



Secure Training Facility

Cardiff

Flood Consequence Assessment

Final report

January 2018

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1.0 INTRODUCTION

This Flood Consequence Assessment (FCA) report has been prepared by Hydrock Consultants Limited (Hydrock) for a proposed Secure Training Facility in Cardiff.

This report aims to address the requirements of Technical Advice Note 15: Development and Flood Risk (TAN15) and Natural Resources Wales, through justifying the location of the proposed development and assessing the identified flooding consequences.

The report considers the requirements for undertaking a Flood Consequence Assessment (FCA) stipulated in TAN15. Only those requirements that are appropriate to a development of this nature have been considered in the compilation of this report.

In order to address the potential concerns the NRW may have with the development of the site to residential development this report considers requirements of TAN15 through:

- Assessing whether the proposed development is likely to be affected by flooding;
- Assessing whether the proposed development is appropriate in the suggested location, and,
- Detailing any measures necessary to mitigate any flood risk identified, to ensure that the proposed development and occupants would be safe and that flood risk would not be increased elsewhere.

The report considers the requirements for undertaking a FCA stipulated in TAN15. Only those requirements that are appropriate to a development of this nature have been considered in the compilation of this report.

This report has been prepared in accordance with current Natural Resources Wales Policy.

2.0 SITE INFORMATION

2.1 Location

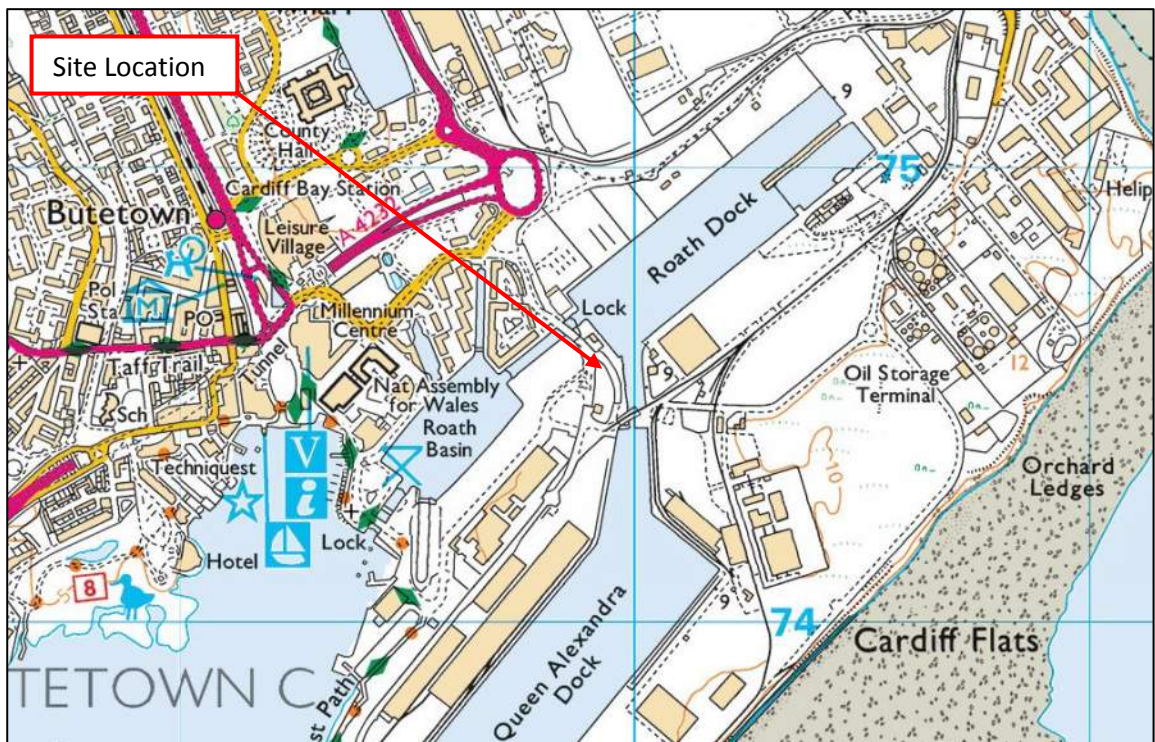
The site is situated on an island within Cardiff Docks; between the Roath Basin, Roath Dock and Queen Alexandra Dock, as shown in Appendix A.

The site location is shown in Figure 1, with the site boundary shown in Figure 2 and, the full address and Ordnance Survey Grid Reference provided in Table 1.

Table 1 Site Reference Information

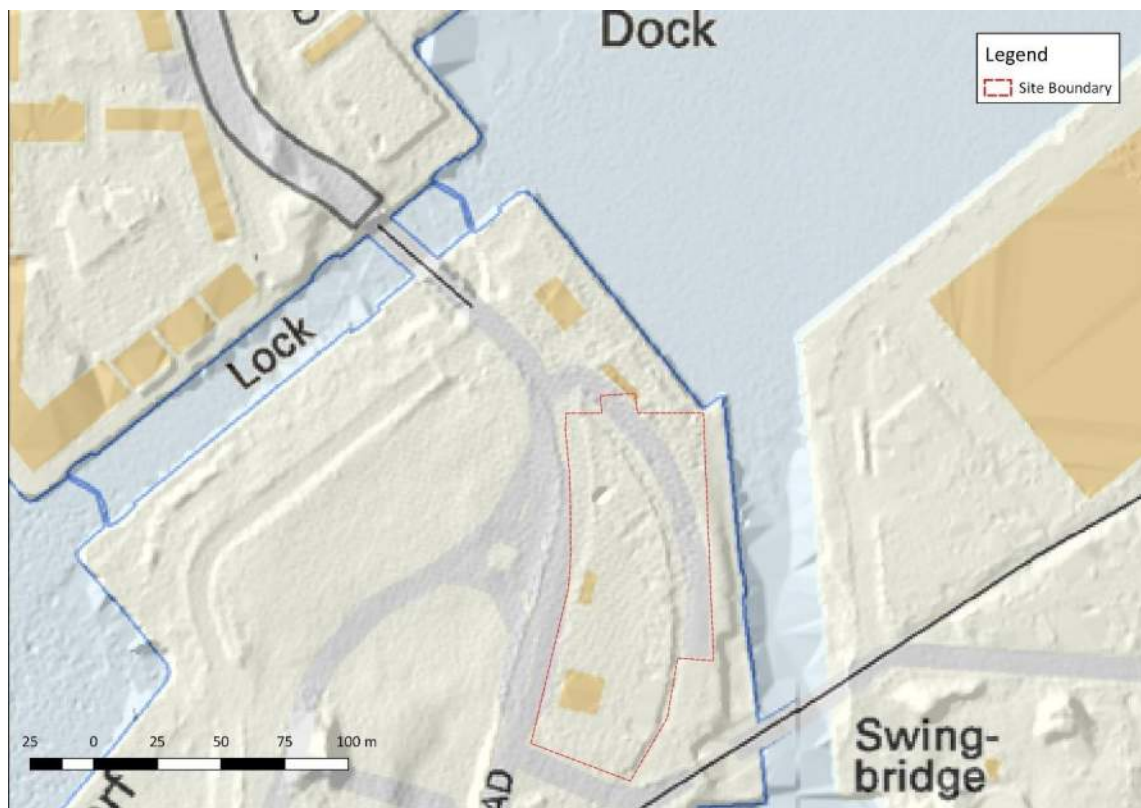
Site Address	Land off Tyneside Road, Adventurers Quay, Caerdydd, CF10 4NR
Grid Reference	319960, 174566 ST199745

Figure 1 Site Location



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Figure 2 Site Boundary (indicative only)



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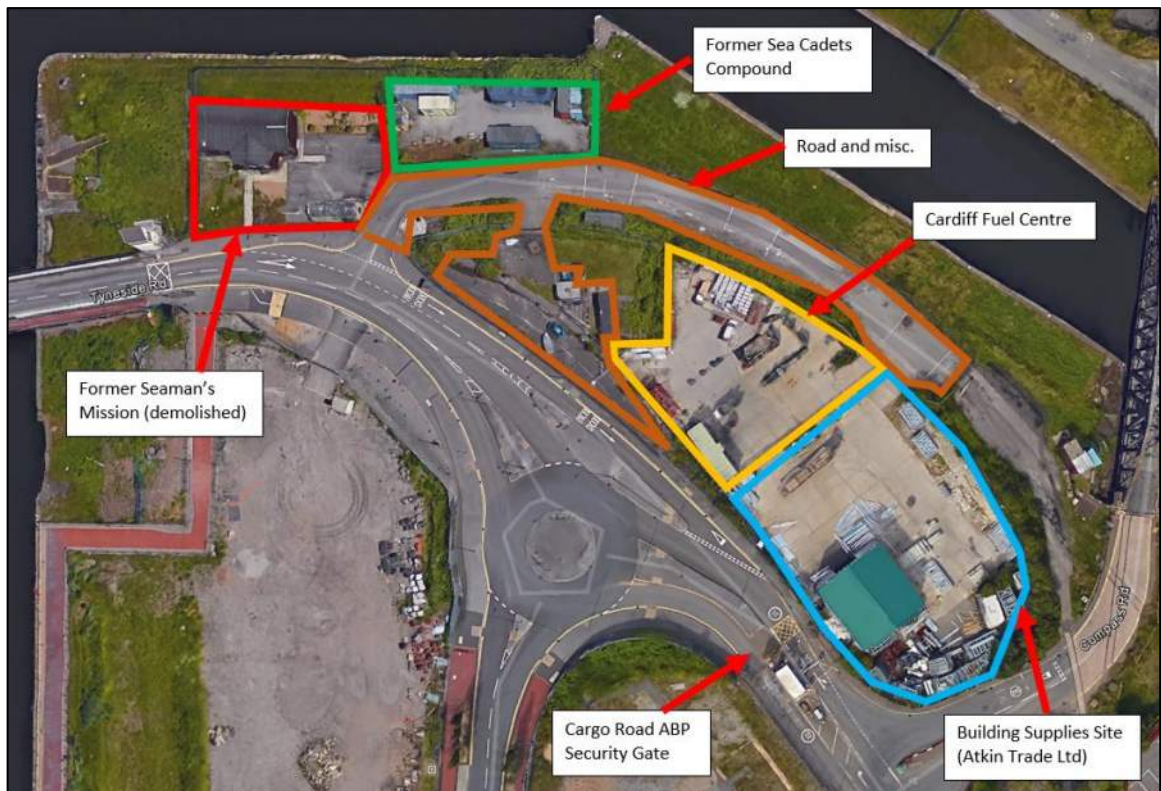
2.2 General Topography

Natural Resources Wales 1m LiDAR DTM shows levels on site vary between 9.3 - 9.7m AOD. The walls of the Roath Dock adjacent to the site are at approximately 9.5m AOD.

2.3 Existing Land Use

The existing brownfield site currently contains very little active development since the demolition of the Seaman's Mission and is sparsely occupied by: the Cardiff Fuel Centre, Cabins and out-buildings formerly associated with the Cardiff Sea Cadets, and Atkin Trade Specialists (referred to as the 'Building Supplies Site' in this report). The layout of the existing site is shown in Figure 3.

Figure 3 Existing Site



2.4 Proposed Development

The proposed development is for a secure training facility which includes teaching, meeting, training and accommodation facilities (with FFL of 10.15m AOD), along with access road, car parking and various and associated external paved areas. The normal site occupancy is anticipated to be between 140 and 170 users several times a week, up to a maximum design peak occupancy of 300 persons across the site. The land that is currently part of the Building Supplies Site will remain undeveloped in the short term. The proposed development is shown in Appendix A.

3.0 SOURCES OF FLOOD RISK

This section summarises the potential flood risk to the site from various sources. A summary of this assessment of flood risk to the site is given in Table 2.

Table 2 Summary of Potential Sources of Flood Risk

Potential Source of Flooding	Overall Risk
Fluvial	Low
Tidal	Low
Surface Water	Very Low
Groundwater	Low
Sewer	Low
Infrastructure Failure	Low

3.1 Fluvial and Tidal Flooding

National Resources Wales detailed flood information (included in Appendix B) includes a map showing the current undefended (worst case) fluvial and tidal flood extents as derived from a combination of detailed and generalised modelled data. This mapping study uses sea levels from within the Severn Estuary, based on the set of extreme sea levels published by the Environment Agency in 2011 for the baseline year of 2008 and shows the site to be in Flood Zone 1 (land assessed as having a $\leq 0.1\%$ Annual Exceedance Probability (AEP) of fluvial or tidal flooding in any given year, equivalent to the 1 in $\geq 1,000$ year return period event).

The levels have been adjusted for climate change from 2008 to 2013 (+17.5mm), projected inland over a digital terrain model to produce elevation and depth grids as well as outlines for both the 0.5% (1 in 200yr) AEP and the 0.1% (1 in 1000yr) AEP tidal events. These levels have been adjusted further for a range of design events with 2016 baseline (28mm above the 2008 figures), and an interpolation between approximately 2km spaced model nodes (410 and 412) used for future levels at the site in the year 2078 (see Table 3). The proposed development is considered to have a design life of 60 years taking it to 2078 (2018 + 60 = 2078). Using a linear interpolation between levels in the years 2066 and 2091, the **0.5% (200yr) AEP level at the site is predicted to be 9.0mAOD.**

Table 3 Extreme sea levels for the site (including 95% Confidence Bound)

Year	Sea Level Rise (m)	Extreme Event Sea Level (mAOD)					
		T25	T50	T75	T100	T200	T1000
2016	0.028	7.9	8.0	8.2	8.2	8.5	9.1
2066	0.426	8.3	8.4	8.6	8.6	8.9	9.5
2091	0.732	8.6	8.7	8.9	8.9	9.2	9.8
2116	1.094	9.0	9.1	9.3	9.3	9.5	10.1

Source: NRW, 2016

There are three major rivers within Cardiff; the River Taf, River Ely, and the River Rhyrne. The River Ely lies to the South-west of the site, The River Taf is North West of the site. The River Rymney is to the North-east of the site. The closest watercourse to the site is the River Taff, approximately 1.4km to the west of the site. Though a high flow fluvial event may exacerbate a

storm surge induced, or other, high tide, given that the site is on the banks of the Cardiff Bay, fluvial levels are likely to be tide locked and the overall fluvial risk is considered relatively low in comparison and therefore is tidally dominated.

With ground levels on site at 9.3 mAOD and above, the site is considered to be currently at a low risk of fluvial and tidal flooding.

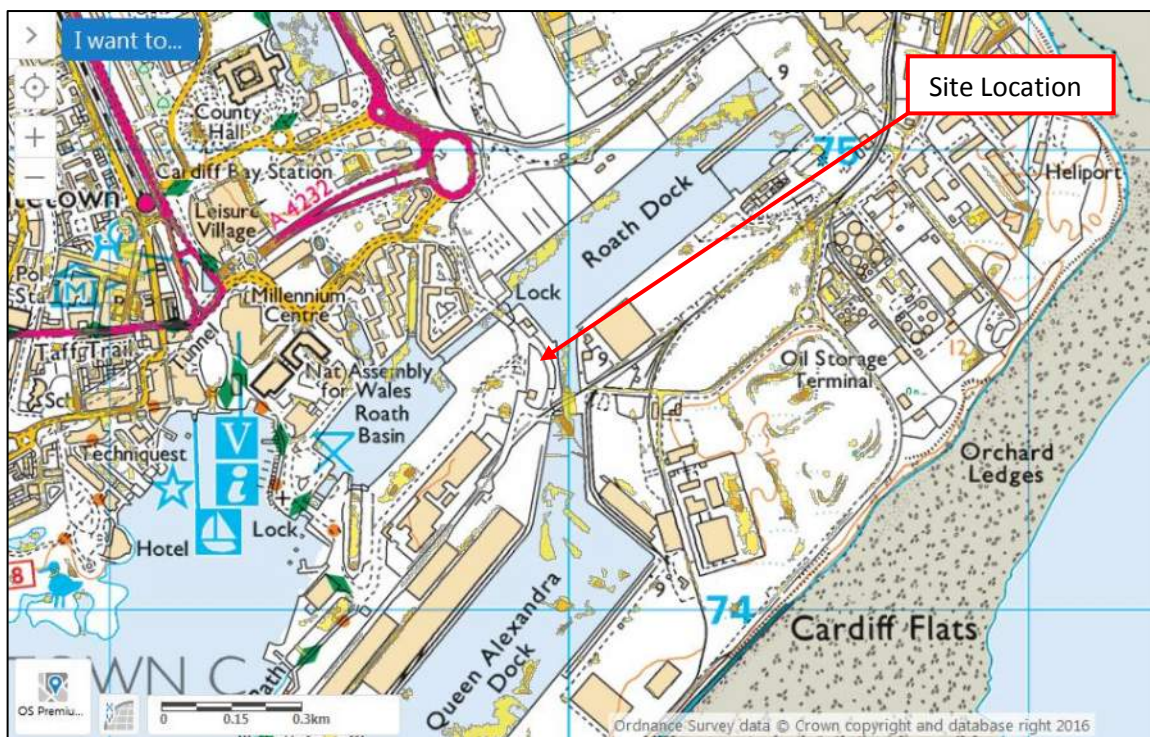
Though the Natural Resources Wales detailed flood information also states that the Cardiff barrage provides protection for events greater than 0.1% (1000yr) AEP, this is not necessarily true over the lifetime of the development. With undefended 0.1% (1000yr) AEP levels in Table 3 significantly above site ground levels, the site is concluded to be within Natural Resources Wales Flood Zone C1. Further references to the Welsh Government Development Advice mapping and Flood Zones is included in Section 5.0.

3.2 Surface Water Flooding

Surface water flooding occurs as the result of an inability of intense rainfall, or overland flows, to infiltrate to ground. This often happens when the maximum soil infiltration rate or storage capacity is reached. Such flows either drain into existing land drainage features or follow the general topography which can concentrate flows and lead to localised ponding/flooding.

The Natural Resources Wales Surface Water Flooding Map is included in Figure 4. The site is shown to be at a very low risk of surface water flooding.

Figure 4 National Resources Wales Surface Water Flooding



Source: Natural Resources Wales

3.3 Groundwater Flooding

British Geological Survey mapping shows the site with Mercia Mudstone Group - Mudstone bedrock geology with superficial tidal flat deposits of Clay, Silt and Sand. The National Soil Resources Institute shows the site with loamy and clayey soils, and a naturally high groundwater level.

The site is largely impermeable surfaces (which would cap any rising a rising water table) and given that there is no higher surrounding ground from which groundwater could egress to the site, the overall risk posed by groundwater flooding to the site is considered to be low.

3.4 Sewer Flooding

The SFRA study area 60LBRM (Atkins 2011, p64) is shown to surround the site. Two sewer related flooding incidences are listed in the study area, one along Greenbay Road and another at the Pengam Green Tesco. These are significantly remote (around 1.5km north) to the site, and the risk of flooding at the site itself from this source is concluded to be low.

3.5 Infrastructure Failure Flooding

The Natural Resources Wales Flood Risk Map (Figure 5) shows the site on the edge of the maximum extent following a failure of a reservoir(s). The chance of this actually occurring is however understood to be extremely low.

Figure 5 National Resources Wales Reservoir Flooding



Source: Natural Resources Wales

There is no known risk from canals or any other artificial source and so the site is concluded to be at low risk of flooding from infrastructure failure.

4.0 HISTORIC FLOODING

An internet search for flooding in Cardiff Bay found reports of an event in December 2009 when the city's Mermaid Quay shopping centre (approximately 650 west of the site) was flooded. The cause of the flooding was unknown, given that the Cardiff Bay Barrage's sluice gates allow the Harbour Authority to accurately control the level of water impounded in the Bay (Wales Online, 2009). Reports indicate a high tide level of 12.1m AOD during this event. The Bay is also understood to have flooded in January 2014 (ITV, 2014). However, these events are not understood to have resulted in flooding of the site.

National Resources Wales holds no historic flood information for the site or nearby vicinity (NRW, 2016).

5.0 TAN15 AND THE PROPOSED DEVELOPMENT SITE

5.1 Planning Policy Requirements

The site is demonstrated in Section 3.1 as being at a low risk from fluvial and tidal flooding, and at a low risk of flooding from all other sources. However, the site could be considered to be within Flood Zone B as defined in Table 4. Over the lifetime of the development, the site will potentially fall within Natural Resources Wales Flood Zone C1 if the tidal defence scheme is not maintained and protection increased in line with climate change induced sea level rise. The site is also currently shown on the north-east edge of the site at the boundary of the Flood Zone C1 extent in the Development Advice Map, Figure 6.

Flood Zone C1 is used to indicate that development can take place subject to application of justification test, including acceptability of consequences.

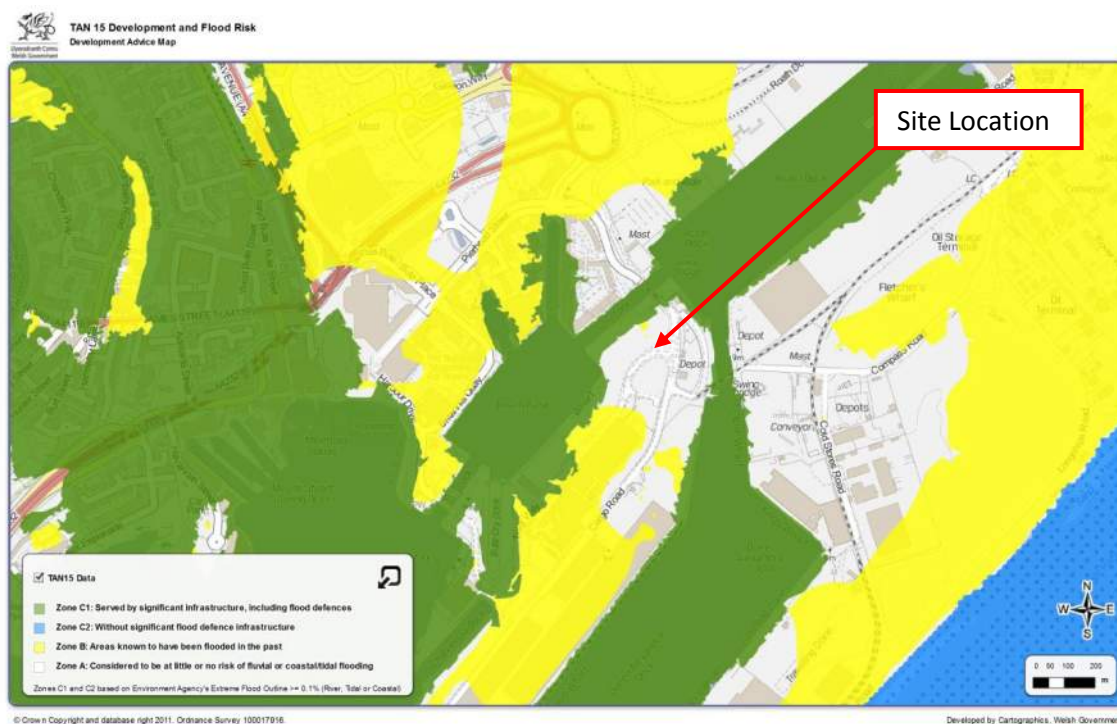
The proposed training facility is considered 'a highly vulnerable development' in terms of flood risk (Welsh Assembly Gov., 2004, Figure 2, p7). The TAN15 Flood Risk Vulnerability and Flood Zone Compatibility matrix (Welsh Assembly Gov., 2004, Section 12, p7) indicates that this vulnerability would be appropriate within Zone C1, subject to the requirements of the justification test and acceptability of consequences.

The proposals are considered to be in line with the justification test (Welsh Assembly Gov., 2004, Section 6, p8) due to the following:

- the objectives are understood to be supported by the local authority, and other key partners, to sustain an existing settlement. The proposals will contribute to employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region; and
- the proposals concur with the aims of Planning Policy Wales and meet the definition of previously developed land (WG, 2016, Figure 4.4, p70)

The consequences are also considered acceptable subject to the application of the flood resistance measure of raising finished floor levels in line with the future design peak flood level. This, along with use of Natural Resources Wales flood warning service (which will give an indication of when travel in the local area may be compromised) will ensure that the proposed development and occupants would be safe for the design life of the development.

Figure 6 Development Advice Map



Source: Welsh Assembly Government

Table 4 National Resources Wales Flood Zones

Description	Zone	
Considered to be at little or no risk of fluvial or tidal/coastal flooding	A	Used to indicate that justification test is not applicable and no need to consider flood risk further
Areas known to have been flooded in the past evidenced by sedimentary deposits.	B	Used as part of a precautionary approach to indicate where site levels should be checked against the extreme (0.1%) flood level. If site levels are greater than the flood levels used to define adjacent extreme flood outline there is no need to consider flood risk further
Based on Environment Agency extreme flood outline, equal to or greater than 0.1% (river, tidal or coastal)	C	Used to indicate that flooding issues should be considered as an integral part of decision making by the application of the justification test including assessment of consequences.
Areas of the floodplain which are developed and served by significant infrastructure, including flood defences.	C1	Used to indicate that development can take place subject to application of justification test, including acceptability of consequences.
Areas of the floodplain without significant flood defence infrastructure.	C2	Used to indicate that only less vulnerable development should be considered subject to application of justification test, including acceptability of consequences. Emergency services and highly vulnerable development should not be considered.

Source: TAN 15 (WA, 2004, p5)

5.2 Flood Resistance

Cardiff Bay is protected from high tides by the Cardiff Bay barrage between Alexandra Dock and Penarth Head. In addition to this, water levels around the site can be controlled by the adjacent dock gates shown in Figure 1 and Figure 2.

The only measure recommended is to raise the building finished floor levels (FFLs) by 600mm (in line with WG, 2004, p27) above the to the 0.5% (200yr) AEP design level of 9.0m AOD to a **FFL of at least 9.6m AOD** (9.0m AOD + 0.6m = 9.6m AOD). It has been confirmed the building FFL will be set at 10.15m AOD, which satisfies this recommendation. As well as protecting the buildings, occupants and contents from an anticipated extreme event, any residual surface water, should it occur, will be directed away (as per best practice design) from the building.

5.3 National Resources Wales Flood Warning Services

National Resources Wales has a 'flood alert' flood warning service for the 'coast from Aberthaw to Severn Bridge / yr Arfordir o Aberddawan hyd at Pont Hafren' (Quickdial number: 0512341). Current warnings are available to view online at <http://naturalresources.wales/flooding/check-flood-warnings>.

6.0 CLIMATE CHANGE

Climate change is anticipated to increase sea levels by between 25 and 30cm by 2050, with a greater increase in the south of Wales than the north (WG, 2004, A2.6, p32).

Increases in Natural Resources Wales design peak seal levels are included in Section 3.1 Fluvial and Tidal Flooding, with consideration of this made in Section 5.2 Flood Resistance.

As surface water is to be discharged into tidal waters, climate change is not considered in Section 7.2 Proposed Surface Water Management.

7.0 SURFACE WATER MANAGEMENT

7.1 Existing Surface Water Management

Due to the nature of the site all surface water runoff from impermeable areas is discharged directly into Cardiff Docks.

The existing development site is drained by traditional piped below ground drainage systems which are privately owned. These drainage systems discharge direct to Cardiff Docks. There are likely to be several existing outfalls through the dock walls into Cardiff Docks.

7.1.1 Existing development drainage

The existing site currently contains a small area of roof and some impermeable surfacing that would generate surface water runoff.

Any existing drainage connection that may be disrupted by the proposed development will be reconnected to the new drainage system.

7.1.2 Existing flows

The total development site area is 7730m², of which 5184m² is impermeable (67%). Considering a short and intense 15 minute duration storm this generates the following discharge rates into Cardiff Docks:

- 15 minute storm, 1 in 2 years = 49 litres per second (34mm/hr)
- 15 minute storm, 1 in 30 years = 93 litres per second (65mm/hr)
- 15 minute storm, 1 in 100 years = 120 litres per second (84mm/hr)

7.1.3 Means of disposal

The existing means of surface water discharge is direct to Cardiff Docks. There is no restriction on the existing discharge rate as it is essentially a sea discharge.

7.2 Proposed Surface Water Management

7.2.1 Proposed development

The proposed development includes the training facility building, access road, car parking and various and associated external paved areas. The remaining land that is currently part of the Building Supplies Site will remain undeveloped in the short term.

7.2.2 Proposed flows

The total development site area is 7730m², of which 6564m² will be impermeable (85%). Considering short and intense 15 minute duration storms this would generate the following discharge rates:

- 15 minute storm, 1 in 2 years = 62 litres per second (34mm/hr)
- 15 minute storm, 1 in 30 years = 118 litres per second (65mm/hr)
- 15 minute storm, 1 in 100 years = 153 litres per second (84mm/hr)

An unrestricted discharge direct to Cardiff Docks is proposed, as it is essentially a discharge to sea and poses no downstream flood risk.

7.2.3 Building drainage

The proposed facility will be served by a private, building regulations compliant, below ground drainage system.

7.2.4 Discharge to Cardiff Docks

The proposed surface water drainage system will discharge to Cardiff Docks as per the existing site. Where possible, the existing outfalls will be utilised to avoid disrupting the dock walls. If a new outfall is required it will be integrated into the dock wall, to a detail that satisfies ABP as the port operator to avoid causing an obstruction through the lock between Roath Dock and Queen Alexandra Dock.

7.2.5 Discharge rate

The proposed discharge rate is at an unrestricted rate in to Cardiff Docks.

7.2.6 Water quality

An alarmed class 1 oil separator will be provided upstream of the outfall into Cardiff Docks to ensure that the water quality is not adversely affected. This will limit both oil and silt content within the discharge. Roof water will not be passed through the separator.

7.2.7 Outline layout

An outline surface water drainage layout is shown on drawing STF-HYD-XX-XX-DR-C-700 rev P6 attached to this report, indicating both on and off-site drainage. Separate external and roof drainage runs are shown to ensure that roof water runoff is not passed through the oil and silt separator that serves the access road, car parking and external areas. The existing outfalls into the dock are shown as being re-used for the permanent works.

8.0 FOUL WATER MANAGEMENT

8.1 Existing Foul Water Management

Due to the nature of the site and the lack a permanent fixed land linking the site to the mainland it has historically not benefitted from the use of traditional public or main sewers, which has required alternative means of foul water drainage.

The existing development site is drained by traditional piped below ground drainage systems which are privately owned. These drainage systems discharge to two septic tank systems, serving the past and existing buildings on the site, which in turn discharge treated effluent to Cardiff Docks for which an NRW discharge consent exists.

Any existing foul drainage connections from the Tyneside Road ABP security gate and the swing bridge control room that may be disrupted by the proposed development will be reconnected to the new drainage system.

8.1.1 Existing Flows

The total foul sewage flow rate from the existing developments on the site is expected to be well under 0.25l/s.

Foul flows from these former and existing developments are minimal due to the commercial and low occupancy nature of the individual operations.

8.1.2 Means of Disposal

ABP, as the port operator, confirmed that the former Seaman's Mission Building (now demolished), the Sea Cadets Cabins/Compound, and the nearby Builder's Merchants were/are drained into two separate septic tank treatment systems, which discharges treated effluent to Cardiff Docks. The tanks are periodically emptied of sludge by licenced waste carriers on a private contract basis.

Due to the comparatively low flow rates and volumes of foul sewage discharging to the septic tanks from these low-occupancy developments it is considered a suitable means of drainage for a site that historically does not have a permanent foul sewer in the local vicinity in which to discharge to.

These units will be fully decommissioned as part of the proposed development

8.2 Proposed Foul Water Drainage

8.2.1 Proposed Flows

The proposed development is expected to generate 1.5 litres per second of foul flow during normal operation and around 2.0 litres per second at peak times.

Maximum 300 short-term visitors (building capacity) = 3l/s

8.2.2 Nearby public sewerage infrastructure

The original and preferred means of foul drainage disposal for the proposed building was to a nearby gravity sewer in Heol Porth Teigr. This is a private foul sewer owned and operated by the Welsh Government and Igloo Regeneration. This existing sewer currently serves the BBC Roath Lock Studios development and the GloWorks office development. This existing sewer is due to serve the remainder of the Porth Teigr development in the future. The downstream end of this existing sewer within Porth Teigr is an adopted Welsh Water sewage pumping station, which was built by Welsh Water as part of the Porth Teigr Infrastructure works contact in 2010. Due to a levels constraint, the upstream end of the existing foul sewer in Heol Porth Teigr would need to be reached by a new private pumping station on the proposed development site.

Following a long period of negotiation with the Welsh Government and Igloo Regeneration, an agreement to allow the proposed development of HMS Cambria to connect into the existing sewer could not be secured due to concerns over ownership, disruption, capacity and future adoption by DCWW). In this case the 2011 automatic sewer transfer (from private to DCWW public ownership) does not apply as it lies within ABP's Cardiff Docks land.

Due to the fact that this part of Cardiff Docks is an island, there are no other fixed links between the site and the mainland, where the remainder of the public sewerage infrastructure lies. The creation of a new foul water sewer link through to the mainland is far beyond what this development could support, which is why an alternative means of foul water disposal was required.

8.2.3 Proposed drainage

a) Building drainage

The proposed solution to drain the proposed HMS Cambria development is to provide a new packaged sewage treatment plant on the site, to discharge treated effluent to Cardiff Docks to the necessary water quality standards. The proposed unit is to be fully compliant with BS EN 12255 and other relevant legislation and standards.

The existing treatment plant has a live discharge consent. This system is to be de-commissioned, but we will require a new consent from NRW to cover this new treatment plant.

b) On-site pumping station

The proposed private foul drainage, the packaged sewage treatment plant and its discharge will be in accordance with the following standards and guides

- Design of below ground drainage systems: BS EN 752-1:1996. Drain and sewer systems outside buildings
- Building Regulations Part H
- Construction of below ground drainage systems: BS EN 1610:2015. Construction and testing of drains and sewers
- Sizing of the sewage treatment plant shall use the guidance within “British Water’s Flows and Loads 4 guidance”
- Design and Specification of packaged treatment plants: BS 6297:1983. Code of practice for design and installation of small sewage treatment works and cesspools
- Manufacture of packaged treatment plants: BS EN 12255-1:2002. Wastewater treatment plants. General construction principles
- The selected packaged sewage treatment plant shall be tested at certified under BS EN12566-3
- Inspection of the unit shall be carried out on at least a weekly basis by trained on-site building management personnel
- Maintenance of packaged sewage treatment plant shall be carried out on at least a quarterly period and inspected at least every week. Maintenance regime to be strictly in accordance with the manufactures’ requirements.
- Discharge consent, water quality standards / limits and monitoring requirements to be in accordance with Natural Resources Wales guidelines and standards

c) Outline Layout

An outline foul water drainage layout is included in Appendix D.

The internal foul building drainage is purely indicative at this stage and has been shown to demonstrate potential connectivity to the main building drainage.

The existing treated effluent discharge pipe is shown as being abandoned as part of this work, with the existing septic tank equipment being removed.

9.0 SUMMARY

This report is a Flood Consequence Assessment for a proposed development on an island within Cardiff Docks, Cardiff.

The existing brownfield site is currently occupied by the Cardiff Fuel Centre, Cabins and out-buildings formerly associated with the Cardiff Sea Cadets and Atkin Trade Specialists. The proposed development is a secure training facility.

The site has been demonstrated as being at a low risk of fluvial and tidal flooding, and at a low risk of flooding from all other sources. Though the site is protected by the tidal defences and currently within Flood Zone B, the site will potentially be within Flood Zone C1 over the lifetime of the development if the tidal defence scheme is not maintained and protection increased in line with climate change induced sea level rise.

Natural Resources Wales holds no historic flood information for the site or nearby vicinity.

The proposed development is considered highly vulnerable with respect to flood risk and is considered appropriate under the justification test and acceptability of consequences. The proposals are shown to be in accordance with the justification test subject to the raising of FFLs in line with the future design flood level, and the consequences of this flood will be acceptable.

Surface water run-off from the site will be discharged at an unrestricted rate into the Cardiff Docks tidal waters, as per the existing arrangement, using existing outfalls where possible. An alarmed class 1 oil separator will be provided upstream of the outfall to ensure that the water quality is not adversely affected.

A foul water management strategy includes facility to discharge foul water from the building, to an on-site private packaged treatment plant, with a treated effluent discharge to Cardiff Docks, as per the current development site situation.

As such the application is shown to meet the requirements of TAN15.

Hydrock Consultants Limited

REFERENCES

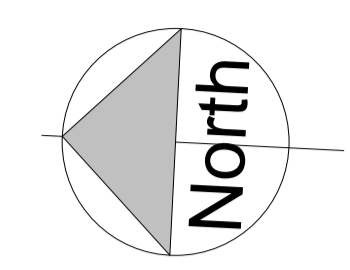
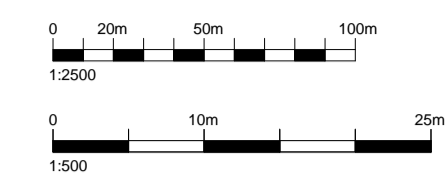
Author	Date	Description
Atkins	Nov 2011	Cardiff Strategic Flood Risk Assessment Phase 2 Part 1 Extend Development Lifetime to 2110 Areas A, G, H and I Final Report
Defence Infrastructure Organisation (DIO)	2016	Climate Impact Assessment Annex A - Estate and Climatic Information Project Cardiff
ITV News	Jan 2014	Clean-up operation continues after severe storms (available at http://www.itv.com/news/wales/update/2014-01-03/parts-of-cardiff-bay-flooded-during-high-tides/)
Wales Online	Dec 2009	Mystery about cause of flooding at Cardiff Bay (available at http://www.walesonline.co.uk/news/wales-news/mystery-cause-flooding-cardiff-bay-2063856)
Welsh Assembly Government (WG)	Jul 2004	Technical Advice Note 15: Development and Flood Risk (TAN15)
Welsh Assembly Government (WG)	Jan 2016	Planning Policy Wales Edition 8

APPENDIX A – SITE LOCATION

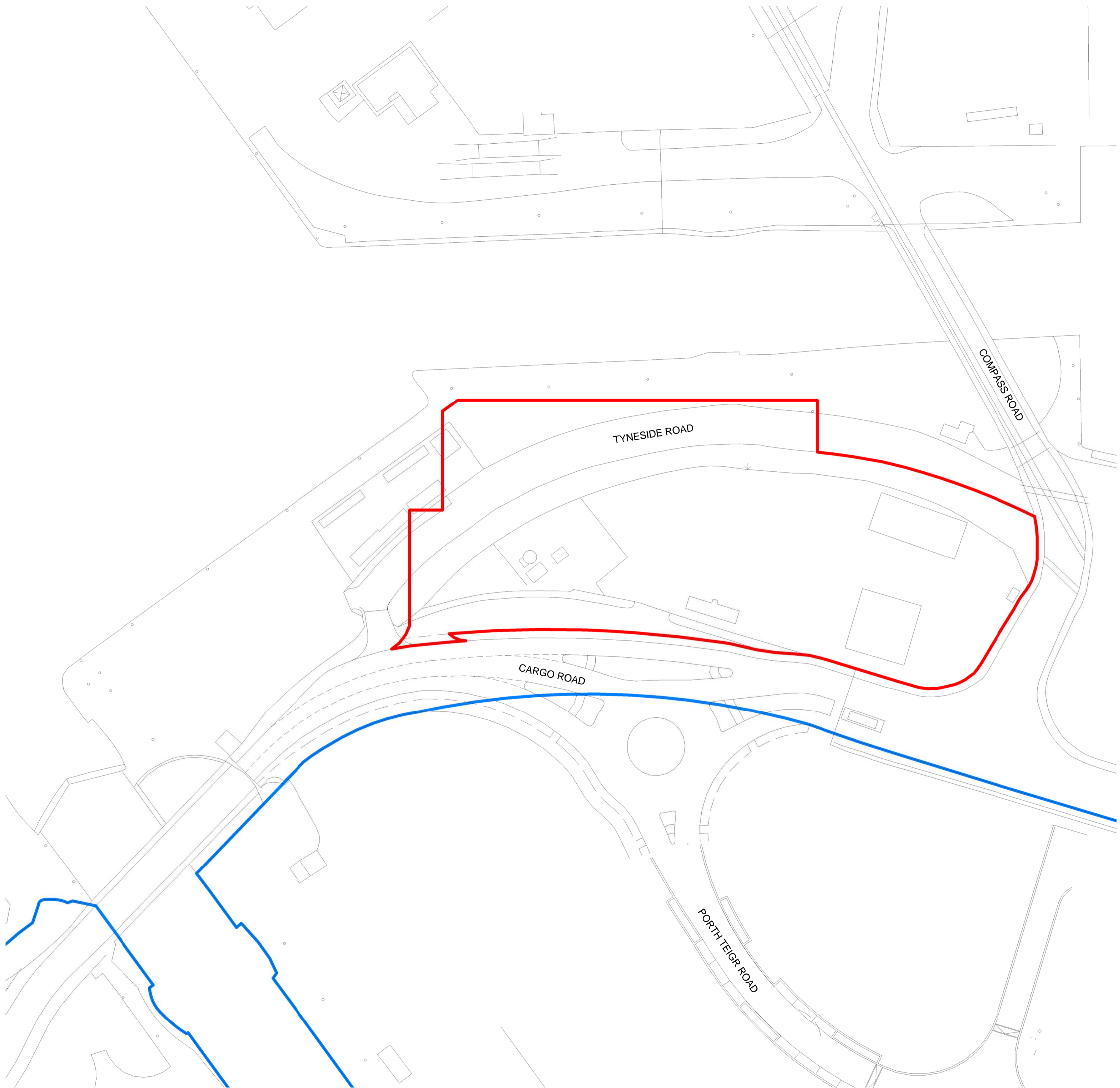
Reference	Title
079-CHT-00-00-DR-A-01001 Rev T2	Site Location Plan

Notes:
Contractors must verify all dimensions on site before commencing any work or shop drawings. This drawing is not to be scaled. Use figured dimensions only.
Subject to statutory approvals and survey.

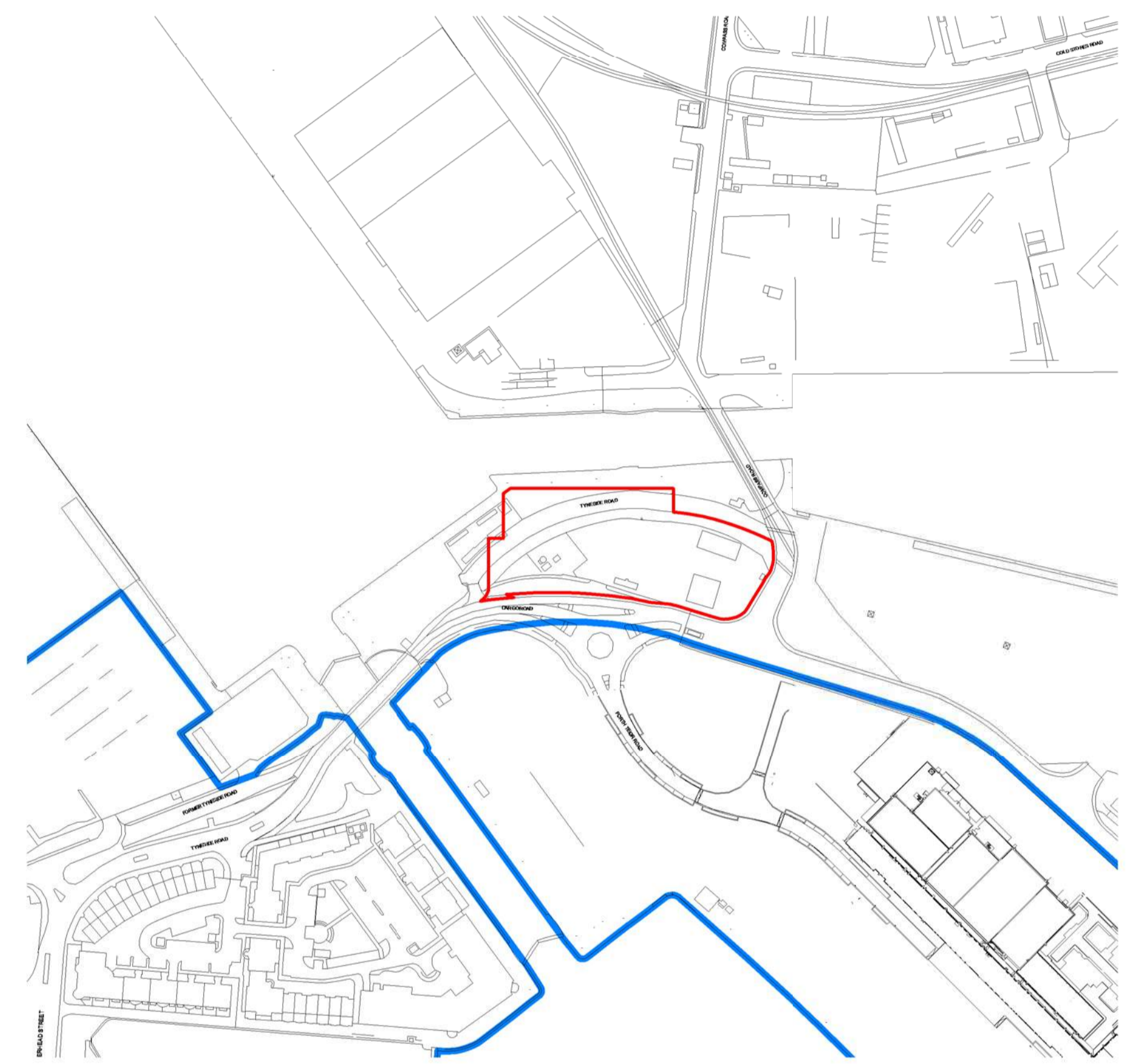
Alerts:
Building areas are liable to adjustment over the course of the design process due to the ongoing construction detailing developments.



— Site Boundary
— ABP Ownership



1 Site Location Plan
1 : 500



2 Site Location Plan
1 : 2500

T 2	TENDER ISSUE	07/07/17	ST
T 1	Issued for client comment	19/04/17	ST
Rev	Description	Date	Issued By

TENDER

chetwoods
architects
32 frederick street, birmingham, B1 3HH
tel (0121) 234 7500 www.chetwoods.com

Project
SECURE TRAINING FACILITY

Client
ABP

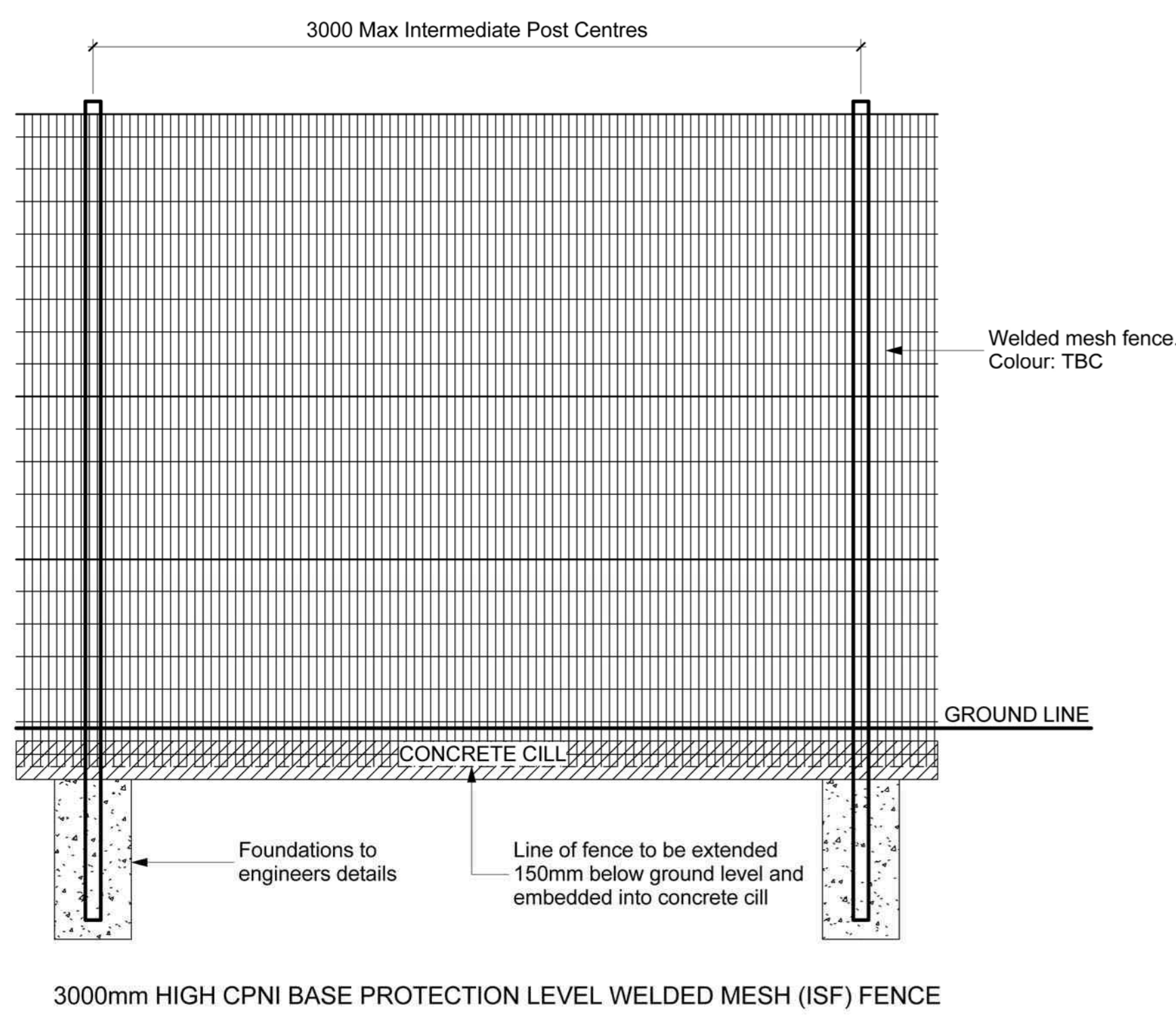
Drawing Title
SITE LOCATION PLAN

Rev.
T2

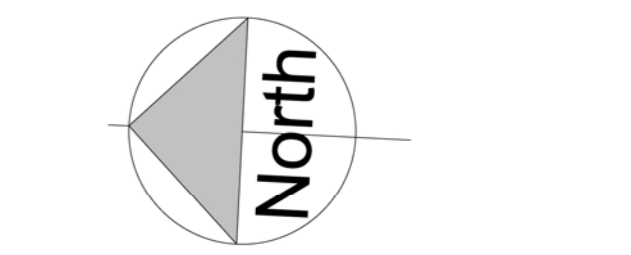
Scale	As indicated	Size	A1	Drawn	ST	TM	Check	TM	Date	31/08/16			
Project	4079	Contractor	CHT	Zone	00	Level	00	Type	DR	Revision	A	Number	01001

APPENDIX B – PROPOSED LAYOUT

Reference	Title
4079-CHT-00-00-DR-A-01051 Rev T2	Proposed External Finishes
4079-CHT-00-00-DR-A-01060 Rev PL2	Proposed Site Plan



Notes:
Contractors must verify all dimensions on site before commencing any work or shop drawings. This drawing is not to scale. Use figure dimensions only.
Subject to statutory approvals and surveys.
Areas building areas are liable to adjustment over the course of the design process due to the ongoing construction detailing developments.



- - - Site Boundary
- - - 3m High CPNI Base Protection Level Welded Mesh (SF) Fence

- Hard Landscaping:**
- Concrete Paving Slabs**
Colour: charcoal
Size: 600mmx600mm
 - Tarmac**
 - Feature Paving**
Colour: silver mid-grey/graphite
Size: 650mmx1500mm
 - Feature Paving**
Colour: graphite
Size: 650mmx1500mm
 - Gravel**
 - Slate Chips**

- Soft Landscaping:**
- Ground Cover Shrubs (appropriate to context)
 - Grass
 - Quercus/Hedging
 - Ilex Castaneifolia x4
 - Crataegus x Prunifolia Splendens x2
 - Pinus Pineae or Pinus Pinaster x1
 - Arbutus Unedo Standard x4
 - Sorbus Intermedia x1

NOTE:
All excavations for hard and soft landscaping, including trees, furniture, signage and fencing to be supervised by an EOD engineer. Refer to EOD contracts desktop study report 1170626 DTS Report 17311 for full mitigation measures.
Soft landscape details to landscape architects design and specification.



1 Proposed External Finishes
1:200

Rev	Description	Date	Issued By
T 1	TENDER ISSUE	07/10/16	ST
T 1	Issued for client comment	16/04/17	ST

TENDER
chetwoods
SPECIALISTS
32 Frederick Street, Birmingham, B1 3BH
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Project:
SECURE TRAINING FACILITY

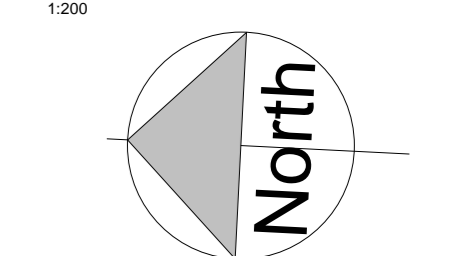
Client:
ABP

Drawing Title:
PROPOSED EXTERNAL FINISHES

As indicated	A0	ST	TM	07/10/16
4079	CHT	00	DR	A 01051

Rev:
T2

NOTES:
 1. Consider that only all dimensions on drawings are to be used for construction and not for site change. The drawing is not to be used for any other purpose.
 2. All dimensions are in meters unless otherwise stated.
 3. All dimensions are to be taken from the centre of the drawing unless otherwise stated.
 4. The drawing is not to be used for any other purpose.
 5. The drawing is not to be used for any other purpose.
 6. The drawing is not to be used for any other purpose.
 7. The drawing is not to be used for any other purpose.
 8. The drawing is not to be used for any other purpose.
 9. The drawing is not to be used for any other purpose.
 10. The drawing is not to be used for any other purpose.



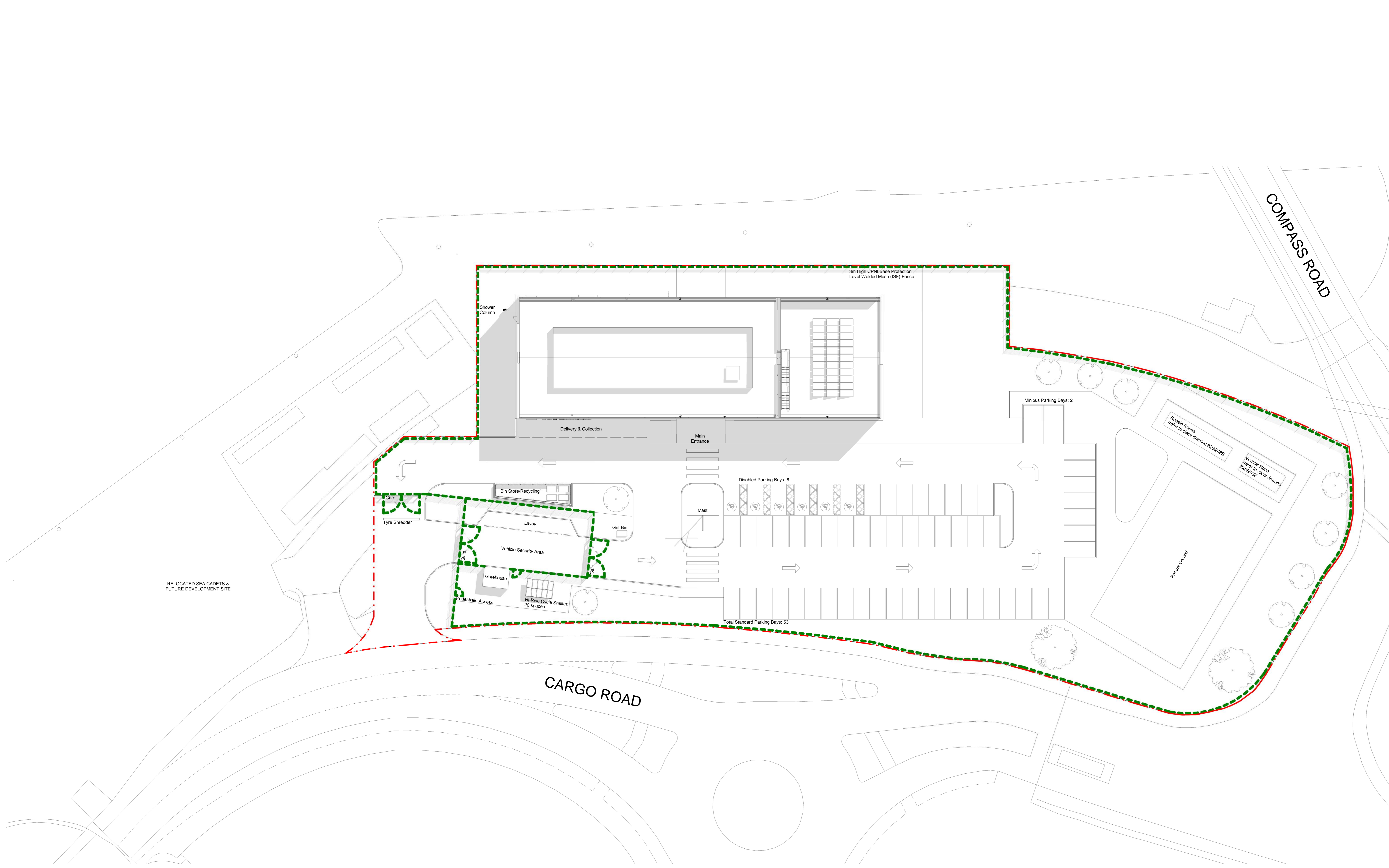
— Site Boundary
 - - - 3m High CPNI Base Protection Level Welded Mesh (SF) Fence

Site Area
 Red Line Boundary: 1.86a / 0.75ha

Parking Schedule
 Standard Parking Bays: 53
 Disabled Parking Bays: 6
 Minibus Marking Bays: 2
 Cycle Spaces: 20

Accommodation Schedule
 Ground Floor: 1025sq.m
 First Floor: 972sq.m
 Second Floor: 783sq.m
 Third Floor: 680sq.m
 Total: 3460sq.m

Gatehouse
 Area: 12sq.m



RELOCATED SEA CADETS & FUTURE DEVELOPMENT SITE

1 Proposed Site Plan
 1 : 200

PL 1	Site not attached to red line boundary	28/11/17	BT
PL 1	Revised to include 100 meters	24/11/17	BT
Rev	Revision Description	Date	Author

PLANNING
 32 Frodoch Street,
 Birmingham, B1 3PL



Project:
SECURE TRAINING FACILITY

Client:
 ABP

Drawing Title:
PROPOSED SITE PLAN

Scale	Site	Drawn	Checked	Date
1 : 200	A0	ST	TM	09/05/16

Project	Originator	Zone	Level	Type	Revision	Number	Rev
4079	CHT	00	DR	A	01060	PL2	

APPENDIX C – NATURAL RESOURCES WALES

Reference	Title
ATI-11172a – Cardiff Bay Sites	Product 4 Detailed Flood Information

ATI-11172a – Cardiff Bay Sites

E: 319850 N: 174606

1.0 Current Flood Map

Figure 1 shows the current Flood Map (version 201607) at this location. The Flood Map represents the undefended fluvial and tidal flood extents derived from a combination of detailed and generalised modelled data.

The current tidal flood map in this area was updated by NRW in 2013. This mapping study uses sea levels from within the Severn Estuary, based on the set of extreme sea levels published by the EA in 2011 (*ref2*) for the baseline year of 2008. The levels were adjusted for climate change from 2008 to 2013 (+17.5mm), projected inland over a digital terrain model to produce elevation and depth grids as well as outlines for both the 0.5% (1 in 200) AEP (annual exceedance probability) and the 0.1% (1 in 1000) AEP tidal events.

More information on the Flood Map can be obtained from the Natural Resources Wales website <http://www.naturalresources.wales/floodriskmap>.

2.0 Extreme Sea Levels & Climate Change Guidance

Sea levels used in this projection model come from a nationally consistent set of extreme sea levels (*ref 2*). These levels were derived using a tidal model calibrated to UK tidal gauge data. The model output is provided for node locations spaced at approximately 2km. 95% confidence bounds for these values were also derived using the confidence intervals for each node location. The extreme sea levels comprise still water level including storm surge, however they do not account for local wave action. The baseline estimations are for the year 2008, so climate change is calculated relative to this year, for example add 28mm for the year 2016.

Extreme sea levels for the node points closest to the site location are included in **Table 1** for a range of return periods (events) e.g. T100 is the 1 in 100 year return period tide, which is equivalent to the 1% AEP (Annual Exceedance Probability). The node locations are shown in **Figure 2**.

Table 1: 2008 Baseline Extreme Sea Levels for adjacent nodes

Node	Easting	Northing	Extreme Event Sea Level (mAOD)					
			T25	T50	T75	T100	T200	T1000
410	321133	174749	7.69	7.81	7.88	7.94	8.08	8.46
412	319666	173088	7.63	7.75	7.83	7.88	8.02	8.42

To provide the estimate of extreme sea levels for the site (**Table 2**), levels were interpolated from the adjacent nodes.

Table 2: 2008 Baseline Extreme Sea Levels interpolated between adjacent nodes

Node	Easting	Northing	Extreme Event Sea Level (mAOD)					
			T25	T50	T75	T100	T200	T1000
Site	320926	173781	7.66	7.78	7.86	7.91	8.05	8.44
95% Confidence Bound (+/- m):			<i>0.20</i>	<i>0.20</i>	<i>0.30</i>	<i>0.30</i>	<i>0.40</i>	<i>0.60</i>

The current guidance on climate change from DEFRA is as follows:

Table 3: Sea level rise, mm per year

Assumed vertical land movement	1990-2025	2025-2055	2055-2085	2085-2115
-0.5	3.5	8.0	11.5	14.5

The calculated future extreme sea levels are shown in **Table 4**. Adopting a precautionary approach as advised by Environment Agency guidance (*ref 4*), these levels include the upper level 95% confidence bound.

Table 4: Extreme sea levels for the site (including 95% Confidence Bound)

Year	Sea level rise(m)	Extreme Event Sea Level (mAOD)					
		T25	T50	T75	T100	T200	T1000
2016	0.028	7.9	8.0	8.2	8.2	8.5	9.1
2066	0.426	8.3	8.4	8.6	8.6	8.9	9.5
2091	0.732	8.6	8.7	8.9	8.9	9.2	9.8
2116	1.094	9.0	9.1	9.3	9.3	9.5	10.1

3.0 Additional Information

NRW holds no historic flood information for the site or nearby vicinity.

For Cardiff the barrage provides protection for events greater than 0.1% AEP.

The local authority may be able to provide information on issues such as localised flooding from sewers, drains and culverts.

4.0 References

1. Tidal Flood Mapping Study (Penarth and Chepstow), Study report Issue 1, Atkins July 2008
2. Department for Environment, Food and Rural Affairs, 2011. *Technical Report Design sea levels*. R&D Report SC060064. Defra/Environment Agency
3. Flood and Coastal Defence Appraisal Guidance: FCDPAG3 Economic Appraisal. Supplementary Note to Operating Authorities – Climate Change Impacts; October 2006; Department for Environment, Food and Rural Affairs.
4. Using the national coastal flood boundary data for England and Wales, Environment Agency Operational Instruction 490_11, Issued 4/2/2011

5.0 Notes

Undefended scenarios are provided as being a possible worst case scenario in the event of defence failure. They are used as the basis of the Flood Map.

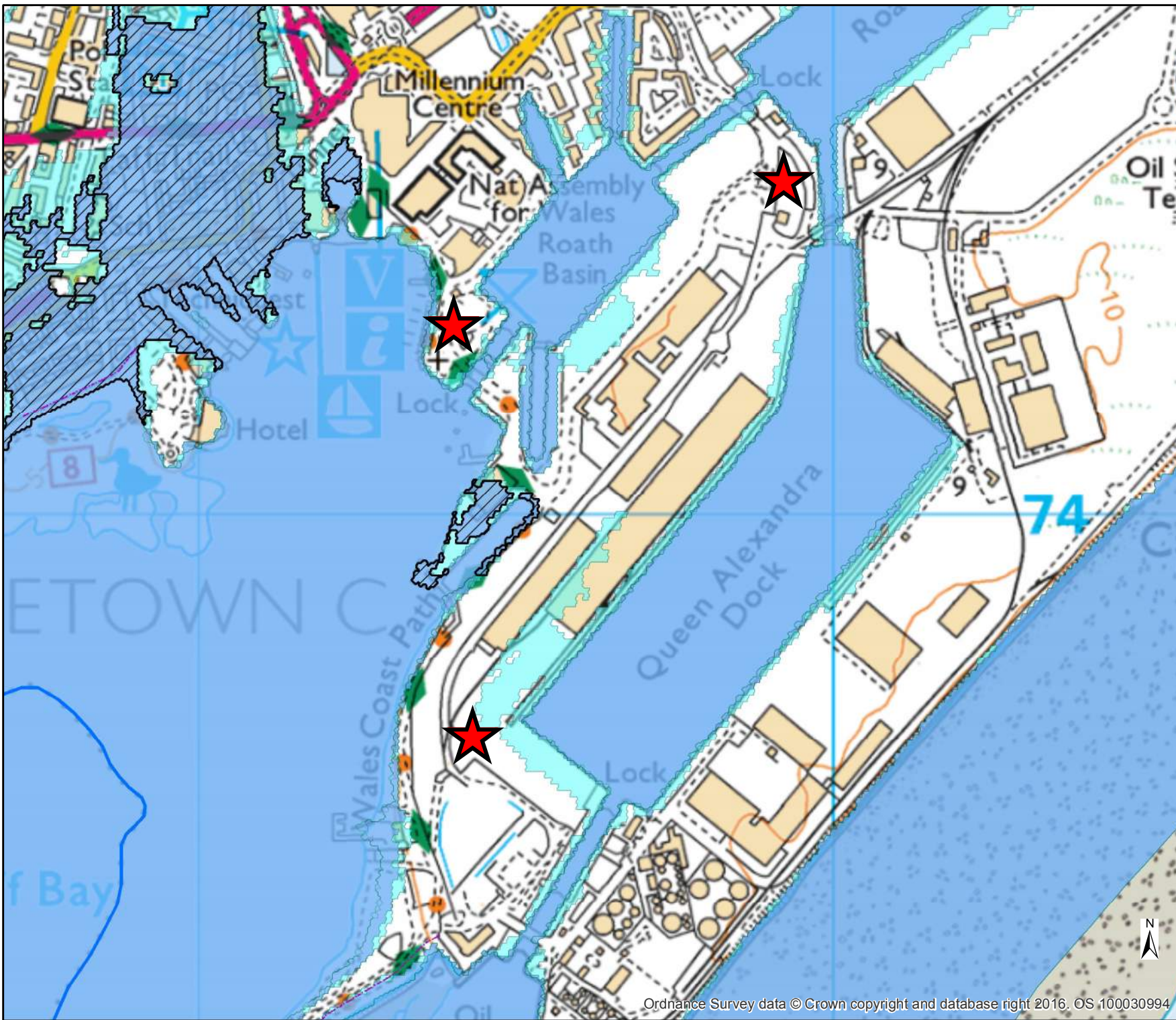
Extreme sea levels provided as part of this project are accurate to one decimal place (**Table 4**). Two decimal places have been provided to show the gradual change between nodes seen in the model, however, this does not imply greater accuracy.

The scope of the model is the mapping of flood risk, it is not intended for detailed design.







The model should be considered as the starting point for more detailed modelling, commensurate with the consequences of flooding at the site of interest.

NRW models are available under licence agreement for the purpose of further development. Contact Natural Resources Wales Data Distribution team for details of terms, conditions and pricing.

If the data is used in support of an FCA, please include the reference number. Please refer to NRW standard terms and conditions.



Legend

-  Site Location
-  Flood Zone 3 (1 in 100 year undefended fluvial and 1 in 200 year undefended tidal extents)
-  Flood Zone 2 (1 in 1000 year undefended fluvial and tidal extents)
-  Areas benefiting from defences
-  Defences
-  Main Rivers

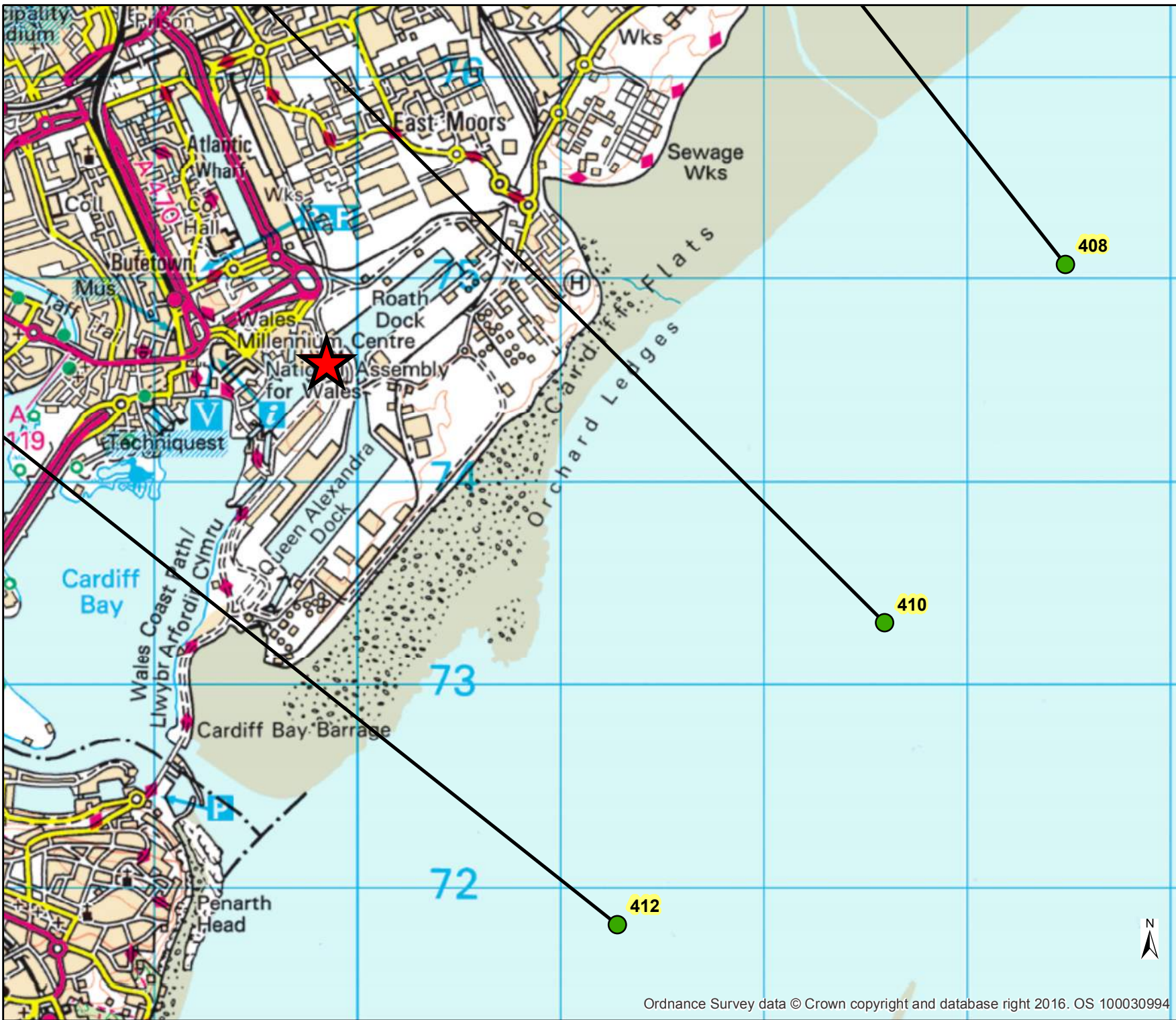
 **Cyfoeth Naturiol Cymru**
Natural Resources Wales

Project
 Cardiff Bay Sites
 (ATI-11099a)

Drawing
 Figure 1:
 Current Floodmap
 [v201607]

Date
 23 Sep 2016

Scale
 1:8,000



- Legend**
- ★ Site Location
 - Projection Lines
 - Extreme Sea Level Node

 **Cyfoeth Naturiol Cymru**
Natural Resources Wales

Project
 Cardiff Bay Sites
 (ATI-11099a)

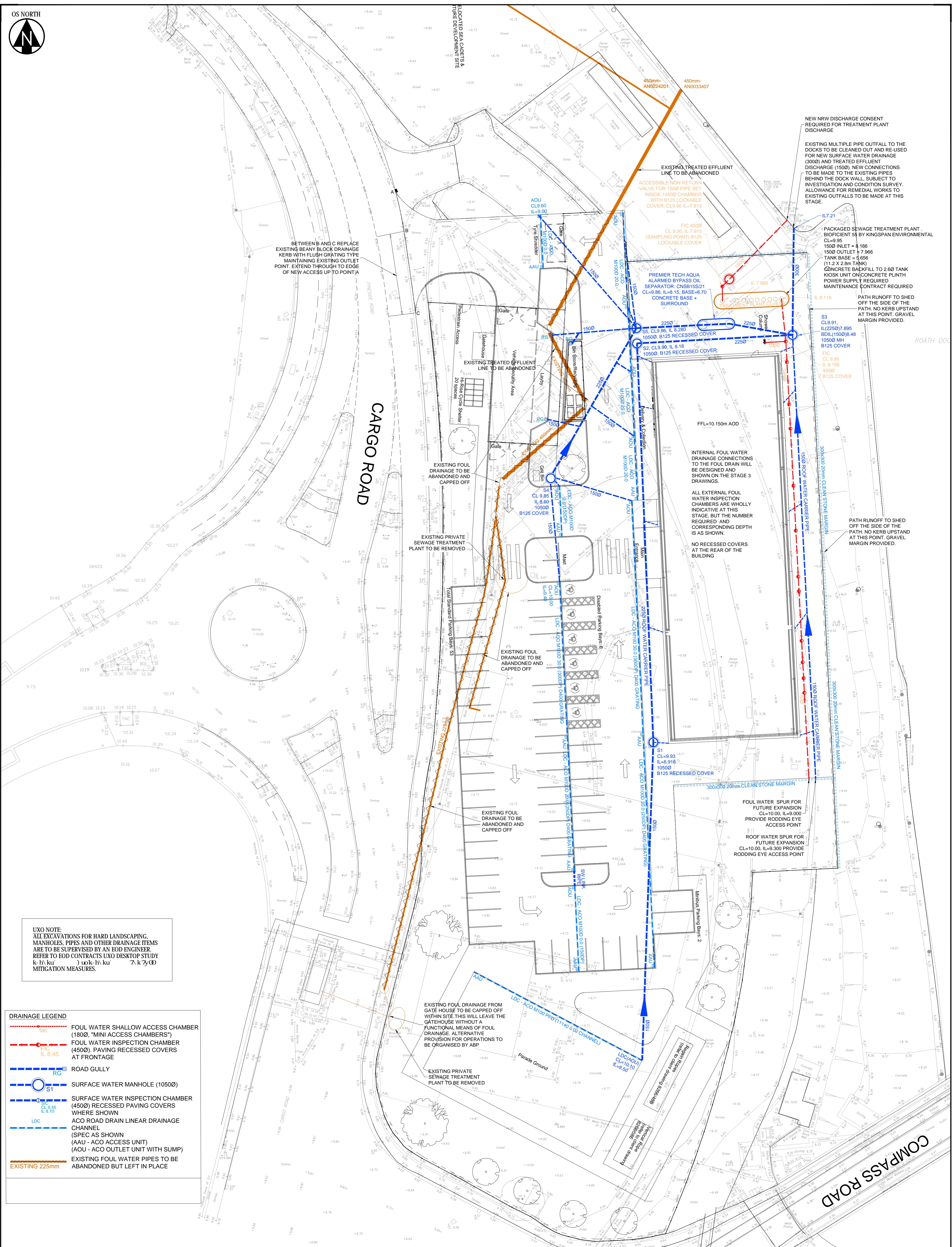
Drawing
 Figure 2:
 Extreme Sea Level
 Node Locations

Date
 23 Sep 2016

Scale 1:25,000

APPENDIX D – DRAINAGE

Reference	Title
STF-HYD-XX-XX-DR-C-0700 P6	Drainage Strategy



BETWEEN B AND C REPLACE EXISTING BEANY BLOCK DRAINAGE KERB WITH FLUSH GRATING TYPE MAINTAINING EXISTING OUTLET POINT. EXTEND THROUGH TO EDGE OF NEW ACCESS UP TO POINT A

EXISTING TREATED EFFLUENT LINE TO BE ABANDONED

ACCESSIBLE NON RETURN VALVE FOR 1500 PIPE SET INSIDE 10500 CHAMBER WITH B125 LOCKABLE COVER. CL.9.90 IL.7.813

FIC 4500 CL.9.90, IL.7.910 (SAMPLING POINT) B125 LOCKABLE COVER

PREMIER TECH AQUA ALARMED BYPASS OIL SEPARATOR: CNSB15521 CL=9.86, IL=8.15, BASE=6.70 CONCRETE BASE + SURROUND

NEW NRW DISCHARGE CONSENT REQUIRED FOR TREATMENT PLANT DISCHARGE

EXISTING MULTIPLE PIPE OUTFALL TO THE DOCKS TO BE CLEANED OUT AND RE-USED FOR NEW SURFACE WATER DRAINAGE (3000) AND TREATED EFFLUENT DISCHARGE (1500). NEW CONNECTIONS TO BE MADE TO THE EXISTING PIPES BEHIND THE DOCK WALL. SUBJECT TO INVESTIGATION AND CONDITION SURVEY. ALLOWANCE FOR REMEDIAL WORKS TO EXISTING OUTFALLS TO BE MADE AT THIS STAGE.

PACKAGED SEWAGE TREATMENT PLANT. BIOFICIENT 55 BY KINGSPAN ENVIRONMENTAL 1500 INLET = 8.166 1500 OUTLET = 7.966 TANK BASE = 5.656 (11.2 X 2.8m TANK) CONCRETE BACKFILL TO 2.60 TANK KIOSK UNIT ON CONCRETE PLINTH POWER SUPPLY REQUIRED MAINTENANCE CONTRACT REQUIRED

PATH RUNOFF TO SHED OFF THE SIDE OF THE PATH. NO KERB UPSTAND AT THIS POINT. GRAVEL MARGIN PROVIDED.

S3 CL.9.91 IL(2250)7.895 BDLL(1500)8.48 10500 MH B125 COVER FIC CL.9.95 IL.8.195 4500 B125 COVER

PATH RUNOFF TO SHED OFF THE SIDE OF THE PATH. NO KERB UPSTAND AT THIS POINT. GRAVEL MARGIN PROVIDED.

INTERNAL FOUL WATER DRAINAGE CONNECTIONS TO THE FOUL DRAIN WILL BE DESIGNED AND SHOWN ON THE STAGE 3 DRAWINGS.

ALL EXTERNAL FOUL WATER INSPECTION CHAMBERS ARE WHOLLY INDICATIVE AT THIS STAGE, BUT THE NUMBER REQUIRED AND CORRESPONDING DEPTH IS AS SHOWN.

NO RECESSED COVERS AT THE REAR OF THE BUILDING

PATH RUNOFF TO SHED OFF THE SIDE OF THE PATH. NO KERB UPSTAND AT THIS POINT. GRAVEL MARGIN PROVIDED.

UXO NOTE:
ALL EXCAVATIONS FOR HARD LANDSCAPING, MANHOLES, PIPES AND OTHER DRAINAGE ITEMS ARE TO BE SUPERVISED BY AN EOD ENGINEER. REFER TO EOD CONTRACTS UXO DESKTOP STUDY k-h-ku' uok-h-ku' 7-k-7y00 MITIGATION MEASURES.

DRAINAGE LEGEND	
	FOUL WATER SHALLOW ACCESS CHAMBER (1800, "MINI ACCESS CHAMBERS")
	FOUL WATER INSPECTION CHAMBER (4500). PAVING RECESSED COVERS AT FRONTAGE
	ROAD GULLY
	SURFACE WATER MANHOLE (10500)
	SURFACE WATER INSPECTION CHAMBER (4500) RECESSED PAVING COVERS WHERE SHOWN
	ACO ROAD DRAIN LINEAR DRAINAGE CHANNEL (SPEC AS SHOWN (AAU - ACO ACCESS UNIT) (AOU - ACO OUTLET UNIT WITH SUMP))
	EXISTING 225mm FOUL WATER PIPES TO BE ABANDONED BUT LEFT IN PLACE

NOTES

ALL INTERNAL FOUL DRAINAGE CONNECTIONS POINTS ARE INDICATIVE AND ARE SUBJECT TO DESIGN BY THE MECHANICAL ENGINEER AND FINAL PLACEMENT BY THE ARCHITECTS BEFORE FINAL COORDINATION WITH THE BELOW GROUND DRAINAGE.

ALL BUILDING RAIN WATER PIPES ARE INDICATIVE ON THE DRAWING BUT SUFFICIENT CARRIER PIPE WORK IS SHOWN FOR LAYOUT FLEXIBILITY.

INTERNAL FOUL WATER DRAINAGE CONNECTIONS TO THE FOUL DRAIN WILL BE DESIGNED AND SHOWN ON THE STAGE 3 DRAWINGS.

ALL EXTERNAL FOUL WATER INSPECTION CHAMBERS ARE WHOLLY INDICATIVE AT THIS STAGE, BUT THE NUMBER REQUIRED AND CORRESPONDING DEPTH IS AS SHOWN.

Rev	Date	Description	By	Ckd
P6	19/12/2017	Stage 2 VE Issue	RB	RB
P5	28/09/2017	Treatment plant relocated	RB	RB
P4	23/06/2017	Package treatment plant option	JB	RB
P3	30/05/2017	Internal foul drainage updated	SJ	RB
P2	19/04/2017	External shower gully point added	SJ	RB
P1	16/03/2017	First Issue	SJ	RB

Hydrock

Temple Court, 13a Cathedral Road, Cardiff, CF11 9HA.
TEL: 02920 023 665 or visit www.hydrock.com

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Notes:
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Project: HMS CAMBRIA

Client: ABP

Drawing Title: DRAINAGE LAYOUT

Project Number: C161526

Drawn: Checked: Scale @ A1: Drawn Date: First Issue:
SJ RB 1:250 28/02/2017 16/03/2017

Status: D2 Purpose of Issue: STG2-VE

Drawing No.: HMS-HYD-XX-XX-DR-C-0700 **Revision:** P6

