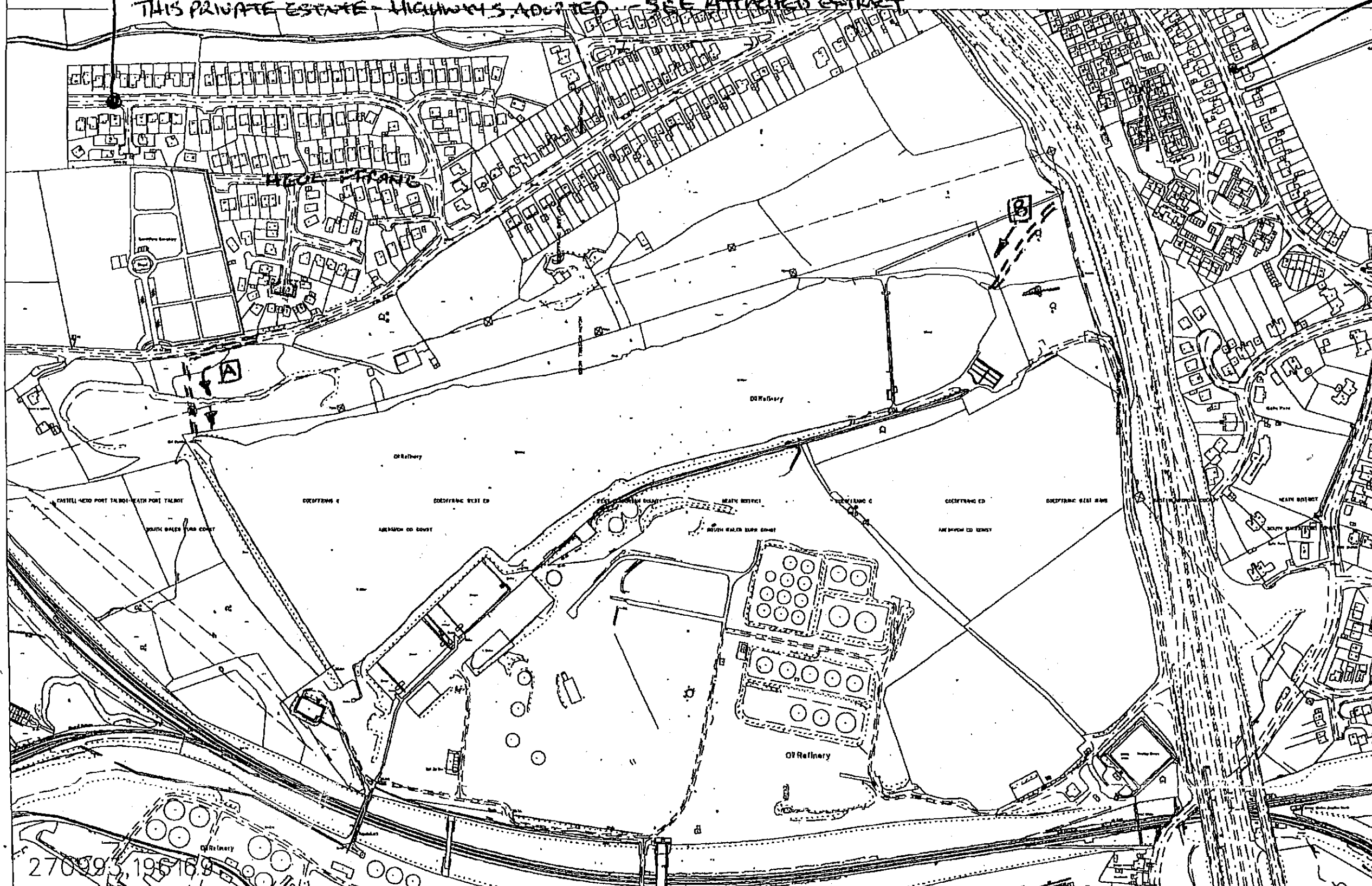
SURFACE WATER

SEWERS SHOWN

ON OSNW

STATUTORY

MAP.



270993, 196169

EXACT LOCATIONS OF ALL APPARATUS
TO BE DETERMINED ON SITE.

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Scale: 1:5000

Appendix C Observed Railway Culvert Sections

