

## **Introduction**

The Department for Energy Security and Net Zero (DESNZ) is undertaking quality assurance (QA) of the National Zoning Model (NZM), which has been developed to support heat network zoning.

The NZM must pass QA clearance prior to the use of the NZM in support of heat network zoning policy.

Part of the quality assurance requires a review and scoring of the NZM codebase which is largely written in Clojure, a language in which the department does not have suitable in-house expertise.

This procurement seeks suitably qualified suppliers to support the QA process. This will be completed working in collaboration with a multidisciplinary team within an existing broader programme and with various suppliers and stakeholder groups.

An initial third-party review of the codebase has been conducted and used to inform this procurement.

## **Interaction with other NZM activity**

The NZM team consists of both DESNZ staff and external consultancy support as detailed in section 4 below. The Centre for Sustainable Energy have developed the NZM to date and will remain in contract as 'NZM developer' for the duration of this specification.

Additional requirements that are anticipated to be procured through lot 3 in 2024 are:

- Lot 3.2 Model management and data support – commencement July 2024
- Additional research / non-core development – commencement Summer 2024
- Future core development beyond current contracts – commencement Nov 2024

Suppliers are welcome to provide services to this and the above listed requirements, they would need to demonstrate in their response that they are able to sufficiently manage any potential conflict in relation to QA i.e. there should be sufficient separation between those developing the model and those fulfilling the role of a third-party QA.

## **Background to the Requirement**

### **Heat Network Zoning Policy**

Decarbonising heat is an integral part of the government's strategy and underpins the Net Zero Strategy, the Heat and Buildings Strategy and most recently, Powering Up Britain. This was affirmed in the Prime Minister's speech on 20 September 2023 where he set out the government's proportionate and pragmatic approach to net zero.

The Energy Act, which received Royal Assent in October 2023, establishes the regulatory framework for heat networks in Great Britain and grants the Secretary of State the powers to introduce heat network zoning in England through secondary legislation ("zoning regulations"). Our stated aim is to introduce Zoning by no later than 2025, and therefore this tender specification is written based on adhering to that timeframe.

The regulations will enable the government to create two new zoning bodies: the heat network zoning authority – shortened to “the Central Authority” – and Zone Coordinators. The regulations will describe the rules these zoning bodies must follow and their roles and responsibilities. The regulations will define how the zoning bodies will identify and designate heat network zones and specify any requirements about how decisions are to be made regarding what heat networks are built in a zone, where and by whom.

Act also includes powers to make regulations to set requirements that apply in zones. This includes:

- Which buildings can be required to connect to a heat network, and when and how such buildings may seek an exemption from this requirement.
- Which types of building in zones, such as new buildings, can be required to install communal heat networks.
- Requiring operators/owners of sources of heat to provide information, and/or to connect to a heat network.
- The rules around terms for supplying heat to a heat network, including prices.
- Introducing limits on greenhouse gas emissions from heat networks in zones.
- Specifying what data may be collected by the zoning bodies, and from whom, to support the identification and designation of heat network zones.
- Ongoing monitoring and reporting requirements.
- How the above requirements will be enforced and the appeals process.

The Department had undertaken two consultations on Heat Network Zoning, one in October 2021 and another ending in February 2024. We aim to publish our consultation response to the second consultation in Summer 2024. It is at this point that we expect the final policy positions to be known. Until this date, it is likely that some of the key requirements of the model functionality may evolve and/or change and therefore it's important that bidders understand that the National Zoning Model workstream will need to adapt to policy changes to ensure that the modelling remains consistent with the latest policy intent. Despite this we have a good understanding of the likely requirements that will be needed, the budget and the timeframes for delivery.

Alongside the development of the Heat Network Zoning Policy, DESNZ (then BEIS) trialled an initial approach to identifying zones as part of the City Decarbonisation Delivery Programme (CDDP). This adapted Centre for Sustainable Energy's THERMOS model to identify potential zones in six cities across England (Birmingham, Bristol, Greater Manchester, Leeds, Newcastle and Nottingham). Zoning was based on a data-driven viability assessment, with refinement from key strategic local stakeholders in each city. The previous tender sought to;

- enable a standardised approach for setting heat network zones that is robust, transparent and minimises duplication of effort;
- provide a consistent foundation for the use of national policy levers to support heat network development within designated zones;
- reduce the burden on local actors by virtue of following a standard approach as opposed to designing a new approach each time; and
- provide a common architecture which allows for the methodology to be updated as and when new assumptions, parameters, carbon targets or policies are introduced.

## Heat Network Zoning Transition Programme

The National Zoning Model is one of six interrelated workstreams that make up the Heat Network Zoning Transformation Programme (HNZTP). This programme aims to prepare for the introduction of heat network zoning in 2025. The programme consists of several workstreams, described below:

**Legislation:** Establish the HN Zoning Policy; with defined statutory roles & responsibilities that enable subsequent delivery of HNZs at desired scale and pace

**National HNZ Modelling:** Develop a robust HNZ identification model, and establish DESNZ capability to continually assure, support and operate the model

**Digital:** Develop an online digital service to provide HNZ information to stakeholders including the visualisation of the HNZ identification model outputs

**Routes to Market:** Develop standards routes to market for the zone delivery procurement/appointment approach by Zone Co-ordinators

**Advanced Zoning Programme:** Undertake development work to support delivery of at least 10 zonal scale HNs in 2025 aligned with the HN Zoning Policy

**Central Authority/Zone Co-ordinator:** Explore the capability of establishing a Central Authority/Zone Co-ordinators (including functions, responsibilities, roles & step-in powers)

The scope of the model is England, as heat policy is devolved. In previous programmes of work, the model outputs have been socialised and tested with 28 towns and cities that formed part of the Heat Network Zoning Pilot Programme (HNZPP) and with the Heat Network Industry Council (HeatNIC). The HNZPP developed a process to identify and refine heat network zones across a range of towns and cities, to support the development of the policy. Zones were identified using a previous iteration of the model to support the identification of where heat networks provide the lowest cost, low carbon solution to decarbonise heat.

The NZM outputs also support the identification of zones within the Advanced Zoning Programme (AZP). The programme is working with 19 cities across England to accelerate the delivery of zonal-scale heat networks as part of the Government's ambition to supply 20% of heat through heat networks by 2050 to enable the UK to reach net zero. The cities that are part of AZP have been identified as those which are further developed around their planning and thinking of heat network development and are ready to deliver at pace and scale. AZP is supporting the development of best practice guidance, providing project development support services, and promoting market transformation ready for national heat network zoning policy.

Additionally the outputs are being used to underpin other work within the Department such as the development of a potential Heat Networks Strategy and also inform an implementation strategy being developed by the Central Authority. DESNZ will manage the interactions between these programmes as part of this tender.

## NZM & Lifecycle of a Heat Network Zones

As set out in the second consultation, a heat network zone has several stages during which different bodies will carry out specific actions. The first stage of the zoning methodology is the identification of indicative heat network zones across England by the Central Authority. This will be carried out using the National Zoning Model. Therefore, it is essential that the Department has a fully Quality Assured MVP National Zoning Model for the policy launch date as it is the first stage in the process.

The second part of the zoning methodology is the refinement of the indicative heat network zones. Both the Central Authority and the relevant Zone Coordinator will review the outputs of the model to check for accuracy. Where appropriate, they will collect additional data to ensure that the indicative zones have been identified using the most accurate information.

The NZM is a data-led spatial energy model developed by the Centre for Sustainable Energy for DESNZ to identify indicative heat network zones across England. The NZM provides granular outputs which, when supplemented with local data, will identify areas that may be taken forward for refinement and, subsequently, designation as heat network zones.

The department has developed the NZM as part of the Heat Networks Zoning Pilot Programme, utilising a specialist team with experience in heat networks, software development and energy modelling, along with input from local authorities and the department's Heat Networks Delivery Unit. The model uses a range of data sources, processing, and optimisation to identify potential zones as shown below:

These stages in the model are described in more detail below:

**Data led mapping:** the model uses a range of data sources to construct a data-rich map of individual building heat demand, potential pipe routes, and geographical features that may act as hard boundaries.

**Lowest cost, low-carbon options evaluated:** the model evaluates the low-carbon options for each building – a low-carbon heat network and an individual building air source heat pump – by combining the mapped data with a standard set of assumptions about technology costs and performance.

The model uses an iterative optimisation algorithm to find the lowest cost combination of Air Source Heat Pumps and heat networks in an area, which subsequently identifies a suggested heating solution for each building. The model repeats the optimisation process using a range of scenarios for the price of heat provided to the distribution network – the “heat price scenarios” – and generates a range of solutions for each building. In later stages, the model will match heat demand to available heat sources to identify the largest potential heat network based on the cost of heat.

We know that many stakeholders will be interested in the outputs of the NZM. The model, and its outputs, will therefore need to be clearly communicated to a range of stakeholders, including local government, building developers and owners, to support local refinement

and designation. We will continue to refine the model and develop the underlying evidence to achieve this.

**Zone shapes produced:** The model discards areas that do not contain a network and combines adjoining areas in the same price scenario to create “zone shapes”.

**Candidate zones produced:** The model connects every zone shape to a heat source provided to the model if the cost of heat from the source is lower than the heat price scenario. This creates many instances which could become zones, called “candidate zones”.

**Indicative zones selected:** Candidate zones may overlap or compete for a single heat source. The model sorts all candidate zones by size and by economic potential. It selects the top configuration as the first indicative heat network zone and removes any other candidate zones which compete for a heat source or overlap spatially. This process continues for the next largest zone until all candidate zones have been selected or discarded.

### Current Model

The National Zoning Model has been primarily developed by the Centre for Sustainable Energy. The purpose of the model is to support the initial identification of heat network zones. The model is highly parameterised and flexible: what a zone is, and what properties a zone must have, depend on what values entered for parameters.

The NZM contains the following 8 main modules:

1. **Dig categorisation model:** assigns each road a classification for use in the optimiser
2. **Heat demand model:** prepares building-level demand data for the optimiser
3. **Region mapping module:** produces region polygons that can be joined to form larger shapes for the zoner
4. **Clustering:** partitions buildings into clusters by road network distance, to create computationally tractable optimisation problems.
5. **Distribution network optimisation:** use MILP identify a minimised present cost of heating for all the buildings in a cluster
6. **Zone shape production module:** creates candidate zone shapes based on outputs of region mapping and optimisation
7. **Zone cost model:** evaluates zones financially, turning candidate zone shapes into candidate zones
8. **Zone selection model:** selects a non-competing set of zones from the candidate zones

### NZM team structure

The NZM team consists of both DESNZ staff and external consultancy support. The Centre for Sustainable Energy have developed the NZM to date and will remain in contract as ‘NZM developer’ for the duration of this work. Chris Small is the National Zoning Model workstream lead.

Mark Howard is the National Zoning Model day-to-day lead.

The successful supplier would report into the DESNZ workstream lead and be expected to collaborate with other suppliers supporting the workstream.

### **Scope and Requirement**

The scope of this requirement includes:

- Assess and score the underlying NZM codebase against Departmental QA guidance.
- Where required, work with the software developer and client to iteratively improve the model's score such that it can pass the relevant threshold within the timeframe.

This is the main focus of the NZM workstream for the duration of the contract, and as such the demand for services is expected to remain relatively constant over this period (August – November 2024)

The successful supplier will be provided with sufficient access to the model codebase to enable the work to be completed.

As the NZM is still undergoing development, it is expected that this access will be to a static version of the codebase. However, the successful supplier may wish have access to the in-development codebase to allow ongoing QA and ease the delivery of objective 3.

### **1. Assess and score the NZM against the Departmental Quality Assurance Log for all relevant task codes**

**Key Deliverable:** *A completed Departmental QA Log with an overall QA score*

1.1 Conduct a review of the NZM codebase, which is predominantly written in Clojure and currently extends to approximately 60,000 lines of code, although it is worth noting that not all lines of code are of equal length. This review should be undertaken against the guidelines for Departmental Quality Assurance and should cover:

- **Structure and Clarity**
  - S1: Project structure
  - S2: Model structure
  - S3: Code consistency and convention
  - S4: Code clarity & robustness
  - S5: Inputs and outputs clarity
  - S6: Results visualisation
- **Verification**
  - Ve1: Data transfer, cleaning and transformation
  - Ve3: Code correctness and information testing
  - Ve4: Regression testing
  - Ve5: Automated and unit testing

\*Note that Ve2 has been intentionally excluded.

1.2 A discovery activity was conducted by a third party in Q1 2024 to support the development of this specification. The discovery included a review of 20,000 lines of code against S3 (Code Consistency and Convention) and delivery of initial

scoring based on the areas reviewed. If these areas are representative of the model, then the scoring would be sufficient for the NZM to achieve QA clearance.

1.3 The discovery provided a useful evidence base for the department to specify the extent and nature of code review required. Depending on the criteria, suppliers may wish to read code, verify existing automated tests, write a series of automated tests, or verify the behaviour of code against known/expected outcomes. It is anticipated that suppliers would use a mix of approaches and varied depth of review, depending on the criticality of the model component to the overall NZM functionality and the QA criteria.

1.4 We have attached the report from the QA Discovery phase for transparency. Please note that after this draft being completed, DESNZ has discussions with both the supplier, and internally with our modelling integrity team, and verbally agreed that it is likely that the QA could be completed in significantly less time than 20 weeks quoted in this report. This is because we do not require a full line-by-line review, and we do not want usability to be Quality Assured as part of this contract, this will significantly reduce those timescales to the ones listed within this ITT. Please note that the report also flags issues that we believe to be slightly trivial (such as short-hand notation 'it's grim but it works' and 'it's a bit of a dog-leg') but conversely this may reflect that the review was relatively positive, if these were deemed to be key items within the report.

1.5 The expected outcome is that the supplier presents scoring and supporting justification for the relevant task codes in the QA log to the NZM team.

## **2. Provide specific guidance to the NZM developer to improve on scores, for any circumstance where it does not meet threshold required**

2.1 Provide specific and actionable feedback and guidance to the NZM developer on how to improve the scores and enhance the quality assurance score. If there are instances where this is challenging, the supplier may wish to take a collaborative approach to support any recommendations.

2.2 Monitor the progress of the NZM developer and evaluate the impact of the feedback on the scores before reassessment

2.3 Report the results and recommendations to the client and highlight risks where it is felt that QA is unlikely to be achieved within the timeframe

2.4 The expected outcome is a set of clear and specific recommendations for improvement tied to each task code within the QA log, where scores are not sufficient.

## **3. Reassess changes to the codebase (including any additional development conducted in parallel to the QA period) and re-score.**

- 3.1 Review the updated NZM codebase, to evaluate the impact of changes on the code quality and functionality, using the same criteria and metrics as the initial assessment and score as per objective 1)
- 3.2 Re-score the NZM based on the revised code quality and functionality and re-submit an updated Departmental QA Log with an overall QA score.
- 3.3 The supplier will be expected to review changes made in response to objective 2, as well as any parallel development carried out on the model following initiation of QA. For example, the initial review and delivery of objective 1 may be carried out on 'V0' of the NZM. Where development has been carried out in addition to responses to objective 2, objective 3 should be delivered against an updated 'V1' of the NZM.
- 3.4 The expected outcome is that the supplier presents updated scoring and supporting justification for the relevant task codes in the QA log to the NZM team.

**4. Provide a summary report of the completed work, sufficient to support the relevant section of the [model report](#) and [QA clearance statement](#)**

- 4.1 Upon completion of objective 3, the supplier should provide a brief report summarising the work completed sufficient to support the relevant section of the [model report](#) and [QA clearance statement](#).
- 4.2 The QA Clearance Statement shall provide recommendation with supporting explanation to the Commissioner or Approver on the overall fitness for purpose of the NZM. This should make clear any important outstanding risks and issues raised through the review process.

**5. Communication, meetings and reporting**

Communication is expected to be conducted with the client predominantly via email and teams calls. The NZM developer runs a Github ticketing system to track issues and plan sprints, it is likely that the successful supplier will communicate technical detail, particularly in relation to objective 2 by this means.

The following teams calls are anticipated:

- Kick-off with NZM team
- Weekly teams call with DESNZ lead
- Calls as required with the NZM developer
- Objective 1 delivery call
- Objective 2 either as call or written
- Objective 3 delivery call
- Objective 4 delivery call
- Closedown call



The objectives are not necessarily expected to be *fully* met in sequence, i.e. it is likely most practical and preferable for streamlined delivery that outcomes from objective 1 and 2 will be delivered by task code, rather than as a complete work package.

### **Aims and Objectives**

The overarching aim of the work is to achieve Departmental Quality Assurance of the NZM to ensure that the model meets the specified requirements for use by December 2024. The aim of this contract is to follow the Departmental QA guidance firstly assess and score the underlying NZM codebase, and work with the software developer and client to iteratively improve the model's score such that it can pass the relevant threshold within the timeframe.

The NZM must pass departmental quality assurance processes to ensure that it is sufficiently robust to support zoning in England. Effective Quality Assurance (QA) ensures that decisions are made with an appropriate understanding of evidence and risks, and helps analysts ensure the integrity of the analytical output.

Within DESNZ, we have a range of tools and guidance to help people with Quality Assurance of analytical models. We use this guidance to ensure that models have been proportionately quality assured, with supporting documentation and evidence to demonstrate that. Full details including relevant templates and guides on QA can be found at: <https://www.gov.uk/government/publications/energy-security-and-net-zero-modelling-quality-assurance-qa-tools-and-guidance>

The NZM is currently entering the final phase of 'Design & Build', with a key workstream milestone of achieving sign off by end November 2024.

Details of the departmental QA processes and tools are published at <https://www.gov.uk/government/publications/energy-security-and-net-zero-modelling-quality-assurance-qa-tools-and-guidance>

The supplier will need to meet some general expectations as part of this lot, including:

- Suppliers must be flexible and adaptable to changes to DESNZ requirements – including resourcing types or capabilities as the needs of the workstream or project changes. These changes will be made in discussion and written agreement with DESNZ as they occur.
- Suppliers will need to work collaboratively across suppliers, DESNZ, key stakeholders both within the NZM workstream, wider project, and wider departmental ecosystem.
- It would be advantageous for suppliers to have knowledge or experience in heat network zoning.
- To minimise disruption and impact on delivery timeframes, suppliers will be expected to adapt delivery approaches to work within the existing project structures, methodologies and dynamics as much as possible.

To meet the aims of this procurement the supplier would need to deliver on the objectives outlined below.

1. Assess and score the NZM against the Departmental Quality Assurance Log for all relevant task codes:

- Structure and Clarity
  - S1: Project structure
  - S2: Model structure
  - S3: Code consistency and convention
  - S4: Code clarity & robustness
  - S5: Inputs and outputs clarity
  - S6: Results visualisation
- Verification
  - Ve1: Data transfer, cleaning and transformation
  - Ve3: Code correctness and information testing
  - Ve4: Regression testing
  - Ve5: Automated and unit testing

\*Note that Ve2 has been intentionally excluded.

2. Provide specific guidance to the NZM developer to improve on scores, for any circumstance where it does not meet threshold required
3. Reassess changes to the codebase (including any additional development conducted in parallel to the QA period) and re-score.
4. Provide a summary report of the completed work, sufficient to support the relevant section of the [model report](#) and [QA clearance statement](#)

The objectives are not necessarily expected to be *fully* met in sequence, i.e. it is likely most practical and preferable for streamlined delivery that outcomes from objective 1 and 2 will be delivered by task code, rather than as a complete work package.

There are a number of HNZTP programmatic dependencies upon the NZM workstream, as such this work must be strictly delivered to timetable.

Key milestones are:

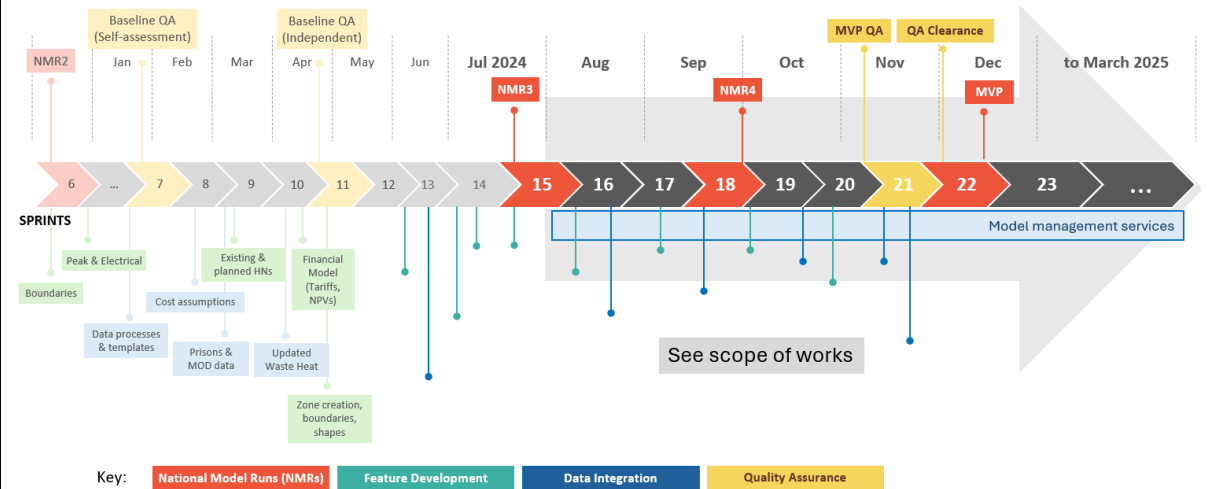
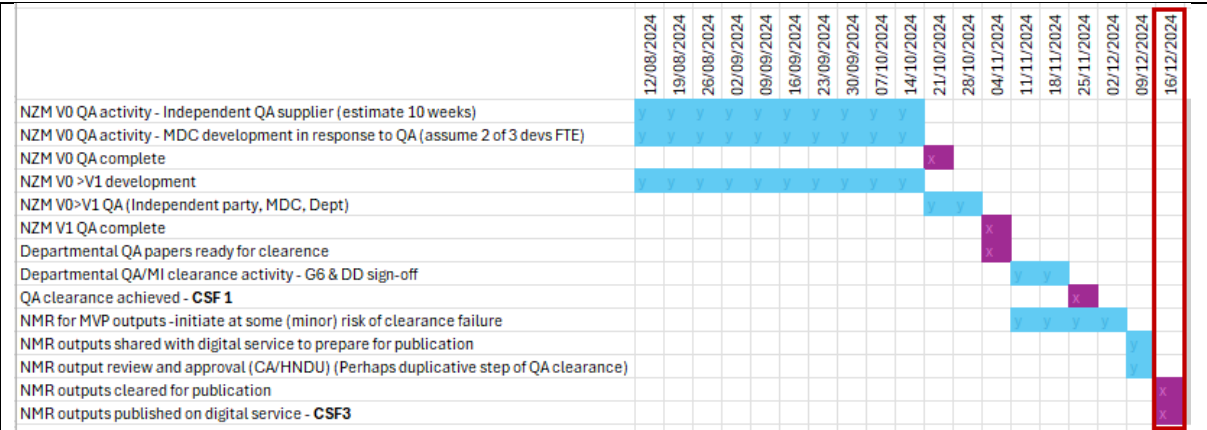
Supplier appointment and kick off – w/c 5<sup>th</sup> August 2024

Objectives 1 & 2 complete – w/c 16<sup>th</sup> September 2024 – this assumes a waterfall approach to delivery, leaving the developer 4 weeks to respond to review. If the supplier adopts an approach that delivers against Objectives 1 & 2 against sections of code (preferred approach) then this milestone could be pushed back to 14<sup>th</sup> October 2024

Objective 3 & 4 complete – w/c 4<sup>th</sup> November 2024

Closedown call – w/c 4<sup>th</sup> Nov 2024

Contract End Date 22<sup>nd</sup> November 2024 - with the option to extend for a further 1 month.



**Data Security & GDPR**

The supplier is required to implement appropriate arrangements for data security at all times. Such procedures must meet the General Data Protection Regulations and the Data Protection Act 2018.

Any successful supplier shall uphold the Framework level requirements in relation to Data Security and adhere to any data processing in alignment with Annex1 of the S3 – Services Purchasing Contract – Framework.

Processes should be in place to safeguard against data loss, including appropriate risk management procedures. The Department reserves the right to vary the contract to ensure compliance with DPA 2018.

**Budget**

The maximum budget for this project is £250,000 excluding VAT.

**Staff Grade Descriptions and Pricing**

Bidders must complete AW5.2 Price Schedule and provide day rates/number of days for completion of the project outputs in line with the job roles defined at Framework Level attached in Appendix B.

Bidders are to ensure that the day rates for each Staff Grade Description do not exceed the maximum rate defined at Framework Level.

By submitting a response, bidders confirm that the prices offered will remain open for acceptance for a minimum of 90 Working Days from the date of submission.

**Payments and Invoicing**

Payments will be linked to delivery of key milestones. The indicative milestones and phasing of payments is as below.

Payment will be made in 4 milestones:

Payment	Deliverable	Percentage of Payment
1	Objective 1 - Assess Codebase	25%
2	Objective 2 - Guidance Feedback	25%
3	Objective 3 - Reassess and Rescore	25%
4	Objective 4 – Summary Report	25%

Before payment can be considered, each invoice must include a detailed elemental breakdown of work completed and the associated costs.

The Department aims to pay all correctly submitted invoices as soon as possible with a target of 10 days from the date of receipt and within 30 days at the latest in line with standard terms and conditions of contract.

**Technical Scoring**

Any Bidder which receives a score of 60 or less in any of the following technical questions will not be considered for appointment:

PROJ1.1 - Methodology and Approach

PROJ1.2 - Project Plan and Timescales

PROJ1.3 - Ability to Deliver

**Terms & Conditions**

Bidders are to note that any requested modifications to the Contracting Authority Terms and Conditions on the grounds of statutory and legal matters only, shall be raised as a formal clarification during the permitted clarification period.

