Framework:	**Collaborative Delivery Framework**
Supplier:	**Ove Arup & Partners Ltd**
Company Number:	**01312453**
Geographical Area:	
Contract Name:	**Newcastle Quayside Modelling**
Project Number:	[redacted]
Contract Type:	**Professional Service Contract**
Option:	**Option C**
Contract Number:	**C24790**
Stage:	**Pre_SOC**

Revision	Status		Originator		Reviewer		Date
v8.0	Final Version	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	28/05/2024

PROFESSIONAL SERVICE CONTRACT under the Collaborative Delivery Framework
CONTRACT DATA

Project Name Newcastle Quayside Modelling

Project Number [redacted]

This contract is made on 11 June 2024
between the *Client* and the *Consultant*

- This contract is made pursuant to the Framework Agreement (the "Agreement") dated 01st day of April 2019 and Framework Agreement Extension dated 1st April 2023 between the *Client* and the *Consultant* in relation to the Collaborative Delivery Framework. The entire agreement and the following Schedules are incorporated into this Contract by reference

- Schedules 1 to 23 inclusive of the Framework schedules are relied upon within this contract.

- The following documents are incorporated into this contract by reference
  FINAL 2024-01_17_PSC_Newcastle Quayside Stage 2_V25.pdf

Part One - Data provided by the *Client*

Statements given in all Contracts

1 General

The *conditions of contract* are the core clauses and the clauses for the following main Option, the Option for resolving and avoiding disputes and secondary Options of the NEC4 Professional Service Contract June 2017.

Main Option	Option C	Option for resolving and avoiding disputes	W2

Secondary Options

X2: Changes in the law

X9: Transfer of rights

X10: Information modelling

X11: Termination by the *Client*

X18: Limitation of liability

X20: Key Performance Indicators

Y(UK)2: The Housing Grants, Construction and Regeneration Act 1996

Y(UK)3: The Contracts (Rights of Third Parties) Act 1999

Z: *Additional conditions of contract*

The *service* is Update the hydraulic model for Newcastle Quayside and assess flood risk.

The *Client* is Environment Agency

Address for communications [redacted]

Address for electronic communications [redacted]

The *Service Manager* is [redacted]
Address for communications [redacted]

Address for electronic communications [redacted]

The Scope is in

FINAL 2024-01_17_PSC_Newcastle Quayside Stage 2_V25.pdf

The *language of the contract* is English

The *law of the contract* is
the law of England and Wales, subject to the jurisdiction of the courts of England and Wales

The period for reply is 2 weeks

The *period for retention* is
6 years following Completion or earlier termination

The following matters will be included in the Early Warning Register

Early warning meetings are to be held at intervals no longer than 2 weeks

2 The *Consultant's* main responsibilities

The *key dates* and *conditions* to be met are *conditions* to be met	*key date*
'none set'	'none set'
'none set'	'none set'
'none set'	'none set'

The *Consultant* prepares forecasts of the total Defined Cost plus Fee and *expenses* at intervals no longer than 4 weeks

3 Time

The *starting date* is 07 June 2024

The *Client* provides access to the following persons, places and things

access	*access date*
Fastdraft	07 June 2024
Asite	07 June 2024

The *Consultant* submits revised programmes at intervals no longer than 4 weeks

The *completion date* for the whole of the *service* is 31 October 2025

The period after the Contract Date within which the *Consultant* is to submit a first programme for acceptance is 4 weeks

4 Quality management

The period after the Contract Date within which the *Consultant* is to submit a quality policy statement and quality plan is 4 weeks

The period between Completion of the whole of the *service* and the *defects date* is 26 weeks

5 Payment

The *currency of the contract* is the £ sterling

The *assessment interval* is Monthly

The *Client* set total of the Prices is [redacted]

The *expenses* stated by the *Client* are as stated in Schedule 9

The *interest rate* is [redacted] per annum (not less than 2) above the Base rate of the Bank of England

The locations for which the *Consultant* provides a charge for the cost of support people and office overhead are: All UK Offices

If Option C is used

The *Consultant's share percentages* and the *share ranges* are:

[redacted]

6 Compensation events

These are additional compensation events

1. not used'
2. 'not used'
3. 'not used'
4. 'not used'
5. 'not used'

8 Liabilities and insurance

These are additional *Client's* liabilities

1. 'not used'
2. 'not used'
3. 'not used'

The minimum amount of cover and the periods for which the *Consultant* maintains insurance are

EVENT	MINIMUM AMOUNT OF COVER	PERIOD FOLLOWING COMPLETION OF THE WHOLE OF THE *SERVICE* OR TERMINATION
The *Consultant's* failure to use the skill and care normally used by professionals providing services similar to the *service*	[redacted]	[redacted]
Loss of or damage to property and liability for bodily injury to or death of a person (not an employee of the *Consultant)* arising from or in connection with the *Consultant* Providing the Service	[redacted]	[redacted]
Death of or bodily injury to the employees of the *Consultant* arising out of and in the course of their employment in connection with the contract	[redacted]	[redacted]
The *Consultant's* total liability to the *Client* for all matters arising under or in connection with the contract, other than the excluded matters is limited to	[redacted]	

Resolving and avoiding disputes

The *tribunal* is litigation in the courts

The *Adjudicator* is	'to be confirmed'
Address for communications	'to be confirmed'
Address for electronic communications	'to be confirmed'
The *Adjudicator nominating body* is	The Institution of Civil Engineers

Z Clauses

Z1 Disputes
Delete existing clause W2.1

Z2 Prevention
The text of clause 18 Prevention is deleted.
Delete the text of clause 60.1(12) and replaced by:
The *service* is affected by any of the following events
• War, civil war, rebellion, revolution, insurrection, military or usurped power;
• Strikes, riots and civil commotion not confined to the employees of the *Consultant* and sub consultants,
• Ionising radiation or radioactive contamination from nuclear fuel or nuclear waste resulting from the combustion of nuclear fuel,
• Radioactive, toxic, explosive or other hazardous properties of an explosive nuclear device,
• Natural disaster,
• Fire and explosion,
• Impact by aircraft or other aerial device or thing dropped from them.

Z3 Disallowed Costs
Add the following in second bullet of 11.2 (18) add:
(including compensation events with the Subcontractor, i.e. payment for work that should not have been undertaken).
Add the following additional bullets after 'and the cost of ' :
• Mistakes or delays caused by the *Consultant's* failure to follow standards in Scopes/quality plans
• Reorganisation of the *Consultant's* project team
• Additional costs or delays incurred due to *Consultant's* failure to comply with published and known guidance or document formats
• Exceeding the Scope without prior instruction that leads to abortive cost
• Re-working of documents due to inadequate QA prior to submission, i.e. grammatical, factual arithmetical or design errors
• Production or preparation of self-promotional material
• Excessive charges for project management time on a commission for secondments or full time appointments (greater than 5% of commission value)
• Any hours exceeding 8 per day unless with prior written agreement of the *Service Manager*
• Any hours for travel beyond the location of the nearest consultant office to the project unless previously agreed with the *Service Manager*
• Attendance of additional individuals to meetings/ workshops etc who have not been previously invited by the *Service Manager*
• Costs associated with the attendance at additional meetings after programmed Completion, if delay is due to *Consultant* performance
• Costs associated with rectifications that are due to *Consultant* error or omission
• Costs associated with the identification of opportunities to improve our processes and procedures for project delivery through the *Consultant's* involvement
• Was incurred due to a breach of safety requirements, or due additional work to comply with safety requirements
• Was incurred as a result of the *Client* issuing a Yellow or Red Card to prepare a Performance Improvement Plan
• Was incurred as a resulting of rectifying a non-compliance with the Framework Agreement and/or any call off

Z4 Share on termination
Delete existing clause 93.3 and 93.4 and replace with:
93.3 In the event of termination in respect of a contract relating to services there is no *Consultant's* share'

Z6 The Schedule of Cost Components
The Schedule of Cost Components are as detailed in the Framework Schedule 9.

Z7 Consultant's share
54.1 The *Service Manager* assess the *Consultant's* share of the difference between the Aggregated Total of the Prices and the Aggregated Price for Service Provided to Date.
The difference is divided into increments falling within each of the share ranges. The limits of a share range are the Aggregated Price for Service Provided to Date divided by the Aggregated Total of the Prices, expressed as a percentage. The *Consultant's* share equals the sum of the products of the increment within each share range and the corresponding *Consultant's* share percentage.
54.2 If the Aggregated Price for Service Provided to Date is less than the Aggregated Total of the Prices, the Consultant is paid its share of the saving. If the Aggregated Price for Service Provided to Date is greater than the Aggregated Total of the Prices, the *Consultant* pays its share of the excess.
54.2A If, prior to Completion of the whole of the service, the Price for Service Done to Date exceeds 111% of the total of the Prices, the amount in excess of 111% of the total of the Prices is retained from the Consultant.
54.3 If, prior to the Completion Date, the Price for Service Provided to Date exceeds 110% of the total of the Prices, the amount in excess of 110% of the total of the Prices is retained from the *Consultant* .
54.4 The *Service Manager* makes a preliminary assessment of the *Consultant's* share at Completion of the Whole of the service using forecasts of the final Aggregated Price for Service Provided to Date and the final Aggregated Total of Prices. This share is included in the amount due following Completion of the whole of the services.
54.5 The *Service Manager* makes a final assessment of the *Consultant's* share, using the final Aggregated Price for Service Provided to Date and the final Aggregated Total of the Prices. This share is included in the final amount due.
93.3 If there is a termination except if Z4 applies, the *Service Manager* assesses the *Consultant's* share after certifying termination. The assessment uses as the Aggregated Price for Service Provided to Date the sum of
• the total of
– the Defined Cost which the *Consultant* has paid and
– which it is committed to pay for work done before termination
and
• the total of
– the Defined Cost which the *Consultant* or *Contractor* has paid and
– which it is committed to pay
in the *partner contract* before the date the termination certificate is issued under this contract.
The assessment uses as the Aggregated Total of the Prices the sum of
• the total of
– the lump sum price for each activity which has been completed and
– a proportion of the lump sum price for each incomplete activity which is the proportion of the work in the activity which has been completed
and
• the total of
– the lump sum price for each activity which has been completed and

Add:
11.2(25) The Aggregated Total of the Prices is sum of
• the total of the Prices and
• the total of the Prices in the *partner contract*

11.2(26) The Aggregated Price for Service Provided to Date is the sum of
• the Price for Service Provided to Date and
• the Price for Service Provided to Date or the Price for Work Done to Date in the *partner contract* .

Z23 Linked contracts
Issues requiring redesign or rework on this contract due to a fault or error of the *Consultant* will neither be an allowable cost under this contract or any subsequent contract, nor will it be a Compensation event under this contract or any subsequent contract under this project or programme.

Z24 Requirement for Invoice
Add the following sentence to the end of clause 51.1:
The Party to which payment is due submits an invoice to the other Party for the amount to be paid within one week of the *Service Manager's* certificate.
Delete existing clause 51.2 and replace with:
51.2 Each certified payment is made by the later of
• one week after the paying Party receives an invoice from the other Party and
• three weeks after the assessment date, or, if a different period is stated in the Contract Data, within the period stated.
If a certified payment is late, or if a payment is late because the *Service Manager* has not issued a certificate which should be issued, interest is paid on the late payment. Interest is assessed from the date by which the late payment should have been made until the date when the late payment is made, and is included in the first assessment after the late payment is made

Z25 Risks and insurance
The *Consultant* is required to submit insurances annually as Clause Z4 of the Framework Agreement

Z 29 Payment for Service Provided to Date
Delete existing clause 11.2 (21) and replace with:
"11.2 (21) The Price for Service Provided to Date is the total Defined Cost which the *Service Manager* forecasts will have been paid by the *Consultant* before the next assessment date plus the Fee. The Price for Service Provided to Date shall not exceed the forecast for the same as provided under clause 20.5"

Z111 PSC - Fee adjustment for non compliance with Scope
Delete existing 11.2 (8) and replace with the following clause
The Fee is the amount calculated by applying the fee percentage to the amount of the Defined Cost excluding the cost of Subcontractors that have not complied with procurement by best value processes as defined in the Scope.
80% of the fee percentage is applied to the amount of the Defined Cost for Subcontractors that have not complied with procurement by best value processes as defined in the Scope.

Secondary Options

OPTION X2: Changes in the law

The *law of the project* is the law of England and Wales, subject to the jurisdiction of the courts of England and Wales

OPTION X10: Information modelling

The period after the Contract Date within which the *Consultant* is to submit a first Information Execution Plan for acceptance is 2 weeks

OPTION X18: Limitation of liability

The *Consultant's* liability to the *Client* for indirect or consequential loss is limited to

[redacted]

The *Consultant's* liability to the *Client* for Defects that are not found until after the *defects date* is limited to

[redacted]

The *end of liability* date is [redacted] after the Completion of the whole of the *service*

OPTION X20: Key Performance Indicators (not used with Option X12)

The *incentive schedule* for Key Performance Indicators is in Schedule 17

A report of performance against each Key Performance Indicator is provided at intervals of

3 months

Y(UK)2: The Housing Grants, Construction and Regeneration Act 1996

The period for payment is 14 days after the date on which payment becomes due

Y(UK)3: The Contracts (Rights of Third Parties Act) 1999

term *beneficiary*

Part Two - Data provided by the *Consultant*

Completion of the data in full, according to the Options chosen, is essential to create a complete contract.

1 General

The *Consultant* is

Name: Ove Arup & Partners Ltd

Address for communications: [redacted]

Address for electronic communications: [redacted]

The *fee percentage* is: Option C — [redacted]

The *key persons* are

Name (1) [redacted]
Job
Responsibilities
Qualifications
Experience

Name (2) [redacted]
Job
Responsibilities
Qualifications
Experience

Name (3)
Job
Responsibilities
Qualifications
Experience

Name (4)
Job
Responsibilities
Qualifications
Experience

Name (5)
Job
Responsibilities
Qualifications
Experience

Name (6)
Job
Responsibilities
Qualifications
Experience

Name (7)
Job
Responsibilities
Qualifications
Experience

The following matters will be included in the Early Warning Register

3 Time

The programme identified in the Contract Data is

to follow

5 Payment

The *activity schedule* is
Quayside modelling - activity schedule v0

Resolving and avoiding disputes

The *Senior Representatives* of the *Consultant* are

Name (1) [redacted]
Address for communications
[redacted]

Address for electronic communications
[redacted]

Name (2)
Address for communications

Address for electronic communications

X10: Information Modelling

The *information execution plan* identified
in the Contract Data is
to follow

Contract Execution

Client **execution**

Signed Underhand by [**PRINT NAME**] for and on behalf of the Environment Agency

[redacted]

[redacted] 11/06/2024 [redacted]

Signature Date Role

Consultant **execution**

Signed Underhand by [**PRINT NAME**] for and on behalf of Ove Arup & Partners Ltd

[redacted]

[redacted] [redacted]

Signature Date Role

Project Details

Environment Agency

NEC4 Professional Service Contract (PSC)

Modelling Technical Scope

Project / contract Information

Project name	Newcastle Quayside Stage 2
Expected completion date	31/03/2025
Version number	25
Environment Agency Area	North East
Area lead	[redacted]
Modelling technical	[redacted]
Contact for additional information	[redacted]

This scope should be read in conjunction with LIT 56326 Fluvial Modelling Standards, the Estuary Standards Technical Report (EHMA) and the Coastal Standards Technical Report (OCHMA) current at the Contract Date. In the event of conflict, this Scope shall prevail. The service is compliant with the minimum technical requirements set out in LIT 56326 Fluvial Modelling Standards, LIT 18686 NEC4 Minimum Technical Requirements for Modelling and EA guidance Flood and Coastal Risk Projects, Schemes and Strategies: Climate Change Allowances current at the Contract Date. Works relating to surface water modelling must also adhere to the following industry standard guidance documents Integrated Urban Drainage Modelling Guide V2.01 (CIWEM) and Code of Practice for Hydraulic Modelling of Urban Drainage Systems 2017 (CIWEM).

Project Objectives

The Newcastle Quayside Stage 2 project is split into two main phases. The objectives of each phase are summarised below:

1. The appraisal stage of the project will aim to **improve our understanding** of extreme water levels and the integrated flood risk to Newcastle Quayside.
    a. The project will provide updated **baseline** modelling for the River Tyne and Newcastle Quayside to inform the project appraisal and business cases. The project will meet the EA's technical standards and use latest data available.
    b. The project will complete a hydrological review and update to include the latest UKCP18 assessments and joint probability analysis for the River Tyne. Initial fluvial assessments will be high level whilst their significance upon flood risk at the study site is tested; detailed fluvial studies will also be undertaken if required.
    c. The project will assess the existing Standard of Protection and how that changes across epochs with the inclusion of climate change.
    d. The project will provide up to date and accurate tools, data, and flood mapping to identify the level of risk at Newcastle Quayside, both in terms of tidal/fluvial and Surface water flood mapping. Note that surface water modelling will be agreed and carried out at a stage separate from this project.
    e. The project will improve upon current flood warnings based on the updated model outputs

2. The detailed design stage of the project will be carried out at a later stage and will aim to **address the risk** of flooding from all sources (tidal, fluvial and pluvial) at Newcastle Quayside (including representation of the south bank of the River Tyne at Gateshead).
    a. The project will deliver **design** modelling to inform optioneering for a Flood Alleviation Scheme.
    b. At the Options stage of the project, the model needs to be able to assess the impact on the South Bank from scheme options, and for the lifetime of the chosen Flood Alleviation Scheme.

Project Overview

a) Newcastle Quayside Flood Alleviation Scheme has two main drivers:
- to implement a scheme to reduce flood risk from the River Tyne
- for surface water, to enhance and make a regionally significant site resilient to climate change.

Existing understanding of flood risk from the River Tyne at Newcastle Quayside is based on ISIS-TUFLOW and HEC-RAS modelling carried out from 2004 to 2014/15. Stage 1 of the project included a detailed review of existing modelling covering the Newcastle Quayside area. In order to fully understand the integrated flood risk at Newcastle Quayside, through collaboration with our suppliers it has been determined that a number of model updates or provision of a new model would be required.

The Newcastle Quayside has high commercial, cultural and historic significance. The area has recently undergone significant regeneration, changing from post-industrial usage to a commercial, social and cultural area. **There are no formal raised flood defences on the Quayside.** It is therefore possible for extreme tides to overtop the quay walls inundating nearby properties and roads. The quay edge varies in level from 4.2m AOD at the Copthorne Hotel (NGR: NZ2491563572) to the lowest point 3.21m AOD just upstream of Swing Bridge (NGR: NZ2516563768), rising up to 4.49m AOD at the Pitcher & Piano Bar (NGR: NZ2573664049). The Environment Agency's indicative flood map reflects the modelling

undertaken during the 2008 JBA modelling study and shows 110 residential and commercial properties (in 2108) that could be flooded from extreme tidal action by a flood with a 1 in 300 (0.33%) or greater chance of happening each year. The current standard of protection provided by the quay is estimated to protect against floods from extreme tidal action with a 1 in 10 (10%) chance of happening each year with the 2013 tidal surge estimated to be a 1 in 200yr return period.

The dominant flood risk mechanism at Newcastle Quayside is believed to be from a tidal event since peak events on the River Tyne are tidally dominated well beyond the Quayside reaches – this however needs to be clarified through the deliverables of this scope. In the analysis for the 2008/09 Project Appraisal Report (PAR), it was identified that for all events, peak levels at the Quayside site were higher than those further downstream due to the funnelling effect of the Tyne. An extreme sea level report from 2008 and a recent data review by one of CDF suppliers has indicated that between a 200 and 400mm increase in level at the Quayside is appropriate due to the funnelling effect of the channel.

It is noted that surface water also plays a major role in the area's flood risk. A separate study will analyse flood risk from this source.

b) The specific area of interest is to be determined through the outputs of this modelling study, however figure 1 below demonstrates an approximate area of interest based on an extreme flood outline as modelled for the 2008 PAR at Newcastle Quayside. Figure 2 shows the River Tyne Study extent from Scotswood Bridge (NGR: NZ2011863781) to Tynemouth (NGR: NZ3637368454). The modelling needs to be updated so that the outputs can be used to complete a detailed economic analysis for the Quayside to inform the business case. The modelling will also need to deliver information to inform optioneering such as defence crest levels for different return periods as well as updating flood maps. Optioneering modelling will need to consider the effect of different scenarios on the south bank of the Tyne along Gateshead. Flood warning improvements should be made as part of as built works post scheme or at the point the project finishes if this does not result in a scheme.

The study area consists of an urban quayside with a tidal reach of the River Tyne as well as the sewer and drainage network. The geographic scope of the project will be defined by the project team following determination of the flood extents for extreme events. Newcastle Quayside has a long history of flood events from both Tidal, Fluvial and Surface Water sources. The most recent events of note occurred in June 2012 when the 'Toon Monsoon' caused a widespread surface water event across Newcastle, with 8 non-residential properties reporting internal flooding on the Quayside. In December 2013 a tidal surge of 1.25m at North Shields brought peak water levels of 4.04mAOD at Newcastle Quayside, flooding 18 non-residential properties along the Newcastle Quayside up to depths of 0.71m. With there not being any formal raised flood defences on the Quayside, in order to manage flooding from the River Tyne, the Environment Agency deploys temporary A framed barriers upon notice of high tide levels.

A PAR study was carried out in 2009, but this was curtailed due to partnership funding not being available. The 2008/9 modelling from JBA to inform the curtailed PAR suggested that there are 32 commercial properties at risk on the Quayside and another estimated 20 residential properties with their accesses compromised during a 100 year event at present day. The current standard of protection provided by the quay walls is estimated to protect against floods from extreme tidal action with a 1 in 10 (10%) chance of occurrence each year.

For the purpose of quotation, suppliers should base their fee on the production of a 1D-2D hydraulic model for the River Tyne, wherein the 1D component of the model extends from just upstream of the A1 bridge at Scotswood to North Shields gauge and 2D components are included for the north bank of the Newcastle Quayside study area between the Ouseburn to Redheugh Bridge and at potential receptor areas. Based on LiDAR, receptor areas may

include the south bank of the Tyne at Gateshead directly opposite Newcastle Quayside, the north bank of the Tyne upstream of the Quayside along the Scotswood Road area and the south bank upstream between Blaydon Burn to the Team confluence. **The finalised model domain will be determined following a detailed review of available data at the method statement stage and may be changed.** Figure 3 shows a preliminary study area for the purposes of this scope.

It is critical that the *Consultant* specifies how the assessment of risk from the Tyne will be modelled and the software that will be used. The *Consultant* shall submit for approval clear recommendations on required activities to build / update the hydraulic model (s) and inflows as part of the modelling method statement.

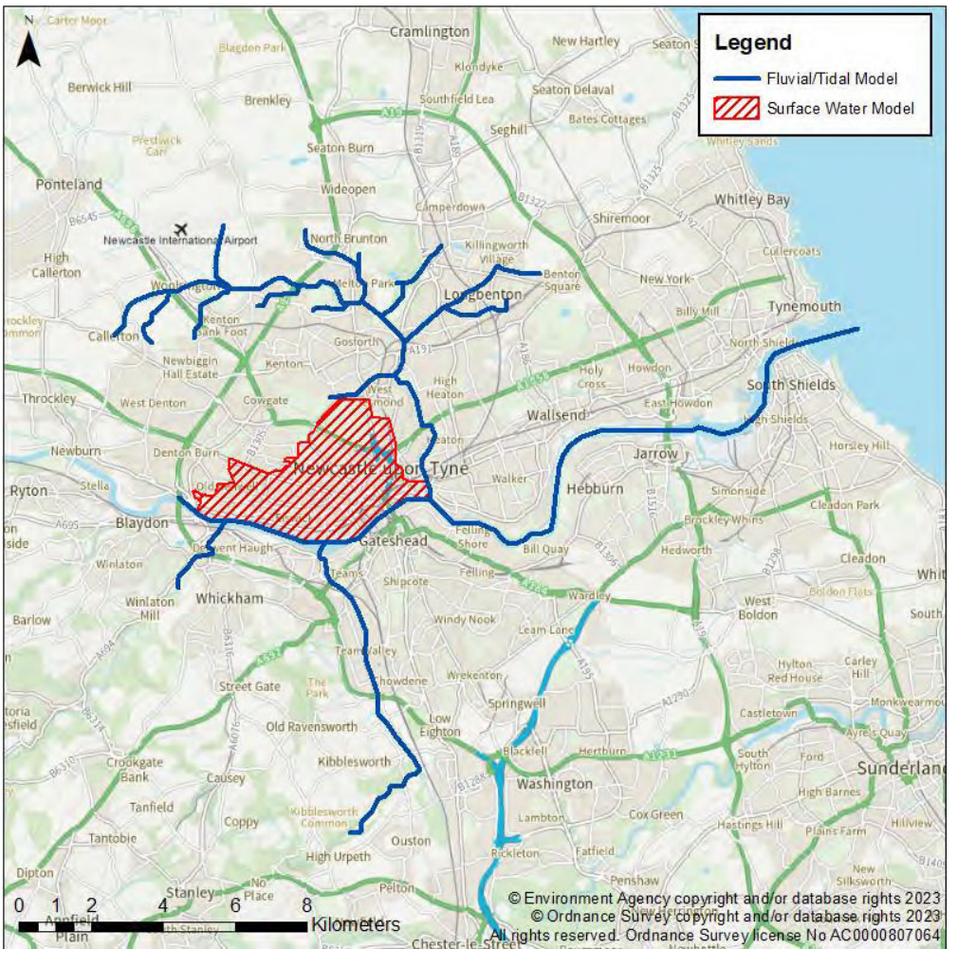

Figure 1. Existing model extents

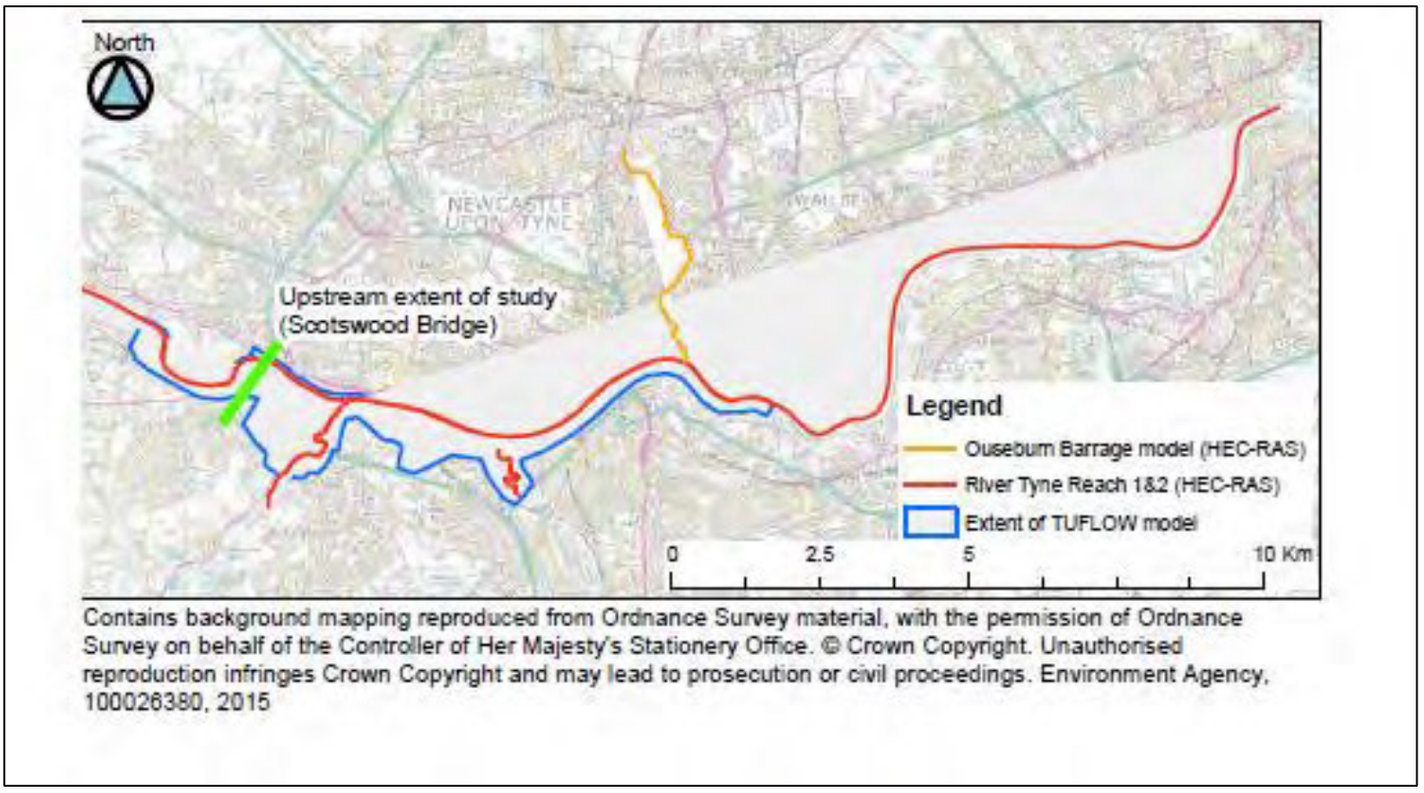

Figure 2. Existing model extents from Scotswood Bridge to Tynemouth

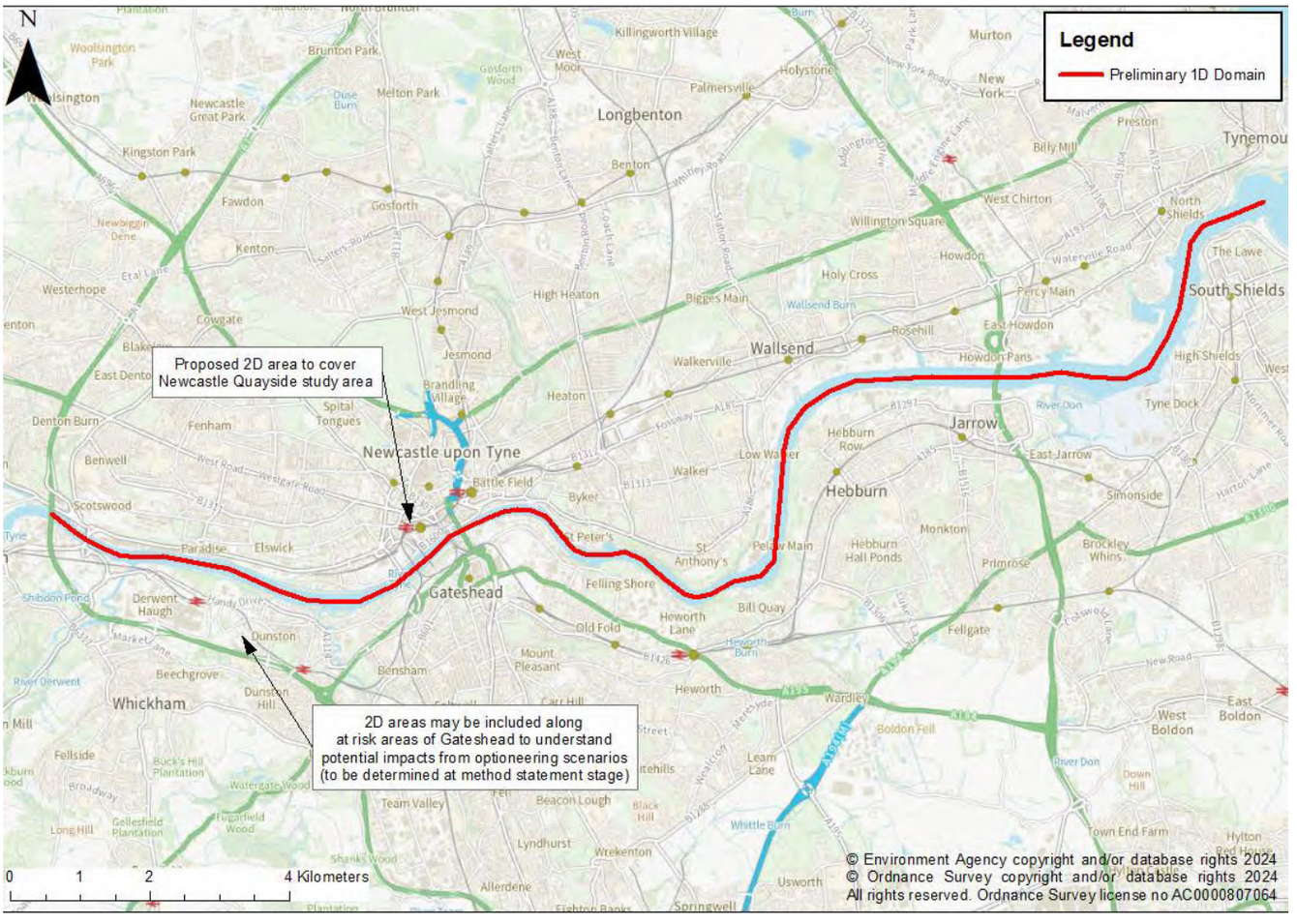

Figure 3. Preliminary study area for purpose of quotation (final study area to be determined at method statement stage)

1: Hydraulic Model Review

Hydraulic model reviews have been completed as part of Stage 1 of this study on the following models:

1. 2004 Tyne HEC-RAS Model - Flood Risk Study of the tidal reach of the River Tyne and lower reach of River Derwent
2. 2006 HEC-RAS Model - Pre-Feasibility Study. Re-used the 2004 model with new tidal boundaries.
3. 2008 Ouseburn Barrage HEC-RAS Model
4. 2014/2015 ISIS-TUFLOW Model - NDT WEM Mapping Tidal Tyne Study. This was an update to the SRFA 2014 study, which undertook a high level assessment of tidal flood risk to the right bank of the River Tyne and the Rivers Derwent and Team.
5. 2017 ICM Model - Newcastle City Centre Surface Water Strategy Model

Recommendations have been used to inform this scope. Relevant recommendations from the below reviews should be captured as part of the modelling methodology. Please refer to the following documents:

1. 273424-14_NewcastleQuay_incomingModelReview_HecRAS_v1
2. 273424-14_NewcastleQuay_incomingModelReview_ISIS_TUFLOW_v1
3. Non-real time Hydraulic Model Review Template_Ver2_V.. (ICM Model review)
4. 273424-14_NewcastleQuay_incomingModelReview_Extreme Sea Level Report review

Following discussions both internally within the Environment Agency and as part of the scoping phase, it has been determined that a new hydraulic model covering the Quayside should be produced as part of this study. The new model may use information from the historical models where appropriate.

2: Hydrological Model & Tidal / Coastal Boundary Review

A review was carried out by the *Consultant* as part of Stage 1 of this study. Recommendations have been used to inform this scope. Relevant recommendations from the below reviews should be captured as part of the modelling methodology. Please refer to the following documents:

1. 273424-14_NewcastleQuay_incomingModelReview_HecRAS_v1
2. 273424-14_NewcastleQuay_incomingModelReview_ISIS_TUFLOW_v1
3. Non-real time Hydraulic Model Review Template_Ver2_V.. (ICM Model review)
4. 273424-14_NewcastleQuay_incomingModelReview_Extreme Sea Level Report review

3: Local Flood History

The *Consultant* shall produce a written commentary in the Interim Hydrology Report or Hydrology Review Report to document local flood history analysis. The commentary shall consider the following:

3.1	Ranking and severity / probability of events.
3.2	Likely causal mechanism of flooding (including combined sources).
3.3	The *Consultant* shall collect and evaluate data from the *Client*.
3.4	The *Consultant* shall evaluate data from social media and any other potential sources of information. Data will be provided by the Environment Agency.

4: Site Visit and Topographic Survey

The *Consultant* shall:

4.1	Visit the site to understand the local flood flow pathways and flood history. The *Client* will facilitate this visit / these visits and arrange for appropriate staff to accompany the *Consultant* to provide local knowledge. The *Consultant* shall give the *Client* 14 working days' notice prior to any required visits, however site visits should not be duplicated across the different elements of this project where possible.
4.2	The Port of Tyne are due to carry out a bathymetric survey of the River Tyne from the A1 Road Bridge to Bill Point, which will be shared with the Environment Agency. It is anticipated that a combination of this survey, other historical surveys and information from the historical modelling projects can be used as the basis for representing channel geometry for the River Tyne. The *Consultant* shall review the existing supplied topographic survey (listed in the Project Specific Data section) and latest LiDAR data, and specify whether additional survey data will be required for the study. If so, the *Consultant* shall provide the survey scope in accordance with the *Client's* standard survey specification (LIT 18749 - National standard technical specifications for surveying services) and provide to the *Client* for review. On acceptance of the scope by the *Client*, the *Consultant* will procure and manage the acquisition of new surveys (the fee must be agreed with the *Client).* It should be noted that the Environment Agency has access to an Arc boat which could potentially be used to survey bathymetry for the Tyne. This may help to streamline collection of any additional bathymetric data for the River Tyne. The following locations and survey types shall be considered:
	Project Specific Requirements
4.3	A review of cross sections has been carried out with some minor points raised. Geometry at TYN01_15511 is unusual - represents the in-channel island for the Swing Bridge. As the model geometry is interpolated between 15420 and 15019 (adjacent to Newcastle Quayside), it is recommended that an additional cross section is considered at the downstream of the island to represent the channel geometry without the island (if this cannot be represented using data from the bathymetric survey).
4.4	Where additional cross sections are required, the *Consultant* shall undertake this sufficient to allow for in bank and floodplain modelling and determination of depths of flooding of properties within the flood plain. Spacing of the survey shall be determined to suit the hydraulic model and to address the issues raised. Consultation with the geomatics team is required.
4.5	Available building threshold survey data for the area has been collected over several different time periods and there are some concerns that this may be causing contradictions in the data. The *Consultant* shall review available threshold survey data and scope for additional survey should they deem it to be appropriate for the needs of the modelling.

5: Fluvial hydrological Assessment & Hydrometric Review

	Overview
	This section applies to the generation of fluvial hydrological boundaries to the Tyne Tidal model only. The generation of tidal boundaries is addressed in section 6 of this document and the generation of pluvial boundaries is addressed in section 12 of this document. Levels at Newcastle Quayside are expected to be dominated by tidal processes, however, the influence of fluvial hydrology on both peak levels and critical levels (e.g. over a threshold for free discharge from surface water outfalls) is unknown. Consequently, a two-stage approach to assessment of fluvial hydrology is proposed: a) ***Pragmatic***– initially adopting a pragmatic approach to fluvial hydrological assessment, and if shown to be significant then b) ***Analytical*** – adopting a more thorough analytical approach which will supersede the pragmatic approach.
	Pragmatic Approach
5.0.1	Initially a pragmatic approach has been agreed for the fluvial hydrological assessment. This work is presented to test the initial assumption that fluvial inputs are not significant and that tidal flows dominate at the Quayside. Influence of the tributaries is anticipated to be small. Flows are dominated by Bywell on the fluvial side of the Tyne. The assumption is that flow at Bywell will be taken as a surrogate for all fluvial inflows for use in the Joint Probability analysis. The file River Tyne Joint Probability FD2308 has been appended to this document which has been produced in order to derive tables of the fluvial/tidal combinations. The *Consultant* is to apply a minimum of 4 scenarios for three wide ranging return periods through the model to identify which combinations are dominant and what is the critical combination of flow and tide at Newcastle Quayside. Two of these combinations should represent the extremes of fluvial dominance versus tidal dominance. Combination pairings chosen should be recorded and confirmed with the *Client.* The *Consultant* should liaise with the *Client* should additional scenarios or return periods be useful to understand patterns of influence at critical levels. If tidal is found to be dominant, then tidal levels can be paired with fluvial QMED, and joint probability analysis between the pluvial short duration rainfall and tidal inputs will be assessed. If fluvial contributions are found to be marginal or significant based on this pragmatic approach, then further collaboration around following the analytical approach to the joint probability analysis using continuous simulation, is required between the *Consultant* and *Client.*

5.0.2	Undertake a light touch review of the existing available analysis and data commensurate with a pragmatic approach. The fluvial hydrology for the Bywell model was updated in 2020 as part of the Bywell, Ovingham and Prudhoe Flood Study (Sep 2020 report), referenced in the Project Specific Data section. The fluvial hydrology for the River Team is currently being updated by Arup as part of a separate study. This new data should be used if it is ready on time. The fluvial hydrology for the River Derwent was updated as part of the Gateshead Metro Green Modelling.
5.0.3	Derive appropriate flow hydrographs and apply in hydraulic model to test sensitivity of fluvial hydrology on Tyne levels at Newcastle Quayside. Summarise findings.
5.0.4	Liaise with *Client* to agree conclusions if fluvial is significant influence. If not continue with pragmatic approach and undertake joint probability between tidally dominated Tyne levels and pluvial flood frequency. If fluvial is significant, then undertake analytical approach.
5.0.5	Undertake light touch reporting as specified in section 5.1. below commensurate with a pragmatic approach – including method statement, draft and final fluvial hydrology reports.
	Reporting
5.1.1	Submit a Hydrology Method statement for acceptance by the *Client* before commencing the hydrological assessment and/or hydrometric review. This shall set out the proposed approach, review of hydrometric data, catchment schematisation, approach to joint probability and set out the methods and outputs.
5.1.2	Submit a Draft Hydrology Review Report to the *Client* for acceptance prior to the commencement of design simulations. This should include a note on the deliverables which will be received in the calibration phase of the study
5.1.3	Submit a Final Hydrology Review Report to the *Client* for acceptance.

	Analytical Approach

5.2.1	The analytical approach will be adopted if the pragmatic approach defined above indicates Tyne levels are sensitive to fluvial hydrology. Should this be the case, then the *Consultant* will undertake an analytical approach. This work is not required to be costed at this stage, but is likely to include the following: • Review data availability – including use of hydraulic models • Prepare and agree method statement with Environment Agency • Catchment understanding and schematization • Undertake assessment required to generate Tyne design levels incorporating fluvial influence • Undertake joint probability to define appropriate pairings of fluvially influenced Tyne levels and pluvial events. This will also be used to inform model boundaries. • Incorporate non stationarity • Produce draft report including deliverables • Submit a final report to the *Client* for acceptance If this work is required, a CE will need to be raised and further discussion with the *Client* to agree the hydrology details required.
	Phasing of inflows and downstream boundary
5.3	Inflow and downstream boundary phasing combinations shall be assessed to determine the critical phasing of tide vs hydrograph peak for the site of interest. The approach to this assessment will be undertaken using a level of detail commensurate with the pragmatic / analytical approach. The *Consultant* shall confirm the combination of phasing's tested, and the critical combination with the *Client* for agreement.
	Climate Change
5.4	A simple approach should be followed assuming that climate change does not change the probability of the events being more likely to occur together in future. It is therefore proposed by the National Evidence and Risk team not to assess dependence of variables with climate change, rather to assess dependence and then apply climate change uplifts individually to tidal and fluvial inputs to simplify the approach.

6: Tidal / Coastal Boundary Analysis

The *Consultant* shall produce a Coastal Boundaries Report to document the tidal boundary analysis. This shall include detail on the boundary data used for the models (State of the Nation, Coastal Flood Boundary (CFB), UKCP18): water levels, wave and wind conditions and respective data sources. This report shall be submitted to the *Client* for acceptance prior to the commencement of design simulations.

The *Consultant* shall derive tidal conditions for design probabilities at North Shields of: 50%, 20%, 10%, 5%, 3.3%, 2%, 1.33%, 1%, 0.5%, 0.1% AEP. As per the Minimum Technical Requirements for Modelling, tide curve generation should follow the CFB 2018 guidance when considering astronomical base tide and surge profile. Tidal estimates are to be updated in line with the latest CFB guidance. The *Consultant* shall agree with the *Client* the overlay of surge and tide with regards to the timing of the peak water level.

Climate change scenarios are required as part of this project to inform the design and economics. Please refer to Minimum Technical Requirements for Modelling for details of climate change requirements. The *Consultant* shall agree with the *Client* the climate change scenarios based on the Environment Agency publication 'Flood and coastal risk projects, schemes and strategies: climate change allowances' (Last updated 20 July 2021).

The UKCP18 RCP8.5 70th and 95th percentiles shall be applied to the Coastal Flood Boundary Extreme Sea Levels for both the 50 and 100 year epochs from the present day for climate change. These allowances should be applied throughout all stages of the project to maintain consistency.

Water levels from the CFB shall be updated from the year 2017 to the current baseline year using the more conservative 95th percentile allowance. Extrapolation beyond 2100 should be based on the 5 year average of the latest 5 years in the UKCP18 projection data. A comparison shall be carried out with the UKCP18 exploratory method beyond 2100. Climate change scenarios shall be applied to the 0.5% and 0.1% AEPs.

Wave-Overtopping analysis:

Overtopping of river banks / flood defences are to be based on extreme still water levels for the Appraisal stage. This is based on the initial assumption that flooding from overtopping of defences at the Quayside are dominated by still water considerations.

Nevertheless, wave conditions and wave overtopping shall be considered and tested with still water levels to understand significance of waves at the Quayside, at the Appraisal stage to inform later the Design stage. Where wave contributions are found to be marginal or significant, then further collaboration is required between the *Consultant* and the *Client*. Any additional work wil be raised as a CE.

EurOtop 2018 is the preferred method to estimate wave overtopping. The *Consultant* shall justify whether the EurOtop empirical formulae or Artificial Neural Network are to be used. Wave conditions for wave overtopping calculations shall be based on an assessment of extreme (fetch limited) wave heights and a joint probability analysis between wind speed (as proxy for wave height) and water levels. Wave overtopping calulcations shall be supplied as an output by the *Consultant*.

Climate change allowances should be applied for both wind and waves (separately) following the allowances as per the latest Environment Agency guidance. The results from each should be compared, and the worst case/most conservative taken forward**.**

Extreme (fetch limited) wave heights:

The Yarde (1996) method used previously in the the 2009 PAR Extreme Sea Level Report to derive extreme wave height is considered appropriate. However, input wind speed for this method should be updated based on analysis of the SoN (State of the Nation) dataset. The SoN wind data can be ranked to establish AEP for each wind sector, and the design wind speeds can be used as input into the Yarde method calculations. Using the event data within direction sectors is likely to result in an underestimate of wave heights due to the reduction in the dataset overall and therefore a conservative assumption on the direction sectors should be made, to be agreed with the *Client*.

The nearest relevant hindcast point is 8km from Newcastle Quayside however it is considered adequate for use in this project. This provides an update to the method based on best practice and latest data.

The Yarde method assumes water depth is not a limiting factor in wave generation and wave growth. Depth limitation for wave height results shall be checked.

Joint probability of wind speed (proxy for wave height) and still water level:

A simple method to combine wave heights and water levels to estimate minimum flood defence levels was followed for the 2009 PAR Extreme Sea Level Report.

Wind speed shall be used as a proxy for wave height i.e. 0.5% AEP wind speed will generate a 0.5% AEP wave height.

The current guidance for joint probability between wind speed and water levels is FD2308. Whilst updated guidance around joint probability analysis (updated FD2308 guidance) will not be available in the near future, it is current best practice to use the SoN data to assess the joint probabilities of wind and still water. SoN data are considered the better and more recent source of data over than FD2308 correlation values. The SoN dataset represents 10,000 years of events. Dependence and marginal analysis has been completed for the SoN dataset and this is considered an improvement on previously available information in FD2308.

The 10,000 year datasets do not need to be run to derive wave overtopping, rather the existing dataset should be used to identify a selection of wind and water level combinations to derive wave conditions for any wave overtopping assessment.

7: Model Proving, Calibration and Verification & Sensitivity	
7.1	The *Consultant* shall provide written interpretation of results, including impact on model calibration/proving, design configuration, onset of flooding, standard of protection and recommendations for prioritisation of maintenance. Standard clause 9.1: Calibrate the through simulation of up to 3 events and verify performance through simulation of up to a further 2 events. Inflows shall be generated using observed rainfall and flow data and the *Consultant* is expected to select events to maximize available information. Variation in antecedent conditions between events must be explicitly computed. Events for calibration should include, but not be limited to the Tidal surge event of 2013 and more recent tidal events where flows have come out of bank at the HARD Rock Café. Suitability of data to calibrate the model should be assessed by the *Consultant* and confirmed with the *Client.* The standard should be a target peak level fit of ± 150 mm at all gauged locations, with replication of overall hydrograph shape. Coastal models must be calibrated using available tide gauges and wave buoys. Variance between the observed and modelled hydrographs shall be presented to the *Client* at a face-to-face calibration review meeting along with draft flood outlines for any out of bank calibration events. The *Client's* acceptance of the calibration is required before progression to design event simulation. The *Consultant* shall provide the deliverables as noted in the Interim Hydrology Report (see 5.1.3) to the *Client* for review and sign off.
7.2	Standard clause 9.4: Sensitivity analysis shall be undertaken for the 0.5% AEP or AEP closest to bank top level (where the 0.5% AEP event is in bank). Sensitivity analysis shall be submitted to the *Client* for acceptance and at a minimum shall comprise the following: • ± 20% flows • ± 20% roughness coefficients for the inundation model • Greater and smaller grid cell size than the proposed grid cell size • Water level using the upper bound confidence interval from the Coastal Flood Boundary data • Wave overtopping defense schematisation parameters. This is for information only at Appraisal stage to provide an understanding of what geometry parameters should be considered in more detail during the Design stage
7.3	Standard clause 9.7: The *Consultant* shall undertake as part of model proving/calibration:
7.3.1	Standard clause 9.7.3: Simulations to determine sensitivity to operation of structures, such as flap valves. These simulations will be confirmed as part of the modelling method statement stage. For the purposes of pricing, please include for up to three such simulations. If these are not identified to be required through the course of the project, the fee can be changed at a later stage in the project.

7.3.2	Standard clause 9.7.4: Simulations to determine sensitivity to initial conditions. For the purposes of pricing, please include for up to three such simulations. If these are not identified to be required through the course of the project, the fee can be changed at a later stage in the project.

8: Design Simulations & Results

	All scenarios listed below must be delivered for defended scenarios: River Tyne and surface water hazard scenarios are modelled with the flood defence system scenario of defended, no failure by breaching. Scenarios: River Tyne (no permanent defences exist): 50%, 20%, 10%, 5%, 3.3%, 2%, 1.33%, 1%, 0.5%, 0.1% - for now price to include runs for fluvial dominated events, tidal dominated events and combined (fluvial and tidal) events. Results from the joint probability event may show that all three sets of runs are not required. If this is the case, adjustments to fee will be agreed at a later date. Please refer to Minimum Technical Requirements for Modelling for details of climate change requirements.
	The *Consultant* shall provide written commentary on the %AEP of onset of flooding, standard of protection, receptors impacted and suitability of fit with the anecdotal historic evidence of flooding. Limitations with historical evidence results shall be clearly identified in the conclusions and further recommendations shall be given if appropriate (e.g. state where new telemetry gauges shall be installed, where new survey / LiDAR would improve model accuracy etc). This commentary is to be included within the draft and final Model Report.
	In addition, the *Consultant* shall:
8.1	Standard clause 10.7: Produce a table of the number of residential, critical infrastructure and other non-residential properties within all defended and defence removed or no defences exist and blockage %AEP outlines referring to the flood level at the nearest river gauge(s) – if applicable.

9: Flood Warning Improvements

	The *Consultant* shall deliver the following services in accordance with the guidance as referred to within the latest version of the Minimum Technical Requirements for Modelling document. The following services are anticipated following receipt of the improved flood outlines, but allowance shall be made by the *Consultant* for liaising with the Flood Resilience team for specific guidance on the process and at key points:

9.1	To be completed as part of as built works post scheme or at the point the project finishes if this does not result in a scheme. Review the existing Flood Alert Area(s) and / or Flood Warning Areas extent(s) in comparison with the updated modelled outputs and advise whether modifications are required to the extent(s). Review the first impacts (out of bank), first property to flood and trigger thresholds using the updated and accepted flood maps / levels. There is / are 1 existing Flood Alert Area(s) and 1 existing Flood Warning Area(s).
9.1.1	Standard clause 11.1.1: Update the existing Flood Alert Areas and / or Flood Warning Areas extents based on the updated modelled outputs (defences removed / no defences exist 0.1% AEP plus historic flood extents, where appropriate) following the *Client's* acceptance of recommended modifications from 9.1 and provide revised extents.
9.1.2	Standard clause 11.4: Deliver an Excel spreadsheet which includes %AEP, land use types, risk category assigned and number of commercial / residential properties for each FWFRA. Information on suggested FWAs shall include names of FWFRAs aggregated to make the FWA, highest AEP, total number of properties, breakdown of commercial and residential properties, vulnerable receptors (utilities, hospitals, care homes etc.) and overall assigned risk category.
9.1.3	Standard clause 11.5: Produce a flood extent shapefile with associated level at Flood Warning gauge for the existing Flood Warning Area Outlines are required for each simulated (with defences) %AEP between onset of flooding and the Extreme Flood Outline. Submit the proposal for the Client's acceptance whether onset of flooding is first property to flood, first impacts or overtopping of defences.
9.1.4	Standard clause 11.6: Produce a flood hazard shapefile with associated level at the Flood Warning gauge for the existing Flood Warning Area. Outlines are required for each simulated (with defences) % AEP between the onset of flooding and the Extreme Flood Outline. Submit the proposal for the Client's acceptance whether onset of flooding is first property to flood, first impacts or overtopping of defences.
9.1.5	Standard clause 11.7: Review the data quality of the gauge sites in the study area and provide a detailed recommendation for the gauges to be used in level-level correlation for each FWA.
9.1.6	Standard clause 11.8: Produce level-level correlation between the onset of flooding location and Flood Warning Gauge Site for each Flood Warning Area. Determine the frequency at which the trigger level will be exceeded. Mane recommendations for improvements, explaining the benefits.
9.1.7	Standard clause 11.9: Produce travel time between the onset of flooding location and Flood Warning Gauge Site based on model results and verify these results through comparison with the available hydrometric data.

10: Produce New Hydraulic Model

10.1	The *Consultant* shall submit a method statement for acceptance based on the scope requirements and recommendations identified in the ARUP reviews undertaken in 2020 (noted in Section 1), prior to modelling activity, providing clear recommendations on required activities to build a new model in line with the Environment Agency hydrology and modelling guidance. The modelling approach should be submitted to the *Client* for acceptance before model build commences. The approach will be based upon the review documents carried out by Arup in Section 1. Following acceptance of the method statement, a draft modelling and hydrology report, and draft deliverables should be provided for the *Client* to review. A three-week review period is required by the *Client* for baseline model review. Milestones for frequency of model review should be agreed with the *Client'*s Evidence and Risk team following modelling software acceptance.
10.2	**A new model will be developed** using the most up-to-date topographic/bathymetric survey and remote sensing data available at the time of baseline model development. This will be carried out in preference to updating one of the older models. The model will need to include the study Quayside area in the left bank 2D domain. A preliminary 1D domain for the model is to represent the River Tyne between the A1 Road Bridge to North Shield. Although the quotation should be carried out on the basis that this will be the 1D study area, the 1D study area may be refined at the method statement stage. At the Options stage of the project, the model needs to be able to assess the impact on the South Bank at Gateshead from Flood Alleviation scheme options.
10.3	In 2008, due to the limited data set available, a conservative approach was adopted where the growth trend line between North Shields and St Omar was set to 0.4m, i.e., the maximum recorded difference between peak tide levels at North Shields and St Omers. A uniform gradient rise along the River Tyne from North Shields to the confluence with the River Team was assumed as part of this simple analysis. Data is available at St Omers from 2003 and North Shields from 1992. Since the analysis undertaken in 2008, there are now 15 years more data. The *Client* has further analysed the funneling effect at Newcastle Quayside using data for these two gauges up to 2017 as well as the peak value difference or the 2013 event, identified in the Newcastle Quayside Data Summary Jan 2022 document referenced in the Project Specific Data section. Further analysis is required between St Omers Gauge and Newcastle Quayside to include all data available up to present day to update the growth trend line.
10.4	Model outputs shall be suitably processed to meet the Minimum Technical requirements subject to the provisions of Section 13 of this document. The appropriate amount of time should be accounted for within the programme where additional processing of outputs is required. Flood zone mapping outputs should not include data relating to sources of flooding other than fluvial or tidal. Therefore, pluvial input shall be removed from flood zone mapping.

10.6	Data gap analysis shall be undertaken at the appraisal stage and shall be captured within the baseline model reporting. Uncertainties should be registered and recorded alongside the modelling to inform the Residual Uncertainty Allowance calculations for the design stage.

11: Options Appraisal: *Not to be priced at this stage*

12: Surface Water- Update Existing Hydraulic Model(s): *Not to be priced at this stage*

13: Delivery of Minimum Technical Requirements

The proposed approach to this project is for the fluvial tidal model to provide a downstream boundary information to the ICM model of the quays. In line with technical modelling requirements, results from the fluvial/tidal scenarios should not include the effects of surface water flooding. It is anticipated that results will be required for fluvial/tidal modelling only, surface water modelling only and for the combined effects.

The MTR's, which do not consider such a context, and were not written with appraisal in mind would, if applied literally, result in duplication of effort and key deliverables, creating the very data inconsistencies that the chosen approach is intended to avoid. For clarity therefore, the table below lists how it is anticipated that the MTR's will be delivered.

As stated flood zone mapping outputs should not include data relating to sources of flooding other than fluvial or tidal. Therefore pluvial input shall be removed from flood zone mapping. Note that fluvial/tidal flood mapping and surface water flood mapping shall be priced separately.

If the *Consultant* is unclear with any of the requirements listed below, please can they discuss with the *Client* prior to commencement.

MTR Component	Fluvial / Tidal model
Fluvial Hydraulic Model tab	
All contents	Y
Surface Water Hydraulic Model tab	
All contents	N
Non Real Time Gen Spec tab	
Format of deliverables	Y
Version Control	Y
Model Deliverables Configuration	Y
Draft report	Y
Deliverables inventory	Y
Model Log	Y (EA to provide the model log of the previous model as starting basis for this)
Modelling Method Statement	Y
Model User Report	Y
Model Passport	Y (EA to provide model passport of the previous model)
Model Handover	Y
Model Deliverables A) Excel worksheet of peak in channel modelled level, flow + velocity	Y Note: this will provided for final outputs only of the baseline and with scheme defended and undefended scenarios.
Model Deliverables B) Total flow at all gauging stations	Y

MTR Component	Fluvial / Tidal model
Non Real Time Gen Spec tab (continued)	
Model Deliverables C) Separate shapefiles (of WL, flow, velocity) for all modelled probabilities and scenarios & D) Topologically processed flood extent shapefiles & E) Flood Zone mapping & F) Areas Benefitting	N Justification: The river model is effectively only being used as a boundary to the surface water model. Providing these shapefiles from both models would potentially result in overlapping and contradictory flood risk data.
Flood Resilience Deliverables	N Justification: Consistency with flood mapping approach
Gridded Data	Y
Model Calibration	Y
Flow Route Representation	Y (where relevant to the study area)
Flood and Reservoir Safety	N
Defences	Technique point: not a deliverable
Climate change	Y
RUA	Y, subject to the guidance of LIT 16921
Breach Analysis	N
Ratings	N (unless hydrology indicates rating review is necessary)
Animations	Y
MapEdit Data Output	Y
MDSF2	N
Model Coversheet	Y (EA to provide model coversheet of the previous model)
FCRM Metadata Spreadsheet	Y (EA to provide metadata spreadsheet of the previous model)
Hydrology	
All contents	Y
Topographic survey	
All contents	Y

Available Data - Treat as Site Information

All datasets supplied for the project must be returned to the *Client* upon project completion. Datasets returned should adopt the appropriate security marking, be password protected/encrypted in accordance with the latest government guidelines. Data that will be made available to the *Consultant* include:

Hydrometric data:

Station	Location	Type (Flow / Level / Rainfall, Wind, Wave Height / Direction)	Period of record	Time interval (15	Fluvial/Coastal	Known data quality issues
NORTH SHIELDS TIDAL 023999	NZ 35943 68245	Level	14/01/1992 - present	15 min	Coastal	Estimated data from start of the record to Jan 2009.
Gateshead St Omers Haugh 023047	NZ 23334 62376	Level	08/05/2003 - present	15 min	Fluvial - Site is in tidal reaches	Period of suspect data Feb 04 - July 04
ROWLANDS GILL 023007	NZ 16815 58094	Flow/Level	DMFs 1962 - present and 15 min 1982 - present	15 min and daily means	Fluvial	
Riding Mill 023023	NZ 02732 61950	Flow**/Level	01/02/1984 - present	15 min and daily means	Fluvial	**We only supply flow data up until approx. 1.7m due to lack of confidence in the flow data at mid-high levels. Above that level the flow drowns out the gauging weir and the rating does not account for the additional water outside the weir. Level data can be supplied across the full range.
BYWELL 023001	NZ 03913 61684	Flow/Level	DMFs 1956 - present and 15 min 01/01/1982 onwards	15 min and daily means	Fluvial	Not an issue just a thought - if modelling along the North Tyne and main Tyne data after 1982 is most suitable as it covers the period after Kielder was built and the river begins to be regulated whereas prior to Kielder the river followed a natural regime.

Asset data types:

The *Client* will provide an AIMS Database containing all asset details at the beginning of the project. Assets to be included are:

Types	Other details
3rd Party Assets	Quay walls

Flood history information:

Event Date	Location	Data Type	Other Details	Known data quality issues
16 Dec 2016	Newcastle Quayside	Flood Report		
5th Dec 2013	Newcastle Quayside (flood warning area 12FWT550)	Flood Report		
4pm 21 March 2015	Newcastle Quayside	Photographs/Aerial Photography	Taken from beneath the Swing bridge	
12th January 2005	Full Flood History data appended	Flood Report	East Coast surge of 1m caused over-topping at the Quayside around the Swing Bridge and Riverside Night club. Water was observed ponding beneath the low level bridge however only to a depth of one inch. Sandbags were deployed by Newcastle City Council.	
20th June 2012	Newcastle Data and online data to be provided	Photographs and video		
Misc	Misc	Misc	A full search of the EA archives will be carried out to determine if any additional information is available for flood events across the proposed study area.	

Project Specific Data:

Please list any relevant existing model reports / technical notes etc.
Tyne Investment Strategy model
2014s1684 NDT WEM Mapping Tidal Tyne FINAL Report v2.0 - 2015 Tyne Tidal JBA Model data and Report
Newcastle_Quayside_EPR_FINAL
2005s1331 - Quayside Pre-Feasibility Study Report(Final)
Newcastle_PAR_K_Flood Inundation Modelling - JBA - 2008 - Flood Modelling Report
Newcastle_PAR_K_Extreme Sea Level Report - 2008 - JBA
Extreme Tidal Levels at North Shields - modelled, CFB and UKCP18
Newcastle City Strategic Surface Water Management Plan - Jan 2006
EA ACCELERATED PROJECTS SPREADSHEET Newcastle Quayside_v2 - Aug 2020
273424-14_NewcastleQuay_incomingModelReview_ISIS_TUFLOW_v1 - Aug 2020
273424-14_NewcastleQuay_incomingModelReview_HecRAS_v1 - May 2020
273424-14_NewcastleQuay_incomingModelReview_Extreme Sea Level Report review_v1 - June 2020
Newcastle Quayside Pre-SOC - Modelling Methodology Technical Note - ARUP - February 2021

River Tyne Joint Probability FD2308
Tyne Estuary Flood Alert and Tyne Estuary at Newcastle Quayside, Low Walker, Lower Derwenthaugh Industrial Estate and Scotswood Flood Warning polygons
Tyne Tidal 1N PDF
Newcastle Quayside Data Summary Jan 2022
Bywell, Ovingham and Prudhoe Flood Study (Sep 2020 report)
Team Valley Integrated Flood Risk Study, November 2014 report
Topographic data (various years) including data collected in 2008 and 2009 as part of the Newcastle Quayside PAR (curtailed) and in 2022 (EA)
Quayside_Interceptor_As-Built_drawings (1 to 8) issued on Sharepoint
Port of Tyne are due to carry out a bathymetric study of the River Tyne from the Swing Bridge to Bill Point. The *client* will also liaise with the Port of Tyne authority to determine whether there are any other recent surveys that can be used for the study.
Requests will be made to local councils including Newcastle City Council, Gateshead Council, North Tyneside Council and South Tyneside Council for any additional information that can support the project.

Existing Model Summary - Fluvial and Tidal Hydraulic Model

Model name	Date	Length of modelled watercourse (km)	Hydraulic model type	Other Type	Description
Ouseburn Barrage HecRAS model	2008		1D		1D HecRAS model of the Ouseburn
Newcastle Quayside Pre-Fesasiblity Study HecRAS model	2006		1D		1D HecRAS of the River Tyne and lower reach of River Derwent
Tyne HecRAS model	2004		1D		1D HecRAS of the River Tyne and lower reach of River Derwent
Tidal Tyne ISIS TUFLOW	2015		1D-2D		The extent of the study is from Scotswood Bridge (NGR 419947, 563634) to Tynemouth (NGR 436479, 568339). The tidal part is 1D- 2D and it is also combined with 2 HECRAS fluvial models (2002 and 2011)
St Omars Haugh/River Team Updated Model	2019		1D-2D		ICM Modelling of the River Team has been carried out, most recently to understand flood risk along St Omars Haugh. Note that an ongoing project to update this model is currently underway, this may become available through the course of the Newcastle Quayside project.
Updated Ouseburn Model	2024		1D-2D		The EA's HEC-RAS model for the Ouseburn and its tributaries and may become available through the course of the Newcastle Quayside project.
Additional models for key tributaries	Misc.		Misc.		Additional models may be available for key tributaries located along the River Tyne if these are considered to be of use for the project. Please get in contract with the project contract for more details.