



Scottish & Southern
Electricity Networks

SHE Transmission

New Suite of Transmission Structures: SSEN003 NeSTS

Project Progress Report

June 2019



1) Executive Summary

Overview of NeSTS

Scottish Hydro Electric Transmission plc (SHE Transmission) is developing a New Suite of Transmission Structures (NeSTS), which are planned to be deployed on the Transmission Network.

Overhead lines (OHLs) built using transmission structures are the most visible element of the transmission network. The impact OHLs have on the environment can cause stakeholders concern.

The only available alternative to the steel lattice structures traditionally used in OHL construction is the T-Pylon. Developed by National Grid, the T-Pylon reduces the visual impact of OHLs but may be unsuited to areas with challenging terrain and propensity for severe weather events.

Establishing new infrastructure in these areas is essential to connect renewable generation, so there is a need for a new type of structure to address stakeholder concern.

The NeSTS project is developing innovative designs for OHL structures based on new technologies and techniques. The new suite of structures will then be deployed on the transmission network.

The NeSTS Project seeks to prove the following benefits:

- Improved OHL environmental performance by lowering visual and construction impacts; and
- Lower OHL whole life asset costs via reduced land, construction, maintenance and outage requirements.

Progress within this Reporting Period

During this reporting period, the Project has focused on:

- Publishing the NeSTS Technical Specification;
- Engaging with stakeholders to review a NeSTS OHL design;
- Testing a cross arm and cross arm to pole joint at full scale;
- Completing review of the parallel design outputs;
- Completing the Decision Point / Review of Business Case stage gate; and
- Developing a type testing programme.

Ofgem approved SHE Transmission's recommendation to proceed to Stage 2 and the construction of a NeSTS OHL on 20 December 2018.

The NeSTS OHL will form part of the Aberarder wind farm connection project.

Tenders for the NeSTS OHL construction from prospective main contractors are being analysed now, and the contract is scheduled to be placed in Summer 2019.

The Project team is interfacing extensively with the Aberarder wind farm connection project team and its stakeholders.

1) Executive Summary

SDRC

The Project completed the delivery of its third SDRC, 11.3 Creation of Technical Specification, with a report submitted on 30 August 2018.

The Project completed the delivery of its fourth SDRC, 11.4 Decision Point / Review of business case, with a report recommending that the Project proceeded to construction of a NeSTS OHL submitted on 28 September 2018.

Ofgem approved this recommendation on 20 December 2018.

The next SDRC is 11.5 Type Testing Agreement; which is on schedule to be completed by 30 September 2019.

Risks

The main risks to the project are:

- That a supplier business could fail during the programme. Second sources are being contracted to mitigate this risk;
- That capacity for full scale testing of the NeSTS supports is not available to meet the programme. Procurement of testing capacity from second sources has commenced to mitigate this risk; and
- That there is a delay in connection of the NeSTS project due to site selection challenges or planning application issues. Consultees are being engaged to mitigate this risk.

Events

The Project has not hosted any events in this reporting period.

Communications

During this reporting period, Project information has been shared directly with stakeholders and published on the Project website.

Dissemination of Project learning has continued with the publication of the Creation of Technical Specification report on 30 August 2018, and the Stage Gate – Decision to Proceed report on 28 September 2018.

2) Project Manager's Report

Project Summary

A New Suite of Transmission Structures will be used to construct an overhead line in 2020.

The design of the structures has been driven by stakeholder requirements and their response to the results is positive.

The NeSTS design was used in a parallel design of an OHL to enable comparison with a conventional lattice steel design, and the results informed SHE Transmission's recommendation to proceed to construction of a NeSTS OHL in Stage 2 of the Project.

Ofgem approved this recommendation, and the Project is now refining and type approving the structures for construction as part of the Aberarder wind farm connection project.

The Project is managed via six work packages. An update on the progress made on each work package during this reporting period is provided below.

Project Management

The Project team and internal stakeholders are engaged and holding regular update meetings.

The Project Steering Group is engaged and holding bi-monthly meetings.

Consultee, supply chain, landowners, the public and transmission operator (TO) stakeholders are engaged and contributing to the Project.

The Project is now interfacing with the Aberarder wind farm project and its prospective main contractors.

During this period, contracts have been awarded for the supply of:

- OHL Support Design Optimisation;
- Full Scale test structure design;
- Full Scale testing;
- OHL Design;
- OHL Materials; and
- OHL Support Prototypes.

The Project is currently in the 'Refinement' stage.

Prototyping and Initial Testing

This work package is complete.

Prototype structures were installed at SHE Transmission premises in Fanellan and at Energyline premises in Copgrove in 2018.

A video summary of a prototype workshop held at Copgrove is available on the Project website (www.NeSTSproject.com).

2) Project Manager's Report

Parallel Design Process

This work package is complete.

Parallel designs of a proposed OHL were completed by a main contractor to enable comparison of NeSTS based design outputs with those of a conventional lattice steel L7c design.

3D visualisations allowing comparison of the NeSTS and L7c options are published on the Project website.

A design adoption work package was also completed, detailing the main contractor's scrutiny and endorsement of the NeSTS designs.

SHE Transmission used these to inform its recommendation to proceed to construct a NeSTS OHL.

Full Scale Testing

Test specifications have been developed and used to order the design of full scale structures and testing services.

A full scale cross arm and pole section were tested in July 2018 at a structure manufacturer's premises. The resulting design refinements have been embodied into the design of NeSTS structures.

Following subsequent design refinement, the Project's lead supplier of steel structures (and testing services) entered an insolvency process.

This has delayed the production of full scale test structures and has necessitated engaging alternative suppliers.

Alternative suppliers have been engaged. The Project intends to contract two sources of these services to mitigate against any further supply issues.

Full scale testing of whole supports and foundations is currently scheduled for Autumn 2019.

Planning, Construction and Monitoring Processes

A 3D model of the proposed NeSTS OHL has enabled consultation with affected communities, landowners, and consultee stakeholders.

Following design refinement based on full scale prototyping and cross arm testing in 2018, further prototype structures and foundations have been ordered for construction in Summer 2019.

These will enable the development of new operational practices and tools to suit the NeSTS designs. Teams from SHE Transmission, the contractor appointed to construct the NeSTS OHL, and other TOs will be invited to participate.

Knowledge Dissemination

The Project website is live and is disseminating design information and updates on progress.

Project information has been shared directly with OHL engineers at GB TOs and with the TO / System Operator (SO) Collaboration Group during this reporting period.

NeSTS OHL design information will be disseminated following its Section 37 application.

2) Project Manager's Report

SDRC

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3) Business Case Update

The Business Case for the NeSTS Project was updated to inform the Decision Point / Review of Business Case stage gate. It was submitted on 28 September 2018 and is published on the Project website (www.NeSTSproject.com).

4) Progress Against Plan

Summary of Progress

The Project has made good progress over the last 12 months and is progressing within budget. Two SDRC were delivered on schedule in 2018, and, following the approval of its Decision Point / Review of Business Case stage gate, the Project has commenced Stage 2 activities to prepare for the construction of a NeSTS OHL.

The planning and environmental process is running 6 months behind the programme forecast in the Project NIC bid due to construction project scheduling.

The insolvency of the Project's lead supplier of steel structures has delayed the full scale component / main element testing by 6 months and the Project has engaged new suppliers accordingly.

The Project remains on schedule to deliver its remaining SDRC.

Learning has been published and shared directly with stakeholders and on the Project website.

Focus This Reporting Period

The focus over this reporting period has been on:

- Publishing the NeSTS Technical Specification;
- Engaging with stakeholders to review a NeSTS OHL design;
- Testing a cross arm and cross arm:pole joint at full scale;
- Completing review of the parallel design outputs;
- Completing the Decision Point / Review of Business Case stage gate; and
- Developing a type testing programme.

Key Activities in Next Reporting Period

The Key Activities between 10 June 2019 and 5 June 2020 planned are:

- Placing a contract with a dedicated testing facility;
- Interfacing with the OHL construction project team and main contractor;
- Testing full scale structures;
- Developing new operational practices, tools, and equipment;
- Publishing a report on the outputs of type testing; and
- Commencing construction of the NeSTS OHL.

5) Progress Against Budget

The table below details the spend to date against the Project budget for each cost category.

Cost Category	Total Budget	Spend to Date	Comment
Labour			
Project team resource costs	£1,645.49k	£522.23k	On plan
Equipment			
Prototyping, testing, and modelling	£258.56k	£0.57k	On plan
Contractors			
Project team resource costs	£5,344.34k	£2,260.99k	On plan
IT			
IT Infrastructure	£204.79k	£176.06k	On plan
Travel & Expenses			
Travel & Expenses	£47.44k	£27.62k	On plan
Total	£7,500.62k	£2,988.02k¹	

Notes:

- Up to 30 March 2019 the project spent £2,923,653 (which has been processed through the Project Bank Account, see Appendix 1 for details). From 30 March – 30 April 2019 the project spent £64,367 which has yet to be processed through the Project Bank Account, so the total Project spend to 30 April 2019 is £2,988,020 (as detailed in the table above).

6) Bank Account

A copy of the current project bank account statement is provided in Appendix 1.

7) SDRC

An update on the Project's SDRC is provided below.

The NeSTS Project identified eight Successful Delivery Reward Criteria (SDRC) which span both the objectives and the lifecycle of the project.

The following table lists each SDRC in chronological order and details the project's progress towards their achievement.

7) SDRC

SDRC	Due	Description	Evidence	Status
11.1	30/9/2016	<p>NeSTS Design Selection</p> <p>The completion of the development of the Support Assessment Matrix. This will be offered to TOs to compare different types of overhead line supports in a technically balanced manner, incorporating the electrical, mechanical, environmental and construction and operational factors of overhead lines design.</p> <p>Selection of the final support designs.</p>	<p>Publish the initial outputs of the Support Assessment Matrix. An accompanying report will provide the technical details of the selected designs by 30 September 2016.</p>	<p>Completed (SDRC met)</p> <p>A report on NeSTS Design Selection and the completed Support Assessment Matrix were published on 30 September 2016.</p>
11.2	30/09/2017	<p>Output of Stakeholder Engagement</p> <p>Implement a programme of stakeholder engagement, supported by a suitable project supplier. This will include organised events and one to one interviews. Quantitative and qualitative analysis will be provided to understand key priorities. SHE Transmission will factor these viewpoints into the functional specification for NeSTS where practical.</p>	<p>Report to the Authority with an assessment on the need for a Customer Engagement Plan and/or data protection strategy by 30 June 2016.</p> <p>Publish a report describing the outputs from stakeholder engagement and demonstrate where these outputs have influenced the NeSTS designs by 30 September 2017.</p>	<p>Completed (SDRC met)</p> <p>An assessment that a Customer Engagement Plan was not required was submitted on 3 May 2016. The Authority agreed with this assessment on 5 July 2016.</p> <p>A report on Outputs of Stakeholder Engagement was published on 28 September 2017.</p>
11.3	30/8/2018	<p>Creation of Technical Specification</p> <p>The NeSTS overhead lines circuit will be designed in parallel with a traditional overhead lines support design - this is to create contingency in the event that NeSTS is not approved for demonstration at the stage gate process. The new technical specification for the supports will show how NeSTS design can be practically applied on a project, and is a key learning output for TOs and the supply chain. This will inform the procurement exercises for the initial deployment.</p>	<p>Publish a report on the outputs of the technical specifications of the NeSTS design stage by 30 August 2018.</p>	<p>Completed (SDRC met)</p> <p>A report on Creation of Technical Specification was published on 30 August 2018.</p>

7) SDRC

SDRC	Due	Description	Evidence	Status
11.4	31/12/2018	<p>Decision Point / Review of business case</p> <p>Review the NeSTS business case to conclude whether or not the Project should continue to Phase 2. The learning gathered at this point will be assessed to ensure that NeSTS still has a positive business case - impacts of any energy policy developments regarding renewable generation and the results of stakeholder engagement will be considered as part of the decision process.</p> <p>It will involve SHE Transmission's Director of Transmission and the SHE Transmission Steering Board.</p>	<p>Submit an update to Section 3 and Appendix 6, the business case of the Full Submission, to the Authority evaluating the project and recommending whether or not to proceed to Phase 2 by 31 December 2018.</p>	<p>Completed (SDRC met)</p> <p>A report on NeSTS Stage Gate – Decision to Proceed containing updates to Section 3 and Appendix 6 of the NIC Full Submission was submitted on 28 September 2018.</p> <p>The Authority approved the decision to proceed on 20 December 2018.</p>
11.5	30/09/2019	<p>Type Testing Agreement</p> <p>Within the first stage of Phase 2 (the demonstration part of the project), the detailed designs will enable the construction of a NeSTS overhead lines support structure, which will be tested at a dedicated testing facility.</p> <p>This is crucial in ensuring the design is supply chain ready and acceptable to other TOs.</p>	<p>A signed agreement with a dedicated testing facility by 30 September 2019.</p>	<p>On Target</p>
11.6	20/02/2020	<p>Completion of Type Testing</p> <p>The overhead lines support will be put through a series of tests in order to ensure that it complies with the relevant standards and specifications including BS EN 60652 and BS EN 61773.</p> <p>The completed test results will provide clear analysis regarding NeSTS's capabilities.</p>	<p>Publish a report on the outputs of the type testing conclusions by 20 February 2020.</p>	<p>On Target</p>
11.7	29/1/2021	<p>Energisation of NeSTS Overhead Lines</p> <p>The energisation of the NeSTS overhead lines circuit is the culmination of the construction and commissioning of a section of the project is a key milestone.</p>	<p>Publish a full report detailing outputs and knowledge capture including an evaluation comparing NeSTS construction, commissioning and energisation with that of a typical steel lattice tower project by 29 January 2021.</p>	<p>On Target</p>

7) SDRC

SDRC	Due	Description	Evidence	Status
11.8	31/03/2022	<p>Publication of e-learning and visualisation tools and project closedown report</p> <p>Knowledge capture and dissemination is of high importance to the project and the acceleration of NeSTS into TOs' business as usual activities. SHE Transmission will develop an e-learning module to assist with training and familiarisation activities amongst TOs and the supply chain.</p> <p>A visualisation tool will also be created to assist TOs with network planning, and to share learning with stakeholders.</p> <p>At the end of the project, full evaluation and key learning points will be considered for inclusion in a comprehensive project closedown process. This will include learning gathered from knowledge events and the progress of the MASC substation during operation.</p>	<p>Complete development of both tools and share with TOs and deliver detailed closedown report to Ofgem by 31 March 2022.</p>	On Target

	Completed (SDRC met)		Emerging issue, remains on target		SDRC completed late
	On target		Unresolved issue, off target		Not completed and late

8) Learning Outcomes

The following learning objectives have been set for the NeSTS project:

- **Develop a proven series of NeSTS design specifications:** The NeSTS project will further develop outputs from the NIA project and demonstrate these on the live transmission network. This will allow us to create the project's key output – a set of design specifications which can be shared with licensees and the supply chain. The specifications will take into account NeSTS's electrical, mechanical and civil engineering requirements.
- **Inform policy and procedure:** Each stage of the project will inform new policies and procedures for construction, operation, maintenance and safety. The development of these documents is fundamental to the successful adoption of NeSTS by other licensees.
- **Create future usage options:** NeSTS will be deployed and assessed against a range of terrain and climate scenarios that are representative of conditions found across GB. We will also implement a programme of prototype and component testing to measure NeSTS against severe weather events. This allows licensees and the supply chain to understand the conditions in which NeSTS is optimally suited, and creates confidence in the new designs.
- **Evaluate acceptance of alternative OHL supports by the consent and stakeholder processes:** During the project's first phase, a comprehensive stakeholder consultation will include discussion with licensees, landowners, statutory authorities and the supply chain. This allows us to understand and accommodate key priorities into the design where practical. Subsequent planning and consent for the planned OHL project will be evaluated to see the benefits of using NeSTS in comparison to conventional OHL methodology, and outputs from

this learning objective will be shared with all stakeholders.

- **Develop and validate Support Assessment Matrix:** The Support Assessment Matrix (SAM) was developed through the NIA NeSTS project to evaluate and compare a series of OHL support designs against a set of Main Design Aspects (MDAs). The SAM will be developed further and validated by NeSTS to produce a highly useful matrix available to the supply chain and to licensees. This creates a centralised vehicle to evaluate and facilitate future OHL support innovations.
- **Create a transmission infrastructure working group:** The NeSTS project will form a working group to create and share best working practices for OHL supports, similar to the Energy Storage Operators' Forum. The OHL working group will review and share best practice worldwide to facilitate further improvements in OHL methodology.

These learning objectives will be met as the NeSTS Project progresses into the design phase through to installation and final operation.

8) Learning Outcomes

Learning during this reporting period

Develop a proven series of NeSTS design specifications

The Preliminary Technical Specification for NeSTS 132kV Double Circuit Medium Duty (DCMD) was published on 30 August 2018.

It has been used as the basis for the Preliminary Technical Specification for NeSTS 132kV Single Circuit (SC) which is currently being used to design the NeSTS OHL.

Inform policy and procedure

Design refinements have been made in response to the prototyping reported in previous periods. Full scale prototypes embodying these have been ordered and will be constructed in Summer 2019 to enable further procedure development.

Create future usage options

A 132kV DCMD suite of supports was designed and used to inform the Decision point/review of business case.

A 132kV SC suite for use at high altitude has been designed for construction of the NeSTS OHL.

Refinements from the 132kV SC design process will be embodied in the 132kV DCMD and 275kV DCMD designs following the construction of the NeSTS OHL.

Evaluate acceptance of alternative OHL supports by the consent and stakeholder processes

The Section 37 application for the NeSTS OHL will be submitted in Summer 2019.

Develop and validate Support Assessment Matrix

The completed Support Assessment Matrix was delivered as part of the first SDRC and is published on the Project website.

Create a transmission infrastructure working group

Learning from the OHL design process and supply chain engagement activities is being shared with GB TOs, and the TO Collaboration Group.

9) IPR

No relevant IPR has been generated or registered during this reporting period, and none is forecast to be generated or registered in the next reporting period.

10) Risk Management

Risk Management Plan

The Project has a Project Risk Management Plan that describes how Project risks are managed throughout the Project.

The Project risk register is regularly reviewed by the Project team and the key Project risks are highlighted and discussed at the bi-monthly steering group meetings, where mitigating actions are agreed.

Risk Register

The current Project Risk Register is provided in Appendix 2.

11) Accuracy Assurance Statement

PPR Preparation Steps

To ensure that the information contained in this report is accurate and completed, the following steps have been taken, the report has been:

- Prepared by the Project Manager;
- Reviewed by the Project Team;
- Reviewed by the Steering Group; and
- Approved by the Project Director and Regulation.

Sign-off

As the senior manager responsible for the NeSTS Project, I confirm that the processes in place and steps taken to prepare this PPR are sufficiently robust and that the information provided is accurate and complete.



Stewart A Reid

Head of DSO & Innovation
Scottish and Southern Electricity Networks

29-5-2019.

Date

12) Appendices

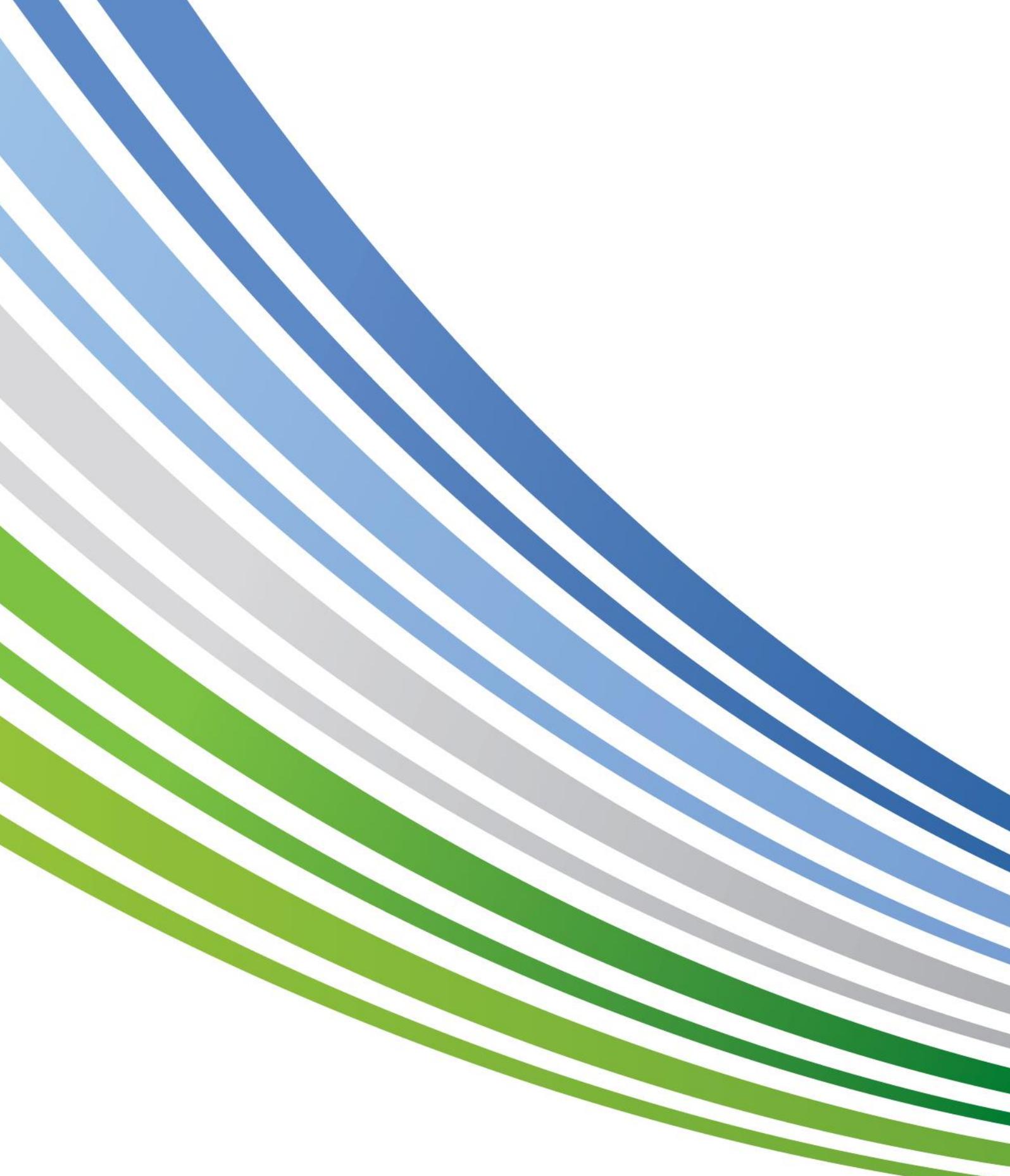
Appendix 1

Project Bank Account Statement

Appendix 2

Risk Register

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SSEN003 NeSTS Project Progress Report June 2019 Rev 1.0

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