Govan Wet Basin Infilling
Volume 1: Environmental Impact Assessment Report

August 2022

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Client:	BAE Systems
Document number:	10180
Project number:	175756
Status:	Final
Author:	Various
Project Director:	Graeme Duff
Date of issue:	4 August 2022
Filename:	Volume 1 – EIA Report

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PREFACE

This Environmental Impact Assessment Report (EIAR) has been prepared under the Marine Works (Environmental Impact Assessment) (Scotland) Regulations 2017 ("the marine EIA Regulations"). The EIAR has been prepared to support an application for a marine construction licence to Marine Scotland Licensing Operations Team (MS-LOT).

The proposals are to infill the existing wet basin at BAE Systems Govan Shipyard Facility up to existing quay level to create a working platform. The area of the construction works is 4.57 hectares which includes the wet basin and contractor compound (Refer to Drawing No 225010-BAE-AHN-ZZ-XX-DR-C-0002, Volume 2 of this EIAR). It is anticipated circa 195,000 m^3 of material will be required to infill the wet basin and that it will be brought to site primarily by barge (~95%) but also by road (~5%).

This EIAR reports the findings of an Environmental Impact Assessment (EIA) which has been co-ordinated and written by EnviroCentre Ltd, with specialist input from technical co-consultants.

This EIAR comprises the following elements:

- Volume 1: Environmental Impact Assessment Report
  - Providing a detailed description of the proposed development and its potentially significant environmental effects, detailing alternative options where applicable, reporting the findings of the EIA, as well as any proposed mitigation measures and providing other relevant background information
- Volume 2: Figures
  - Including figures and plans relating to individual chapters of Volume 1
- Volume 3: Technical Appendices
  - Containing detailed technical reports and baseline studies which act as background reports to Volume 1.

The following documents have also been prepared to support the application. These form part of the overall submission, but they do not form part of the EIAR:

- Non-Technical Summary (NTS) – this provides an overview of the proposed development and summarises the findings of the EIA and any key mitigation measures proposed, in an easily accessible format; and
- Marine Construction License Application – the application for construction in the marine environment is required to consent activities up to Mean High Water Springs (MHWS).

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1 INTRODUCTION

1.1 Terms of Reference

EnviroCentre Ltd has been appointed by Arch Henderson on behalf of BAE Systems Ltd to undertake an Environmental Impact Assessment (EIA) of the proposals to infill the wet basin at Govan Shipyard and Maintenance Facility (Govan shipyard) (Refer to Drawing No 175756-GIS001, Volume 2 of this EIAR) to form a working platform. This Environmental Impact Assessment Report (EIAR) comprises the written findings of the EIA process undertaken under the Marine Works (Environmental Impact Assessment (Scotland) Regulations 2017 ('the Marine EIA Regulations').

1.2 Report Usage

The information and recommendations contained within this report have been prepared in the specific context stated above and should not be utilised in any other context without prior written permission from EnviroCentre.

If this report is to be submitted for regulatory approval more than 12 months following the report date, it is recommended that it is referred to EnviroCentre for review to ensure that any relevant changes in data, best practice, guidance or legislation in the intervening period are integrated into an updated version of the report.

Whilst the Client has a right to use the information as appropriate, EnviroCentre do not accept liability to any third party for the contents of this report unless written agreement is secured in advance, stating the intended use of the information. EnviroCentre accept no liability for use of the report for purposes other than those for which it was originally provided, or where EnviroCentre have confirmed it is appropriate for the new context.

1.3 Structure of the EIAR

The EIAR is presented within three volumes, which are set out within Table 1.2 below:

Table 1-1: Structure of the EIAR

Item	Description	Author
Volume 1: Environmental Impact Assessment Report		
Chapter 1: Introduction	This chapter sets the context for the EIA and introduces the development in a broad context	EnviroCentre
Chapter 2: Proposed Development	This chapter sets out the development description upon which the environmental assessment is based, as well as examining design and alternatives considered.	EnviroCentre (with marine engineering input by Arch Henderson)
Chapter 3: EIA Methodology and Scoping	This chapter introduces the EIA methodology by which the proposed development was designed, along with an outline of how the EIAR has responded to comments throughout the process.	EnviroCentre
Chapter 4: Planning Context	This chapter assesses the level of compliance of the proposed development,	Cameron Planning

Item	Description	Author
	drawing upon the evidence contained within the EIAR, in relation to land-use planning policies and marine planning.	
Chapter 5: Water Environment	Chapter 5 assesses the impact of the proposed development upon the water environment, including water quality and pollution. It also includes the Flooding Risk of the development.	EnviroCentre
Chapter 6: Noise	This chapter deals with airborne noise as a result of the proposed development with regards to construction noise.	EnviroCentre
Chapter 7: Land Quality	This chapter deals with issues associated with potential land contamination and the requirements with respect to infill material quality	EnviroCentre
Chapter 8: Cultural Heritage	This chapter details the assessment of the proposed scheme's likely effects on cultural heritage receptors (referred to forthwith as heritage assets), a collective term used to describe archaeological assets, built heritage features and historic landscapes	Mott MacDonald
Chapter 9: Other Issues	This chapter covers areas of the environment which are important to note but have not been identified as having potentially significant effects throughout the EIA process (as detailed within Chapter 3: EIA Methodology and Scoping). These include Air Quality, Archaeology & Cultural Heritage, Biodiversity, Climate Change, Landscape & Visual, Population & Human Health, Material Assets and Accidents & Natural Disasters.	EnviroCentre and Mott MacDonald
Chapter 10: Schedule of Mitigation	This chapter sets out a summary of all mitigation measures proposed within the EIAR within a schedule which can then be used to inform a Construction Environmental Management Document (CEMD).	EnviroCentre
Chapter 11: Conclusions	This chapter summarises the key findings of the EIAR, discusses CEMD principles, and provides a Statement of Significance in relation to the proposed development.	EnviroCentre
Volume 2: Figures	This volume provides the figures relevant to each chapter within Volume 1 and is provided as a standalone volume to aid comparative assessment.	All
Volume 3: Technical Appendices	This volume provides the relevant technical background papers and studies which have informed each chapter.	All

The following documents have also been prepared to accompany the planning application, which do not form part of the ES but are nevertheless associated with it.

- **Non-Technical Summary (NTS)** – this provides an overview of the proposed development and summarises the findings of the EIA and any key mitigation measures proposed, in an easily accessible format; and
- **Marine Construction License Application** – the application for construction in the marine environment is required to consent activities up to Mean High Water Springs (MHWS).

1.4 Objective and EIA Context

The purpose of an EIA is to identify and evaluate the likely significant effects of a proposed development on the environment and to identify measures to mitigate or manage any significant adverse effects before a marine licence is determined. The EIA process provides an opportunity to 'design out' adverse effects wherever possible. Where adverse effects cannot be designed out, mitigation measures can be proposed to avoid, compensate or reduce significant environmental effects to an acceptable level. EIA is an iterative process which allows feedback from stakeholder consultation and the results from baseline studies to be fed into the design process of the development.

The objectives of the EIAR are:

- To establish a robust environmental baseline upon which to base environmental assessment, incorporating field surveys, desk study and consultation;
- To provide an assessment of the potential environmental impacts of the proposed development and to determine which of these, if any, are likely to result in a significant effect on the receiving environment; and
- Where significant effects are predicted, to determine mitigation measures to reduce the residual effects to acceptable levels.

The results and findings of the EIA are presented in this EIAR. The environmental information presented is derived through a systematic process of identification, prediction and evaluation of the likely significant environmental effects of the proposed development.

Schedule 4 of the Marine EIA Regulations requires that the following information is provided:

- A description of the location of development, its physical characteristics and land-use requirements during construction and operation;
- A description of the main characteristics of the operational phase of the development;
- An estimate of residues and emissions produced during the construction and operation phases;
- A description of reasonable alternatives, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects;
- A description of the relevant aspects of the current state of the environment and an outline of the likely evolution thereof without implementation of the development as far as reasonable;
- A description of environmental receptors likely to be significantly affected by the development;
- A description of the likely significant effects of the development on the environment;
- A description of the forecasting methods or evidence used to identify and assess the significant effects;
- A description of the measures envisaged to mitigate significant effects;
- A description of expected significant adverse effects deriving from the vulnerability of the development to risks of major accidents and/or disaster; and
- A non-technical summary of the aforementioned information.

This EIAR meets these requirements within each technical chapter, with the primary description of development comprising Chapter 2: Proposed Development, and a description of how the EIA Regulations have been addressed within Chapter 3: EIA Methodology.

1.5 Key Terms

To ensure clarity and consistency through the EIAR, the following key terms have been used:

- 'the proposed development' refers to the construction of the proposed development as described in Chapter 2: Proposed Development;
- 'the site' is the land and water bound by the red-line boundary in which the proposed development lies, and is illustrated within Drawing No. 175756-GIS001 within Volume 2 of this EIAR;
- The 'Study area' is the area over which desk based or field assessments have been undertaken and are identified within each chapter. The core study area varies depending on the nature of the potential effects within each discipline, as informed by professional guidance and best practice regarding EIA. All of the core study areas cover the site and are described within the methodology section of the relevant chapters within this EIAR.

1.6 The Applicant

BAE Systems Ltd is a global company that specialises in advanced defence technology across the air, maritime, land and cyber domains. Govan Shipyard is one of many facilities operated by BAE Systems Ltd around the world and specialises in the manufacture of complex surface ships.

1.7 The Project Team

The EIA carried out in relation to the proposed development has been undertaken by specialist environmental and technical consultants on the basis of project information supplied by the Applicant and their engineers and following consultation with statutory consultees.

Table 1-2: Project Team and Competent Expertise

Project Role	Organisation	Lead Author & Reviewer	No. of Years' Experience	Qualifications & Professional Memberships
Inputs to EIA Process				
Project Manager	EnviroCentre	Graeme Duff	20	BSc (Hons) MSc, CSci FGS
Project Co-ordinator	EnviroCentre	Emma Cormack	20	BSc (Hons), MIEnvSc
Project Reviewer	EnviroCentre	Ian Buchan	20	BSc (Hons), PhD, Chartered Member of the Institute of Logistics and Transportation, Member of the Institution of Environmental Sciences (MIEnvSc)

Volume 1: Environmental Impact Assessment Report				
Chapter 1, 2, 3, 9 & 10	EnviroCentre	Emma Cormack	20	BSc (Hons), MIEnvSc
Planning and consultation	Cameron Planning	Steven Cameron	20	MRTPI
Water Environment	EnviroCentre	Graeme Duff	20	BSc (Hons) MSc, CSci FGS
Flood Risk Assessment	EnviroCentre	Iain Struthers	18	BSc BE (Hons) PhD
Noise	EnviroCentre	Craig Cloy	17	MA MIOA
Land Quality	EnviroCentre	Graeme Duff	20	BSc (Hons) MSc, CSci FGS
Cultural Heritage	Mott MacDonald	Ross Cameron	15	MLitt, MA (Hons), MCIfA

2 PROPOSED DEVELOPMENT

2.1 Site and the Surrounding Area

2.1.1 The General Area

Govan shipyard is situated in an urban area to the southwest of Glasgow City Centre. The surrounding area comprises a mixture of uses including industrial, business, commercial, residential along with the Queen Elizabeth University Hospital complex.

The Govan shipyard is located on the southern bank of the River Clyde and is bounded to the south by Govan Road, Elder Park and a residential area with another residential area to the east. Glasgow Harbour residential area lies opposite the site on the northern bank of the River Clyde. To the west of the site is the A739, the Queen Elizabeth University Hospital (750m from site), and a large area comprising industrial, business and commercial activities.

2.1.2 The Site

The existing BAE Systems shipyard at Govan has been used for ship building since the middle of the 19th century.

It covers approximately 10 hectares of land adjacent to the River Clyde with an existing waterfront 590m in length (Refer to Drawing No. 175756-GIS001 for site location). A combination of inclined slipways, masonry walls, sheet piled wharf structures and an extent of informal riverbank forms the water frontage to the site (northern boundary) with the wet basin located on the western area of the shipyard.

The wet basin itself is currently not in use.

2.2 The Need for Development

BAE Systems have been exploring their options for developing the Govan shipyard to support the long-term future of shipbuilding at the site. The aim was to create a modern, undercover building that enables construction within an enclosed controlled environment to support future ship building at the shipyard.

The Strategic Development phase identified a number of high-level considerations that needed to be taken into account. These were:

1. To reduce end-to-end ship build time;
2. To reduce downtime during ship construction;
3. To increase productivity. Through creation of an enclosed ship manufacturing facility, leading to more activities being completed in-situ at Govan before transfer to Scotstoun Yard;
4. To improve quality through reduced weather impact;
5. The facility will fully support Digital Shipbuilder enablement; and
6. To ensure the long term viability of the ship yard.

A Baseline scenario and 3 alternative options were considered during the Strategic Development phases of this project.

- The Baseline scenario looked to extend an existing building on site. This required significant modifications and demolition work so was discounted on the grounds that significant disruption to business operation was highly likely.
- Option 1 was a Riverside development. This option was discounted for principally the same reasons as the Baseline scenario, though the effects of disruption to business operations were not considered to be as severe.
- Option 2 was the wet basin infill. This option was identified as being the most feasible to allow the expansion of the shipyard assembly line within a controlled environment without significant disruption to business as usual.
- Option 3 looked to develop the area to the west of the wet dock. This Option offered less disruption; however, this option was discounted due to significant engineering challenges causing unknown cost increases.

The Strategic Development identified Option 2 as being the most favourable for developing the Govan shipyard to support the long-term future of shipbuilding at the site.

2.3 The Proposed Works

The proposals are to infill the existing wet basin located at Grid Reference 254624 666109 up to existing quay level to create a working platform. The area of the construction works is 4.57 hectares which includes the wet basin and contractor compound (Refer to Drawing No 225010-BAE-AHN-ZZ-XX-DR-C-0002, Volume 2 of this EIAR). It is anticipated circa 195,000 m^3 of material will be required to infill the wet basin and that it will be brought to site primarily by barge (~95%) but also by road (~5%).

BAE Systems are currently considering their options to construct a Ship Block Outfit Hall (SBOH) on the newly formed working platform.

The nature of the works is such that they will span the intertidal area within the basin. In the intertidal area there is a cross-over of regulatory remit with the marine licensing regime extending to the MHWS level and the planning authority's control extending to the LWMS level (Refer to Drawing No 225010-BAE-AHN-ZZ-XX-DR-C-0005, Volume 2 of this EIAR).

It should be noted that this EIAR and Marine Works Licence application to MS-LOT relates solely to the works within the marine environment of the wet basin. A separate application will be submitted to Glasgow City Council (GCC) under the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (The EIA Regulations) for the proposed SBOH works, including basin infill. A separate EIA will be provided with this application which will consider the impacts with the development following on from the infilling exercise.

Chapter 4 of this EIAR provides further clarity on the planning context.

2.4 Consents Programme

Provided in Technical Appendix 2-1, Volume 3 of this EIAR is a table containing the timelines which the project team are working to in order to provide sufficient information for regulatory bodies (in this case MS-LOT, GCC and eventually SEPA) such that they can review, comment and issue direction or permissions where appropriate.

2.5 Construction Works Description

It is envisaged that construction works will involve the activities listed below. Two options for the methodology of infill are identified depending in the source of the infill material. A visual description of the works is provided in Drawing No 225010-BAE-AHN-ZZ-XX-DR-C-0004, Volume 2 of this EIAR.

Infilling Option 1 – Infilling Works based on Crushed Aggregate from Land Based Quarry.

- Infilling Works (due to potential tidal constraints for marine navigation in the maintained channel it is anticipated that infilling works will be permitted 24 hours a day, 7 days a week)
- Install silt curtain and/or bubble curtain at entrance to Govan Basin (including a demountable section to allow passage of tug / barges into the basin area)
- Aggregate for infilling the basin will be loaded onto a barge / vessel at a separate facility
- Tug to tow barge to site with aggregate for infilling the basin.
- On arrival at the Govan Basin the demountable section of silt curtain will be opened to allow passage of the barge into the basin area and reclosed once the barge has passed through and prior to discharge of infill material.
- A long reach excavator will be loaded onto the barge at the quayside and will initially place 4Nr. 0.5m thick layers of infill material totalling 2m deep over the soft layer of material in the basin working in a north to south direction. This material will be placed methodically in a 2m x 2m grid to stabilise the soft bed material. The long reach excavator will be fitted with a GPS machine control system for the accurate placement of the infill material
- In advance of the barge exiting the infill area of the basin a period of time will be accommodated to allow for a reduction in the level of suspended solids prior to the demountable section of the silt curtain being opened to allow the barge to exit and it will be reclosed once the barge has passed through.
- The above process will be repeated until the 2m thick stabilisation layer is complete.
- The bulk infilling works to the basin may continue to be infilled using barges and excavators or a self-discharging vessel.
- As the basin is infilled the available draft and under keel clearance for barges / vessels will reduce and infilling to a more localised location within the basin infill area will be necessary. This infilled material will be placed inside the silt curtain encapsulation area and placed to a level above MHWS, at periods of low tide this material will be dozed further south within the basin infill area until filling is complete
- Infilling of the wedge void behind the existing sheet pile wall forming the perimeter of the Govan Basin will be filled concurrent with the bulk infilling works (this may require local demolition of the existing cope beam and cutting down or extraction of sheet piles)
- Existing drainage discharging around the perimeter of the existing Govan basin will be collected by newly installed new carrier drain and discharge will be via a number of new outfalls to be installed through the new piled wall
- Depending on final detailed design compaction of the infill material may be necessary above mid tide level. If this is necessary, it may be compacted in nominal layers using conventional rollers or using dynamic compaction such as Rolling Impact Compaction (RIC) / High Energy Impact Compaction (HEIC) / Vibro Compaction (VC)

Infill Option 2 – Infilling Works based on suitable Marine Dredged Material (beneficial reuse marine dredged material)

- Infilling Works (due to potential tidal constraints for marine navigation in the maintained channel it is anticipated that infilling works will be permitted 24 hours a day, 7 days a week)
- Install silt curtain or bubble curtain at entrance to Govan Basin (including a demountable section to allow passage of tug / barges into the basin area)

- Subject to final methodology and material sources a berm of material may be placed towards the northern end of the dock infill area
- Aggregate for infilling the berm in the basin will be loaded onto a barge / vessel at a separate facility
- Tug to tow barge to site with aggregate for infilling the basin.
- On arrival at the Govan Basin the demountable section of silt curtain will be opened to allow passage of the barge into the basin area (bubble curtain will permit the vessel to sail through) and reclosed once the barge has passed through and prior to discharge of infill material.
- If a berm is required this material may be discharged from a split hopper barge by bottom dumping or a long reach excavator will be loaded onto the barge at the quayside and will place the material on the basin bed, depending on the final height of the berm a temporary water discharge box weir may be installed for the infilling works
- The primary source of infill material may come from marine dredged aggregates using a Trailer Suction Hopper Dredger (TSHD) (recovery of this material is under a separate MS-LOT Licence)
- Again, depending on final methodology, a shallow layer of material may be placed over the existing basin bed material to cap it, this may be undertaken by a combination of rainbowing directly from the TSHD or discharged via a floating pipeline and spreader barge with a discharging nozzle circa 0.3m thick layers of infill material totalling up to 2m deep over the soft layer of material in the basin working in a north to south direction. This material will be placed methodically to stabilise the soft bed material. The spreader barge will be controlled by a mooring spread fastened to the existing bollards in the basin and fitted with a GPS machine control system for the accurate placement of the infill material
- The TSHD will subject to navigational constraints and harbour master approval either moor in the river channel or in an area within the basin that is not to be infilled.
- A temporary mooring spread will be installed along with the floating pipeline and the land side fixed pipeline
- Once the vessel is moored the floating pipeline will be connected to the TSHD and the dredged sand material discharged into the basin with excess pump water discharged through the silt curtain / bubble curtain or weir box
- As material builds up in front of the landside discharge pipeline the material will be dozed forward (north), and the pipeline extended as necessary to achieve the final levels
- Infilling of the wedge void behind the existing sheet pile wall forming the perimeter of the Govan Basin will be filled concurrent with the bulk infilling works (this may require local demolition of the existing cope beam and cutting down or extraction of sheet piles)
- Existing drainage discharging around the perimeter of the existing Govan basin will be collected by newly installed new carrier drain and discharge will be via a number of new outfalls to be installed through the new piled wall
- Depending on final detailed design compaction of the infill material may be necessary above mid tide level. If this is necessary, it may be compacted in nominal layers using conventional rollers or using dynamic compaction such as Rolling Impact Compaction (RIC) / High Energy Impact Compaction (HEIC) / Vibro Compaction (VC)

Piling Works for New Quay Wall

To accommodate the construction of the new piled wall, the infill will temporarily extend beyond the plan footprint of the northern boundary of the proposed piled wall. It is proposed to construct the new piled wall from the newly placed infill material

- The piled wall is subject to detailed design but may consist of a combi tubular pile / infill sheet pile with tie rods connected back to a sheet piled anchor wall

- A temporary piling gate will be supported from a series of spud piles driven into the existing bed material using vibro or impact piling hammers and the piling gate positioned
- Once the pile gate has been successfully erected the first tubular pile will be pitched.
- The crane will then use a combination of a vibro and impact piling hammers to drive the pile to the final design level. The above procedure will be repeated until the first gate of tubular piles are complete. The pile guide frame will then be removed and repositioned for the next gate of piles with the temporary spud piles extracted using the vibro piling hammer
- As the installation of the tubular piles progresses along the wall the crawler crane will pitch and drive the infill piles between the tubular piles using both Vibro and impact piling hammers.
- The tubular combi piles may require a rock socketed spigot pile at the toe drilled into the bed rock, this will be undertaken by rotary percussive piling rig with a down the hole hammer. Once the rock socket is drilled a steel spigot pile will be installed inside the combi tubular pile and into the rock socket and concreted into place.
- The anchor pile wall will be installed using a combination of vibro and impact piling techniques
- The tie rods will be installed from the front combi tubular piles to the sheet pile anchor wall
- Relieving platform piles between the front combi piled wall and the rear anchor wall will be installed using a combination of vibro and impact piling techniques
- The temporary over filled material to the north of the new piled wall will be excavated and recovered to land.
- The concrete capping beam will be constructed onto the combi tubular pile wall
- Following completion of the capping beam installation of quay furniture and fenders will commence
- Demobilisation

2.6 Construction Works Timing

It is anticipated that construction works will take a total of circa 34 weeks. Within this period it is noted that piling to create the outer quay wall is estimated to last circa 14 weeks.

3 EIA METHODOLOGY

3.1 Introduction

The purpose of an EIA is to identify and evaluate the likely significant effects of a proposed development on the environment and to identify measures to mitigate or manage any significant adverse effects before a marine license application is determined. The EIA process provides an opportunity to 'design out' adverse effects wherever possible. Where adverse effects cannot be designed out, mitigation measures can be proposed to avoid, compensate or reduce significant environmental effects to an acceptable level. EIA is an iterative process which allows feedback from stakeholder consultation and the results from baseline studies to be fed into the design process of the proposed development.

In determining the requirement for an EIA, Schedule 1 of the Marine EIA Regulations sets out the types of development for which EIA is a mandatory requirement, whilst Schedule 2 lists the projects where the need for EIA is judged on a case-by-case basis, depending on whether a proposal is likely to cause significant environmental effects or is located in a sensitive area as defined by the Marine EIA Regulations.

In this instance, the proposed development is considered by MS-LOT to constitute Schedule 2 development as defined by the Marine EIA Regulations as it falls under Regulation 1 (e) "*Reclamation of land from the sea*".

By virtue of its nature, size and location, the proposed development could potentially have (if unmitigated) significant adverse effects on the environment. Schedule 4 of the EIA Regulations specifies the information that should be included in an EIAR, and this chapter discusses where and how the EIAR meets the requirements of the EIA Regulations.

3.2 General EIA Methodology

Whilst each environmental topic discussed within the EIAR establishes its own methodology based upon good practice and relevant industry guidance, there is a basic methodological framework which is applied to EIA chapters.

3.2.1 EIA Key Stages

This EIAR identifies, describes and assesses the likely significant impacts and their effects of the proposed development on the environment, both direct and indirect. The EIA process involves the following key stages:

- Baseline Studies – identification of existing environmental conditions through review of existing information, monitoring and field studies as required, to provide a baseline against which to assess the likely impacts of the proposed development;
- Potential impacts – identification of potential impacts and their resulting effects during the construction phase (the operational phase will be primarily addressed in the application to GCC under The EIA Regulations and decommissioning of the proposed development itself is considered inappropriate to the proposed development), in relation to the design mitigation already implemented and where applicable, taking alternatives into account;

- Significance Assessment – evaluation of the effects, resulting from the identified potential impacts, to determine their significance, both positively and negatively, and incorporating cumulative effects;
- Mitigation and Monitoring – the identification of measures to avoid, reduce or compensate likely significant effects and the steps taken to monitor these potential environmental effects; and
- Residual Effects – identification of residual effects assuming successful implementation of mitigation.

For consistency where possible, the same headings have been used within the technical sections of this EIAR.

3.3 The EIA Assessment Methodology

3.3.1 Sensitivity/Importance of Receptors

The sensitivity of the baseline conditions/receptors is defined according to the relative importance of existing environmental features on or in the vicinity of the site, or by the sensitivity of receptors which would potentially be affected by the proposed development.

Criteria for the determination of sensitivity (e.g. high, medium or low) or of importance (e.g. international, national, regional or authority area) were established for each topic assessment based on prescribed guidance, legislation, statutory designation and/or professional judgement. The criteria for each environmental parameter are provided in the relevant specialist chapters of this EIAR and may differ between technical topics dependent upon guidance which defines that approach (e.g. Chartered Institute of Ecology and Environmental Management).

3.3.2 Magnitude of Impact/Change

The methods for predicting the nature and magnitude of potential impacts vary according to the subject area. Quantitative methods of assessment can predict values that can be compared against published thresholds and indicative criteria in Government guidance and standards. However, it is not always possible to ascribe values to environmental assessments and therefore qualitative assessments are sometimes used. Such assessments rely on previous experience and professional judgement. The methodologies used for assessing each topic area are described within the specialist chapters of this EIAR.

In general terms, the magnitude of impact on environmental baseline conditions is identified through detailed consideration of the proposed development, taking due cognisance of any legislative or policy standards or guidelines, and/or the following factors:

- The degree to which the environment is affected, e.g. whether the quality is enhanced or impaired;
- The scale or degree of change from the existing situation;
- Whether the impact is temporary or permanent, indirect or direct, short-term, medium-term or long-term; and
- Any in-combination effects and potential cumulative effects.

In some cases the likelihood of impact occurrence may also be relevant and, where this is a determining feature of the assessment, this is clearly stated.

3.3.3 Significance of Effect

Significant effects are predicted where important resources, or numerous sensitive receptors, could be subject to impacts of considerable magnitude. Effects are unlikely to be significant where low value or non-sensitive resources are subject to minor effects.

The criteria for determining the significance of an effect have been developed giving due regard to the following, where applicable;

- Sensitivity, importance or value of the resource or receptor;
- Extent and magnitude and duration of the impact; and
- Performance against environmental quality standards.

The criteria and assessment methodology used for each topic considered within this EIAR are set out within the 'Methodology' section of the respective EIAR chapter.

Unless otherwise stated, reported effects are considered to be adverse. It is however possible that some effects may be positive and these are stated and explained where appropriate.

The EIAR reports on the significance of the environmental effects as per the EIA Regulations. Although a significant effect does not always have to equate to an unacceptable effect, in order to ensure impartiality, the EIAR does not comment on acceptability.

3.3.4 Design Mitigation and Residual Effects

Design mitigation is integral to providing an environmentally robust development whereby suggestions for mitigation are incorporated into the project prior to 'design freeze'. This in-built mitigation represents, where applicable, environmental good practice and places a responsibility upon the Applicant to provide environmentally sustainable design solutions.

Residual effects of the proposed development are those that remain, assuming successful implementation of the identified mitigation measures. All remaining effects of the proposed development, following the application of mitigation measures, are summarised clearly and their significance stated, within the 'Residual Effects' section of each specialist chapter.

Where applicable, the EIAR also reports measures for enhancement which would be enshrined by marine licence condition.

3.3.5 Cumulative Impact Assessment

Consideration of cumulative effects is a requirement of the EIA Regulations. By definition, these are effects that result from incremental changes caused by past, present and reasonably foreseeable actions together with the proposed development. There are different types of cumulative effects (such as in-combination and sequential effects) and typically cumulative impact assessment is a key part of the EIA process.

A review of the Glasgow City Council Planning portal with respect to riverside development planning applications within the last 2 years was undertaken. The following project of significance was identified within 1km of the site:

20/02342/FUL | Erection of opening bridge over the River Clyde with associated path connections, landscaping, lighting and drainage. | Site At Water Row/ Meadowside Quay Glasgow

The Govan to Partick Bridge will span the River Clyde between Water Row in Govan and Pointhouse Quay at the Riverside Museum.

The construction works for the bridge started in May 2022 with a projected completion date towards the end of 2023.

The site is located approximately 1km to the east of the Govan Wet Basin. On the basis of the distance between the sites and adoption of the identified appropriate mitigation measures during construction, it is considered that there will be no significant cumulative impacts associated with the developments.

As previously noted, this EIAR and Marine Works Licence application to MS-LOT relates solely to the works within the marine environment of the wet basin. A separate application will be submitted to Glasgow City Council (GCC) under the Town and Country Planning (Environmental Impact Assessment) (Scotland) Regulations 2017 (The EIA Regulations) for the proposed SBOH works, including basin infill. A separate EIA will be provided with this application which will consider the impacts from the development following on from the infilling exercise.

3.4 Consultation

A request for a Screening Opinion was submitted to MS-Lot in May 2022 under Part 2, Regulation 10 of the Marine EIA Regulations. The Screening Request was accompanied by an EIA Screening Report in accordance with Part 2, Regulation 10(2) to assist MS-Lot and statutory consultees to form a Screening Opinion.

A Screening Opinion was received in July 2022. This section describes the key requirements for inclusion within the EIAR. The narrative from the Screening Opinion has been paraphrased for brevity within Table 3.1 along with a pointer as to where these specific requests are addressed within this EIAR. The full Screening Report and Screening Opinion are provided within Technical Appendix 3-1, and 3-2, Volume 3 of this EIAR.

Table 3-1: Summary of Screening Consultation Responses

Environmental Topic	Screening Comment	How and Where Addressed
Flooding	Potential for significant impacts upon flood risk (both in terms of the functional flood plain and also the capacity loss during flood events) within the tidal ready of the upper River Clyde.	Chapter 5 and Technical Appendices 5-1 and 5-2
Water Quality / Protected Species	Potential impacts upon water quality / protected species as part of the coffer dam construction and infilling process.	Chapter 5
Cultural Heritage	Infilling the wet basin has the potential to significantly impact on the setting of the Category A listed building and should be assessed. The assessment should demonstrate a full appreciation of the special interest of the Category A listed building and its setting, including the contribution made by the wet basin. Consult with GCC's archaeology and conservation advisors regarding the assessment of the wet basin itself and any impacts upon it.	Chapter 8

	Recommendation of appropriately detailed description of any such mitigation measures should be set out as part of the EIAR.	
Biodiversity	The location is sufficiently distant from the Inner Clyde European Special Protection Area that there will be no likelihood of significant impacts on this (or any other) international designation. Depending on the specific nature of the works, it is possible that the impacts on marine mammals as European Protected Species may need to be considered, however this can be done out with the full EIA process.	Technical Appendices 7-1 and 5-2

3.5 Final Content and Structure of the EIAR

Accordingly based on the above summary of consultation responses and initial baseline collection, it was possible to complete the EIA with a clear focus on the main topics requiring full and detailed impact assessment. These topics are listed below and this Volume contains a chapter for each:

- Water Environment (Including Flood Risk)
- Noise;
- Land Quality;
- Cultural Heritage;
- Other Issues.

The chapters which are scoped in are supported by technical assessment reports where necessary and which comprise Volume 3: Technical Appendices of the EIAR. Those environmental topics which are not considered at EIA level given either the level of project information available at this stage, or based upon an unlikely event of significant effects, are included for information within Chapter 9: Other Issues. This includes discussion of Air Quality, Biodiversity, Climate Change, Landscape & Visual, Population and Human Health, Material Assets and Accidents & Natural Disasters.

The EIAR also contains Chapters on the Schedule of Mitigation associated with the EIA (Chapter 10: Schedule of Mitigation) and a brief chapter (Chapter 11: Conclusions) which summarises the EIA and contains a statement of significance.

4 PLANNING CONTEXT

4.1 Introduction

The proposed works relate to the infilling of the existing wet basin at BAE's Govan Shipyard in Glasgow. The nature of the works is such that they will cross over the intertidal area within the basin, where potentially both terrestrial town planning and marine licensing controls have a remit (Refer to Drawing No 225010-BAE-AHN-ZZ-XX-DR-C-0005, Volume 2 of this EIAR). The marine licensing regime extends to the MHWS level and the planning authority's control extends to the LWMS level.

The relationship between the statutory land use planning system and marine planning and licensing, is set out in Scottish Government Circular 2015/1[1].

The planning policy profile crosses over between the adopted local development plan policies, including Scottish Planning Policy, and the strategic policies set out by the Scottish Ministers in the National Marine Plan.[2] The latter document sets out general planning principles created by the Scottish Ministers, some of which will apply to the proposed marine works. GCC's adopted City Development Plan provides the principal terrestrial planning policy framework against which planning applications will be determined.

4.2 The Proposed Works

Through previous discussions with MS-LOT it has been made clear that the proposed licence application and EIA need to be explicit with regards to the manner in which the proposed works will be assessed, and whether works fall under the Town and Country Planning (Scotland) Act or under the Marine (Scotland) Act. GCC's focus as planning authority is on development above the LMWS level. The separation between LMWS and HMWS is a vertical separation within the existing wet basin as opposed to a 'land-based' separation, where the separate jurisdictions and potential overlaps can be clearly defined (Refer to Drawing No 225010-BAE-AHN-ZZ-XX-DR-C-0005, Volume 2 of this EIAR). As the infill works take place wholly within the marine environment, i.e. the wet basin, these works fall within the jurisdiction of MS-LOT.

The development as a whole, comprises two distinct stages as set out below:

1) Infilling of the wet basin, employing a silt curtain, bubble screen or similar barrier during infilling works with the eventual construction of a coffer dam and new quay wall
2) Development of new Ship Assembly Hall on the infilled basin

This EIA and Marine Works Licence application to MS-LOT relates solely to the works within the marine environment of the wet basin.

The proposed works have also been subject to two separate EIA exercises, one in relation to the Marine EIA Regulations requirements and one under The EIA Regulations. The Marine EIA has been pursued as a separate process to provide certainty over the potential environmental effects arising from the marine works. The Town and Country Planning EIA will incorporate the Marine EIA topic findings to support the planning application to be submitted to Glasgow City Council.

[1] https://www.gov.scot/publications/circular-1-2015-relationship-between-statutory-land-use-planning-system/
[2] https://www.gov.scot/publications/scotlands-national-marine-plan/

The proposed works comprise of the following detail:

Marine Works – infilling of existing tidal wet basin with maintenance dredge material or crushed aggregate, including installation of silt curtain, bubble screen or similar barrier across basin entrance. The existing basin quay walls are vertical, with separation between LWMS and HWMS set against the quay wall. The whole of the basin however sits within the marine environment and the proposed basin infill consequently comprises of marine licensable works. The construction of a permanent cofferdam will be delivered as a later phase of the works. The infilling of the basin, together with the cofferdam construction, fall under the licensing remit of MS-LOT.

Town Planning Works – with the proposed basin infill being addressed under the marine licensing regime, the proposed development under the Town and Country Planning (Scotland) Act, comprises of terrestrial construction works. The shipyard surface ground area around the wet basin will be cleared of existing small buildings in anticipation of the proposed new Assembly Hall being constructed. The proposed SBOH comprises of a single building structure with dimensions anticipated to be a width of 67m, a length of 176m and height of 44m. The new SBOH will sit on the land reclaimed from the wet basin. The new quay wall will also benefit from any planning permission granted by GCC.

4.3 Land Use Planning Policy

The proposed infill works to the wet basin will be consented under the marine licensing regime and marine planning policies will be of more relevance to the decision-making process, rather than town and country planning policy. The marine works will ultimately contribute to the formation of a new area of shipyard estate, which is intended to accommodate a new SBOH. The Town Planning policy framework is therefore relevant to consideration of the proposal in so far as the proposed end use will need to be compatible with existing land uses. This section considers the proposed works with a view to the end use being compatible with adopted planning policy.

Within the adopted Glasgow City Plan the surrounding land is designated as an Economic Development area under policy CDP3: Economic Development, the aim of which is to '*promote the creation of economic opportunity for all the City's residents and businesses and encourage sustained economic growth'*. The policy sets down a number of objectives and requirements, including:

- directing industry and business uses to the city's Economic Development Areas;
- Integrating other compatible, employment supporting land uses to Economic Development Areas; and
- supporting investment in new infrastructure and environmental improvements to unlock the development potential of constrained Economic Development locations.

This final bullet point in the policy is the most pertinent to the current proposals. The existing shipyard is constrained by its geographic boundaries, including the River Clyde and Govan Road, as well as sitting adjacent to Govan Conservation Area and a range of listed buildings. The existing shipyard facility itself constrains future development. The complexities of shipbuilding and the sheer scale required to be able to provide a competitive modern shipbuilding facility has led BAE to look at the underused wet basin as a potential location for additional ship assembly capability.

In addition, Policy CDP 7: Natural Environment Impact of New Development, advises that new development should not have an unacceptable effect, either directly, indirectly, or cumulatively, on:

1. the purpose, integrity or character of areas designated for their landscape importance;
2. sites, habitats, species or ecosystems protected by law, or which are designated as important for their nature conservation value;

3. sites designated as important for their geodiversity value; or
4. trees, woodlands or hedgerows that are of importance.

It is noted that the Council may require the developer to undertake surveys, prior to planning applications being determined. A bat survey has been undertaken to support the separate planning application.

It is also a requirement of the City Development Plan that new development should not further fragment habitats, networks or isolate habitats or species, but should enhance natural and landscape assets.

Policy CDP 8: Water Environment advises that applicants will be required to demonstrate that proposals contribute to:

- minimising and reducing flood risk;
- avoiding any increased risk of flooding from any source either within the development site, or out with the site as a consequence of the development; and
- avoiding any increase in the quantity and rate of surface water run-off from any site.

There is a strong presumption against development likely to have an adverse effect on the water environment. Developers are required to ensure that natural physical characteristics, as well as water quality, are protected, wherever possible.

Biodiversity as an EIA topic was scoped out of the EIA at the Screening stage. In order to support that conclusion, a Preliminary Ecological Appraisal (PEA) (refer to Technical Appendix 7-1, Volume 3 of this EIAR) was conducted in May 2022 to inform proposed works.

It is also noted that a site specific Flood Risk Assessment (refer to Technical Appendix 5-1, Volume 3 of this EIAR) has been commissioned using the updated River Clyde model as the basis to assess coastal/tidal/fluvial flood risk to the site for baseline (current) and post-works conditions, with the difference between predictions used to assess the impact of flooding upon the site, as well as the potential impact of the proposed works upon altering flood risk elsewhere within the River Clyde.

From a town planning perspective, the development project accords with the adopted Development Plan. The planning merits and assessment against planning policy will be addressed separately, and in more detail, within the planning application to be submitted for the proposed SBOH works, including basin infill.

4.4 Marine Planning

4.4.1 The Clyde Marine Planning Partnership

With regards to Marine Planning, the Clyde Marine Planning Partnership (CMPP)[3] was one of the first marine partnerships established with the objective of taking forward regional marine planning in the Clyde through a regional marine plan. The plan has not yet been developed; when it is, it will aim to balance environmental protection with economic growth on the Clyde. The local level regional marine plan must comply with Scotland's National Marine Plan. The Clyde Marine Planning Partnership would nevertheless be a consultee with regards to the proposed works.

[3] https://www.clydemarineplan.scot/

4.5 The National Marine Plan

The National Marine Plan was published in 2015 and lays down policies for sustainable development within the marine environment. The Plan specifically recognises the interface between marine and terrestrial planning and acknowledges that in most cases development within the marine environment will also have terrestrial planning implications.

The Plan lays out a core set of General Policies which apply across all developments and use of the marine environment. These General Policies are intended to represent the characteristics against which the sustainability of development and use is considered. The General Policies apply to all plan making and decision making in the marine environment. The policies provide a clear overarching framework for all activity. More detailed policies in the sector chapters of the Plan are subject to the General Policies.

4.5.1 General Policies

The following relevant General Policies will be taken into consideration in any decision-making process.

GEN 1 General planning principle: There is a presumption in favour of sustainable development and use of the marine environment when consistent with the policies and objectives of this Plan.

GEN 2 Economic benefit: Sustainable development and use which provides economic benefit to Scottish communities is encouraged when consistent with the objectives and policies of this Plan.

GEN 3 Social benefit: Sustainable development and use which provides social benefits is encouraged when consistent with the objectives and policies of this Plan.

GEN 4 Co-existence: Proposals which enable coexistence with other development sectors and activities within the Scottish marine area are encouraged in planning and decision-making processes.

GEN 5 Climate change: Marine planners and decision makers must act in the way best calculated to mitigate, and adapt to, climate change.

GEN 6 Historic environment: Development and use of the marine environment should protect and, where appropriate, enhance heritage assets in a manner proportionate to their significance.

GEN 8 Coastal process and flooding: Developments and activities in the marine environment should be resilient to coastal change and flooding, and not have unacceptable adverse impact on coastal processes or contribute to coastal flooding.

GEN 12 Water quality and resource: Developments and activities should not result in a deterioration of the quality of waters to which the Water Framework Directive, Marine Strategy Framework Directive or other related Directives apply.

GEN 13 Noise: Development and use in the marine environment should avoid significant adverse effects of man-made noise and vibration, especially on species sensitive to such effects.

The proposed infilling of wet basin does not conflict with the Marine Plan General Policies. Development that has sustainable economic (GEN 2) and social benefits (GEN 3) are encouraged in the Plan. The minimum benefit of the proposed development will be to provide an additional area of shipbuilding estate within the existing Govan Shipyard. The development is intended to accommodate a future SBOH which will ensure the existing shipbuilding activity going forward. The development has

both economic and social benefits through the support of economic activity and commitment to direct and indirect supply chain employment.

The marine works licence application is supported by this EIAR which address issues relating to the historic environment (GEN 6), coastal processes and flooding (GEN 8), water quality and resource (GEN 12) particularly through the submission of a Flood Risk Assessment and Noise (GEN13).

4.5.2 Marine Planning Policies

The Shipping, Ports, Harbours and Ferries sector of the Marine Plan sets out a number of objectives, none of which the proposed development is in conflict with. It also defines the following marine planning policies.

TRANSPORT 1: Navigational safety in relevant areas used by shipping now and in the future will be protected – the proposed development is located within the existing Govan Shipyard which historically has launched ships into the River Clyde. Navigational safety within the River Clyde during launch events is therefore already addressed. The proposed works will utilise existing maintenance dredging regimes to provide infill material to be deposited by barge. The transfer of material by barge will as a matter of course take account of navigational safety.

TRANSPORT 2: Marine development and use should not be permitted where it will restrict access to, or future expansion of, major commercial ports or existing or proposed ports and harbours – there is no conflict.

TRANSPORT 3: Ferry routes and maritime transport to island and remote mainland areas provide essential connections and should be safeguarded from inappropriate marine development and use that would significantly interfere with their operation – there is no conflict with ferry routes or maritime transport; navigational risk is fully addressed.

TRANSPORT 4: Maintenance, repair and sustainable development of port and harbour facilities in support of other sectors should be supported in marine planning and decision making – the proposed development supports the existing shipbuilding activity and is consequently, in principle, supported by the Marine Plan.

TRANSPORT 5: Port and harbour operators should take into account future climate change and extreme water level projections – although not a port/harbour operation, the proposed works have been assessed with regards to the flood model for the River Clyde.

TRANSPORT 6: Marine planners and decision makers and developers should ensure displacement of shipping is avoided where possible – no displacement is expected.

In assessing the proposed development activity in the context of the National Marine Plan, we find that there is no conflict with the objectives, General Policies or sector policies within the Plan. In principle the Plan supports sustainable development that has an economic and social benefit.

We would also note that the Plan states in para 2.16, that it should be applied proportionately, taking account of the potential scale of impact of any proposal as well as the sensitivity of the environment and/or any potential social or economic effect under consideration.

4.6 Conclusions

In conclusion, we find that the proposed development does not conflict with either terrestrial planning interest with regards to the proposal or marine planning policy as set out in the National Marine Plan.

5 WATER ENVIRONMENT

5.1 Introduction

This Chapter of the EIAR will assess the likely impact of the proposed works upon the water environment adjacent to the site during the infilling works only (Refer to Chapter 2.3 of this EIAR). The Water Environment is considered to encompass hydrology and water quality. As the proposed infilling works will ultimately result in new land being created, the risk of flooding once the infilling works are completed, is also considered.

The associated interactions between the water environment, ecology and fisheries will be considered within the Other Issues (Biodiversity) Chapter of this EIAR.

The Water Framework Directive (WFD) (Council Directive 2000/60/EC[4]) aims to protect and enhance water bodies within Europe and covers all estuarine and coastal waters out to 1 nautical mile. This requires that there is no deterioration in the quality of surface or groundwater bodies and aims to achieve good ecological status or potential. The implications of the WFD must be considered when assessing this project and the details of how compliance will be achieved provided in the EIAR.

The development proposals have the potential to cause changes to the baseline hydro(geo)logical conditions at the site, and in the surrounding area. Given the importance of water as a valued resource, and of ensuring sustainable development, an initial assessment of the water environment is considered essential.

5.2 Relevant Guidance

5.2.1 Scottish Planning Policy

Scottish Government planning policy on managing flood risk and drainage is provided by Scottish Planning Policy (SPP) paragraphs 254–268.[5] This policy is based on the following principles:

- Developers and planning authorities must give consideration to the possibility of flooding from all sources;
- New development should be free from significant flood risk from any sources;
- In areas characterised as “medium to high” flood risk for watercourses and coastal flooding new development should be focused on built up areas and all development must be safeguarded from the risk of flooding;
- The storage capacity of functional flood plains should be safeguarded from further development. The functional flood plains comprise areas generally subject to an annual probability of flooding greater than 0.5%;
- Drainage is a material consideration and the means of draining a development should be assessed. Any drainage measures proposed should have a neutral or better effect on the risk of flooding both on and off the site.

SPP proposes a Risk Framework approach which identifies flood risk in three main categories:

[4] EUR-Lex - 02000L0060-20141120 - EN - EUR-Lex (europa.eu)
[5] Scottish Government, 2014

- **Little or no risk area** (annual probability of flooding less than 0.1%). No constraints to development due to flood risk.
- **Low to medium risk area** (annual probability of flooding between 0.1% and 0.5%). Suitable for most developments, excepting civil infrastructure (unless existing civil infrastructure within a low to medium risk area is being extended, or else if civil infrastructure must be placed within this risk area for operational reasons).
- **Medium to high-risk area** (annual probability of flooding greater than 0.5%). Suitable for residential, institutional, commercial and industrial development within built-up areas (provided adequate flood protection is planned or already exists). Generally, not suitable for civil infrastructure or most vulnerable uses (such as schools and care homes) or for general development in undeveloped or sparsely developed areas (unless essential for operational reasons and alternative locations at lower flood risk are not viable).

5.2.2 SEPA Guidance

SEPA issued guidance in relation to preparing Flood Risk Assessments (FRAs).[6] Technical requirements for FRAs depend on the complexity of the site with more complex or high-risk sites requiring detailed assessments. In summary, FRAs must include the following:

- Background site data, including suitable plans and/or photographs;
- Historic flood information;
- Description of methodologies used;
- Identification of relevant flood sources;
- In case of river flooding: assessment of river flows, flood levels, depths, extents, displaced flood storage volumes, etc.;
- Assessment of culverts, sewers or other structures affecting flood risk;
- Consideration of climate change impacts;
- Details of required flood mitigation measures; and
- Conclusions on flood risk related to relevant national and local policies.

SEPA have also issued guidance on the regulation of surface water discharges.[7] Surface water discharges are authorised by General Binding Rule (GBR) 10 of the Controlled Activities Regulations (CAR), a licence or by a construction SuDS licence depending on the nature of the development. SuDS are a requirement for surface water runoff draining to the water environment from all new buildings, roads other than waterbound roads, yards and any other built development (constructed on or after 1 April 2007) under CAR, excepting single dwellings and discharge to coastal waters.

Surface water discharge to transitional waters (i.e. estuaries and tidally-impacted reaches of rivers) normally only requires minimal SuDS, such as simple source control treatment. In application, for SuDS discharging to transitional waters, attenuation is not required.

5.2.3 Glasgow City Council Guidance

GCC require that both a FRA and a Drainage Impact Assessment (DIA) are undertaken for any residential development comprising more than 5 dwellings and for industrial and commercial developments of more than 250 m^2.

GCC's requirements for the FRA generally match those of SEPA. DIA reporting must detail proposed drainage provision for the site, with an emphasis on demonstrating that proposals will protect the site

[6] Technical Flood Risk Guidance for Stakeholders", v12, (SEPA, 2019)
[7] WAT-RM-08; SEPA, 2019

itself from flooding due to surface runoff and that surface runoff from the site will not detrimentally impact flood risk elsewhere. Arrangements and requirements for maintaining site drainage over the operational life of the site must also be confirmed, including details of vesting/adoption (if site drainage will not be privately maintained by the site operator). Where proposals will generate wastewater, DIA reporting must provide details of proposed wastewater drainage arrangements and confirmation of vesting by Scottish Water.

5.3 Consultation

Consultation has been undertaken with GCC and SEPA regarding flood risk, confirming that the updated River Clyde model is considered to be state of the art for FRA in the tidal reaches of the River Clyde and should be used to assess flood risk for the current site.

Consultation regarding drainage (SuDS) design and reporting requirements has been issued to GCC, with a response not received at the time of writing.

5.3.1 Assessment Criteria

The assessment criteria set out in Table 5-1 and Table 5-2 have been used to develop a matrix to assess the significance of impacts from this proposed development option on the local hydrology and coastal processes (Table 5-3).

Table 5-1: Criteria for assessing impact magnitude

Definition	Impact magnitude
Negligible	Very light change from baseline (pre-development) conditions. Change barely distinguishable, approximating to the “no change” situation.
Low	Minor shift aware from baseline (pre-development) conditions. Change arising from the loss/alteration will be discernible but underlying character/composition/attributes of the baseline condition will be similar to predevelopment circumstances/patterns.
Medium	Loss or alteration to one or more key elements/features of the baseline (pre-development) conditions such that post development character/composition/attributes of baseline will be partially changed.
High	Total loss or major alteration to key elements/features of the baseline (pre-development).

Table 5-2: Criteria for assessing receptor sensitivity

Sensitivity	Description
Low	Characteristics and features that do not make a significant contribution to the local regime or are already altered from natural conditions.
Medium	Natural features or characteristics that are of local importance.
High	High value natural features or characteristics that are of regional importance or sensitive to small scale change.

Table 5-3: Impact significance matrix

Magnitude of impact	Sensitivity of receptor		
	Low	Medium	High
Negligible	Negligible	Negligible	Low
Low	Low	Low	Medium
Medium	Low	Medium	High
High	Medium	High	High

Impacts assessed as “medium” or “high” (grey shaded cells in Table 5-3) are considered “significant” with reference to EIA regulations.

5.4 Baseline Conditions

5.4.1 Geology and Hydrogeology

The site is underlain by Limestone Coal Formation, consisting of sedimentary rock cycles of the Clackmannan Group, formed in a setting dominated by swamps, estuaries and deltas during the Carboniferous Period (328 to 329 million years ago). Superficial deposits largely consist of Alluvium or made ground within this area.

The Clackmannan Group rocks are characterised as a moderately productive aquifer, with generally low yields, except were disturbed by mining activities.[8]

5.4.2 Topography and Bathymetry

Ground levels in the landward areas immediately bordering the dock vary between approximately 4.7 mAOD (around the northern end of the dock) and 5.8 mAOD (at the south-eastern corner of the dock). Surveyed depths within the Govan Basin range between 0m below CD on the southern margin, to 7.6m below CD on the western margin, and between 6 to 6.5m below CD through the navigation channel to the River Clyde.[9]

5.4.3 Tidal Water Levels

The tidal levels at Glasgow as presented in the Admiralty Tide Tables[10] are shown in Table 5.4. The mean tidal range at Glasgow is 4.1m during spring tides, and 2.1m during neap tides.

Table 5-4: Tidal Range at Glasgow

Tide Condition	Chart Datum (mCD)	Ordnance Datum (mAOD)
Highest Astronomical Tide (HAT)	5.3	2.8
Mean High Water Springs (MHWS)	4.8	2.3
Mean High Water Neaps (MHWN	3.9	1.4
Mean Sea Level (MSL)	2.9	0.4
Mean Low Water Neaps (MLWN)	1.8	-0.7
Mean Low Water Springs (MLWS)	0.7	-1.8
Lowest Astronomical Tide (LAT)	-0.2	-2.7

5.4.4 Hydrology

The River Clyde drains a catchment area of around 1,903 km^2 to the gauging station Clyde at Daldowie (n.o.84013), located upstream of the tidal limit. The mean flow for the River Clyde at Daldowie is 48.35 m^3/s, whilst the Q95 low flow (exceeded on average for 95% of the year) is 9.75 m^3/s. The QMED

[8] BGS 1 to 50k mapping and BGS Geoindex
[9] Peel Ports Group – River Clyde, HM 1005-2-1 GOVAN BASIN, surveyed Jan 2021: *https://www.peelports.com/marine/our-ports/clydeport*
[10] UKHO (2022). Admiralty Tide Tables Volume 1B: United Kingdom and Ireland (Excluding Isles of Scilly, English Channel to River Humber, Channel Islands and European Channel Ports) (Vol. 1).

(mean annual maxima flood) flow at Daldowie is 424 m^3/s, whilst the highest flow on record, of 1,109 m^3/s (extrapolated), occurred on 12th December 1994.

The River Kelvin confluences with the River Clyde upstream of the project site, draining a catchment area of around 335 km^2 to the gauging station Kelvin at Killermont (n.o.84001). The mean flow for the River Kelvin at Killermont is 8.64 m^3/s, whilst the Q95 low flow (exceeded on average for 95% of the year) is 1.53 m^3/s. The QMED (mean annual maxima flood) flow at Killermont is 80.5 m^3/s, whilst the highest flow on record, of 253 m^3/s (extrapolated), occurred on 12th December 1994.

5.4.5 Geomorphology

The local reach of the River Clyde is classified by SEPA as a transitional water (Clyde Estuary – Inner; ID: 200510) and is tidally influenced. The reach is designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant impact on navigation and from an increased risk of subsidence or flooding. It is classified, as of 2021, as having a Good physical condition.

The banks of the River Clyde in the vicinity of the project site are heavily engineered, with dock and quay structures present on either bank and the channel is disconnected from surrounding floodplains. The navigation channel is subject to routine dredging to maintain the depth of water for shipping. A number of weir and bridge structures are present, further impacting sediment transport processes.

5.4.6 Flood Risk

A Flood Risk Assessment with respect to the proposed infilling of the Wet Basin has been produced and is provided in Technical Appendix 5-1, Volume 3 of this EIAR.

The dock is located in the tidal reaches of the River Clyde, with design coastal flood levels summarised in Table 5.5. Climate change is predicted to cause a sea level rise of 850 mm within the Firth of Clyde by 2100 based on UKCP18 outputs. This impact is attenuated as the extreme tidal surge propagates up the river, with the predicted impact of sea level rise upon predicted flood levels at Govan therefore being less than 850 mm greater than equivalent predictions without climate change.

Table 5-5: Predicted design coastal flood levels in the river section adjacent to the dock (obtained from the River Clyde Model Update Technical Report December 2021; Fairhurst)

Design Event	Predicted Flood Level at River Centre (mAOD)
1 in 200 year	4.85
1 in 200 year (+850 mm sea level rise)	5.56
1 in 500 year	5.05
1 in 500 year (+850 mm sea level rise)	5.74
1 in 1,000 year	5.20
1 in 1,000 year (+850 mm sea level rise)	5.88

Ground levels in the landward areas immediately bordering the dock vary between approximately 4.7 mAOD (around the northern end of the dock) and 5.8 mAOD (at the south-eastern corner of the dock) and will thus be partially overtopped by the 1 in 200 year event and fully overtopped by the 1 in 1,000 year (plus climate change) event. An FRA, considering flooding behaviour from the River Clyde as well as all other sources, is therefore required.

5.4.7 Drainage

The site itself is currently within the tidal waters of the River Clyde, and therefore current drainage conditions do not warrant consideration. Proposed works will create new ground above normal tidal levels, such that surface water drainage provision will be required for the site. Given the proximity of the river, surface water will be discharged directly to the River Clyde.

Existing surface water drainage which releases into the basin will be captured by new carrier drains which will discharge through outfalls installed in the new quay wall (refer to Drawings WDH-AHN-01-00-DR-C0103 and WDH-AHN-01-00-DR-C0106 in Volume 2 of this EIAR). There will be no mixing of this surface water drainage with any proposed new drainage captured as part of subsequent development works on the infilled basin.

Outfalls will be installed in the new quay wall which will ultimately be utilised to discharge surface water to the River Clyde related to drainage required for the future development of buildings and infrastructure on the infilled basin. The assessment of the future development drainage is out with the scope of this assessment.

5.4.8 Water Quality & Water Framework Directive Classification

As described in Chapter 5.2.5, the River Clyde is classified by SEPA as a transitional water (Clyde Estuary – Inner; ID: 200510) and is tidally influenced. The reach is classified, as of 2021, as having a Moderate water quality condition. The following water quality pressures are identified:

- Point source discharges (waste water / sewage disposal).
- Unknown pressures, to be determined.

5.4.9 Sediment

Historic sediment sampling within the wet basin has identified concentrations of contaminants that exceed Marine Scotland Action Level 1 and 2. The parameters of concern included heavy metals, poly aromatic hydrocarbons (PAHs) and poly chlorinated biphenyls (PCBs). The key contaminants with potential to impact water quality are considered to be metals as these have the potential to dissolve/desorb from sorption sites, whereas the organic contaminants (PAHs and PCBs) have a greater affinity for the organic materials which they are bound to, and are more likely to remain strongly bound to the sediment, or if they become dissolved, quickly adsorbed onto organic matter.

5.5 Impact Assessment

5.5.1 Potential Impacts

The local reach of the River Clyde would be regarded as having a medium importance as a habitat, based on its WFD classification. Given the density of development on both banks of the River Clyde, any flood risk detriment has the potential to impact a large number of (predominantly commercial and industrial) properties, such that the local reach would be regarded as having a very high significance/importance in relation to flood risk.

The importance/significance of the receiving environment, as summarised above, will be factored against the magnitude of impact obtained from the assessments described in Chapter 5.3.1 in order to determine the significance of environmental impact. The significance of impacts on flood risk, drainage

and water quality will be reported for residual impacts only (i.e. the remaining impacts following implementation of mitigation) for the construction and operational phases of the proposed project.

The key potential environmental impacts on the water environment during construction and operation have been identified and are outlined below:

- Potential changes in local drainage and flood risk;
- Potential contamination of transitional/estuarine water and sediments through spillages and/or sediment transfer (oil, fuels and suspended solids); and
- Potential interactions between water environment and estuarine process impacts and associated ecology and environmental designations.

5.5.2 Construction Phase Assessment

A Water Framework Directive Assessment has been undertaken and is provided in Technical Appendix 5-2, Volume 3 of this EIAR.

The construction of the development may lead to physical and chemical contamination of the environment including groundwater (associated with the compound area and existing terrestrial areas associated with the construction works) and surface water (the River Clyde). Groundwater can also act as a pathway for pollution to the River Clyde.

Physical contamination in the form of suspended solids could occur during infilling of the basin and construction of quay walls due to:

- Infilling of the basin;
- Extraction of existing sheet piles (where required);
- Dredging to maintenance level at the completion of the infill works;

Chemical pollution could occur due to:

- Accidental spillages of oils, fuels or chemicals from storage areas;
- Leaks from vehicle and plant;
- Discharges from sanitary and welfare facilities; and
- Existing sediment within the wet basin has historically been found to exceed the Marine Scotland Action Level 1 and 2 criteria. There is potential for suspension of these contaminated sediments during the infilling works

The proposed infill and dredging works could potentially cause plumes of suspended solids and a reduction in water quality with a resultant impact on aquatic life.

The key contaminants within disturbed existing sediment or infill material with potential to impact water quality are considered to be metals as these have the potential to dissolve/desorb from sorption sites, whereas organic contaminants (such as PAHs and PCBs) have a greater affinity for the organic materials which they are bound to and are more likely to remain strongly bound to the sediment, or if they become dissolved, quickly adsorbed onto organic matter.

The key potential impact is considered to be an increase in turbidity/suspended solids during the infilling and dredging activity. Although this is likely to cause localised degradation in water quality, it is considered that this will be a short term, localised event.

Pollutants could potentially enter groundwater or run directly into the river should spillage occur in the compound area (most likely associated with any refueling activities). The potential magnitude of a deterioration of water quality during the construction phase is considered “high” (Table 5.3) if not mitigated.

5.5.3 Impacting of Infilling on Flood Predictions

An FRA has been completed and is provided in Technical Appendix 5-1, Volume 3 of this EIAR. The following summarises the findings of the FRA.

Infilling of the wet basin is predicted to have a negligible impact upon flooding behaviour for the 1 in 200 year event, with or without climate change impacts. The range of predicted local impact varies between a 5 mm reduction in peak water levels (at SEC_48 for the 1 in 200 year plus sea level rise event) and a 1 mm increase in peak water levels (upstream and downstream of the site for the 1 in 200 year plus sea level rise and plus climate change events).

Table 5-6: Predicted change in peak water levels (in mAOD) at river centre locations in the local river reach due to wet basin infilling. Negative values indicate reduction due to infilling

Location	1 in 200 year	1 in 200 year + sea level rise	1 in 200 year + climate change
SEC_25	-0.003	0.000	-0.002
SEC_26	-0.002	0.000	-0.002
SEC_27	-0.003	0.001	-0.001
SEC_28	-0.002	0.000	-0.002
SEC_29	-0.002	0.000	-0.002
SEC_30	-0.003	0.000	-0.002
SEC_31	-0.003	0.000	-0.002
SEC_32	-0.003	0.001	-0.002
SEC_33	-0.003	0.001	-0.002
SEC_34	-0.003	0.000	-0.002
FAIR_BAS	**-0.003**	**0.001**	**-0.002**
SEC_36	**-0.003**	**0.000**	**-0.002**
SEC_37	-0.003	-0.001	-0.002
SEC_38	-0.002	0.001	-0.002
SEC_39	-0.002	0.001	-0.002
SEC_40	-0.001	0.002	-0.002
SEC_41	-0.001	0.000	-0.002
SEC_42	-0.001	-0.001	-0.001
SEC_43	-0.001	0.001	0.001
SEC_44	-0.002	-0.002	0.001
SEC_45	-0.002	-0.001	0.001
SEC_46	-0.002	-0.004	-0.001
SEC_47	-0.002	-0.004	-0.002
SEC_48	-0.002	-0.005	-0.003
SEC_49	-0.003	-0.003	-0.003
YARROWS	-0.002	-0.003	-0.003

Figure 5.1 through Figure 5.3 present difference maps, showing the impact of basin infilling upon predicted peak water levels for all local 2D cells for the 1 in 200 year, 1 in 200 year plus sea level rise and 1 in 200 year plus climate change scenarios, respectively. Adjacent to the basin, river centre peak water levels are predicted to reduce by 3 mm for the 1 in 200 year event, be unchanged for the 1 in

200 year plus sea level rise event (with increases of up to 6 mm within the infilled basin itself), and reduce by 2 mm for the 1 in 200 year plus climate change event.

The mechanism for these minor predicted changes in peak water level is unclear. Basin infilling may slightly alter attenuation of tidal propagation, resulting in very minor changes in the predicted flood peak. Alternatively, or additionally, these changes may be model artefacts associated with localised instabilities which are observable throughout the model domain in isolated river edge cells (which can be seen in Figure 5-1: Change in predicted peak water levels due to wet basin infilling (1 in 200 year event)

It is noted that increases in peak water levels of up to 3 mm are predicted towards the downstream end of the model (below Erskine Bridge), separated from the site by similar reductions in peak water level, which cannot be logically associated with basin infilling, giving further weight to the conclusion that such minor changes in peak water level predictions may be artefacts associated with the numerical solver.

Noting that the events simulated account for what should be the worst-case impact (i.e. the events at which river water levels are just below and just above that necessary to flood the infilled basin), the impact of infilling for higher or lower return periods will, logically, also be negligible.

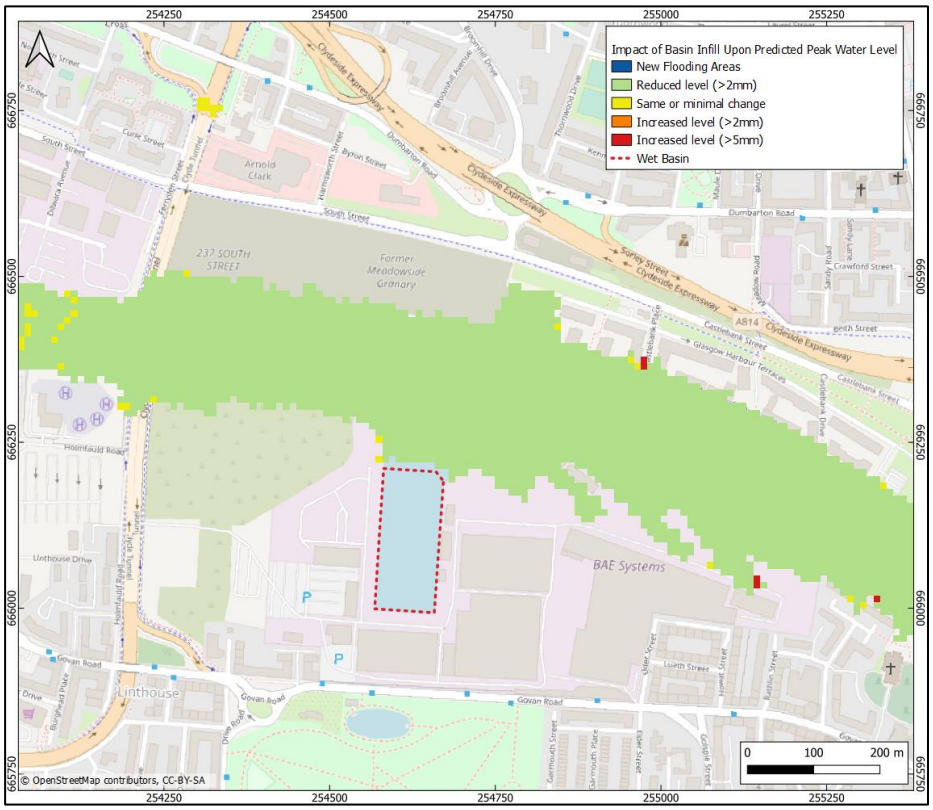

Figure 5-1: Change in predicted peak water levels due to wet basin infilling (1 in 200 year event)

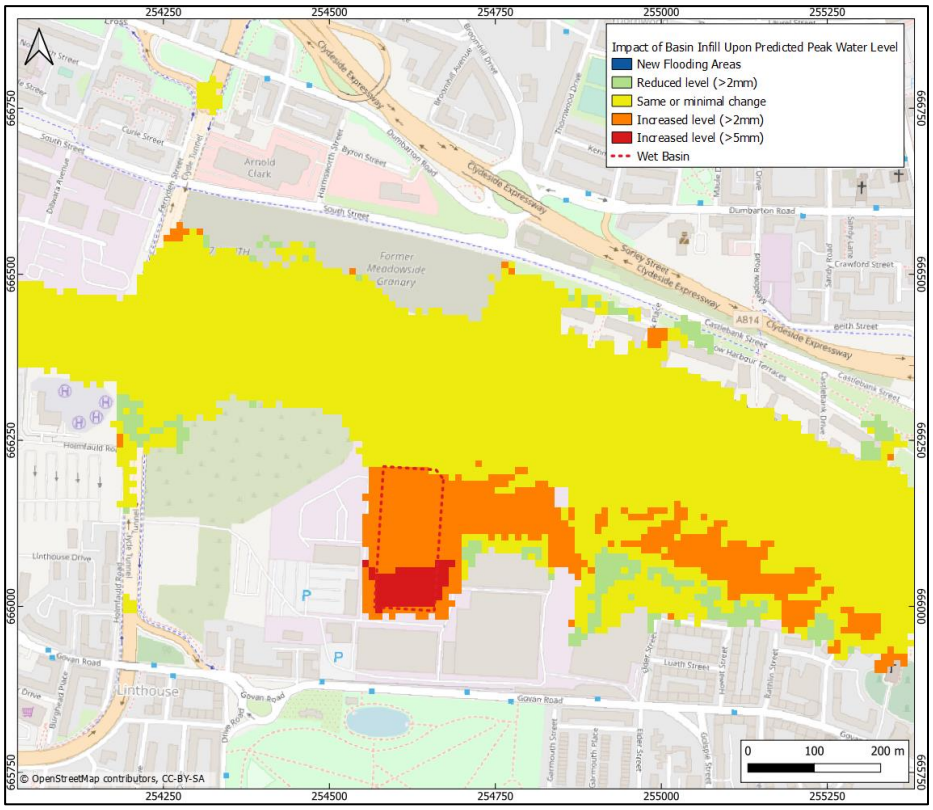

Figure 5-2: Change in predicted peak water levels due to wet basin infilling (1 in 200 year plus sea level rise event)

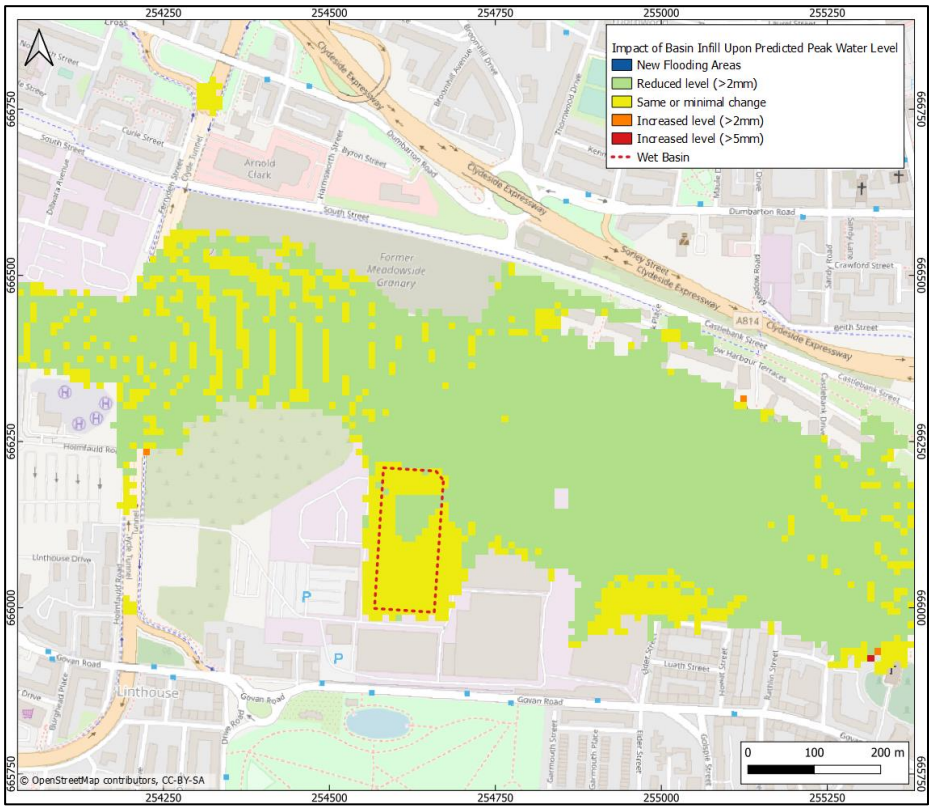

Figure 5-3: Change in predicted peak water levels due to wet basin infilling (1 in 200 year plus climate change event)

The table below provides a summary of flood risk from all sources, inclusive of proposed mitigation and management measures.

Table 5-7: Summary of Flood Risk

Flood source or mechanism	Risk Classification (with mitigation & management)	Proposed Management Measures
Tidal-Fluvial (Coastal-River)	Medium to High Risk	The infilled basin will be subsequently developed for water compatible usage; flood management measures for this development should be considered separately, accounting for the fact that the combi wall crest level is predicted to provide only marginal protection against flooding of the infilled platform for the 1 in 200 year extreme tidal event; it may be overtopped if there is significant wind coincident with the tidal surge peak, and will be at increased risk of overtopping in the future due to sea level rise associated with climate change.
Surface Water	Low or No Risk	The infilled wet basin will itself be lower than surrounding ground, with the combi wall preventing discharge into the river. In the interim period until the site is fully developed, and while the infill material may have sufficient infiltration to manage this risk, it is recommended that one or more flap valved outfalls should be integrated into the combi wall as a contingency to allow rapid drainage of any surface water flooding (as well as any tidal-fluvial overtopping of the combi wall crest) from the site.
Infrastructure	Low or No Risk	None.
Groundwater	Low or No Risk	None.

The assessment considers infilling of the wet basin only, noting that the platform created by infilling will subsequently be developed for water compatible usage. While the site is predicted to be at medium to high tidal-fluvial flood risk, this usage is appropriate at such a location.

Comparison between baseline and post-infilling flood predictions confirms that the proposed wet basin infilling has no detrimental impact upon increasing flood risk elsewhere.

5.6 Mitigation Measures

5.6.1 General Measures

The site will be secured against unauthorised access to reduce risk of vandalism (that potentially causes pollution) (PPG1, PPG2, PPG26).

An Incident Management Plan will be prepared for construction phases of the project, taking full consideration of best practice, statutory requirements and identification of areas of highest sensitivity. This will provide site spill response procedures, emergency contact details and equipment inventories and their location. All construction staff will be made aware of this document, and its content, during site induction and it will be available in the site office (PPG7, PPG18 and PPG21).

5.6.2 Deterioration of Water Quality

Prior to the commencement of demolition and construction, a Construction Environmental Management Plan (CEMP) and a monitoring programme will be prepared. The CEMP will describe in detail the nature of works proposed and the environmental protection measures being applied to ensure that all activities are carried out with due regard to the (water) environment and the prevention of pollution. The monitoring programme will likely include water quality sampling.

Best practice will be followed throughout the development phases. All relevant Pollution Prevention Guidance (PPG) will be adopted where appropriate and detailed as follows:

5.6.3 Monitoring Plan

It is anticipated that a monitoring plan will be implemented. The aim of this will be to

1. characterise the baseline conditions prior to construction works commencing; and
2. Assess the effectiveness of all pollution prevention measures, to demonstrate regulatory compliance and to allow corrective measures to be taken if required.

The monitoring plan will be developed in conjunction with the preferred contractor when appointed. It will then be implemented with the agreement of SEPA and Marine Scotland and will be incorporated into the CEMP.

It is considered that the following elements would be included within the agreed monitoring plan:

- Regular visual inspection of surface water, more frequent during periods of infilling and dredging activity, in order to monitor levels of sediment suspension and dispersion;
- Water quality monitoring: A monitoring plan, covering baseline, construction and post-construction phases will be agreed with SEPA and Marine Scotland;
- Monitoring as required to satisfy the conditions of any future discharge licence(s) or other environmental legislation;
- Frequent inspections to ensure the effective operations of all mitigation measures including weekly inspections of potential pollution sources and construction SuDS.
- Monitoring following any pollution incidents; and
- On-going liaison with SEPA and Marine Scotland as required during construction.

5.6.4 Physical Pollution (Suspended Solids)

- Construction Sustainable Urban Drainage System (SuDS) shall be in place and maintained regularly;
- Infilling and dredging method to be designed to limit release of sediment during works;
- A physical silt barrier, bubble curtain or isolation barrier will be placed between the infill area and the River Clyde during infill and prior to establishment of the coffer dam;
- A fish rescue and translocation exercise will be undertaken within the wet basin following installation of the physical barrier;
- Turbidity Monitoring to ensure that material is not being widely displaced. A baseline would need to be established prior to infilling and dredging progressing;
- Discharges from the temporary construction drainage system will be routed through settlement lagoons, silt busters or other treatment systems as required to prevent pollution of the river;
- The site roads will be regularly brushed and kept free from dust and mud deposits. Dust suppression measures may be applied if required (PPG6); and

- Requirement of stockpiling will be reduced through material management. If stockpiles are required, material will be situated within bunded areas at least 10m away from the river and out with areas at risk of flooding to minimise any sediment mobilisation.

5.6.5 Chemical Pollution (Fuel/Oil/Cement)

- Installation of oil separators to reduce risk of pollution from fuel/oil spills (PPG 1);
- All wastes will be stored in designated areas that are isolated from the surface drainage system and out with flood prone areas and bunded to contain any spillage (PPG1);
- Fuel, oil and chemical storage will be sited on an impervious base within a bund in a secured area (PPG2, PPG5, PPG6, PPG7, PPG8);
- Any refuelling facilities will be inspected regularly, and the maintenance record will be available for inspection (PPG7);
- Weekly inspection of machinery, oil storage area bunds, tanks and pipework for signs of damage (PPG2);
- If working from floating plant, oils and chemicals will be prevented from entering the river, e.g. during a spillage incident on board or machinery failure;
- Accessibility to all parts of any installed separator will be maintained as and when required (PPG3); and
- Concrete management (if required) will be implemented including careful choice of concrete product. This includes the usage of ready-mix concrete which will reduce the potential for spills and usage of ‘environmentally friendly’ products to protect the concrete in the marine environment (PPG5). Pouring of concrete will take place within well shuttered pours to prevent egress of concrete from the pour area. Concrete pouring will be avoided during adverse weather conditions.

5.6.6 Dewatering

- Discharges from any dewatering activities will be routed through a suitable construction SuDS which could include silt busters or other treatment systems if required to prevent pollution of the river;
- In the event of a pollution incident, pumping will be immediately stopped. In case of an oil or fuel spillage, any free product would be isolated by containment booms to prevent wider contamination. Oil will then be skimmed from the surface before dewatering is resumed; and
- All dewatering activities will be undertaken in accordance with relevant regulations and guidance including CAR General Binding Rules (GBR) 15 and 16.

5.6.7 Sanitary Facilities

All sanitary facilities within the construction compound are to be connected to the foul sewer.

5.6.8 Activity Licencing

Construction works in and near the river and (construction) drainage discharges into the river may be subject to an authorisation by SEPA under the Controlled Activities Regulations (CAR). In any case all activities in or near the water environment should satisfy relevant GBRs under CAR.

5.6.9 Construction Drainage

During the construction phase the existing drainage system will be dismantled. Existing outfalls will be removed or blocked to ensure that any pollutants from the construction site do not enter the river. A construction SuDS will be installed incorporating pollution prevention measures as indicated above in line with current CAR guidance, including GBR 10 and 11.

5.7 Residual Impacts

A summary of the impact analysis and residual impacts following mitigation is provided within Table 5-8. Residual effects can be considered to be of negligible, low, medium or high significance. Only residual effects that are medium or high are considered to be significant. The residual impacts of the proposed works are considered to be low to negligible given the appropriate level of mitigation measures which will be adopted.

Table 5-8: Summary of Residual Effects

Effect	Source of effect	Phase	Type of effect	Duration	Probability of occurrence	Magnitude of effect pre-mitigation	Significance of effect pre-mitigation	Mitigation measures	Residual effect (post-mitigation)
Deterioration of water quality	All working areas	Construction	Negative	Temporary	Possible	High	High	Construction SuDS; best practice construction activities (PPG); water environment licencing for construction; CEMD / CEMPs. Development of a Fish Rescue Plan to translocate fish from the wet basin and the use of silt curtain/bubble screen or barrier to prevent release of suspended sediments during the infilling works.	Low
	Extension and release of existing drainage network	Operation	Negative	Permanent	Possible	Medium	Medium	Permanent SuDS (including oil separators); foul water drainage to public sewer.	Low
Change in flood risk (on-site)	Entire site	Operation	Negative	Permanent	Possible	Medium to High	Medium	Flood management measures for the final development should be considered. The ultimate development is for a water compatible use and therefore this land usage is considered appropriate.	Low
Change in flood risk (off-site)	Entire site	Operation	Negative	Permanent	Possible	Negligible	Negligible	None required.	Negligible

5.8 Cumulative Impact

A Flood Risk Assessment has also been produced which adds representation of the proposed Wet Basin Hall building (and adjoining accommodation building). A copy of this is provided as Technical Appendix 5-3.

This assessment considers flood risk impact for the platform with building, considering two variations: (i) the hall with external doors closed during flooding, representing a worst-case in terms of potential floodwater displacement, and (ii) the hall with external doors open, in which only the concrete walls and structures within the hall are considered as solid obstacles to the movement of flood water.

Table 5.9 provides a summary of flood risk from all sources, inclusive of proposed management measures and considerations

Table 5.9: Summary of flood risk

Flood source or mechanism	Risk Classification (with mitigation & management)	Proposed Management Measures
Tidal-Fluvial (Coastal-River)	Medium to High Risk	The infilled basin platform is predicted to be only marginally above the 1 in 200 year extreme tidal event; it may be overtopped if there is significant wind coincident with the tidal surge peak, and will be at increased risk of overtopping in the future due to sea level rise associated with climate change. The proposed Wet Basin Hall, as a water compatible usage, is appropriate for placement in a location of medium to high flood risk. The near-ground elements of the hall should be designed using construction methods and material which are resilient to water damage and to the pressure that may be exerted on the structure by floodwaters exceeding 600 mm in depth and 0.5 m/s in velocity. As the ground immediately north of the accommodation block is within the predicted flood extent, flood resilient construction methods and materials should also be used for the lower-lying elements of this building, noting that the main floor of this building will be raised above 1 in 200 year plus climate change predicted flood levels by more than 3.5 m. While evacuation of the accommodation building in the event of flooding may not be necessary, given the raised floor level, any evacuation should be westwards onto adjoining higher ground.
Surface Water	Low or No Risk	Drainage outfalls into the River Clyde must be fitted with non-return “flap” valves, to prevent backflow of the drainage system in the event of extreme high water levels in the river.

Infrastructure	Low or No Risk	None.
Groundwater	Low or No Risk	None.

The following summarises the findings of the assessment:

5.8.1 Flood Risk Context

The site is nominally located just outwith the 1 in 200 year tidal-fluvial flood extent for current climate conditions, and therefore at low to medium flood risk. However, climate change and potential wind effects will likely result in the site being at medium to high tidal-fluvial flood risk over much of the operational life of the site. Regardless, the proposed water compatible usage is appropriate at such a location.

5.8.2 Flood Impacts

Comparison between baseline and post-infilling flood predictions confirms that the proposed development has no detrimental impact upon increasing flood risk elsewhere. Variations in predicted peak water levels between pre-development (baseline) and post-development are within 3 mm (with exception of isolated cells and patches exhibiting numerical instability), which is likely to be below the predictive precision of the model.

5.8.3 Access and Egress

The site is predicted to be marginally protected against flooding from the 1 in 200 year event (without sea level rise / climate change), although wind action coincident with the flood peak (not accounted for in this prediction) may cause flooding of the site. While flooding may therefore impact access and egress to the Wet Basin Hall, this is generally acceptable for water compatible usages.

The accommodation block adjoining the hall will be raised above flood risk, with a flood-free access/egress/evacuation route westwards from this building.

5.8.4 Freeboard

Freeboard provision is not required for water compatible usages. It is nonetheless recommended that site design and operation gives due consideration to predictive uncertainties as well as potential increases to flood levels due to coincident wind action. With this in mind, all habitable spaces within the Wet Basin Hall (including toilets and vending areas) will be set at least 1 m above floor level, as well as all service infrastructure. All other habitable accommodations including offices, lockers, canteen areas, etc, will be located 4.5 m above floor level (either within the upper level of the plinth or else within the accommodation block).

5.8.5 Summary

The proposed development is compliant with SEPA’s Development Management Guidance on Flood Risk (2018a), and therefore compliant with Scottish Planning Policy in terms of flood risk.

On the basis of this assessment there is not considered to be a significant impact associated with the post infilling development works proposed for the site.

6 NOISE

6.1 Introduction

The purpose of this chapter is to summarise the technical noise impact assessment report contained within Technical Appendix 6-1, Volume 3 of this EIAR, and to provide a level of significance in line with EIA assessment. Whilst the technical noise impact assessment report covers the entire construction works, this chapter details the noise monitoring, modelling and the results of the impact assessment, which has been carried out for the infilling works only.

Please note that this chapter relates to airborne noise only, underwater noise arising from the proposed development is considered within Chapter 7.2 of this EIAR.

6.2 Legislation, Guidance and Noise Definitions

A brief description of noise assessment guidance specific to this assessment is provided in the sections below.

6.2.1 BS5228-1:2009+A1:2014; Code of Practice for Noise and Vibration Control on Construction and Open Sites.

Methods for calculating noise and vibration produced by construction and open sites are provided in BS5228-1:2009+A1:2014[11]. Annexes C and D of Part 1 provide generic source data for different types of noise source, as well as methods for calculating noise from stationary and mobile plant. Specific advice on noise from sources such as piling is provided.

The ABC method of assessing construction noise impact, as detailed within Annex E.3.2 considers the existing ambient noise climate at the receptors.

6.2.2 PAN 1/2011 Planning and Noise

Advice on the role of the planning system in helping to prevent and limit the adverse effects of noise is provided in Planning Advice Note (PAN) 1/2011 – Planning and Noise[12]. PAN 1/2011 promotes the principles of good acoustic design and a sensitive approach to the location of both noise sensitive and noise generating developments. PAN 1/2011 promotes the avoidance of significant adverse noise impacts from new development while supporting sustainable economic growth. The input of environmental health officers and professional acousticians from an early stage is recommended to avoid unreasonable effects on quality of life. PAN 1/2011 promotes the application of reasonable criteria to assess noise impact but does not suggest specific target levels, allowing for consideration of contextual and non-acoustic factors.

[11] British Standards Institute (2014), *Code of Practice for Noise and Vibration Control on Construction and Open Sites, Parts 1 & 2*.
[12] The Scottish Government (2011), *PAN 1/2011 Planning and Noise*.

6.2.3 Assessment of Noise: Technical Advice Note

Assessment of Noise: Technical Advice Note[13] (TAN) is supplementary guidance to PAN 1/2011 published by the Scottish Government. TAN recommends a five-stage process to the assessment of noise, as detailed below

Stage 1: Initial Process

The development is categorised according to whether it has the potential to generate noise *i.e.* a Noise Generating Development (NGD) or be affected by the existing noise *i.e.* a Noise Sensitive Development (NSD). All Noise Sensitive Receptors (NSRs) that have the potential to be impacted by the proposed development are identified and prioritised according to their level of sensitivity. Residential NSRs are noted to be of high sensitivity.

Stage 2: Quantitative Assessment

The quantitative assessment method depends on the type of development proposed *i.e.* Noise Sensitive Development (NSD) or Noise Generating Development (NGD). Typically the assessment will compare absolute levels (predicted or measured) with an agreed target. The magnitude of the impact is then defined by assessing the amount the predicted noise level exceeds the agreed assessment target criteria for either day or night time periods.

Stage 3: Qualitative Assessment

The qualitative assessment allows the magnitude of the impact established in Stage 2 to be adjusted accordingly to account for additional factors not addressed in the quantitative assessment.

Stage 4: Level of Significance

The level of significance of the noise impact at the NSR is obtained through the relationship of the receptor's sensitivity to noise and the magnitude of the noise impact. The prescribed level of significance is used to determine whether or not noise is a key decision making issue for the NSR in question.

Stage 5: The Decision Process.

Stages 2 to 4 are repeated for all identified NSRs and a Summary Table of Significance is completed which provides an overview of the level of significance of the noise impact on all NSRs. The recommendation from the environmental health officer to the planning officer should be informed by the distribution of levels of significance.

6.2.4 World Health Organization Guidelines for Community Noise

In *Guidelines for Community Noise*[14], 55 dB $L_{Aeq,16h}$ is indicated as a criterion threshold below which few people are seriously annoyed for an outdoor living area, during daytime and evening hours. A lower guideline value of 50 dB $L_{Aeq,16h}$ is provided as a criterion below which few people are annoyed. In addition, the guidance identifies that negative sleep impacts are avoided at 30 dB $L_{Aeq,8h}$ for continuous noise sources.

[13] The Scottish Government (2011), *Assessment of Noise: Technical Advice Note.*
[14] World Health Organization (1999), *Guidelines for Community Noise*.

6.2.5 ISO 9613-2:1996 – Acoustics – Attenuation of Sound during Outdoor Propagation – Part 2: General Method of Calculation

ISO 9613-2:1996[15] presents a standardised methodology to calculate the propagation of outdoor sound levels based on source characteristics, environmental conditions and intervening features.

6.2.6 Noise Definitions

The following definitions relating to noise are used in this chapter:-

$L_{Aeq, T}$: Equivalent continuous A-weighted sound pressure level. This is the single number that represents the average sound energy over that time period. It is the sound level of a notionally steady sound that has the same energy as a sound that fluctuates over a specified measurement period.

$L_{A90, T}$: The noise level exceeded for 90% of the measurement period.

$L_{A10, T}$: The noise level exceeded for 10% of the measurement period.

$L_{AF, max}$: The A-weighted maximum sound pressure level over the measurement period. The measurement is taken using the fast time weighting of the sound level meter.

Free-field: As sound propagates from the source it may do so freely, or it may be obstructed in some way by a wall, a fence, building, earth bund, etc. The former is known as free-field propagation.

Ambient Sound Level, L_a: As defined in BS4142:2014; equivalent continuous A-weighted sound pressure level of the totally encompassing sound in a given situation at a given time, usually from many sources near and far, at the assessment location over a given time interval, T.

Façade Effect: When sound is reflected back towards its source, off a surface, such a wall, the reflected and incident sound waves interfere constructively, causing what is known as façade effect, or pressure doubling. This increases the noise, compared to that which exists in free-field, by approximately 2.5 dB(A).

Octave: A range of frequencies whose upper frequency limit is twice that of its lower frequency limit.

Octave Band: Sound pressure level is often measured in octave bands, the centre frequencies of the bands are defined by ISO – 31.5Hz, 63Hz, 125Hz, 250Hz, 500Hz, 1kHz, 2kHz, 4kHz, 8kHz, 16kHz to divide the audio spectrum into 10 equal parts. The sound pressure level of sound that has been passed through an octave band pass filter is termed the octave band sound pressure level.

6.3 Potential Impacts

Due to the proximity of the site to existing residential properties there is the potential for noise from activities carried out during the construction phase of the development to impact on them.

6.4 Consultation

EnviroCentre Ltd placed a noise consultation request with the Environmental Health Department at Glasgow City Council (GCC) in May 2022, with a follow up request in June 2022. At the time of writing no response has been received. The methodology presented in the following section outlines that proposed within the consultation request.

[15] International Organization for Standardization (1996), *ISO 9613-2:1996 – Acoustics – Attenuation of Sound during Outdoor Propagation – Part 2: General Method of Calculation*.

6.5 Noise Assessment Methodology

The following methodology has been carried out;

- Attended monitoring of day and night-time baseline noise at a sample of 8 areas representing the most exposed residential receptors surrounding the site.
- Review proposed construction schedule, locations, associated noise generating activities and plant.
- Identify a sample of worst-case significant concurrent noise generating activities / phases.
- Digital 3D noise propagation modelling of construction noise at surrounding residential receptors.
- Assessment of construction noise impacts following ABC Method provided in BS5228, Part 1, in accordance with TAN 2011.
- Provide advice on noise mitigation and management techniques where appropriate.

6.6 Target Criteria: BS5228-1:2009+A1: 2014 – Methodology (ABC Method)

The assessment of construction noise is carried out in accordance with guidance provided in BS 5228-1:2009+A1:2014 'Code of Practice for Noise and Vibration Control on Construction and Open Sites – Part 1 Noise'. The standard describes methods for evaluating the potential significant effects of construction noise, one of which is the 'ABC' method which is based on exceedance of fixed noise limits. The ABC method, as detailed within Annex E.3.2 has been used within this noise assessment, as it considers the pre-existing industrial noise climate at the receptors.

The ABC method considers that a potential significant effect occurs when the total noise level at a dwelling, including construction activity, exceeds the appropriate category values shown in Table 6-1. The table is used as follows;

- The ambient noise is determined and rounded to the nearest 5dB.
- The rounded ambient noise level is then compared with the total noise level, including construction. A significant effect at a noise sensitive receptor is considered to occur when the total noise, including construction activity exceeds the appropriate category values, shown in Table 6-1.
- The ABC method of BS5228-1:2009+A1:2014 does not provide specific guidance on determining the magnitude and significance of noise impacts above the threshold values shown in Table 6-1. In order to determine the level of significance, guidance provided in the Technical Advice Note (TAN) 1/2011 has been used. The significance criteria adopted within this noise assessment are shown in Table 6-2.

Table 6-1: Threshold of Significant Effect at Dwellings

Period	Threshold Value, in Decibels (dB)		
	Category A	Category B	Category C
Night-time (23:00 to 07:00)	45	50	55
Evenings weekday (19:00-23:00), Saturdays (13:00-23:00) and Sundays (07:00-23:00)	55	60	65
Daytime weekday (07:00-19:00) and Saturdays (07:00-13:00)	65	70	75
Note 1: A significant effect has been deemed to occur if the total L_{Aeq} noise level, including construction, exceeds the threshold level for the Category appropriate to the ambient noise level. Note 2: If the ambient noise level exceeds the Category C threshold values given in the table (i.e. the ambient noise level is higher than the above values), then a potential significant effect is indicated if the total L_{Aeq}, T noise level for the period increases by more than 3 dB due to site noise. Note 3: Applied to residential receptors only.			
Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are less than these values. Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are the same as category A values. Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5 dB) are higher than category A values.			

Table 6-2: TAN 1/2011 Significance Criteria for the Assessment of Construction Noise

Significance	Level Above Threshold Value dB(A)	Definition
Neutral	< 0	No effect, not significant, noise need not be considered as a determining factor in the decision making process.
Slight adverse	≤ 0 to < 3	These effects may be raised but are unlikely to be of importance in the decision making process.
Moderate adverse	≤ 3 to < 5	These effects, if adverse, while important, are not likely to be key decision making issues.
Large adverse	≤ 5.0 to < 10	The effects are likely to be important considerations but where mitigation may be effectively employed such that resultant adverse effects are likely to have a moderate or slight significance.
Very large adverse	≥ 10	These effects represent key factors in the decision making process. They are generally, but not exclusively, associated with impacts where mitigation is not practical or would be ineffective.

6.7 Baseline Noise Conditions

6.7.1 Overview

A baseline noise survey at a sample of 8 locations surrounding the site were carried out over the course of multiple site visits during June and July 2022. The daytime baseline noise at each position was measured for one hour on two consecutive days on 20th and 21st June. The night time baseline noise was initially planned to be captured by completing two rounds of 15 minutes at each location

over the course of the night of the 20th/21st June. The first round of 15 minute measurements was completed for all positions on this evening, however due to developing rain only 3 of the 8 positions were captured a second time. A second round of night time monitoring was completed on the night of the 07th/08th July in order to capture the second round of measurements at the remaining 5 positions.

Measurements were conducted using a Norsonic Nor140 (serial number 1403301), Norsonic Nor 118 (serial number 11831675) and calibrated using a Nor-1251 calibrator (serial number 30796) before and after measurements, with a maximum drift of 0.2 dB noted. Calibration certificates are available on request. Measurements were conducted 1.3 m above ground using a fast time weighting. The noise surveys were attended during each monitoring visit.

6.7.2 Noise Measurement Details

The measurement locations are considered to be representative of the residential receptors with the greatest chance of disturbance from construction noise and are shown in Drawing No 175756-GIS002A, Volume 2 of this EIAR. A full description of each monitoring location along with meteorological conditions and detailed notes of noise observed during the monitoring are provided in the technical noise impact assessment report contained within Technical Appendix 6-1, Volume 3 of this EIAR.

6.7.3 Baseline Noise Results

A summary of the day and night-time results can be found in Table 6-3 and Table 6-4.

Table 6-3: Daytime Baseline Sound Measured Results

ID	Date	Start time	Duration, T (hrs:mins)	$L_{Aeq,T}$ (dB)	$L_{A90,T}$ (dB)
1	20/06/2022	12:31	01:00	56.5	53.9
	21/06/2022	14:05	01:00	56.5	55.1
2	20/06/2022	16:30	00:47	65.1	62.5
	21/06/2022	15:12	01:00	64.4	61.9
3	20/06/2022	15:13	01:00	58.1	54.5
	21/06/2022	12:58	01:00	56.4	53.6
4	20/06/2022	13:50	01:00	60.5	50.3
	21/06/2022	11:42	01:00	55.6	47.5
5	20/06/2022	12:43	01:00	54.1	43.9
	21/06/2022	12:36	01:00	55.2	40.9
6	20/06/2022	13:54	01:00	51.2	46.4
	21/06/2022	16:02	01:00	51.8	46.5
7	20/06/2022	15:02	01:00	55.2	51.3
	21/06/2022	13:46	01:00	52.4	48.5
8	20/06/2022	16:09	01:00	53.1	45.1
	21/06/2022	14:51	01:00	49.1	43.8

Table 6-4: Night-time Baseline Sound Measured Results

ID	Date	Start time	Duration, T (hrs:mins)	$L_{Aeq,T}$ (dB)	$L_{A90,T}$ (dB)
1	21/06/2022	00:06	00:15	55.5	53.6
	21/06/2022	01:29	00:15	53.6	52.4
2	20/06/2022	23:43	00:15	58.0	51.7

ID	Date	Start time	Duration, T (hrs:mins)	$L_{Aeq,T}$ (dB)	$L_{A90,T}$ (dB)
	21/06/2022	01:07	00:15	53.9	44.3
3	21/06/2022	00:46	00:15	57.0	44.3
	07/07/2022	23:56	00:15	50.2	44.8
4	21/06/2022	00:26	00:15	46.9	40.3
	08/07/2022	00:21	00:15	47.4	38.1
5	20/06/2022	23:54	00:15	61.3	36.9
	21/06/2022	01:20	00:15	48.5	35.9
6	21/06/2022	00:55	00:15	63.6	38.6
	08/07/2022	00:42	00:15	43.5	40.5
7	21/06/2022	00:14	00:15	42.9	39.8
	08/07/2022	01:02	00:15	44.9	42.1
8	21/06/2022	00:34	00:15	44.9	40.8
	08/07/2022	01:22	00:15	42.0	40.2

6.8 Noise Modelling

6.8.1 Introduction

3D computer noise modelling of the various stages of construction activity at the site has been carried out using CadnaA software. Details on worst case construction activities, durations, operating times, and associated items of noise generating plant for each stage of construction used within the noise models have been supplied by Arch Henderson.

6.8.2 Noise Sensitive Receptors

A sample of eight noise sensitive receptors were chosen as being representative of those most exposed to noise from construction activities. The most exposed receptor height for the flats and houses has been utilised in the modelling and assessment, which was determined through considering the line of sight and angle of view to the noise sources. The NSRs are described in Table 6.5, and shown in Drawing No. 175756-GIS005, Volume 2 of this EIAR.

Table 6-5: Noise Sensitive Receptor Locations; Construction Noise

NSR ID	Location	Grid Reference	Most Exposed Receptor Height (m)
NSR 1	Meadowside Quay Walk, Flats	254860 666394	4
NSR 2	Dumbarton Road, Flats	254812 666656	10
NSR 3	Byron Street, Flats	254401 666704	7
NSR 4	South Street, Flats	254251 666679	7
NSR 5	Holmfauld Road, Houses	254169 666058	4
NSR 6	Aboukir Street, Flats	254481 665929	10
NSR 7	Garmouth Street, Houses	254844 665741	7
NSR 8	Wanlock Street, Houses	255252 666033	7
NSR F1	Future Flats – Granary Quay	254763 666418	10

NSR F1 has been added in order to account for a new residential development currently under construction directly adjacent to the west of the existing flats on Meadowside Quay Walk. As the construction plan for the infill of the Wet Basin is projected to continue until July 2023, it is possible that this new residential development will be completed and at least partially occupied prior to the completion of the construction works on the Govan Shipyard site. It has therefore been included in order to represent a worst case scenario, as this location is closer than any existing NSR and has clear line of sight to the Wet Basin. All of the results presented for NSR F1 have been calculated with the future apartment building in place, using the same parameters and the associated building included in the model.

As there is potential for the future apartment building at NSR F1 to reduce line of sight and therefore modelled levels at NSR 2, the modelled results for all scenarios at NSR 2 have been calculated without this future building at NSR F1 included as this represents a worst-case scenario in terms of noise propagation.

6.8.3 Construction Noise Model Input Parameters

During infilling of the wet basin, a number of concurrent groups of activities and items of plant shall be operational. The concurrent groups of activities and plant have been identified through review of the construction details and schedules provided by Arch Henderson.

The construction plant included in the infilling modelling exercise are identified as:-

- Dredging;
- HGV deliveries and concrete batching;
- Piling; and
- Infill and Compaction

Calculations were carried out using noise data and guidance provided in BS5228-1:2009+A1:2014, to derive predicted noise levels at noise sensitive receptors. Where data was not available within BS5228, noise data has been sourced from the following publications;

- Rob Witte, *Noise From Moored Ships*, Internoise 2010.
- Royal Haskoning DHV, *Swansea Channel Noise Impact Assessment, Memo,* 25th June 2014.
- Tarbert Ferry Terminal - Subtidal Benthic Ecology Survey Report (January 2018). APEM Scientific Report P000002178a. Aspect Land & Hydrographic Surveys Ltd.

Full details of the items of modelled construction plant, noise data (including data source), operating times, durations and source heights for each of the considered scenarios is provided in Technical Noise Assessment report, Technical Appendix 6-1, Volume 3 of this EIAR.

6.8.4 Modelled Scenarios

Noise modelling scenarios have been set up to account for the cumulative impact of the concurrent stages. The scenarios have been set up to model the worst-case potential combination of construction activities for each set of months considered. Periods where fewer noisy activities are expected, or general site levels are expected to be lower have not been modelled. A summary of the worst case combined construction stages and relevant assessment periods for each of the modelled scenarios is shown in Table 6-6. It should be noted that while the modelling has predicted all operations within a scenario to be concurrent, this is a conservative assumption and some activities will in fact be contiguous. Note also that the majority of dredged material to be used for infill will be imported from

an off-site location. Dredging of the basin mouth is a shorter duration activity following completion of the new front quay wall.

Table 6-6: Modelled Scenarios: Construction Noise

Modelled Scenario	Modelled Combination of Construction Stages (Worst Case)	Relevant Assessment Periods
1	Spreading from Dredger	Evening, Night, Weekend
	Night Infill	
2	Spreading from Dredger	Evening, Night, Weekend
	Night Infill	
	Dredging Basin Mouth	
3	Piling (worst case of impact assumed)	Weekday, Weekend
	Spreading from Dredger	
	Infill and Compaction	
	HGV Deliveries and Concrete Batching	
4	Dredging Basin Mouth	Weekday, Weekend
	Spreading from Dredger	
	Infill and Compaction	
	HGV Deliveries and Concrete Batching	

Full details of each scenario is provided in Technical Noise Assessment report, Technical Appendix 6-1, Volume 3 of this EIAR.

6.8.5 Construction Noise Model Assumptions

A number of assumptions have been established during the CadnaA modelling exercise, as detailed below:

- The ground model uses Lidar 1m resolution Digital Terrain Model (DTM) height data obtained from the Scottish Remote Sensing Portal[16] for the BAE Complex and the surrounding area.
- The heights of buildings have been obtained using a Digital Surface Model (DSM) of the area from the Scottish Remote Sensing Portal;
- Predicted levels are calculated in the free-field environment;
- Ground absorption has been set to 0 for areas of soft ground, 0.5 for mixed soft/hard ground, and 1 for hard ground. The surface of the water is considered a reflective surface with an absorption of 0;
- Weekday evening noise levels generated by construction activities for scenarios 1 and 2 have been assumed to be the same as those generated during night time hours;
- Weekend daytime noise levels generated by construction activities for scenario 3 has been assumed to be the same as those generated during weekday hours;
- The noise model assumes locations of plant based on descriptions of construction activities provided by Arch Henderson;
- Worst case scenario combinations of construction activities likely to occur during the considered assessment periods have been assumed;
- The following sources have been modelled as line sources within CadnaA;
    - Heavy goods vehicles (HGVs) and dump trucks;
    - Concrete trucks; and
    - Moving construction plant such as dozers and impact compaction rollers.

[16] Scottish Remote Sensing Portal | Scottish Government (remotesensingdata.gov.scot)

- Noise associated with Sopsan Dau dredging barges delivering and placing infill material has been modelled within CadnaA as discrete point sources on a 14 x 72 x 2.5 metre block to represent:
    - Vessel engine noise;
    - Jet pump output; and
    - Pump ashore output/rainbow spreading.
- All remaining sources (not outlined above) have been modelled within CadnaA as point sources.

Details of all sources included within the model and their operating times are provided in Technical Noise Assessment report, Technical Appendix 6-1, Volume 3 of this EIAR.

6.9 Construction Noise Impact Assessment

The noise model results for each modelled scenario of construction activity, along with the BS5228 assessment at each of the considered noise sensitive receptors are summarised in Table 6-7 to Table 6.15. The results for NSR F1 for all three scenarios have been calculated using the same BS5228 ABC Category Threshold Levels as NSR 01. The predicted level within the tables is defined as the total construction and ambient noise level at each receptor location.

For the ABC Category Threshold calculations refer to the Technical Noise Assessment report, Technical Appendix 6-1, Volume 3 of this EIAR.

Table 6-7: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 1

NSR 01	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	N/A	N/A	N/A	60.0	56.7	Neutral	60.0	56.4	Neutral	55.0	55.2	Slight Adverse
2	N/A	N/A	N/A	60.0	57.5	Neutral	60.0	57.2	Neutral	55.0	56.2	Slight Adverse
3	65.0	66.5	Slight Adverse	60.0	66.4	Large Adverse	N/A	N/A	N/A	N/A	N/A	N/A
4	65.0	66.4	Slight Adverse	60.0	66.3	Large Adverse	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-8: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 2

NSR 02	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	N/A	N/A	N/A	65.0	61.9	Neutral	65.0	61.9	Neutral	55.0	54.4	Neutral
2	N/A	N/A	N/A	65.0	61.9	Neutral	65.0	61.9	Neutral	55.0	54.5	Neutral
3	70.0	66.5	Neutral	65.0	65.1	Slight Adverse	N/A	N/A	N/A	N/A	N/A	N/A
4	70.0	66.4	Neutral	65.0	65.0	Slight	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-9: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 3

NSR 03	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	N/A	N/A	N/A	60.0	55.2	Neutral	60.0	55.0	Neutral	55.0	51.8	Neutral
2	N/A	N/A	N/A	60.0	55.4	Neutral	60.0	55.2	Neutral	55.0	52.2	Neutral
3	65.0	63.4	Neutral	60.0	63.0	Moderate Adverse	N/A	N/A	N/A	N/A	N/A	N/A
4	65.0	63.0	Neutral	60.0	62.6	Slight Adverse	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-10: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 4

NSR 04	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	N/A	N/A	N/A	60.0	53.3	Neutral	60.0	53.3	Neutral	50.0	47.5	Neutral
2	N/A	N/A	N/A	60.0	53.6	Neutral	60.0	53.6	Neutral	50.0	48.5	Neutral
3	65.0	59.9	Neutral	60.0	59.1	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
4	65.0	59.8	Neutral	60.0	59.0	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-11: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 5

NSR 05	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	N/A	N/A	N/A	55.0	52.5	Neutral	55.0	52.4	Neutral	55.0	49.2	Neutral
2	N/A	N/A	N/A	55.0	52.7	Neutral	55.0	52.6	Neutral	55.0	49.5	Neutral
3	65.0	60.0	Neutral	55.0	59.6	Moderate Adverse	N/A	N/A	N/A	N/A	N/A	N/A
4	65.0	59.7	Neutral	55.0	59.2	Moderate Adverse	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-12: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 6

NSR 06	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	N/A	N/A	N/A	55.0	50.4	Neutral	55.0	50.0	Neutral	50.0	46.6	Neutral
2	N/A	N/A	N/A	55.0	50.6	Neutral	55.0	50.3	Neutral	50.0	47.2	Neutral
3	65.0	62.3	Neutral	55.0	62.2	Large Adverse	N/A	N/A	N/A	N/A	N/A	N/A

4	65.0	62.0	Neutral	55.0	61.8	Large Adverse	N/A	N/A	N/A	N/A	N/A	N/A

Table 6-13: Noise Model Results and BS5228 Assessment; Noise Sensitive Receptor No. 7

NSR 07	Weekday Daytime			Weekend Daytime			Evening			Night-time		
Scenario	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance	Threshold Level dB(A)	Predicted Level dB(A)	Significance
1	N/A	N/A	N/A	55.0	52.4	Neutral	55.0	52.4	Neutral	50.0	43.1	Neutral
2	N/A	N/A	N/A	55.0	52.4	Neutral	55.0	52.4	Neutral	50.0	43.1	Neutral
3	65.0	55.6	Neutral	55.0	53.2	Neutral	N/A	N/A	N/A	N/A	N/A	N/A
4	65.0	55.6	Neutral	55.0	53.2	Neutral	N/A	N/A	N/A	N/A	N/A	N/A

6.10 Discussion of Scenario Impacts

The worst case noise impacts for each of the modelled scenarios on concurrent construction stages and relevant assessment periods are summarised below.

Scenario 1: This scenario considers the noise impact of a TSHD spreading infill material via the rainbow method and two 18T dozers moving material at the edge of the Wet Basin and on reclaimed land within the Basin. The works modelled within this scenario have been assessed during evening, night time and weekend daytime hours.

This scenario is predicted to meet the evening and weekend threshold levels as defined using the ABC method of BS 5228 at all noise sensitive receptors resulting in a Neutral impact.

At NSR 1 and NSR F1, work during night time hours is predicted to result in a Slight Adverse impact. For all other receptors night time works are predicted to result in a Neutral impact.

Scenario 2: This scenario considers the noise impact of a TSHD spreading infill material via the rainbow method, dredging operations at the mouth of the Wet Basin using a TSHD, and two 18T dozers moving material at the edge of the Basin and on reclaimed land within the Basin. The works modelled within this scenario have been assessed during evening, night time and weekend daytime hours.

This scenario is predicted to meet the evening and weekend daytime threshold levels as defined using the ABC method of BS 5228 at all noise sensitive receptors resulting in a Neutral impact.

At NSR 1 and NSR F1, work during night time hours is predicted to result in a Slight Adverse impact. For all other receptors night time works are predicted to result in a Neutral impact.

Scenario 3: This scenario considers the noise impact of impact piling, spreading of infill material via the rainbow method from a TSHD, infill and compaction by earth moving vehicles on reclaimed land, concrete batching and HGV deliveries. The works modelled within this scenario have been assessed during weekday and weekend daytime hours.

Weekday daytime works are predicted to result in a Moderate Adverse impact at NSR F1 and a Slight Adverse impact at NSR 1. The impact is predicted to be Neutral at all other receptors.

Weekend daytime works are predicted to result in a Large Adverse impact at NSR 1, NSR 6 and NSR F1. A Moderate Adverse impact is predicted at NSR 3 & NSR 5, and a Slight Adverse impact is predicted at NSR 2. The impact is predicted to be Neutral at NSR 4, NSR 7 and NSR 8.

Scenario 4: This scenario considers the noise impact of dredging operations at the mouth of the Wet Basin using a TSHD, spreading of infill material via the rainbow method from a TSHD, infill and compaction by earth moving vehicles on reclaimed land, concrete batching and HGV deliveries. The works modelled within this scenario have been assessed during weekday and weekend daytime hours.

Weekday daytime works are predicted to result in a Moderate Adverse impact at NSR F1 and a Slight Adverse impact at NSR 1. The impact is predicted to be Neutral at all other receptors.

Weekend daytime works are predicted to result in a Large Adverse impact at NSR 1, NSR 6 and NSR F1. A Moderate Adverse impact is predicted at NSR 5, and a Slight Adverse impact is predicted at NSR 2 and NSR 3. The impact is predicted to be Neutral at NSR4, NSR 7 and NSR 8.

6.11 Discussion of Impacts

6.11.1 Greatest Evening Noise Impacts

Evening noise will largely be due to infill of material from TSHD via the rainbow spreading method which has been conservatively assumed to be constantly operating with shore side support from two dozers. During the course of dredging the basin mouth with a TSHD it is expected that these operations would also be continuously active during the evening. Modelled levels are predicted to be below the thresholds defined in the ABC method of BS 5228 at all receptors and Neutral impact is therefore predicted at all receptors during the evening.

6.11.2 Greatest Night-time Noise Impacts

Night time noise will largely be due to infill of material from TSHD via the rainbow spreading method which has been conservatively assumed to be constantly operating with shore side support from two dozers. During the course of dredging the basin mouth with a TSHD it is expected that these operations would also be continuously active during night time hours.

The greatest impacts during night-time hours are predicted at NSR 1 and NSR F1. Both of these receptors are located on the opposite shore of the River Clyde with direct line of sight to the mouth of the Wet Basin and partial line of sight to the rest of the site. These receptors are predicted to experience Slight Adverse impact for both of the modelled night time scenarios. No impact is predicted at all remaining NSRs.

6.11.3 Greatest Weekday Daytime Noise Impacts

The loudest noise generating activities for weekday daytime works are predicted to be a combination of impact piling, compaction of infill material on reclaimed land and noise from movements and tipping of dump trucks. Impact piling is active in Scenario 3 and inactive in Scenario 4, which also includes dredging of the basin mouth with a TSHD. Although piling is among the loudest contributing sources at most noise sensitive receptors, the reduction in modelled noise levels with piling inactive and dredging of the basin mouth active is typically around 1 dB or less, indicating that daytime construction noise is not dominated by a single source.

Similar to night-time works, the greatest impacts during daytime hours are predicted at NSR 1 and NSR F1 on the opposite shore of the River Clyde with direct line of sight to the mouth of the Wet Basin and partial line of sight to the rest of the site. These receptors are predicted to experience Slight Adverse impact and Moderate Adverse respectively for both of the modelled day time scenarios. No impact is predicted at all remaining NSRs.

6.11.4 Greatest Weekend Daytime Noise Impacts

The loudest noise generating activities for weekend daytime works are predicted to be the same as weekday daytime works, namely a combination of impact piling, compaction of infill material on reclaimed land and noise from movements and tipping of dump trucks.

Due to the increased ABC Threshold sensitivity for weekend daytime hours defined in BS5228-1:2009 and shown in Table 6-1, greater impacts are predicted at the majority of receptors in comparison to weekday daytime hours.

NSR 1 and NSR F1 on the opposite side of the River Clyde are predicted to experience Large Adverse impacts during this working period. NSR 6 is located at the south eastern site boundary with direct line of sight to the Basin over the southern boundary wall and is subject to a Large Adverse impact. A Moderate impact is predicted at NSR 5 due to the arrival and departure of HGVs and dump trucks delivering materials via the western gate on Holmfauld Road.

A Slight Adverse impact is predicted at NSR 2 and NSR 3, whilst a Neutral impact is predicted at NSR 4, NSR 7 and NSR 8.

6.12 Construction Noise Mitigation

Construction activities during evening hours are predicted to have a Neutral level of significance during evening hours at all receptors. NSRs 2 – 8 are also predicted to have a Neutral significance of impact during daytime and night time hours.

NSR 1 is predicted to have a Slight impact during daytime and night time hours, while NSR F1 is predicted to have a Slight impact during night time hours and a Moderate significance of impact during daytime hours.

As per Table 6-2, impacts of Slight and Moderate adverse impact are defined in Tan 2011 as undesirable, but not likely to be key decision making issues. It is therefore considered that mitigation of construction noise impacts during weekday daytime, evening and night time hours is not necessary. The existing noise environment at NSR 1 and NSR F1 is already dominated by noise from ship assembly from the BAE yard and fabrication sheds during typical operations. Therefore residents are less likely to be disturbed by a modest increase in noise levels which is similar in character to the typical existing ambient noise.

At the weekend, the worst case daytime impacts from construction activities are predicted to be of Large Adverse significance at NSR1, NSR 6 and NSR F1 with Neutral, Slight and Moderate significance of impact predicted at the remaining receptors. This impact is predicted due to concurrent infill, dredging, spreading and ground compaction activities.

Impacts of Large adverse significance are defined in TAN 2011 as likely to be important considerations, however, mitigation may be effectively employed such that resultant adverse effects may have a Moderate or Slight significance (refer to Table 6-2). To reduce the level of impact from Large Adverse significance during the weekend daytime, noise mitigation measures are recommended in the following sections.

6.12.1 Piling and Compaction

Piling will be carried out initially using a vibratory hammer, with the impact hammer being used to drive the piles into their final position. The use of the impact hammer generates the greatest level of noise during this process. Compaction is also carried out using vibratory rollers in addition to the mobile rapid impact compactor which generates greater amounts of noise. In order to reduce the level of impact during the most sensitive weekend daytime period at receptors across the river, the following measures are recommended;

- The use of impact hammers on piles and rapid impact compaction hammering on reclaimed land should, where practicable, be scheduled for weekdays and avoided at weekends;
- The use of quiet hammer systems and acoustic shrouding techniques should be considered during impact piling.

6.12.2 Compaction

Compaction is carried out using vibratory rollers in addition to the mobile rapid impact compactor which generates greater amounts of noise. In order to reduce the level of impact during the most sensitive weekend daytime period at receptors across the river, the following measures are recommended;

- The use of rapid impact compaction hammering on reclaimed land should, where practicable, be scheduled for weekdays and avoided at weekends.

6.12.3 Construction Noise Management

It is recommended that best practice construction noise management techniques should be employed following guidance provided in BS5228-1:2009. This includes Best Available Techniques (BAT) for reducing noise from vehicle movements and tipping of materials and upkeep of plant and machinery so as to prevent faults and minimise operational noise. The general principles of the Considerate Constructors Scheme should be followed where practicable.

6.13 Residual Effects

Noise generated by construction activities is temporary in nature, therefore there are no predicted long-term residual effects.

6.14 Cumulative Impacts

The introduction of the proposed assembly hall would enclose noise-emitting operations which are currently undertaken outdoors. This would reduce the impact on surrounding receptors. No increase in the operational noise from the site is anticipated as a result of the scheme. There is therefore not considered to be any significant cumulative impact in relation to noise associated with the post infilling operation of the site.

7 LAND QUALITY

7.1 Introduction

This chapter presents an assessment of the likely significant effects of the proposed development on soil and land quality. A key focus of the assessment is consideration of the likely significant effects of ground contamination on human health and the potential for impact to surface water.

The objectives of this chapter are to:

- Provide detail on the legislative context for the assessment.
- Detail the methodology used to undertake the assessment;
- Discuss the current and expected future (post-remediation) baseline conditions at the site and surroundings;
- Identify mitigation measures (where required) to address identified likely effects; and
- Assess potential residual effects.

The assessment is informed by a Geotechnical and Geo-Environmental Desktop[17] investigation produced by Mott MacDonald. A copy is provided in Technical Appendix 7-1.

7.2 Policy, Legislation and Guidance

The following section details the pertinent legislation, planning policy and technical guidance that relates to this assessment

7.2.1 Legislation

The specific legislation applicable to the geo-environmental assessment of the site are detailed below:

- Environmental Protection Act 1990 (Part IIA) (as amended);
- The Environment Act 1995 (Section 57);
- The Contaminated Land (Scotland) Regulations 2000 (as amended);
- EU Water Framework Directive 2000/60/EC (“the WFD”);
- Groundwater Daughter Directive to the WFD 2006/118/EC;
- The Water Environment (Controlled Activities) (Scotland) Regulations 2011 (as amended in 2013 and 2017)

7.2.2 Planning Policy

Planning policy that is specifically relevant to this assessment include:

- Scottish Planning Policy 2014
- Planning Advice Note 33: Development of Contaminated Land
- Marine Policy Statement 2011

[17] Mott MacDonald - BAE Govan – New Assembly Hall Geotechnical and Geo-Environmental Desk Study, June 2022

7.2.3 Relevant Technical Guidance

The assessment has been informed by the following technical guidance:

- Land Contamination Risk Management, Environment Agency 2021
- BS 10175:2011+A2:2017 Investigation of potentially contaminated sites. Code of practice.
- SEPA WAT PS10 Assigning Groundwater Assessment Criteria for Pollutant Inputs

7.3 Methodology

The approach to the assessment has incorporated the following stages:

- Review of existing site condition with respect to the proposed development to identify potential risk to key receptors associated with existing contamination at the site.
- Identification of mitigation measures in relation to construction and operational phases to ensure the site is suitable for the proposed use.

7.4 Baseline

7.4.1 Current and Historic Site Use

The site has been subject to extensive development associated with its continual use as a shipbuilding yard since the Fairfield Shipyard was established in 1864. This has included various building layouts, cranes, railways and other infrastructure. The Wet Basin is shown to have been first excavated in the late 1800s and subsequently developed and widened in the early 1900s, the 1970s and circa 2005.

It covers approximately 10 hectares of land adjacent to the River Clyde with an existing waterfront 590m in length (Refer to Drawing No. 175756-GIS001 for site location). A combination of inclined slipways, masonry walls, sheet piled wharf structures and an extent of informal riverbank forms the water frontage to the site (northern boundary) with the wet basin located on the western area of the shipyard.

The wet basin itself is currently not in use.

7.4.2 Surrounding Site Use

The Govan shipyard is located on the southern bank of the River Clyde and is bounded to the south by Govan Road, Elder Park and a residential area with another residential area to the east. Glasgow Harbour residential area lies opposite the site on the northern bank of the River Clyde. To the west of the site is the A739, the Queen Elizabeth University Hospital (750m from site), and a large area comprising industrial, business and commercial activities.

7.4.3 Geology

No geological designations are known to be present on the site or its surrounds.

Geological mapping indicates that the superficial deposits onsite at surface have been replaced by Made Ground, however the BGS Geoindex online viewer indicates that undifferentiated recent sediment is present onsite.

Holocence aged Alluvium is indicated to be present at surface immediately south of the site and north of the River Clyde, and Quaternary Undifferentiated River Terrace Deposits are shown to outcrop slightly further to the south and north.

A small pocket of Devensian aged Raised Tidal Flat Deposits are present at surface in the southwest corner of the site, with further local outcrops present within a 1km of the site boundary in all directions. A small pocket of Devensian Raised Marine Beach Deposits outcrop north of the River Clyde alongside Devensian Glacial Till.

The BGS Lexicon describes the soils on site as follows:

- **Alluvium:** 'unconsolidated detrital material deposited by a river, stream or other body of running water - Normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present.'
- **Raised Tidal Flat Deposits**: "Silt, clay and fine-grained sand with lenses of gravel"
- **River Marine Beach Deposits**: "Gravel and sand, commonly silty. Gravel typically cobble grade, poorly sorted, clast supported with subangular to rounded clasts. Sand mainly medium-grained."
- **Glaciofluvial Deposits**: "deposited by meltwater streams. Includes mostly coarse-grained sediments (i.e., sand and gravel) with some finer-grained layers (i.e. clay and silt). Sand and gravel, locally with lenses of silt, clay or organic material."
- **Glacial Till**: 'unsorted and unstratified drift, generally over-consolidated, deposited directly by and underneath a glacier without subsequent reworking by water from the glacier. It consists of a heterogenous mixture of clay, sand, gravel, and boulders varying widely in size and shape (diamicton).

The bedrock geology beneath the site is indicated to comprise the Limestone Coal Formation (LSC) of the Clackmannan Group. Despite its name the Limestone Coal Formation contains few Limestones with the BGS memoir[18] describing the lower part of the formation, which is indicated to be present beneath the site, as interbedded dark grey mudstones with siltstones and sandstones, with clayband ironstones and blackband ironstones.

Historic site investigation within the vicinity of the wet basin incorporates:

- BH128, BH128A, BH129, BH130A, BH132, BH133, BH136, BH140 and BH142 from Dames and Moore Report No 44701-002 (October 2000). A copy of this is provided in Technical Appendix 7-2.

The borehole logs indicate that the geology within the proximity of the wet basin incorporates up to 4.5m of made ground (consisting of materials ranging from silt to coarse sand with abundant anthropogenic materials) overlying sands with occasional silt and clay lenses.

7.5 Hydrology

The River Clyde is located immediately to the north of the site. The following table details a summary of current SEPA water quality status information.

[18] Hall, I. H. S., Browne, M. A. E., and Forsyth, I. H. (1998). *Geology of the Glasgow District.* Memoir of the British Geological Survey Sheet 30E (Scotland) (London. British Geological Survey)

Table 7-1 Summary of Water Body Information[19]

Parameter	Description
Water Body Name	Clyde Estuary – Inner (Inc Cart)
Water Body ID	200510
Water Body Type	Transitional
Water Body Total Area	4.4 km^2
Overall Water Body Status	Moderate (2020)
Ecological Status	Poor (2020)
Chemical Status	Poor (2020)
Hydromorphological Status	Poor - The water body has been designated as a heavily modified water body on account of physical alterations that cannot be addressed without a significant impact on navigation and from an increased risk of subsidence or flooding.
Other Parameters Rated at Good Status	Biological Elements, Fish, Copper and Unionised Ammonia
Other Parameters Rated Below Good Status	Dissolved Inorganic Nitrogen, Chromium, Morphology

The river is currently classified as having an overall moderate status with a poor status in relation to chemical quality.

7.6 Sediment

Chemical testing of wet basin sediment has been undertaken to inform disposal options for dredged sediment. A history of recent dredging and infilling of the wet basin can be broadly summarised as follows:

- There is evidence to suggest slag was placed in the west of the wet basin in 2004. This was subsequently dredged and deposited in the southwest corner of the wet basin in 2012.
- The western and northern extent of the wet basin has been subject to recent dredging, possibly in 2020.
- The eastern and southern extent of the wet basin do not appear to have been dredged in the recent past.

A summary of the two most recent marine sediment testing reports is presented below:

[19] https://www.sepa.org.uk/data-visualisation/water-environment-hub/

It should be noted that these assessments are primarily focused on the suitability of the material for disposal at sea as part of dredging campaign. The assessments utilize the Marine Scotland Action Level 1 and Action Level 2 for screening as follows:

- Sediment with contaminant concentrations below AL1 is generally considered to be below background levels for contamination and is suitable for disposal at sea.
- Concentrations between AL1 and AL2 indicate additional risk assessment and testing may be required to assess suitability for sea disposal
- Concentrations above AL2 is generally considered unlikely to be suitable for disposal to sea without further testing, risk assessment and consultations with Marine Scotland

EnviroCentre were commissioned by Arch Henderson on behalf of BAE to undertake a Best Practicable Environmental Option Assessment (BPEO) in support of maintenance dredging on the River Clyde under the 'Dredging and Deposit of Solid Waste in the Territorial Sea and UK Controlled Waters Adjacent to Scotland Marine (Scotland) Act 2010'. The assessment included testing at three sample stations (shallow grab samples, S11, S12, S13) within the wet basin, as shown on Figure 1.1.

Figure 7-1 Sediment Sampling Locations

Chemical analysis records failures against Marine Scotland Action Level 1 (AL1) for contaminants including metals, total hydrocarbons and PAHs. No exceedances were recorded against Marine Action Level 2 (AL2).

It should be noted that the samples were located in the north and west of the west basin, i.e. areas that have been subject to regular dredging and maintenance and therefore more likely to be representative of recently deposited sediment.

The following table summarises the results.

Table 7-2 Chemical Analysis Screening Summary - EnviroCentre Report (2020)

Sample ID	Metals		TBT		Hydrocarbons	PAHs	PCBs	
Action Level	AL1	AL2	AL1	AL2	AL1	AL1	AL1	AL2
S11	Fail	Pass	Pass	Pass	Fail	Fail	Pass	Pass
S12	Fail	Pass	Pass	Pass	Fail	Fail	Pass	Pass
S13	Fail	Pass	Pass	Pass	Fail	Fail	Pass	Pass

7.3.2 Structural Soils Investigation for Arch Henderson (2012)

The Structural Soils marine sampling and testing investigation from 2012 included three vibrocore sampling stations on the eastern side of the basin (S3, S4 and S5). The test results recorded numerous heavy metals and organotins to exceed AL1 and AL2 (Table 7-3). Exceedances were also recorded for organic contaminants.

Table 7-3 Chemical Analysis Screening Summary - Structural Soils (2012)

Sample ID & Depth	mg/kg (Blue = >AL1, Red = >AL2)									
	Arsenic	Cadmium	Chromium	Copper	Mercury	Nickel	Lead	Zinc	Dibutyltin	Tributyltin
S3 -3.5CD	14	5.9	353	201	0.85	48	296	690	0.01	0.1
S3 -6.0CD	12	4.7	224	127	0.74	47	169	435	0.5	1.7
S3 -8.4CD	2	0.9	9	13	0.17	10	6	22	0.004	0.004
S4 -4.0CD	12	4.9	248	137	0.73	10	6	462	0.02	0.5
S4 -6.0CD	50	11.9	1550	417	2.02	68	909	1920	0.4	2.41
S4 -8.4CD	97	12	2010	522	5.45	67	1450	3360	0.009	0.2
S5 -5.5CD	17	5.6	340	141	0.9	52	252	600	0.009	0.1
S5 -6.0CD	18	6.6	426	253	0.86	65	308	764	0.03	1.5
S5 -8.4CD	85	12	1890	538	4.83	71	1520	3160	0.007	0.007

Samples S4 and S5 generally show contaminant concentrations increasing with depth below the wet basin bed. Highest concentrations of heavy metals were generally recorded at the base of the cores, approximately 4.5m below the base of the basin. Highest concentrations of tributyltin were recorded in the middle of the cores. Concentrations of heavy metals recorded in 2012 are significantly higher than those recorded by EnviroCentre in the north and west of the basin (i.e. areas which have been subject to regular dredging).

The testing from the east of the basin suggests that the sediment may not be suitable for disposal at sea due the concentrations recorded above AL2.

7.7 Hydrogeology

The site lies in the area of the Govan sand and gravel groundwater body.

The following table details a summary of current SEPA groundwater quality status information.

Table 7-4 Summary of Water Body Information[20]

[20] https://www.sepa.org.uk/data-visualisation/water-environment-hub/

Parameter	Description
Water Body Name	Govan Sand and Gravel
Water Body ID	150779
Water Body Type	Groundwater
Water Body Total Area	32.9 km^2
Overall Water Body Status	Poor (2020)
Chemical Status	Poor (2020)
Chemical – Surface Water Interaction	Poor
Water Quality	Poor

Groundwater in this area is currently characterised as being Poor quality. It is noted that for the majority of the proposed development area there is no existing groundwater as it is currently a surface water basin.

With regards to the bedrock aquifer the site is underlain by the Clackmannan Group which is classified as a moderately productive aquifer with generally low yields, aside from where mining activity has occurred, in which flow rates of up to 10 L/s can be expected. The site is associated with the Glasgow and Motherwell ground water body (ID: 150677) which is classified as a poor-quality ground water body.

7.8 Mining Stability

A Mining Stability Report has been undertaken by JWH Ross in 2013[21] for the northeast area of the site on land east of the Wet Basin, encompassing the SBOH, Slipway No. 1 and the Fabrication Shed. This utilised available mining information and available ground investigations for the site up to the report year of 2013.

The report states that the Knightswood Gas Coal is considered to be the lowest coal seam of past economic significance within the Limestone Coal Group and considering the conjectural outcrop position is to the east of the site boundary and that it dips to the east, it is not considered to be present beneath the site.

The report goes on to state that below the horizon of the Knightswood Gas Coal there are several named ironstone seams (and associated thin coals), listed below, of past economic significance that likely subcrop in an approximately north-south direction through the site.

However, with the exception of the Lower Garscadden Blackband Ironstone these are not mapped. No evidence of any workings of these seams was identified in the report.

The report concludes that the site may be regarded as minerally stable

[21] JWH Ross, BAE Systems at Govan Road Mining Stability Report, September 2013

7.9 Impact Assessment

7.9.1 Conceptual Site Model

The information gathered in the Mott MacDonald desk study has been interpreted to develop a preliminary conceptual site model (CSM) for the development. The CSM details potential contaminant sources, transport pathways and possible receptors that may be present. A preliminary (qualitative) contaminated land risk assessment has been completed for each pollutant (source, pathway & receptor) linkage.

Sources, Pathways and Receptors are described as follows:

- Sources: a potential or known contaminant source.
- Pathway: a route or means by which a receptor can be exposed to, or affected by, a contaminant, e.g. dermal contact.
- Receptor: something that can be adversely affected by a contaminant, such as people, an ecosystem, property or controlled waters.

7.9.2 Potential Sources of Contamination

Table 7-5 provides a summary of the potential sources and associated contaminants of concern for the site, informed by the Department of Environment 'Industry Profiles' (DOE 1995). It is not intended to provide an exhaustive list of contaminants for analysis during any future ground investigation on site, as selection of the contaminants for analysis should be based on the objectives of the investigation, the Conceptual Site Model (CSM) and the ground conditions encountered on site. Figure 7-1 shows locations of potential contaminant sources.

Table 7-5 Potential Sources of Contamination

Potential Sources	Details	Contaminants of Concern
On-Site		
Contaminated sediment/silts within the wet basin	The site has a long history of shipbuilding operations. Previous GIs suggest presence of heavy metals, organotin and hydrocarbons.	Metals (including lead, zinc, copper, chromium, arsenic, mercury, tin etc), hydrocarbons, PAHs PCBs, anti-fouling agents/biocides, asbestos
Ground gas associated with recent sediments/silt deposits in wet basin.	Historical GIs have described sediment in wet basin as organic which indicates the potential for ground gas generation associated with its decomposition.	Carbon dioxide (CO2), methane (CH4), carbon monoxide (CO), hydrogen sulphide (H2S)
Contaminated soil and groundwater associated with historical and present-day shipyard operations (including historical tank located west of	Activities associated with historical and existing shipyard operations, waste disposal, chemical/fuel storage and spillage.	Metals, hydrocarbons (oils, diesel), PAHs, cyanides, VOCs, SVOCs, asbestos, chlorinated solvents

wet basin, buildings and laydown area).		
Ground gas associated with made ground, alluvium and raised marine deposits.	There is the potential for generation of ground gas from within made ground and organic rich natural deposits beneath the site.	Carbon dioxide (CO2), methane (CH4), carbon monoxide (CO), hydrogen sulphide (H2S)
Off-Site		
Made Ground associated with historical Refuse Heaps and Sand Pits (1913-1971 maps) situated west of site boundary.	Historical mapping shows sand pits to have been previously infilled with unknown material that may be contaminated.	Metals, hydrocarbons (oils, diesel), PAHs, cyanides, VOCs, SVOCs, asbestos
Historical soil and groundwater contamination associated with historical gasometer (1895-1896 map).	A gasometer was recorded approximately 60m south of wet basin in 1895-1896 mapping only.	Metals, coal tars (hydrocarbons/PAHs), inorganics incl. ammonium sulphates/cyanide, asbestos

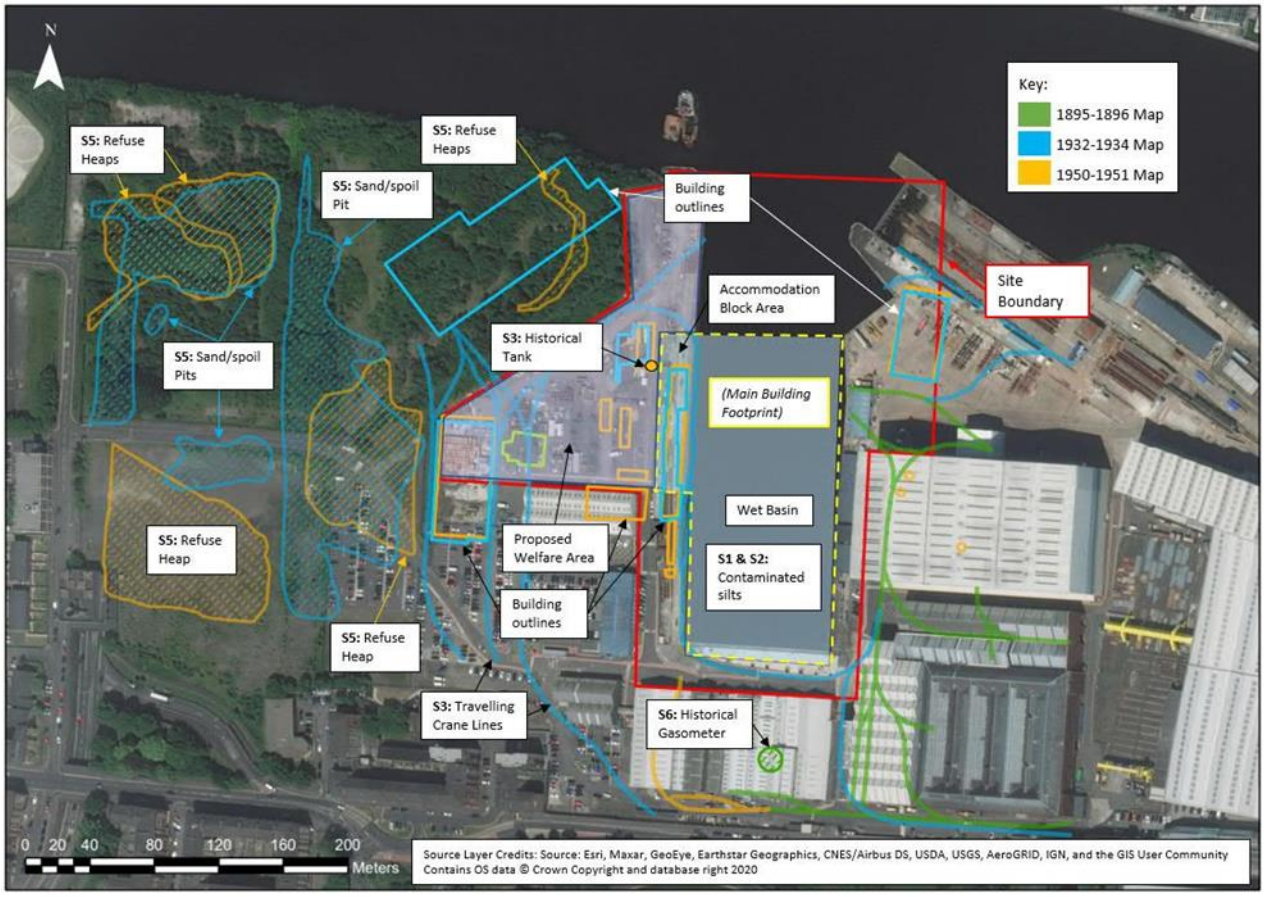

Figure 7-2 Location of Potential Contamination Sources

7.9.3 Potential Contamination Pathways

The following potential contaminant pathways have been identified:

- Soil and dust ingestion (indoors & outdoors)
- Dermal contact (indoors & outdoors)
- Inhalation of dust (indoors & outdoors)
- Inhalation of vapours (indoors & outdoors)
- Inhalation and/or accumulation of ground gas
- Direct contact with contaminated or corrosive soils
- Contaminant leaching
- Vertical/horizontal contaminant migration in superficial deposits
- Vertical/horizontal contaminant migration via service trenches & foundations

7.9.4 Potential Receptors

Potential receptors identified are

- Future site users – site workers
- Construction & maintenance workers
- Construction materials (e.g. water supply pipes, buried concrete)
- Surface waters (River Clyde)
- Superficial groundwaters (Govan Sand & Gravel Groundwater Body)
- Bedrock groundwaters (Glasgow & Motherwell Groundwater Body)

7.9.5 Conceptual Site Model

A qualitative land risk assessment has been completed for the site with the results displayed in Table 7-6.

The preliminary risk assessment is based on the following assumptions:

- It is assumed that the New Assembly Hall will be a large open well-ventilated structure. The accommodation building will have small, enclosed rooms
- The assessment assumes that no new sources of contamination will be introduced during the development – i.e. construction materials will be non-hazardous and inert.
- It is assumed that a robust Construction Environmental Management Plan (CEMP) will be adopted during the construction works and, as a result, no contamination will occur from leaks and spills during construction.
- The risk assessment does not consider asbestos or radiological contamination.

Table 7-6 Conceptual Site Model

Source	Pathway	Receptor	Risk Classification	Comment
On-Site – Wet Basin				
Contaminated recent sediment/silts within the wet basin	Soil and dust ingestion (outdoors) Dermal contact (outdoors) Inhalation of dust (outdoors) Inhalation of vapours (outdoors)	Construction & maintenance workers	Probability: Likely Consequence: Medium Risk: Moderate	Construction workers may come in to contact with contaminated sediment during construction works. Risk to site construction and maintenance personnel should be mitigated by site specific risk assessment and method statements and, where necessary, the use of personal protective equipment (PPE). No feasible pollutant linkage to future site users (R1) is envisaged as the basin sediments are assumed to be encapsulated in the wet basin beneath clean upfill material and the building footprint. An intrusive ground investigation (GI) and Generic Quantitative Risk Assessment (GQRA) is required to determine the risk to human health and whether remedial measures are required to make the site suitable for use.
	Direct contact with contaminated or corrosive soils	Buried structures & water supply pipes	Probability: Low likelihood Consequence: Medium Risk: Moderate/low	The risk to buried concrete should be assessed in accordance with the guidance presented in BRE Special Digest 1: 2005. This will require laboratory testing of sediment and groundwater samples to inform concrete class specification. It is unlikely that the basin sediments will come in to contact with water supply pipes. It is likely that this material will be encapsulated by clean upfill material
	Contaminant leaching Vertical/ horizontal contaminant migration in groundwater	Surface waters (River Clyde)	Probability: Likely Consequence: Medium Risk: **Moderate**	The basin sediments are likely to be in hydraulic continuity with the River Clyde and the Govan Sands & Gravels Groundwater Body. Existing sheet piled walls (if confirmed to be extending to rock) are likely to limit potential for lateral contaminant migration within the superficial aquifer. The basin sediments are currently in direct contact with the River Clyde. Following development, the sediments are likely to be cut off from the river by a piled basin closure structure. The design of the closure structure it to be determined, but it will likely reduce the potential for lateral contaminant migration to the River Clyde. Groundwater flow is likely to be from the bedrock and superficial aquifer towards the River Clyde, consequently it
	Contaminant leaching Vertical/ horizontal contaminant migration in groundwater	Superficial groundwaters (Govan Sands & Gravels Groundwater Body)	Probability: Likely Consequence: Medium Risk: **Moderate**	

	Vertical/horizontal contaminant migration via service trenches & foundations	Bedrock groundwaters (Glasgow & Motherwell Groundwater Body)	Probability: Unlikely Consequence: Medium Risk: **Low**	is considered unlikely that the sediments have significant potential to contaminate the bedrock groundwater body. An intrusive GI and GQRA is required to determine risk to the water environment and whether remedial measures are required to make the site suitable for use. This will involve collection/testing of sediment from the basin to characterise the nature and significance of the contaminants within the basin and collection of water samples from monitoring wells located in the vicinity of the basin.
Ground gas associated with recent sediment/silt deposits in the wet basin.	Inhalation and/or accumulation of ground gas	Future site users Construction & maintenance workers	Probability: Low Likelihood Consequence: Severe Risk: **Moderate/Low**	The wet basin sediments are often described as 'soft black organic silt' are considered to have potential to generate ground gas. The proposed foundations for the New Assembly Hall are likely to be piled which will penetrate down to bedrock and could provide a migration pathway. Ground gas monitoring is recommended below the proposed accommodation block and potentially beneath the main building following completion of the basin closure and infilling. Ground gas risk assessment should be completed in accordance with BS 8485:2015+A1:2019 to determine whether ground gas protection measures are required. A foundation works (piling) risk assessment is likely to be required
On-Site Remaining Site Area				
Contaminated soil and groundwater associated with historical and present-day shipyard operations (including historical tank located west of the wet basin, buildings and laydown area).	Soil and dust ingestion (indoors & outdoors) Dermal contact (indoors & outdoors) Inhalation of dust (indoors & outdoors) Inhalation of vapours (indoors & outdoors)	Future site users Construction & maintenance workers	Probability: Likely Consequence: Medium Risk: **Moderate**	There is potential for contaminants to be present associated with historical land use which could pose a risk to human health if exposure pathways are present. An intrusive GI and GQRA is required to determine the risk to future site users and whether remedial measures are required to ensure the site is suitable for use. The risk to site construction and maintenance personnel should be mitigated by site specific risk assessments, method statements and, where necessary, the use of personal protective equipment (PPE).

	Direct contact with contaminated or corrosive soils	Construction materials (e.g. water supply pipers, buried concrete)	Probability: Likely Consequence: Medium Risk: **Moderate**	The risks to buried concrete should be assessed in accordance with the guidance presented in BRE Special Digest 1: 2005. This will involve laboratory testing of soil and groundwater samples to inform concrete class specification. Installation of new potable water supply pipes will be required for the proposed New Assembly Hall. A water supply pipe risk assessment should be undertaken in accordance with UKWIR Report Ref: 10/WM/03/21 to ensure that pipe materials are suitable for the site-specific ground conditions. This will involve collection, testing and assessment of soil samples
	Contaminant Leaching	Surface Waters (River Clyde)	Probability: Likely Consequence: Medium Risk: **Moderate**	Potential moderate risk to the River Clyde and to the Govan Sand & Gravel Groundwater Body due to contaminants associated with the historical land use. The bedrock may be afforded some protection from contaminant sources due to depth of bedrock strata and likely groundwater discharge towards the River Clyde. Risk level will depend on nature and extent of contaminants in the soil and groundwater. An intrusive GI and GQRA is required to determine risk to the water environment and whether remedial measures are required. This will involve testing of soil and leachate samples, installation of groundwater monitoring standpipes and testing of groundwater samples to inform the assessment. The ground investigation should include targeted investigation in the vicinity of the former tank
	Contaminant leaching Vertical/ horizontal contaminant migration in groundwater Vertical/horizontal contaminant migration via service trenches & foundations	Superficial groundwaters (Govan Sands & Gravels)	Probability: Likely Consequence: Medium Risk: **Moderate**	
		Bedrock groundwaters (Clackmannan Group)	Probability: Low Likelihood Consequence: Medium Risk: **Moderate/Low**	
Ground gas associated with Made Ground and alluvium and raised beach deposits Made Ground associated with historical Refuse Heaps and Sand Pits	Inhalation and/or accumulation of ground gas	Future Site Users	Probability: Likely Consequence: Severe Risk: **High**	There is a potential for ground gas generation from Made Ground, alluvium and raised marine deposits beneath the site and potential infilled ground to the west of the site. There is also a potential gas source to the west of the site associated with infilling of historical sand pits As such, an intrusive GI and ground gas risk assessment is required to determine risk to future site workers and whether ground gas protection measures are required. GI to include installation of gas monitoring standpipes and gas monitoring to inform the risk assessment, which should be completed in accordance with BS 8485:2015+A1:2019
		Construction and Maintenance Workers	Probability: Likely Consequence: Severe Risk: **High**	
	Contaminant Leaching Contaminant leaching	Surface Waters (River Clyde)	Probability: Likely Consequence: Medium	It is unlikely that the historical gasometer to the south of the site will have significantly impacted groundwater quality below the

	Vertical/ horizontal contaminant migration in groundwater		Risk: **Moderate**	site. However, the general heavy industrial land use on the wider BAE site and in the surrounding area is likely to have contributed to background contamination of groundwater and surface water receptors.
		Superficial groundwaters (Govan Sands & Gravels)	Probability: Likely Consequence: Medium Risk: **Moderate**	
		Bedrock groundwaters (Clackmannan Group)	Probability: Likely Consequence: Medium Risk: **Low/Moderate**	

7.10 Impact Assessment Summary and Proposed Mitigation

A preliminary Conceptual Site Model has been developed to identify potential contaminant sources, pathways and receptors associated with the proposed development and to enable completion of a Preliminary Risk Assessment. The following sources have been identified associated with the site history and geology:

- Contaminated sediment/silts within the wet basin
- Ground gas associated with recent sediments/silt deposits in wet basin.
- Contaminated soil and groundwater associated with historical and present-day shipyard operations (including historical tank located west of wet basin, buildings and laydown area).
- Ground gas associated with Made Ground, alluvium and raised marine deposits.
- Made Ground material associated with historical Refuse Heaps and Sand Pits situated west of site boundary.
- Historical soil and groundwater contamination associated with historical gasometer

A summary of the risk to potential receptors is presented below.

Water Environment – Historical investigations have recorded contaminated sediments within the wet basin associated with the former site use. The highest concentrations of heavy metals appear to be in the east of the basin where there are no records of recent maintenance dredging. No data is available for the south west corner of the basin where slag disposal is suspected to have occurred.

The contaminated sediments are currently in contact with the River Clyde and overlie the Govan Sand & Gravel superficial groundwater body and potentially pose a risk to these receptors. Following development, the sediments are likely to be cut off from the river by a piled basin closure structure. The design of the closure structure is to be determined but may reduce the potential for lateral contaminant migration to the River Clyde.

Contaminated soil and groundwater could also be present on land associated with the historical land use . Contaminants associated with the historical land use are considered to pose a moderate risk to the quality of the River Clyde and the superficial groundwater body.

Ground investigation is required to confirm the ground conditions and contaminant concentrations within the soil, wet basin sediment and groundwater in order to facilitate water environment risk assessment.

Human Health – The contaminant sources identified by the desk study pose a potential risk to construction workers and future site users. Given the industrial nature of the development, the risk to future site users may potentially be mitigated by capping of contaminants below buildings, upfill material and hardstanding. However, ground investigation testing and risk assessment is required to quantify the risk in consideration of the final development proposals.

Construction workers are more likely to be exposed to contaminants during possible earthworks, excavations, trafficking or other activities which may generate dust or involve dermal contact. Ground investigation and risk assessment is recommended to inform future planning of the works and facilitate implementation of risk mitigation to protect construction workers.

Made ground, basin sediments and organic rich natural deposits (if present) have the potential to generate elevated ground gas concentrations which could pose a risk to future site users and construction workers. The risk is likely to be highest in confined spaces and within the proposed accommodation building. Ground investigation, borehole installations, ground gas monitoring and risk

assessment is recommended to determine the risk posed to sensitive receptors and the requirement for ground gas protection easures in buildings.

Asbestos Containing Materials –It is noted that asbestos was visually identified in the Dames & Moore historical GI undertaken to the west of the wet basin. Asbestos is a contaminant that is often encountered on former shipbuilding sites. It is therefore possible that asbestos containing materials could be encountered during future ground investigation and/or construction work and could pose a risk to human health.

It is recommended that future planned works (including ground investigation activities) consider the risk from asbestos in soil and sediment within the wet basin. If asbestos is detected in future ground investigation works, it is likely that an asbestos risk assessment will be required and should be undertaken by a competent specialist consultant.

Buried concrete & water supply pipes - The risks to buried concrete from aggressive ground conditions should be assessed in accordance with the guidance presented in BRE Special Digest 1: 2005. This will involve laboratory testing of soil and groundwater samples to inform concrete class specification.

Installation of new potable water supply pipes will be required for the proposed Assembly Hall. A water supply pipe risk assessment should be undertaken in accordance with UKWIR Report Ref: 10/WM/03/21 to ensure that pipe materials are suitable for the site-specific ground conditions. This will involve collection, testing and assessment of soil samples along the route of proposed pipe alignments.

Existing Sediment - A Best Practicable Environmental Options (BPEO) report undertaken by EnviroCentre in 2020 included assessment of shallow sediment collected from the north and west of the wet basin (i.e. areas that have been subject to maintenance dredging). The report concluded that sea disposal of the sediment would have no significant long-term impact on the marine environment.

Historical marine sampling and testing completed in 2012, located in the east of the basin which has not been subject to recent maintenance dredging, has identified contaminant concentrations in excess of ‘Action Level 1’ and ‘Action Level 2’. This material is unlikely to be suitable for dredge disposal at sea.

The preliminary development proposals do not include dredging and disposal of basin sediment. However, it is recommended that characterisation and testing of the sediment is completed in the event that future dredging is required and to inform contaminated land risk assessment should the material remain in-situ or require off-site land disposal as waste. Investigation and testing should be completed in accordance with Marine Scotland guidance and extend to the base of the recent sediment potentially impacted by shipbuilding activities (estimated to be 5-8m below the riverbed). The investigations should also target the potential slag disposal area in the south west of the basin.

7.11 Infill Material

The development works will incorporate infilling of the existing wet basin to form a new area of land for development.

Material identified for use as part of the infill works should be appropriately tested and assessed to confirm that it meets the required geotechnical requirements for the project and should have a geo-environmental assessment to confirm that the material will not represent a potential risk to human health or the environment as part of the development works,

The approach to the geo-environmental assessment should be agreed with the regulators, however it is proposed that the adopted screening criteria will incorporate:

- Marine Scotland Action Level 1 and 2.
- Human Health Generic Assessment Criteria for a Commercial/Industrial Land Use Scenario
- Assessment of Risk to the Water Environment Utilising Transitional Water Environmental Quality Standards as the Target Criteria.

Where potential waste materials are considered as part of the infill exercise then consultation should be undertaken with the regulators to confirm any waste licensing requirements (this may be dependent on the approach adopted for the infill).

As detailed in Chapter 5 the approach to infilling should incorporate a silt curtain/bubble screen or similar barrier to prevent release of suspended sediment to the River Clyde during the construction phase.

7.12 Summary of Effects

On the basis that the proposed site investigation works and subsequent risk assessment works are undertaken (and any remedial measures identified following this adopted), it is considered that there would be no significant effects with respects to land quality or contamination that would be considered to be significant in relation to the EIA regulations.

A summary of the identified mitigation measures for the development are provided below.

- Site investigation to further assess the identified significant source-pathway-receptors of concern.
- Risk to site construction and maintenance personnel should be mitigated by site specific risk assessment and method statements and, where necessary, the use of personal protective equipment (PPE).
- Installation and validation of appropriate ground gas protection measures (if identified as a requirement from the site investigation) within all future structures being constructed.
- Construction methodology such as appropriate piling to minimise the risk of creating ground gas and vapour pathways and design of the piling approach informed by Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination (EA 2001).
- Appropriate assessment of any proposed material for use as infill to ensure that the material does not pose a risk to human health or the environment as part of the re-use.

7.13 Residual Effects

The following table summarises the findings of the impact assessment and the associated identified residual effects and significant of the effects.

Table 7-7: Residual Effects Summary

Potential Impact to Receptor	Mitigation Measures	Residual Effects and Significance
Impact to Human Health (Construction Workers) From Contaminated Soils.	Site investigation, site specific assessment and production and implementation of method statements.	No significant human health impact.

	Use of appropriate PPE.	No significant residual effects.
Impact to Human Health (Future site users)	Site investigation and site specific risk assessment. If required remediation strategy to be designed, agreed with the regulator. Required remedial measures to be implemented and appropriately validated.	No significant human health impact. No significant residual effects.
Surface Water	Site investigation, development and agreement of remedial strategy with regulators (if required). Production and implementation of CEMP. Agreement of criteria for infill material with the regulators and appropriate testing and assessment inline with the agreed approach.	No significant impact to the water environment. No significant residual effects.

7.14 Statement of Significance

An assessment has been undertaken on the potential impacts to land quality and from existing soil and groundwater contamination associated with the proposed construction works at BAE Govan Shipyard.

The site has historically been utilised for ship building and the proposed development relates to continuation of this use.

To inform the development a site investigation and subsequent risk assessment is to be undertaken to identify any potentially significant source-pathway-receptor linkages. Should this assessment identify unacceptable risks then a remediation strategy will be produced, agreed with the regulator and implemented as part of the development works (including validation).

Any proposed infill material for the wet basin is to be appropriately assessed to ensure it does not pose an unacceptable risk to human health or the environment prior to re-use.

On the basis of the implementation of this approach the effects of the proposed development in relation to impact from existing ground and groundwater contamination and the potential for impact to ground conditions are not considered to be significant.

8 CULTURAL HERITAGE

8.1 Introduction

This chapter details the assessment of the proposed scheme's likely effects on cultural heritage receptors (referred to forthwith as heritage assets), a collective term used to describe archaeological assets, built heritage features and historic landscapes. This chapter includes an assessment of potential impacts, the significance of effects, the requirements for mitigation and the residual effects.

The assessment has been undertaken in accordance with the Historic Environment Scotland (HES) and Scottish Natural Heritage (SNH) 'Environmental Impact Assessment Handbook (2018)'[22]. The Design Manual for Roads and Bridges (DMRB): LA104 Environmental assessment and monitoring (2020a[23] and LA106 Cultural heritage assessment (2020b)[24] guidance were also consulted. While this guidance was primarily developed for road and bridge schemes, it is considered to provide a robust environmental assessment framework.

This cultural heritage chapter is supported by the following technical appendices:

- Volume 3, Technical Appendix 8-1.

8.2 Assessment Methodology

A full assessment of the impact of the proposed scheme on all heritage assets (including unknown archaeology) has been undertaken based on guidance outlined in Section 4.3 of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1).

An assessment of the value of each heritage asset was undertaken on a five-point scale from very high, high, medium, low and negligible, based on professional judgement and guided by the criteria outlined in DMRB LA104 (2020a).

Utilising the assessment approach in DMRB LA104 (2020a) significance of effect upon the cultural heritage receptor is assessed according to the value of the heritage asset and the magnitude of change. The impacts may be either adverse or beneficial.

The significance of an effect is determined based on the magnitude of an impact and the sensitivity of the cultural receptor affected by the impact of that magnitude. Very Large, Large and Moderate effects are considered significant, and these have the potential to be material in the decision-making process.

8.2.1 Study Area

The cultural heritage baseline for the proposed scheme has been identified using the proposed scheme area and a study area of a 1km radius from the proposed scheme boundary for designated heritage assets and a 500m radius for non-designated heritage assets, this includes indicating the

[22] Historic Environment Scotland and Scottish Natural Heritage 2018, Environmental Impact Assessment Handbook
[23] Design Manual for Roads and Bridges (DMRB). 2020a, Volume 11, Section 2, Part 4 LA104 Revision 1 'Environmental assessment and monitoring'
[24] Design Manual for Roads and Bridges (DMRB). 2020b, Volume 11, Section 3, Part 2 LA106 Revision 1 'Cultural heritage assessment'.

potential for the presence of unknown archaeological remains. Heritage assets beyond the 1km study area have been included where professional judgement aided by the use of a Zone of Theoretical Visibility (ZTV) has considered inclusion necessary. Such assets typically comprise those considered of very high or high value that are particularly sensitive to change, such as Category A and some Category B listed buildings, designed gardens and landscapes, and conservation areas.

The extent of the study area therefore allows for a proportional assessment of the setting of heritage assets, including key historic views to and from the proposed scheme. It should also be noted that the ZTV may overestimate views as it was designed with the potential building height of the assembly hall in mind (46.5m46.8m to ridge), but this means that all the very high and high value heritage assets that have the potential to be impacted by the proposed scheme have been appropriately considered within this assessment.

The study area for the proposed scheme is illustrated in Appendix A of the Cultural Heritage Baseline which can be found in Volume 3, Technical Appendix 8-1.

8.2.2 Relevant Legislation and Policy

This assessment has been undertaken in cognisance of the legislation, policy and guidance outlined in Section 4 of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1).

The overarching legislation in relation to Cultural Heritage in Scotland is provided by:

- The Ancient Monuments and Archaeological Areas Act 1979;
- Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997; and
- Historic Environment Scotland Act 2014

Policy documents used to guide the assessment include:

- Scottish Planning Policy (SPP) 2014;
- Historic Environment Policy for Scotland (HEPS) (2019); and
- Planning Advice note (PAN) 2/2011: Planning and Archaeology.

The Glasgow City Development Plan (2017) is the main policy document used to determine planning applications within the Govan area. The relevant policy pertaining to this chapter is Policy CDP9 Historic Environment.

The assessment has been prepared in cognisance of best practice and relevant guidance, including:

- Managing Change in the Historic Environment series, notably that covering Setting (HES 2016);
- Guide to conservation areas in Scotland (Historic Scotland 2005);
- Chartered Institute for Archaeologists (CIfA) Code of Conduct: professional ethics in archaeology (2021);
- Standard and Guidance for historic environment desk-based assessment (CIfA, 2020);
- Environmental impact Assessment Handbook (HES and SNH 2018); and
- Principles for Cultural Heritage Impact Assessment (CIfA, Institute of Historic Building Conservation (IHBC) and Institute of Environmental Management and Assessment (IEMA) (2021).

8.2.3 Summary of Consultations

This assessment has been undertaken in consultation with historic environment stakeholders including Historic Environment Scotland (HES), West of Scotland Archaeology Services (WoSAS), and the Conservation Officer at GCC. The consultation undertaken with cultural heritage stakeholders is discussed in detail within Section 3.5 of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1) and are summarised in **Error! Reference source not found.** below.

Consultee	Description
Historic Environment Scotland (HES)	HES provided a response to Marine Scotland in relation the Marine Screening Report for Environmental Impact Assessment (EIA) on 30th June 2022. HES noted that while the Fitting-out Basin (Wet Basin) itself is not listed, it is broadly contemporary with the adjacent Category A listed 1048 Govan Road, Govan Shipbuilders' Store, Former Engine Works of Fairfield Shipbuilding and Engineering Company (MM007), hereafter called the 'Former Engine Works'. Therefore, infilling the Fitting-out Basin (Wet Basin) has the potential to significantly impact on the setting of the Category A listed building. HES recommended that to fully assess this impact, the EIA should demonstrate a full appreciation of the special interest of the Category A listed Former Engine Works (MM007) and its setting, including the contribution made by the Fitting-out Basin (Wet Basin). This initial response from HES also recommended a Written Scheme of Investigation (as defined by CIfA 2020c) for all archaeological investigation, recording, excavation and/or watching briefs in advance of, and during construction work. The work will involve consultation with HES and the WoSAS on behalf of GCC, to establish and agree the scope and extent of this work, necessary monitoring by these authorities and approval of the report in advance of submission as part of the EIA and planning process.
West of Scotland Archaeology Services (WoSAS)	As advisers to GCC in all matters pertaining to archaeology, WoSAS were consulted upon on 5th July 2022. A response was received on the 6th July 2022. WoSAS highlighted that the most obvious issue in this area would be its proximity to Govan Old Parish Church (MM001). WoSAS highlighted the potential for material relating to contemporary early medieval occupation to be present in the vicinity of the scheme, but also noted that the potential may not be particularly high as a result of the high levels of ground disturbance that will have taken place on the site itself during its use as a shipyard. WoSAS also pointed out that the non-designated heritage assets within the study area may somewhat under-represent the significance of the proposed scheme area as an industrial 'monument'. As such, they emphasised that the assessment would need to give weight to the effect of the proposal on the structures of the shipyard itself. WoSAS were also contacted on 5th August 2022 in relation to the potential archaeological mitigation measures proposed as part of the proposed scheme. From consultation it was agreed that as the Fitting-out Basin (Wet Basin) (MM054) is to be infilled this would mean that the asset is largely preserved below the finish ground level- a laser scan would be a suitable method of record. It was also confirmed that it would be ideal for the mooring posts (MM095) and winches (MM096) to remain in situ; however, the WoSAS recognised that these may need to be relocated elsewhere to suit the requirements of the functioning shipyard. As such, they agreed that monitoring the removal of the mooring posts or winches may provide some opportunity to clarify how the walls of the Fitting-out Basin (Wet Basin) were tied into the surrounding ground but also recognised that this may only provide limited information.
GCC Conservation Officer	Glasgow City Council (GCC) were contacted on 6th July 2022. It was advised that once the EIA Scoping submission had been allocated to a case officer, then consultations could be initiated with the Conservation Officer at GCC. However, as this is yet to be confirmed no formal consultation has been held with Conservation Officer yet.

8.2.4 Limitations and Assumptions

The full limitations and assumptions associated with this chapter can be found in Section 3.8 of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1). A summary is provided below:

- This assessment is reliant on available data. All designated and non-designated data is up to date as of 8th July 2022.
- It has been assumed that in areas of early modern and modern development, archaeological remains from earlier periods are likely to be disturbed, incomplete, or destroyed due to later development. This will have reduced their heritage value to none, negligible or low
- Where design or construction information is not available, a worst-case-scenario approach has been adopted in line with the precautionary principle as defined in section E of the Environmental Impact Assessment Handbook (Historic Environment Scotland and Scottish Natural Heritage 2018)[25].
- This assessment is based on all available information at the time of the production of the Environmental Impact Assessment Report.
- The databases employed in this assessment have been used as a starting point for further research rather than as a definitive list. Where there is an absence of data, professional judgement has been used to reach informed decisions regarding the historic environment.

8.3 Baseline

The full baseline conditions are reported in Section 4 of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1). A summary baseline has been produced below detailing the key information needed for assessment of the identified cultural heritage receptors. Each heritage asset has been assigned a unique MM (Mott MacDonald) reference number, which is shown within the text (e.g. MM001) for ease of reading.

8.3.1 Data Collection

8.3.1.1 Desk Based Assessment

The baseline for this assessment is informed by accessing readily available historical and archaeological records. The sources consulted are outlined in Section 3.3 of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1).

8.3.1.2 Surveys

Two surveys were conducted as part of the baseline and EIA as in line with best practice and recommended guidance[26].

The first was a comprehensive archaeological walkover and setting assessment of the proposed scheme area carried out on 6th July 2022. The walkover survey was used to assess the setting of heritage assets within the proposed scheme area and inform an understanding of the potential impact of the proposed scheme. It was also used as an opportunity to identify any non-designated heritage assets not previously identified from documentary evidence that may be impacted by the proposed scheme.

[25] Historic Environment Scotland and Scottish Natural Heritage 2018, Environmental Impact Assessment Handbook.
[26] SNH and HES 2018, Environmental impact Assessment Handbook, p.180; CIfA 2020, Standard and Guidance for historic environment desk-based assessment

A second archaeological walkover and setting assessment survey was carried out on 29th July 2022. The walkover covered publicly accessible areas in the study area and involved site visits to key heritage assets identified in the baseline, including Listed Buildings and the Govan Conservation Area in order to complete setting and character assessments and inform an understanding of the potential impact of the proposed scheme.

No further surveys have been undertaken in advance of the EIAR.

8.3.2 Designated Heritage Assets

There are 53 designated heritage assets within the 1km study area and included from the wider landscape based on professional judgement. These consist of:

- One scheduled monument.
- One garden and designed landscape.
- Four conservation areas.
- 46 listed buildings (12 Category A listed buildings, 30 Category B listed buildings, and four Category C listed buildings).

Of these, a scheduled monument, conservation area and nine listed buildings are considered key heritage assets based on professional judgement alongside their value, distance from, and intervisibility with the proposed scheme. These are summarised below, and a full description can be found in Section 5.11 and the Gazetteer (Section 6) of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1). Their locations are also shown in Appendix A of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1).

8.3.2.1 Scheduled Monuments

Located 850m east of the proposed scheme area, Govan, carved stones and Old Parish Church graveyard (MM001) is made up of 31 early medieval carved stones found in Govan Old Parish Church and the graveyard site south and east of the church from which the carved stones were recovered. The stones are considered of national importance due to their unique character and association with the Kingdom of Strathclyde. In particular, the 'hogback' burial stones in the collection may shed light on the nature and extent of Scandinavian influence in western Scotland during the early medieval period.

8.3.2.2 Conservation Area

Located 30m immediately south of the proposed scheme area, the Govan Conservation Area (MM003) was designated in 2008 and reviewed in 2016. It covers the historic centre of Govan, including Elder Park and the landscape immediately surrounding this. It excludes the proposed scheme area north of Govan Road but incorporates the former Fairfield Shipyard Offices and their extension at 1048 Govan Road (MM008), the remainder of the area covers Govan Old (MM001) and Govan Cross.

8.3.2.3 Listed Buildings

Two Category A listed buildings are associated with the shipyard. This includes the ‘1048 Govan Road, Govan Shipbuilders' Store, Former Engine Works of Fairfield Shipbuilding and Engineering Company’ (MM007) which borders the south-east corner of the proposed scheme area and is described as the ‘finest surviving engineering works in Scotland and perhaps in Britain’[27]. The Engine Works was the centre of what was an internationally significant shipbuilding yard. The second is the former headquarters of the shipyard ‘1030, 1048 Govan Road, Govan Shipbuilders Ltd, General Offices’ (MM008) which lies 155m south-east of the proposed scheme area.

[27] Hume, J. R., Kelly, T. A. D., and Paton, A. 2017, Govan Shipbuilding, p.24.

The remainder of the listed buildings are located within Elder Park and include the Category A listed Elder Park Library (MM011) and Statue of Isabella Elder (MM012). There are three Category B listed buildings also within the park including Elder Park Cottage (MM024), the fragments of Linthouse Mansion (MM025) and statue of John Elder (MM026). A full list of all designated heritage assets identified within the study area are presented in the Gazetteer (Section 6) of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1)Their locations are also shown in Appendix A of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1)

8.3.3 Non Designated Heritage Assets

There are 43 non-designated heritage assets within the study area, this includes one non-designated maritime heritage asset and two assets identified during the walkover survey. Of these, there are eight assets which are considered key heritage assets within the proposed scheme area. These are summarised below, and a full description can be found in Section 5.12 and the Gazetteer (Section 6) of the Cultural Heritage Baseline (Volume 3, A Technical Appendix 8-1). Their locations are also shown in Appendix A of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1, Figure A:2).

There are six non-designated heritage assets within the shipyard recorded within the Glasgow Sites and Monuments Record (SMR) and National Record of the Historic Environment (NRHE). This includes the Fairfield Shipyard and Engine Works, Fitting-out Basin (wet basin)[28] (MM054), Plumber's Shops (MM055), Plate Fabrication Shed (MM056), site of the former Giant Cantilever Crane (MM057), New Fabrication Shed (MM058), and the site of the former cranes, including their tramways (MM085).

Two non-designated assets relating to the Fitting-out Basin (wet basin; MM054) were also identified during the walkover survey; 22 mooring posts (MM095) and two shipyard winches (MM096).

A full list of all non-designated heritage assets identified within the study area are presented in the Gazetteer (Section 6) of the Cultural Heritage Baseline. Their locations are also illustrated in Appendix A of the Cultural Heritage Baseline.

8.3.4 Archaeological Potential

The potential for archaeological remains relating to the prehistoric, Roman, early medieval, medieval and post-medieval periods is considered to be low. Due to the industrial character of Govan there is a high potential for archaeological remains associated with the early modern and modern periods. The geo-archaeological and marine potential of the proposed scheme area is considered to be low given the consistent dredging of the Clyde from the 19th century onwards.

A summary of the archaeological potential of the proposed scheme along with the potential heritage value of the remains, should they be present, is outlined in Table 5.6 of the Cultural Heritage Baseline.

8.4 Assessment of Effects

This section sets out the potential impacts and effects to heritage assets which could be experienced during construction of the proposed scheme. Further details regarding specific potential impacts to

[28] This is the wet basin which has been referred to as the ‘Fitting-out Basin’ in the Cultural Heritage Baseline (107212-MMD-00-XX-RP-YD-0007-P01) as per its record in the Glasgow SMR as maintained by WoSAS.

individual heritage assets can be found within the Impact Assessment (Section 7) in the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1).

8.4.1 Summary of Effects

The predicted construction and operation effects for heritage assets which have been included for assessment within this chapter are summarised below. The predicted construction effects for heritage assets not included for assessment within this chapter are detailed within the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1).These heritage assets are not included as they are not located directly adjacent to the proposed scheme or residual effects are not significant or neutral in magnitude.

8.4.1.1 Construction Effects

Temporary

No significant temporary construction effects are expected upon the heritage value of any of the cultural heritage receptors included within this chapter. This is largely due to the industrial nature of the shipyard and surrounding area which means the character of conservation areas and the setting of the heritage assets can accommodate change from the noise and presence of construction machinery. The protection afforded by proposed additional mitigation such as the implementation of a Construction Environment Management Plan (CEMP), will reduce or eliminate effects during the construction phase. As such, the effect for all receptors is considered to be Neutral.

Permanent

Construction of the proposed scheme is likely to result in a Slight Adverse, Non-significant effect upon the heritage value of the Category A listed ‘1048 Govan Road, Govan Shipbuilders' Store, Former Engine Works of Fairfield Shipbuilding and Engineering Company’ (MM007), hereafter ‘Former Engine Works’ for ease of reading. This will be as a result of partial changes to the building’s setting and an impact on its associative value with the Fitting-out Basin (wet basin; MM054).

- There will be no physical impact on the building. Therefore, the historic and architectural interest associated with the cast-iron framework of the building, which makes a strong positive contribution to its heritage value, will be retained.
- There will be a change to the setting of the Former Engine Works (MM007), but this change will only partially impact its heritage value. The relationship between the building and Fitting-out Basin (wet basin; MM054) has been diminished by later development. This includes the modern metal cladding extension on the north and west sides which screens the asset from the location of the Fitting-out Basin (wet basin; MM054). This limits how the relationship between the Former Engine Works (MM007) and the Fitting-out Basin (wet basin; MM054), is understood, and therefore how this element of the setting of the building contributes to its heritage value. Despite the construction of the new assembly hall, the character of the area will continue to be industrial, the setting of the Former Engine Works will continue to partially contribute to its heritage value.
- The Former Engine Works (MM007) also has value due to its association with the Fitting-out Basin (wet basin; MM054) as it forms part of its historic context. The association of the Former Engine Works (MM007) with the wet basin helps to explain the functionality of the Govan shipyard, which contributes to the heritage value of the building. This relationship will be retained as the Fitting-out Basin (wet basin; MM054) will still survive as archaeological remains beneath the new building. However, once infilled, the relationship between the Former Engine Works (MM007) and basin within the shipyard will not be easily interpretable. Therefore, this will contribute to an impact on the heritage value of the Former Engine Works (MM007).

Construction of the proposed scheme is likely to result in a Moderate Adverse, Significant effect upon the heritage value of the Fitting-out Basin (wet basin; MM054) as it will involve infilling the basin. This will also impact how the basin contributes to the value of associated cultural heritage assets within the shipyard, including original fabric associated with the basin (MM095 and MM096).

- The infilling of the basin will not alter the fabric of the basin walls as it will be infilled with an inert material. The base of the basin will be directly impacted by piling within the basin. These will impact the heritage value of the asset as it will not be understood as a working basin; however, the basin will be preserved as an archaeological monument, as the walls and majority of the fabric of basin will be retained.
- The presence of the new assembly hall, over the former basin, will mean that the basin cannot be readily interpreted as such, and its original function, and the contribution this makes to its heritage value will be lost. It should be noted that the design preserves the form of the north entrance from the River Clyde so its former presence can still be partially discerned on the waterfront.
- The associated bollards and cranes which surround the basin will be removed. The loss of these associated assets will also impact the heritage value of the basin.

Construction of the proposed scheme is likely to result in a Moderate Adverse, Significant effect upon the heritage value of the mooring posts (MM095) as they may need to be removed during construction.

- Although the mooring posts (MM095) may be removed during construction resulting in their total loss, it is anticipated that this impact will be partially mitigated as design measures will be taken to ensure that these features are reinstated around the former edge of the basin or elsewhere within the shipyard to retain their relationship with the site.
- The infilling of the basin and construction of the new assembly hall will alter the setting of the heritage asset, but the industrial character of the setting will be retained through the functioning shipyard. Therefore, this will not impact the heritage value of the asset.
- The infilling of the basin itself will remove the relationship between the Fitting-out Basin and the mooring posts which served the basin.

Construction of the proposed scheme is likely to result in a Moderate Adverse, Significant effect upon the heritage value of the shipyard winches (MM096) as they may need to be removed during construction.

- Although the shipyard winches (MM096) may be removed during construction, it is anticipated that this impact will be partially mitigated as design measures will be taken to ensure that these features are reinstated around the former edge of the basin or elsewhere within the shipyard to retain their relationship with the site.
- The infilling of the basin and construction of the new assembly hall will still alter the setting of the heritage asset, but the industrial character of the setting will be retained through the functioning shipyard. Therefore, this will not impact the heritage value of the asset.
- The infilling of the basin itself will remove the relationship between the Fitting-out Basin and the shipyard winches which served the basin. However, it is anticipated that this impact will be partially mitigated as design measures will be taken to ensure that the former edge of the basin is delineated and its relationship with the mooring posts is retained.

No significant effects are expected upon the heritage value of other cultural heritage receptors included within this chapter. This is due to the protection afforded by proposed embedded mitigation alongside additional and enhancement measures, with the effect being considered Neutral.

8.4.2 Mitigation Measures

The proposed scheme has been designed, as far as possible, to minimise effects on heritage assets. Appropriate mitigation options have been identified based on a review of guidance provided by HES, DMRB LA104 and LA106 and using professional judgement.

Mitigation measures to reduce the impacts from the construction phase of the proposed scheme upon heritage assets are summarised below. These include committed measures which have been considered in reducing the significance of effects, as well as additional potential mitigation measures that should be considered as the detailed design develops, but have not been considered to reduce the significance of effect at this stage.

8.4.2.1 Committed Mitigation Measures

Design

Design measures associated with the proposed scheme must include:

Highlighting and respecting the former presence of the basin.

- This may include the use of physical markings within the ground surfacing. This should ideally be alongside the re-instatement of the mooring posts (MM095) and shipyard winches (MM096) around the former edge of the basin.
- It is proposed 1no mooring posts (MM095) and 1no shipyard winch (MM096) to be located in proposed green lung/plaza
- The use of minimal or sympathetic design measures regarding the new assembly hall to reduce changes within the settings of heritage assets. This may include using a grey or white southern façade to compliment the industrial and predominantly red brick character of the shipyard, including the Category A listed former Engine Works (MM007).

Construction

Committed mitigation measures to reduce the impacts from the construction phases of the proposed scheme upon heritage assets must include:

- Management of temporary impacts on the heritage value of assets due to a change in their setting through the implementation of a Construction Environment Management Plan (CEMP).

Prior to any construction work associated with the proposed scheme, the following archaeological mitigation measures must also be implemented:

- The Fitting-out Basin (wet basin; MM054) - A full appraisal of the wet basin to ensure that the basin is preserved through record and appropriately archived with HES. Any building recording would be in accordance with HES (2003) and ALGAO (2013) guidance.

The above methods will be established through consultation with and outlined in an archaeological Written Scheme of Investigation (WSI) approved by WoSAS as representatives of GCC on matters pertaining to archaeology.

8.4.2.2 Potential Mitigation Measures

It is recommended that heritage input is sought during detailed design in order to ensure designs are appropriate to their context, avoiding harm to the historic environment and maximising enhancement.

Additional potential mitigation measures may also include:

- Highlighting the relationship between the wet basin and the Category A listed ‘1048 Govan Road, Govan Shipbuilders' Store, Former Engine Works of Fairfield Shipbuilding and Engineering Company’ (MM007) through interpretation panels, artwork or other visual representation. This should explain the presence of the Fitting-out Basin (wet basin; MM054), its historic context, the relationship with the Former Engine Works (MM007), and how the new facility represents a continuing evolution of the working shipyard.

This section provides a summary of the residual effects for the cultural heritage receptors having taken into account the embedded, good practice and committed mitigation. Summary tables of the significant residual effects is provided in Section 7 of the Cultural Heritage Baseline (Volume 3, Technical Appendix 8-1).

The construction works will result in significant permanent effects on the Fitting-out Basin (wet basin; MM054) as it will be infilled, and the new assembly built over this. The residual effect after the embedded mitigation, additional and enhancement measures outlined above is therefore considered to still have a Moderate Adverse, Significant effect on the heritage value of the asset.

Construction works will result in non-significant permanent effects to the heritage value of the Category A listed Former Engine Works (MM007) as a result of changes to the building’s setting and impact on its heritage value due to its association with the Fitting-out Basin (wet basin; MM054). This will be ensured through mitigation measures, including sympathetic design, delineating the former edge of the Fitting-out basin (wet basin, MM054), through the reinstatement of the mooring posts (MM095) and winches (MM096), the use of physical ground markings to highlight the relationship between the wet basin and building, and the use of interpretation panels or artwork. This is designed to ensure some of the heritage value due to association with the Fitting-out basin is retained. As such, following appropriate mitigation, the proposed scheme is considered to have a Slight Adverse, Non-significant effect on the heritage value of the asset.

Construction works will also result in non-significant effect on the mooring posts (MM095) and two winches (MM096) surrounding the wet basin. They will need to be removed as part of the construction of the proposed scheme. However, the residual effect after the reinstatement of some of these features in an appropriate position around the former edge of the Fitting-out Basin (wet basin; MM054) and/or elsewhere within the shipyard, is considered to have a Slight Adverse, Non-significant effect on the heritage value of the asset.

9 OTHER ISSUES

This chapter provides a summary and assessment where applicable of additional potential environmental effects or features which are relevant to the proposed development but have not been included in the full EIAR given significant effects were not deemed to be likely.

It is not the purpose of this chapter to draw conclusions on the level of significance based upon detailed methodology (as per the other chapters outlined throughout this EIAR), but instead offer a synopsis of relevant information.

On the basis of professional judgement and review of baseline conditions, full impact assessment was not considered necessary for the following topics:

- Air Quality;
- Biodiversity;
- Climate Change;
- Landscape and Visual;
- Population and Human Health;
- Material Assets; and
- Accidents and Natural Disasters.

9.1 Air Quality

In relation to Air Quality, the site is not located within an Air Quality Management Area (AQMA) and there are no residential receptors immediately adjacent to the proposed construction works. The main concern in relation to air quality impacts is considered to be from construction generated dust emissions. Industry standard measures will be employed during the construction works to manage construction dust. These measures will be implemented through a Construction Environmental Management Document (CEMD).

9.2 Biodiversity

9.2.1 Preliminary Ecological Appraisal

EnviroCentre Limited conducted a Preliminary Ecological Appraisal (PEA) to inform the proposed works in May 2022. The PEA detailing full methodology and results is provided in Technical Appendix 9-1, Volume 3 of this EIAR.

A summary of the key findings of the PEA is provided below.

“The wet basin that dominates the site is part of a non-statutory designation, River Clyde Site of Importance for Nature Conservation (SINC). No further statutory designated ecological sites are located within the site boundary, though five statutory designated sites up to 10km from the site, four further non-statutory designated sites within 2km of the site, and one ancient woodland within 2km of the site have been recorded.

Faunal species recorded onsite at the time of the survey included likely nesting swallows and commuting and foraging black headed gull, herring gull, blackbird, and wood pigeon. Two buildings of low bat roosting suitability were also noted adjacent to the site boundary. Suitable habitat for badger,

otter, reptiles, aquatic/semi-aquatic mammals, and fish are present/likely present onsite and/or within bounding habitats and therefore have potential to utilise the site or be impacted by development.

At present no protected species licencing requirements have been identified. However, further survey work/actions have been recommended which include:

- Engagement with Glasgow City Council regarding scope of survey work and SINC designation;
- Consultation with Marine Scotland, SEPA and the local fisheries trusts (i.e. Clyde Rivers Foundation) regarding local fish presence; and
- Bat Activity Survey of buildings with low bat roost potential where disturbance is likely to occur (Note: This has subsequently been undertaken and will form part of the submission for the SBOH to GCC).

Pre-commencement checks for nesting birds, badger, and otter have also been recommended.

Although further surveys are still required to formally establish mitigation, mitigation recommendations have been provided and include:

- Implementation of a site-specific Construction Environmental Management Plan;
- Implementation of a site-specific Wastewater Management Plan;
- Implementation of an Invasive species Management Plan;
- Implementation of a Marine Mammal Protection Plan;
- Compliance with SEPA Guidelines for Pollution Prevention;
- General mitigation including installation of protective Heras fencing, sensitive timings of work, sensitive working methods, sensitive storage of building materials, and covering of any open trenches overnight;
- Installation of swallow nesting cups; and
- Implementation of a sensitive lighting strategy”

9.2.2 European Protected Species and Fish Risk Assessment

A European Protected Species (EPS) and Fish Risk Assessment (including an Underwater Noise Assessment)is provided in Technical Appendix 9-2, Volume 3 of this EIAR.

In conjunction with this assessment, a Water Framework Directive Assessment (incorporating consideration of impacts related to Biology-Fish and Invasive Non Native Species (INNS)) was also produced, and is provided in Technical Appendix 5-2, Volume 3 of this EIAR.

A summary of the key findings of these assessments are provided below:

Biology-Fish and Marine Mammals
The Clyde Estuary -Inner (inc Cart) is currently classified as Good with respect to fish.

The proposed development works has potential to impact fish both in relation to impact to water quality from release of suspended sediment (including potentially contaminated sediment) during the infilling works, and entrainment of fish during the basin infill.

The Marine Mammal and Fish Risk Assessment reviewed risks related to underwater noise, suspended sediment release and entrainment once the basin is isolated from the main stem of the river.

The underwater noise risk assessment concluded that the risk to fish and marine mammals was very low from the proposed development works.

The risk assessment did identify potential for impact in relation to release of suspended sediment and entrainment of fish. The following mitigation measures were identified with respect to protection of fish.

- Fish rescues and translocations will take place at the outset of construction to reduce fish mortality. This will commence following installation of a silt curtain/bubble screen or barrier across the wet basin to prevent fish re-entering the wet basin infill area.
- A Fish Rescue Method Statement will be agreed in advance with the relevant Statutory Nature Conservation Bodies (SNCBs) to target fish species which may inhabit the basin.
- The presence of the silt curtain/bubble screen or barrier will also restrict the potential for release of suspended sediment outwith the construction area.

It is considered that implementation of the identified mitigation measures will ensure that the development does not result in a deterioration of the Good status of the Clyde Estuary Inner (Inc Cart). Following completion of the site works the development is not considered to pose a risk that will impact the water body from retaining the classification of Good going forward.

Invasive Non Native Species (INNS)
The Clyde Estuary – Inner (Inc Cart) was recorded as having a High classification in relation to freedom from invasive species in 2014 and 2021. Other areas of the Clyde Estuary are known to have been impacted by INNS historically, the Firth of Clyde Forum developed a Biosecurity Plan[29] in 2012-2016 identifying existing and potential INNS issues to be considered going forward. At the time of the report the carpet sea squirt Didemnum vexillum was identified as a high environmental risk within the Clyde Estuary.

The works will incorporate use of a dredge vessel that may have been mobilised from other water bodies. The Clyde is regularly dredged for maintenance requirements and as such the risks related to the wet basin infill are not considered to be different to current routine operation within the river. Adoption of best practice in line with existing Biosecurity Plans and guidance and appropriate equipment maintenance would result in the risk from INNS introduction to be low.

The works may involve dredging from one area of the Clyde Estuary with the material subsequently forming part of the infill material for the basin. As such there is potential for transfer of benthic INNS from one area of the Clyde to the basin. Given that during the basin infill a silt curtain, bubble screen or barrier will be present to isolate the basin from the river (primarily to restrict release of suspended sediment and entrance of fish into the basin), then any INNS that may be transferred will be entrained within the basin during the infill operation. The wet basin infill is therefore not considered to result in a deterioration with respect to INNS and following completion of the project it is not considered to represent a future risk to the water body for meeting its WFD targets.

9.3 Climate Change

Climate change has taken a prominent position within policy and legislation at a national level, with the Climate Change (Emissions Reduction Targets) (Scotland) Act 2019 setting a target date of net-zero

[29] Firth of Clyde Forum Biosecurity Plan 2012-2016

emissions of all greenhouse gases by 2045. The Climate Change Plan update published in December 2020 provides a pathway for Scotland to meet the emissions reduction targets through to 2032. It identifies that public bodies have a part to play in decarbonising Scotland through leading by example.

The shipyard is considered to be water compatible and once the wet basin has been infilled, the working platform will be incorporated into the existing shipyard operations. Any increase in emissions created during construction is likely to be negligible, and pollution and emissions control would be discussed within a detailed Construction Environmental Management Plan (CEMP). Discussion of the vulnerability of the project to climate change is primarily concerned with the water environment, including flood risk and wave overtopping due to increases in sea level. This effect is considered within Chapter 5 Water Environment of this document.

9.4 Landscape and Visual

The site is located within an existing operational shipyard within an urban area of Glasgow City. It is anticipated there will be a minor impact on the visual amenity of the area during construction, however this is considered to be temporary.

9.5 Population and Human Health

The proposed work is within an operational shipyard which is restricted to members of the general public. BAE Systems Ltd ensures all employees adhere to their H&S management system which is continually reviewed and updated as required to protect employee health. During construction existing legislation and health and safety requirements will be used to identify risks and help protect human beings and the environment. It is therefore considered there will be no significant direct or indirect impact on either population or human health as a result of the proposal.

9.6 Material Assets

Material assets can be interpreted in a number of different ways which fall into two categories, the built assets and natural assets which are valued for socio-economic and/or heritage reasons. It is considered that the infilling of the wet basin will be protecting and enhancing the existing shipyard assets and ensuring a sustainable use.

9.7 Major Accidents and Natural Disasters

Similar to other shipyards, there is potential for accidents to occur, however BAE Systems Ltd actively operates H&S management systems to promote safe and efficient shipbuilding operations. It ensures that all operations under their jurisdiction are done in such a manner so as to keep safe its employees, contractors, the public, the shipyard and the environment.

The wet basin is not located within an area of significant seismic activity, nor is climatic factors prone to creating disasters such as tsunamis, hurricanes or catastrophic flooding.

10 SCHEDULE OF MITIGATION

10.1 Introduction

This Chapter presents a summary of the mitigation and enhancement measures identified by the specialist environmental studies throughout the EIA process. It indicates how these mitigation measure have or would be implemented. In addition to summarising mitigation, enhancement measures identified in the topic specific Chapters of this EIAR are also highlighted.

The mitigation and enhancement measures included in this EIAR would be implemented during one or more of the following three broad phases of the proposed development:

- Measures incorporated during the design process;
- Measures required through the construction phase; and
- Measures likely to be required during post-construction.

Table 8-1 below provides a summary of the mitigation measures proposed for each issue identified by the EIA process. The measures are divided into the categories outlined above. It should be noted that the table presents a summary only; further details on the mitigation and enhancement measures are included within each Chapter of this EIAR.

The Schedule is designed to provide a comprehensive summary of all construction or physical mitigation measures that would require to be carried through into the construction and operation of the proposed development, to ensure that the environmental assessment outcomes discussed throughout this EIAR are reached, e.g. to ensure that significant adverse effects are avoided where applicable and possible.

10.2 Mitigation Measures

Mitigation detailed in each technical chapter has been summarised below.

Table 10-1: Schedule of Mitigation

Feature / Topic	Mitigation	Timing
Chapter 5: Water Environment		
Construction Environmental Management Plan	A Construction Environmental Management Plan (CEMP) will be developed to ensure that the mitigation measures outlined in the EIA are followed during the proposed construction works. The CEMP will include surface water management and pollution prevention measures (e.g. Pollution Prevention Plan), and will be in place during construction and operation. The CEMP will remain a live document and will be continually updated as the work progresses. The CEMP will be developed as a practical tool to facilitate the management of environmental mitigation measures and to provide a clear roadmap of the key roles and responsibilities during construction. All mitigation measures will be incorporated into the CEMP, which will include detailed Construction Method Statements (CMS). An Environmental Clerk of Works (EnvCoW) will monitor the construction works to ensure that the CEMP and associated mitigation measures are being implemented effectively.	Construction
Best Practice	Best practice will be adopted throughout all phases of development, following current guidance as listed in Chapter 5 of this EIAR. The programme of works, including timings and methods, will be planned, monitored and managed to minimise the potential negative environmental impacts.	Construction
Pollution Incident Response Plan	A Pollution Incident Response Plan will be set out in the CEMP relating to the construction of the proposed development, statutory requirements and identification of areas of highest sensitivity. This will provide site spill response procedures, emergency contact details and equipment inventories and their location. All staff will be made aware of this document and its content during site induction. A copy will be available in the site office at all times.	Construction
Water Quality	A monitoring plan (incorporating baseline monitoring) will be produced detailing the proposals for monitoring water quality prior to and during works with respect to potential for water quality impact. A silt curtain/bubble curtain (or similar barrier) will be installed prior to fish rescue and the infilling works to address risks associated with generation of suspended solids during the infilling works.	Construction
Chapter 6: Noise		
Rapid Impact Compaction	These activities, where possible should be scheduled for weekdays and avoid weekends.	Construction
General Measures	Develop a Construction Noise Management Plan detailing the best practice construction noise management techniques which shall be employed at the site.	Construction

Feature / Topic	Mitigation	Timing
General Measures	The general principles of the Considerate Constructors Scheme should be followed where practicable.	Construction
Chapter 7: Land Quality		
Ground and Sediment Contamination	A site investigation and geo-environmental risk assessment will be carried out to appropriately characterise the existing ground and sediment conditions. Following site specific risk assessment a remedial strategy document will be produced (if required). The remedial approach will be agreed with the regulators and implemented as part of the construction phase.	Design and Construction
Infill Material Quality	Proposed infill material will be appropriately tested and assessed against appropriate assessment. A silt curtain/bubble curtain (or similar barrier) will be installed prior to fish rescue and the infilling works to address risks associated with generation of suspended solids during the infilling works.	Construction
Chapter 8: Cultural Heritage		
Cultural Heritage	The use of physical markings within the ground surfacing. This should ideally be alongside the re-instatement of the mooring posts (MM095) and shipyard winches (MM096) around the former edge of the basin.	Design
Cultural Heritage	It is proposed 1no mooring posts (MM095) and 1no shipyard winch (MM096) to be located in proposed green lung/plaza	Design
Cultural Heritage	The use of minimal or sympathetic design measures regarding the new assembly hall to reduce changes within the settings of heritage assets.	Design
Cultural Heritage	Management of temporary impacts on the heritage value of assets due to a change in their setting through the implementation of a Construction Environment Management Plan	Construction
Cultural Heritage	A full appraisal of the wet basin to ensure that the basin is preserved through record and appropriately archived with HES. Any building recording would be in accordance with HES (2003) and ALGAO (2013) guidance. The above methods will be established through consultation with and outlined in an archaeological Written Scheme of Investigation (WSI) approved by WoSAS as representatives of GCC on matters pertaining to archaeology.	Construction
Chapter 9: Other Issues		
Construction Dust	Mitigation is proposed to deal with potential dust issues etc. within the Other Issues chapter. Good practice activities such as the development of a Dust Management Plan would be prepared as part of the CEMP.	Construction

General Measures	General mitigation including installation of protective Heras fencing, sensitive timings of work, sensitive working methods, sensitive storage of building materials and covering of any open trenches overnight.	Construction
Invasive Species	Implementation of an Invasive Species Management Plan	Construction
Lighting	Implementation of a sensitive lighting strategy	Design/construction/post construction
Fish rescue and translocation	Fish rescues and translocations will take place at the outset of construction to reduce fish mortality. This will commence following installation of a silt curtain/bubble screen or barrier across the wet basin to prevent fish re-entering the wet basin infill area. A Fish Rescue Method Statement will be agreed in advance with the relevant Statutory Nature Conservation Bodies (SNCBs) to target fish species which may inhabit the basin.	Construction
Ornithology	Installation of swallow nesting cups	Design/construction/post construction
Pollution	Pollution of the marine environment should be prevented in order to safeguard water quality and marine life	Construction
Wastewater Management Plan	Implementation of a site-specific Wastewater Management Plan.	Construction

10.3 Construction Environmental Management Document

The Schedule of Mitigation would form the basis of the subsequent Construction Environmental Management Document (CEMD).

The CEMD would be a working document which would be updated throughout the construction phase of the project. It would also provide a clear roadmap of the key roles and responsibilities during construction works. An Environmental Manager would be identified who would be responsible for the implementation of the CEMD ensuring that all measures identified within the Schedule of Mitigation are applied and adhered to.

11 CONCLUSIONS

11.1 Introduction

The predicted environmental effects related to the construction of the proposed development have been considered throughout the design of the proposed infilling works. The final design of the proposed infilling works has been subject to a detailed EIA which has sought to minimise the effects of the proposals. Mitigation measures are detailed within their respective specific chapters of this EIAR and summarised within Chapter 8 of this EIAR.

The conclusions of each chapter are presented below.

11.2 Water Environment

An assessment of the proposed works on the Water Environment was undertaken and detailed in Chapter 5. The assessment concluded that the magnitude of effects in relation to water quality impacts were deemed to be minor or negligible with suitable mitigation measures in place and therefore **not significant**.

In relation to flood risk, the assessment identified there was a Medium to High Risk of Tidal-Fluvial (Coastal-River) flooding. However, as the ultimate end use would be water compatible in conjunction with consideration of suitable free-board allowances within the end design, **No significant effects** are predicted.

The infilling of the wet basin is not predicted to detrimentally impact the flood risk of surrounding areas therefore **no significant effects** are predicted.

11.3 Noise

As detailed in Chapter 6, the construction noise impacts of the infilling works for daytime (week and weekends), evening and night-time were modelled to inform a comprehensive noise assessment. The assessment concluded that there would be **no significant effects** during the weekday, evening and night-time periods for the majority of receptors considered. However, for weekend day **significant effects** were predicted at numerous receptors. The avoidance of the weekend day time period should therefore be avoided were possible which would result in **no significant effects**.

11.4 Land Quality

An assessment of the proposed works with respect to Land Quality was undertaken and detailed in Chapter 7. On the basis that the proposed site investigation works and subsequent risk assessment works are undertaken (and any remedial measures identified following this adopted) it is considered that there would be **no significant effects** to with respects to land quality or contamination.

11.5 Cultural Heritage

An assessment of the proposed works with respect to impact to Cultural Heritage was undertaken and detailed in Chapter 8.

The construction works will result in significant permanent effects on the Fitting-out Basin (wet basin; MM054) as it will be infilled, and the new assembly built over this. The residual effect after the embedded mitigation, additional and enhancement measures outlined above is therefore considered to still have a **Moderate Adverse, Significant effect** on the heritage value of the asset.

Construction works will result in non-significant permanent effects to the heritage value of the Category A listed Former Engine Works (MM007) as a result of changes to the building's setting and impact on its heritage value due to its association with the Fitting-out Basin (wet basin; MM054). This will be ensured through mitigation measures, including sympathetic design, delineating the former edge of the Fitting-out basin (wet basin, MM054), through the reinstatement of the mooring posts (MM095) and winches (MM096), the use of physical ground markings to highlight the relationship between the wet basin and building, and the use of interpretation panels or artwork. This is designed to ensure some of the heritage value due to association with the Fitting-out basin is retained. As such, following appropriate mitigation, the proposed scheme is considered to have a **Slight Adverse, Non-significant effect** on the heritage value of the asset.

Construction works will also result in non-significant effect on the mooring posts (MM095) and two winches (MM096) surrounding the wet basin. They will need to be removed as part of the construction of the proposed scheme. However, the residual effect after the reinstatement of some of these features in an appropriate position around the former edge of the Fitting-out Basin (wet basin; MM054) and/or elsewhere within the shipyard, is considered to have a **Slight Adverse, Non-significant effect** on the heritage value of the asset.

11.6 Other Issues

A range of other issues were explored, such as Air Quality, Biodiversity, Climate Change, Landscape & Visual, Material Assets, Population & Human Health and Major Accidents & Natural Disasters. **No significant effects** are predicted under any of these topics.