



# Economic Licence Change in Scope

BOC & H2T  
Discontinuation



**Northern  
Endurance  
Partnership**

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# Economic Licence Change in Scope BOC & H2T Discontinuation

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Applicability:	NEP – Net Zero North Sea Storage Limited
Issue Date:	16-06-2026
Issuing Authority:	██████████
Revision Code:	B01

## Document information

Security Classification:	██████████
Next Review Date:	Not Applicable

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**Symbols and abbreviations**

AGI	Above Ground Installation
APDP	Approved Project Development Plan
BOC	BOC Ltd.
BPEOC	BP Exploration Operating Company Ltd.
CCS	Carbon Capture & Storage
CiS	Change in Scope
COD	Commercial Operation Date
DCO	Development Consent Order
DESNZ	Department of Energy Security & Net Zero
ECC	East Coast Cluster
FEED	Front End Engineering & Design
FID	Final Investment Decision
FSD	Financial Settlement Document, per TRI Licence
H2T	H2Teesside
HAZOP	Hazard and Operability
HAZID	Hazard Identification
HP	High Pressure
HPC	High Pressure Compression
LOPA	Layers of Protection Analysis
MoC	Management of Change
MTPA	Million Tons Per Annum
MTPAi	Million Tons Per Annum, instantaneous
OSBL	Outside Battery Limits
NEP	Northern Endurance Partnership
NZT	Net Zero Teesside
T&S	Transportation and Storage
TRI Licence	Transportation and Storage Regulatory Investment Licence
WCA	Wells Construction Agreement

## 1 Introduction

The Northern Endurance Partnership (NEP) is developing onshore and offshore infrastructure needed to transport CO<sub>2</sub> from carbon capture projects across Teesside and the Humber - collectively known as the East Coast Cluster - to secure storage under the North Sea. NEP has the potential to store up to 23MTPA via the Endurance Saline Aquifer store and adjacent expansion stores. The infrastructure is crucial to achieving net zero in the UK's most carbon intensive industrial regions, whilst at the same time bringing employment and supply chain development locally and across the UK.

The Teesside Carbon Capture Pipeline is the infrastructure designed to transport CO<sub>2</sub> from industrial carbon capture projects across Teesside to a compression facility and out to the Endurance carbon store via an offshore pipeline. NEP aims to commence commercial operations in 2028.

NEP is also progressing development work for the Humber Carbon Capture Pipeline - the proposed infrastructure that would transport CO<sub>2</sub> from carbon capture projects in the Humber region to secure offshore storage under the North Sea.

NEP is an incorporated joint venture between shareholders bp, Equinor and TotalEnergies, established solely to develop and operate CO<sub>2</sub> transportation and storage infrastructure in the Teesside and Humber regions

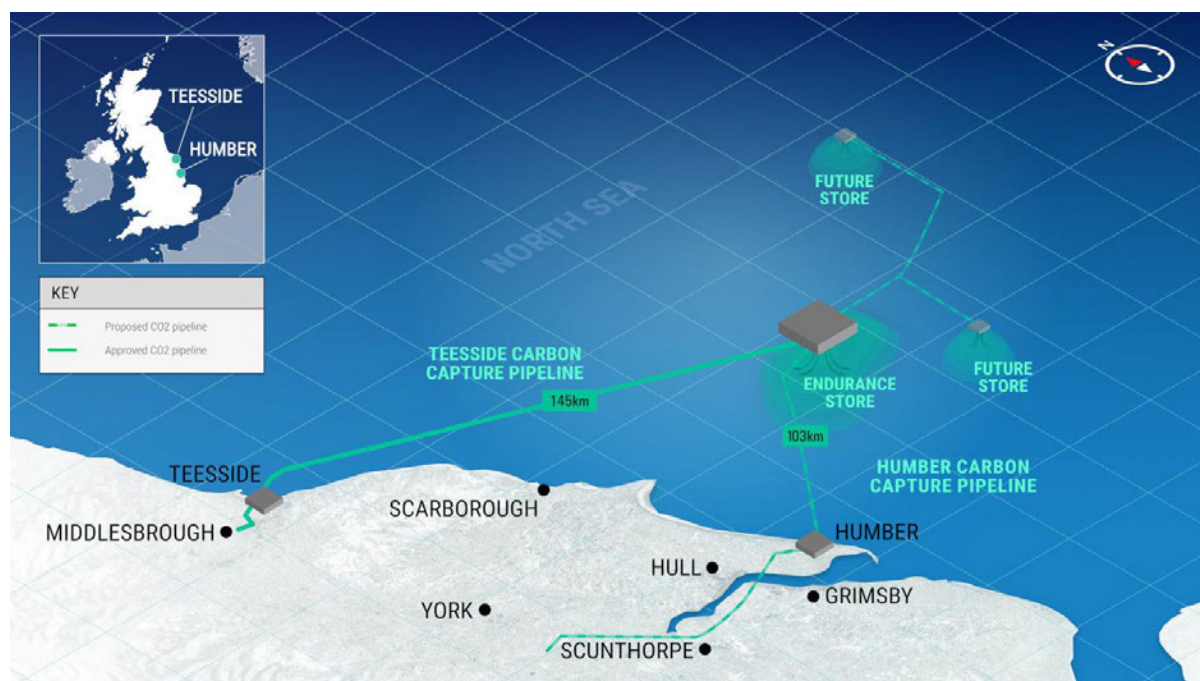


Figure 1: Overview of Northern Endurance Partnership

## 2 Purpose of this document

This Change in Scope (CiS) re-opener paper has been prepared and published in accordance with Section J2 and Schedule 10 of the Carbon Dioxide Transport and Storage Regulatory Investment (TRI) Licence issued to Net Zero North Sea Storage Limited on 9 December 2024.

The TRI Licence grants approval to Net Zero North Sea Storage Limited (the registered operating company of Northern Endurance Partnership (NEP)) to develop, maintain, and operate the Transport and Storage (T&S) Network in accordance with the Approved Project Development Plan (APDP).

The TRI Licence is designed to be re-opened where, following Licence Award, a CiS occurs to the Approved T&S Network. Such changes may arise from the completion of Development Activities, proposed network expansions, or the cancellation of specific network elements.

Licence Special Condition J2 sets out the provisions for Supervening Event Re-Openers, including those triggered by a CiS. Ofgem will assess the impact of this CiS on the Phase 1 project budget and associated licence conditions and will make adjustments to the TRI Licence as appropriate.

This document provides supporting evidence to assist Ofgem in its assessment of this Change in Scope, in accordance with the principles set out in Ofgem's Re-opener Guidance. In particular, the Guidance requires NEP to:

- set out the strategic options considered;
- provide an assessment of costs and benefits; and
- present clear engineering justification for the proposed approach.

This paper addresses those requirements by describing the relevant context and operational boundary conditions, identifying and assessing the feasible options, and presenting the rationale for the preferred option, together with associated cost estimates. Alternative options considered are also described.

The intention is to provide a transparent and proportionate basis for Ofgem to determine whether the proposed changes represent an economic and efficient response to the revised circumstances, consistent with the protection of current and future network users.

Unless stated otherwise, all financial values presented in this paper are in £ Real 2024 values consistent with the DESNZ cost assessment process. Where appropriate, we have also converted to £ Real 2021 values to allow comparison back to the Licence Financial Settlement Document (FSD).

### 3 Executive Summary

The East Coast Cluster (ECC), covering Teesside and the Humber, was selected by the UK government in October 2021 as one of the UK's first carbon capture and storage (CCS) clusters. In March 2023, three projects - Net Zero Teesside Power (NZT), H2Teesside (H2T), and BOC's Teesside Hydrogen CO<sub>2</sub> Capture project (BOC) - were chosen as the initial users of the Northern Endurance Partnership (NEP) transportation and storage network.

In 2025, NEP was notified that H2T and BOC would not be continuing as part of the ECC. This leaves NZT as the initial user, resulting in lower and more irregular CO<sub>2</sub> flows for a number of years. This creates several challenges for the transportation and storage network:

- Parts of the network will be underused
- Operating conditions will fall below optimal levels
- Stop-start operation will increase wear and tear on equipment
- A higher risk of halite precipitation in the offshore injection wells, reducing performance over time.

DESNZ has launched a process to select additional Teesside Capture Projects that could deliver an additional 1-2 MTPA of CO<sub>2</sub> per year by 2032. NEP are supporting DESNZ in the Selection Process, however the outcome is still highly uncertain at this time and NEP must therefore use this opportunity to make the system more resilient for prolonged NZT-only operation.

To manage these changes, NEP proposes a number of technical updates to the project, including revising design assumptions, updating technical modelling, re-running safety studies, and updating key documents, permits and licences. These updates will be managed through a formal change process.

Regarding the onshore pipeline network, NEP has taken some immediate steps to protect value. Work on spur lines and facilities that would have specifically served the withdrawn users has been paused, pending their recommended removal from the project. At the same time, the main onshore pipeline is still being progressed to ensure future users can connect to the network quickly and cost-effectively. Other options were considered, such as reducing the size of the network or cancelling infrastructure. However, these would lower overall capacity and waste money already spent, while potentially increasing future costs and the risk of delays.

NEP is also proposing to adjust how the offshore CO<sub>2</sub> storage system is tested before it becomes operational. Instead of testing the full capacity upfront, it is proposed that testing will be phased to match the confirmed user portfolio, initially at 2.55MTPAi in a two online, one offline configuration [REDACTED]. The number of activated wells would also be adjusted from 4 to 3, with two wells non-activated. These adjustments aim to improve reliability and reduce operational expenditure, while keeping additional wells in reserve, ready for future users. It is also recommended that the overall well count of the Endurance Storage System as described in the APDP is not changed (ie. 5 injection wells and 1 monitoring well). The proposed adjustments therefore improve system resilience without changing the overall 4MTPA design capacity of the network.

Overall, NEP is recommending a robust set of changes to reflect the new situation, protecting value for both current and future network users. These changes are expected to reduce the project's capital funding allowance, and the proposed updates to the project Financial Settlement Document (FSD) are summarised in Table 1, below.

**Table 1: Summary of Recommended Capex Adjustments**

Item	Proposed Adjustment (Real 24, per CAC4)	Proposed Adjustment (Real 21, per FSD)
Removal of H2T and BOC Spur Lines	-£6.8m	-£5.74m
Additional engineering to re-validate the T&S system	+£2m	+£1.69m
<b>Total</b>	<b>-£4.8m</b>	<b>-£4.05m</b>

#### 4 Change in Scope Context

In October 2021, the East Coast Cluster (ECC), comprising Teesside and Humber industrial areas, was successful in being selected by DESNZ as one of the first carbon capture, usage and storage clusters to be taken forward in HMG’s cluster sequencing process. In March 2023, DESNZ selected three East Coast Cluster projects - Net Zero Teesside Power (NZT), H2Teesside (H2T) and Teesside Hydrogen CO<sub>2</sub> Capture (BOC) as planned initial users.

NEP reached Financial Close on Phase 1 on 9 December 2024 with initial users and future users planned to be connected to the High-Pressure Compression (HPC) system via the Onshore Transport System, whereas NZT Power is co-located with NEP (see Figure 2).



**Figure 2 – NEP, Planned Initial Users and Onshore Transport System (per APDP)**

At Financial Close, NZT Power confirmed simultaneous Final Investment Decision (FID) with NEP, while FIDs for H2Teesside (H2T) and Teesside Hydrogen CO<sub>2</sub> Capture (BOC) remained outstanding. All three carbon capture projects sought support through the UK Government

Contract for Difference (CfD) mechanisms - the Dispatchable Power Agreement for NZT Power, the Low Carbon Hydrogen Agreement for H2T, and Industrial Carbon Capture Agreement for BOC. Under these arrangements, network users are selected for CfD by DESNZ, and NEP is subsequently informed when a project has been either selected or discontinued. During 2025, NEP received notice of discontinuation of two planned initial users: of BOC via formal notice from DESNZ in September 2025; and of H2T in December 2025 following bp announcement to withdraw the DCO and discontinue the project.

BOC and H2T are identified as Phase 2 users in the APDP ie. not scheduled to supply CO<sub>2</sub> prior to NEP's COD, but indicatively anticipated to come online from December 2028, therefore enabling NEP to reach an initial 4 MTPA capacity.

The discontinuation of BOC and H2T will result in lower and intermittent total flow rates as a result of NZT being the only user of the T&S system until further users come online. Given BOC's small expected CO<sub>2</sub> volumes, its cancellation has limited technical impact on the T&S network. However, the H2T impact is more significant, as its CO<sub>2</sub> volumes were expected to underpin the network baseload to keep above minimum flow operating limits, which in turn allows NZT Power's flexible CO<sub>2</sub> profile to be accommodated. Cancellation of BOC also has an impact on the onshore gathering network being constructed in Teesside, which will be now not used until additional users are confirmed.

In February 2026, DESNZ launched the East Coast Cluster Teesside Selection Process, to identify new users for connection to NEP infrastructure. The process aims to allocate 1-2 MTPA of capacity and eligible projects must be able to connect and be operational by 2032. If new users are selected, a further Change in Scope under the Economic Licence will be triggered and appropriate adjustments made to the licence, including the APDP, to reflect the revised user portfolio at that time.

The potential technical challenge of a prolonged NZT-only scenario was analysed and reviewed with DESNZ prior to licence award, during the cost assessment process over 2023-2024, and NEP undertook a further risk assessment in 4Q2025 following a prolonged delay to the determination of the H2T DCO. Now the scenario has materialised, this paper has been developed to further detail the technical impacts of a prolonged low and intermittent flow, as well as reviewing the infrastructure and testing changes that will be required to successfully achieve system acceptance, ensure the system remains fit for purpose for future users, and that investment in the T&S network is economic and efficient.

## 5 Summary of Impacts and Proposed Changes

The impact of the two discontinued users has been assessed and a range of potential changes to the Transport and Storage (T&S) project scope has been identified and evaluated. Each potential change has been subject to a proportionate cost-benefit assessment to determine whether it represents an economic and efficient response to the revised utilisation profile. The outcome of that assessment is a recommended approach for each identified impact.

The table below summarises:

- the principal impacts arising from the discontinuation of H2T and BOC; and
- the Licence implications of those impacts, including recommended changes

Detailed justification for each recommendation, including the options considered and the rationale for selecting the preferred approach, is provided in the subsequent sections of this paper.

**Table 2: Summary of Impacts and Recommended Changes**

Impact	Implications and <b>Recommended Changes (bold)</b>
The main onshore gathering pipeline and the spur lines for H2T and BOC will not be utilized at start-up.	<b>Capex Adjustment</b> to reflect the removal of the spur lines. <b>APDP update</b> - propose removing the H2T and BOC spur lines from T&S Project scope.
Single remaining user (NZT) [REDACTED]	<b>APDP update</b> - propose to update the APDP System Acceptance criteria to reflect a “two online and one offline well configuration”, with 2.55 MTPAi demonstrated, aligned with max. NZT rate. There is no change to the overall number of wells.
Further technical work, including full MoC, is required to fully understand the technical impacts of a low and intermittent flow.	<b>Capex Adjustment</b> to cover re-validation work.
Intermittent and lower rate of flow is likely to result in increased Halite precipitation around wellbores.	Opex Adjustment - due to vessel mobilisations required to undertake additional water washes to prevent degradation of active wells.
Additional offshore and onshore maintenance of compression and offshore infrastructure	Opex Adjustment - there will likely be an increase in Opex due to the increased cycling of compressors and wells

*NEP note that licence Opex adjustments will not be made as part of this CiS Re-opener, but rather via the separate process described under section H12 of the Economic Licence.*

## 6 Changes to the Onshore Gathering Network

### 6.1 Current Status

The Approved T&S Network includes the onshore gathering network, as defined in the APDP. It can be considered as having three main pipeline sections (CPL-1, CPL-2 and CPL-3), Above Ground Installations (AGIs) for pipeline tie-ins, services and pigging, as well as supporting elements such as foundations and bridges (Figure 3).

Significant investment has already been committed to the onshore CO<sub>2</sub> gathering network. This includes sunk costs associated with linepipe procurement, with a dedicated onshore pipeline project team in place, detailed engineering under way, and construction works scheduled to commence in the first half of 2026.

Progress to date can be summarised as follows:

#### Detailed engineering

- The lead Outside Battery Limits (OSBL) contractor has increased engineering resource to deliver detailed design and construction drawings for CPL-1.
- Key technical assurance milestones have been completed, including HAZID, HAZOP, LOPA, and 30% and 60% design reviews. The only major outstanding review is the 90% model review.

### Materials and equipment procurement

- Fabrication of the 22-inch linepipe and induction bends for CPL-1 has been completed. These materials are currently in the Teesside region at the coating subcontractor and nearing completion.

- [REDACTED]

### Construction readiness

- Pre-construction surveys are ongoing under the relevant land and property agreements to support detailed design and construction planning.
- NEP's contractor has mobilised its construction management team to prepare the required documentation and execution planning ahead of commencement of permanent construction works [REDACTED].
- Civil and structural facility contracts associated with CPL-1, CPL-2 and CPL-3 have been awarded by NEP. [REDACTED]

- [REDACTED]

[REDACTED]

Figure 3: Onshore Gathering Network Overview



## 6.2 CPL-2: H2T Gathering Pipeline

Following withdrawal of the H2T DCO, NEP is no longer able to construct the pipeline between H2T and NEP. As H2Teesside has discontinued development, CPL-2 would not be utilised in the current configuration of the network. NEP therefore recommends that CPL-2 be removed from the approved T&S project scope within the APDP. This reflects a proportionate response to changed circumstances and avoids committing further expenditure on infrastructure that no longer has a pathway to a user requirement, thereby protecting value for current and future network users.

## 6.3 CPL-2: Sunk Costs and Potential Savings

Linepipe and bends for the CPL-2 pipeline have already been ordered and are therefore a sunk cost. Additional materials and equipment have not yet been ordered and are placed on hold. These could be cancelled to give a procurement saving. Additionally, construction activity of CPL2 has not begun and therefore, labour and materials for construction could be cancelled.

Engineering work for the CPL-2 pipeline is substantially complete. The engineering resource required to complete engineering work would instead be required to change engineering designs and plans to accommodate the change in scope. The net impact is expected to be negligible, therefore no resource frame saving is anticipated.

In total, the combined effect of cancelling uncommitted materials and avoiding construction costs would deliver an estimated **£5.3m saving** (Real 24).

**Table 3: CPL-2 Budget vs. Committed Spend (Real 24)**

		Budget	Committed spend (inc termination)
<b>Engineering</b>	Detailed design	■	■
<b>Procurement</b>	Linepipe & bends	■	■
	Materials & equipment	■	■
<b>Construction</b>	Construction	■	■
<b>Total</b>		£8.4m	£3.1m

## 6.4 CPL-3: BOC Pipeline

CPL-3 is a short 8" pipeline connecting the main gathering pipeline CPL-1 with the BOC user. It is a line that was envisaged to be used by BOC only. It has a modest capacity of 0.40 MTPAi (12.68 kg/s) CO<sub>2</sub>, sized purely based on the expected CO<sub>2</sub> flow from BOC. Following notification from DESNZ in September 2025 that BOC was not proceeding further in the Cluster Sequencing Process, CPL-3 will now not be utilised and it is recommended to remove this from T&S project scope in the APDP. It is also recommended that AGI-C1 is reduced in scope to reflect now redundant AGI infrastructure.

## 6.5 CPL-3: Sunk Costs and Potential Savings

CPL-3 materials and equipment have not yet been ordered and are now placed on hold. Additionally, construction of the CPL-3 spur line has not begun and therefore labour and



In summary, NEP is already highly progressed and committed to CPL-1, with around 50% of the total budget committed.

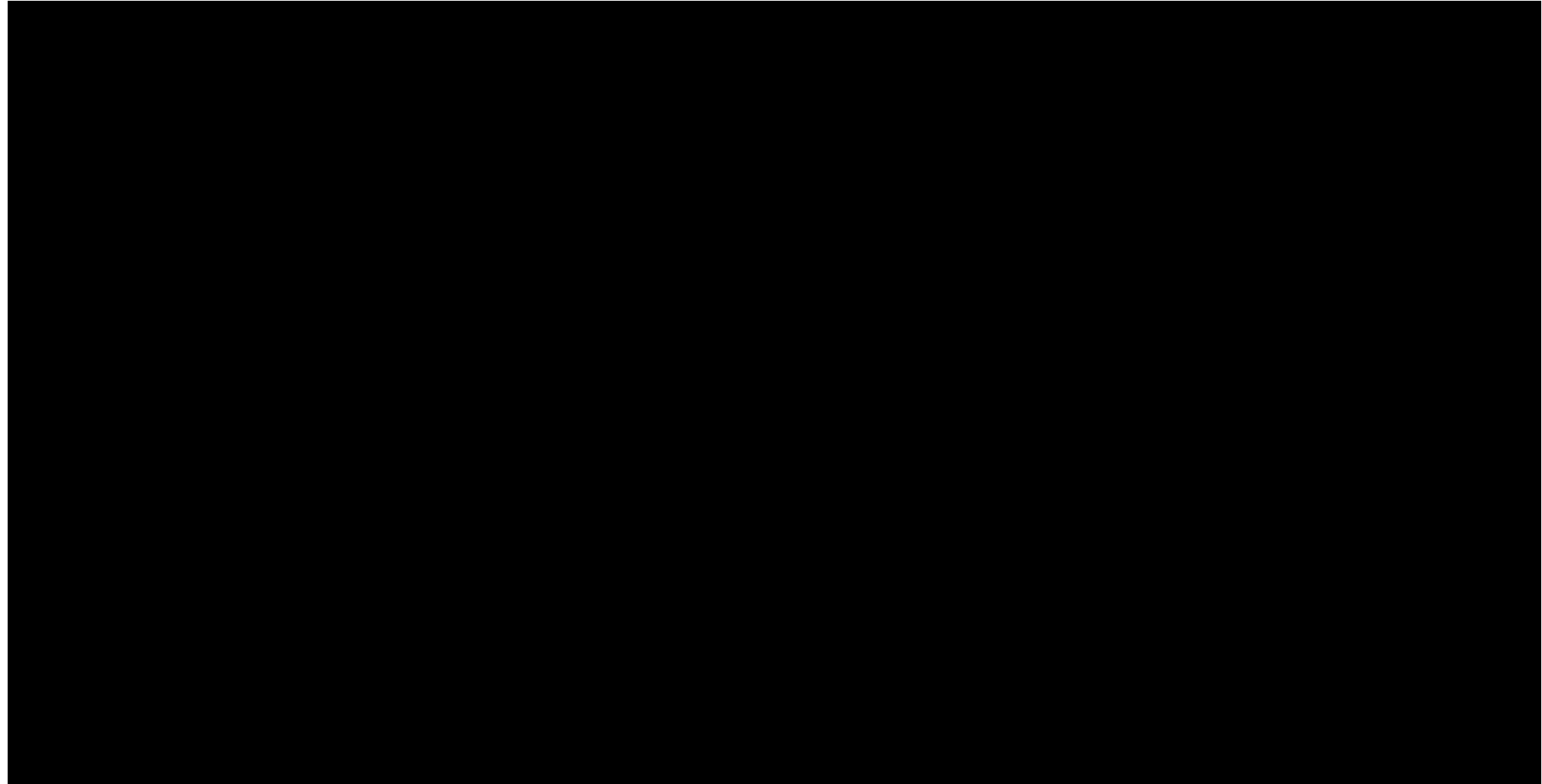
**Table 5: CPL-1 Budget vs. Committed Spend (Real 24)**

		Budget	Committed spend (exc. termination)
<b>Engineering</b>	Detailed design	█	█
<b>Procurement</b>	Linepipe & bends	█	█
	Materials & equipment	█	█
<b>Construction</b>	Construction	█	█
<b>Total</b>		£65.7m	£32.7m

## 6.7 CPL-1: Future User Potential

In February 2026, DESNZ launched the East Coast Cluster Teesside Selection Process, to identify new users to connect to NEP infrastructure. The process aims to allocate 1-2 MTPA of capacity and eligible projects must be able to connect and be operational by 2032. CPL-1 will be fundamental to connecting selected future users from the North Bank of the Tees to the network, via either AGI-C1 or AGI-C2. It is anticipated that the connection scope and therefore Capex for most projects in the North Tees area would therefore be relatively limited, involving short spurlines and minor modifications to existing AGIs. Without construction of CPL-1 as planned, it is likely not possible to connect users north of the River Tees by 2032. Cancelling CPL-1 then building again in the future would also incur additional costs due to the need to revalidate or repeat previously completed engineering on pipeline and AGIs, as well as repeat procurement activities and land access negotiations.

Based on the results of the market survey on Teesside that DESNZ led in 2025, to determine the levels of interest from carbon capture projects to connect into Teesside network, there are numerous projects in the North Tees area, of which a number are amongst the most mature in the region (Fig. 4). Without prejudicing the outcome of the Teesside User Selection Process, the relatively high level of project maturity and limited additional Capex required to connect users on the North Bank of the Tees supports the need for the continued execution of CPL-1. CPL-1 remains high Value for Money by providing an expedient pathway to connect future users, increase network utilisation and reduce T&S tariffs per tonne of CO<sub>2</sub> in the most expedient and efficient way.



## 6.8 CPL-1: Recommendation

It is recommended to retain CPL-1, the main CO<sub>2</sub> gathering pipeline, to ensure future emitters north of the River Tees can be connected and that the ~£33m investment to date is not wasted.

If CPL-1 were not built as planned, NEP may be unable to connect new users north of the River Tees by 2032, as targeted in the current DESNZ selection process. Delivering an alternative route would require re-acquiring land rights and repeating major procurement and engineering activities, adding significant time and cost.

## 6.9 Alternatives Considered

### Removal of the CPL-1 Pipeline:

If the CPL1 pipeline was removed from T&S Project scope, there would be additional cost exposure to terminate contracts, safely demobilise from site and remove partially constructed apparatus to satisfy ground conditions of lease agreements.

Overall there could be a reduction of £26.7m if CPL1 scope was removed.

**Table 6: Committed Spend - Removal of CPL-1 Pipeline (Real 24)**

		Budget	Committed spend (inc. termination)
<b>Engineering</b>	Detailed design	■	■
<b>Procurement</b>	Linepipe & bends	■	■
	Materials & equipment	■	■
<b>Construction</b>	Construction	■	■
<b>Total</b>		£65.7m	£39m

Due to the high degree of committed spend, removal of the CPL-1 pipeline is not recommended.

### Reduced length of the CPL-1 Pipeline:

NEP considered reducing the length of the CPL-1 pipeline so that it terminated just after the tunnel on the north side of the River Tees. This would reduce construction activity north of the river. However, the change would require substantial additional engineering work, including new FEED and detailed design, creating cost and schedule pressures that could jeopardise the planned COD. ■ ■ ■

[REDACTED]  
[REDACTED]  
[REDACTED]

For these reasons, this option is not recommended.

## 7 Well Configuration and Systems Acceptance Testing

### 7.1 Current status

The current system acceptance as described in the APDP is designed to test for an injection capacity of at least 4MTPA in a “three online and one offline well configuration”. This was predicated on the availability of 3 users within 1.5 years of COD. The requirement to prove 4MTPA means testing at least 3 wells with CO<sub>2</sub> assuming a maximum of 1.5MTPAi as outlined in Annex 4 of the CS001 storage permit.

### 7.2 Well Configuration and Systems Acceptance Testing Recommendation

NEP recommend adjusting the well configuration and systems acceptance testing to a progressive testing criteria initially designed to meet the needs of the single user (NZT) which is up to 2.55MTPAi. This change maximises system reliability and performance without changing the overall 4MTPA design capacity of the network. [REDACTED]  
[REDACTED]  
[REDACTED]

The recommendation to adjust the well configuration and systems acceptance testing is driven by the need to manage and mitigate the precipitation of halite (salt) within the reservoir rock formation surrounding the wellbores. Halite precipitation is caused by injected CO<sub>2</sub> evaporating the highly saline formation water within the reservoir interval, resulting in halite forming within the pore space between rock grains. Without mitigation, repeated cycles of halite precipitation can impare injectivity. Modelling demonstrates that the best way to minimise precipitation is to maintain high CO<sub>2</sub> velocity in the near-wellbore in order to push the CO<sub>2</sub>-brine interface away from the well. Higher velocities can be achieved via two methods:

- (1) Reducing the number of wells online injecting the same CO<sub>2</sub> volume.
- (2) Optimising the well perforations to achieve higher flow rates.

[REDACTED]  
[REDACTED] Therefore the system is moving to lower and more intermittent flows than envisaged in the current APDP. In order to protect the system from halite precipitation, the number of wells initially online should be reduced and the perforation strategy optimised.

[REDACTED]  
[REDACTED] It is therefore recommended to use a “two online and one offline configuration” (i.e. test 3 wells) with two wells that are preserved (non-activated). Systems acceptance testing should reflect the need to prove this maximum instantaneous rate, proving sufficient injection capacity is available for Phase 1 user.

A “two offline and one offline” configuration will result in two wells being preserved for future users, up from a single well preserved in the current APDP. The two preserved wells will benefit from no exposure to CO<sub>2</sub> during the acceptance testing, reducing the risk of injectivity decline due to halite precipitation and improving the redundancy of the network. These

preserved wells can be brought online with low incremental cost and effort once new users are connected to the system. To mitigate the lack of CO<sub>2</sub> test data in the preserved wells, all wells will undergo brine injectivity testing, which can then be correlated with CO<sub>2</sub> injectivity in the CO<sub>2</sub> tested wells.

To further reduce the halite risk in the vicinity of the wellbore in NZT-only operations, the perforation intervals are being reduced in order to achieve higher CO<sub>2</sub> velocities. Modelling has shown that wells with this new perforation configuration are able to achieve the maximum rate permitted in the Store Permit at the time of system acceptance. Contingencies are also in place at the time of drilling to adjust the perforation intervals if it is indicated that there is a risk that injection capacity will fall below system acceptance requirements.

Despite the pragmatic mitigations outlined above, injectivity decline due to intermittent CO<sub>2</sub> profiles from NZT for longer than expected without a baseload user will likely remain an enduring risk for active wells and could require additional mitigation in the form of additional unplanned water washes or re-perforations. This is reflected in Table 7:

**Table 7: Commercial Impact of NZT-only operations**

Technical Risk	Mitigation	Commercial Impact
Low and intermittent injection increases the risk of halite precipitation due to capillary brine flow back to the wells during shut in periods leading to loss of injectivity.	- CO <sub>2</sub> injection should be limited to those wells that are intended to meet [REDACTED] "at least 2.55MTPAi" using a "two online and one offline configuration" and leaving 2 wells on preservation mode - water washes required to dissolve precipitated salt and recover injectivity	Additional yearly water wash campaign on 3 wells after initial system acceptance testing. [REDACTED] [REDACTED]

### 7.3 Alternative options considered

The alternative option considered is continuing with the APDP requirements and testing the T&S System up to the 4MTPA capacity (i.e. testing 4 wells) as per the current APDP.

The main argument against testing 4 wells to demonstrate the 4MTPA capacity is the increased risk of injection decline across all wells. Whilst this risk is also present in a 3 well configuration, the impacted number of wells is reduced. This approach would also result in increased opex from the need to perform additional water washes on 4 active wells to mitigate against the impact of low and intermittent flow instead of 3. This is shown in the table below.

**Table 8: Commercial Impact of Testing up to 4MTPA Capacity (not proposed)**

Technical Risk	Mitigation	Commercial Impact
Intermittent injection to demonstrate 4 MTPA capacity increases the risk of halite precipitation due to capillary brine flow back to the wells during shut in periods leading to loss of injectivity.	- Water washes required to dissolve precipitated salt and restore injectivity	Additional yearly water wash campaign of 4 wells after initial system acceptance testing [REDACTED] [REDACTED]

## 8 Offshore Well Count

### 8.1 Current status

The APDP specifies for Phase 1 that there will be six wells drilled. Five injection wells are to be located on the Endurance Storage Site, of these wells one will be non-activated. In addition to these injection wells, there will be one monitoring well drilled.

The Phase 1 wells programme is now substantially advanced, with all major long lead items already placed and service contracting well underway. Engineering maturity has continued to build through the completion of the global riser analysis and initiation of well programming, while detailed interface work with EPCIC2 and subsea suppliers is progressing to ensure hardware readiness for mobilisation.

Phase 1 wells are in the late stages of design and readiness. Long lead items for wells have been procured and engineering design has been completed for the wells. Rig linked readiness activities have been completed across 2025.

### 8.2 Offshore Well Count Recommendation

It is recommended that the components of the Endurance Storage System as described in the APDP is not changed (ie. development of 5 injection wells and 1 monitoring well). There is significant sunk cost in the wells and subsea scope due to early termination fees for equipment, committed vessel days, committed rig days, procurement and committed engineering work.

NEP also note that the ECC Teesside Selection Process is running currently under the assumption that a 4MPTA system will be available for the future users.

### 8.3 Alternative Options Considered

Reducing the number of wells by one well was considered- which would leave 4 injection wells and 1 observation well, with one of the injection wells as a non-activated well. However, the rig early termination fee [REDACTED] and well tangible long lead items that have been committed. This results in an estimated £20.4m sunk cost per well, from a total average cost of approximately £45m per well. There could therefore be approximately £25m saving by not proceeding with one of the wells, through reduced call-off of bulks and services and saved rig days.

**Table 9: Sunk Costs Per Phase 1 Well**

Category	Sunk Cost per well
Rig cancellation cost	[REDACTED]
Drilling Tangibles	[REDACTED]
Completion Tangibles	[REDACTED]
Wellhead and Xmas Tree	[REDACTED]
<b>Total</b>	£20.4m

[REDACTED] Many

common costs are shared across the entire well set (engineering, tooling, vessel mobilisations, testing, etc). Removing a single well would not eliminate these costs; only spread them over fewer wells, raising the “per-well” cost of the remaining programme. There would be some potential to save costs through a reduction in vessel days, but this would be dependent on successful remarketing by contractors and is not guaranteed.

Removing one well would also trigger re-work of system level design and some aspects of detailed engineering, all of which would be treated as chargeable variations under the EPC12 contract and the cost of which is highly uncertain. There is therefore a material risk of cost increase under EPC12 if changes are made to the well programme.

Furthermore, DESNZ has recently launched a Teesside User Selection Process which aims to allocate 1-2MTPA of capacity and is predicated on the 4MTPA capacity as described in the APDP. Reducing the number of wells in the T&S System prevents NEP from meeting the 4MTPA built capacity and creates significant pressure on NEP’s ability to achieve readiness for accepting new users by 2032.

It may be possible to drill the additional well at a later date and be ready for 2032, however the sunk cost, plus incurring at least the same cost again to drill the well later would be a highly inefficient use of investment. There is additional risk to drilling later due to uncertainty around mobilisation costs and future rig rates, plus NEP would need to mobilise a CO<sub>2</sub> ready rig which is not currently required.

## 9 Additional Engineering Studies

The base case concept for the T&S System has always assumed that the CO<sub>2</sub> profile would rapidly become a steady-state above minimal flow conditions. Early engineering work did consider the impact of low and intermittent CO<sub>2</sub> flows for a prolonged period, but only as a sensitivity risk assessment. With NZT as the only user for a number of years to come, further detailed work is needed to fully quantify the impact.

A key first step will be to recalculate the number of well open/close cycles expected under this dispatchable regime and compare this against the fatigue design limits for both the wells and the pipeline system. This includes verifying that project pipeline fatigue cycles, wellhead choke actuation cycles, and startup/shutdown pressure swings to ensure they remain within qualification envelopes. In parallel, the updated flow pattern may alter halite precipitation risks, particularly during prolonged low-flow or no-flow periods, so halite modelling will also need to be updated. The effort required for this step will primarily involve resource to complete re-validation. [REDACTED]

If these engineering studies identify that design limits are likely to be exceeded or approached too closely, the project will need to explore mitigations. Potential options include widening the allowable operating pressure range, permitting deeper pressure drops closer to the critical pressure during shutdown, or re-optimising the well operating philosophy to reduce cycling frequency.

Completing this validation is essential before construction progresses. While it will require additional engineering effort and cost, it is a necessary step to ensure that the system is designed and qualified for the way it will now be expected to operate.

## 10 Maintenance Requirements

### 10.1 Current status

The base case concept for the T&S System has assumed that the CO<sub>2</sub> profile would gain a significant baseload component after a period of intermittent injection resulting from NZT only operations.

### 10.2 Impact and additional requirements

NEP have been delivering updated cost estimates for Opex to Ofgem on a quarterly basis. As a result of the prolonged low and intermittent flow in the T&S System there are expected to be additional costs which will be reflected in future Opex forecast estimates. It is worth noting that NEP does not expect the licence FSD Opex forecast to be adjusted as part of this re-opener, with these changes approximated and included for information only.

Key changes to the Opex forecasts are driven by the increase in cyclical loading of the wells due to increased starting and stopping of CO<sub>2</sub> input from NZT as the only user. This leads to increased wear and tear of equipment. In addition, it is expected that there would be some additional maintenance costs to the onshore compressors due to the start-stop mode of operation.

Technical analysis currently indicates that the effect of the cyclical loading of the pipeline will not require additional inspection or Opex for the pipeline.

**Table 10: Estimated Effect of Changes on Opex**

Technical Risk	Mitigation	Commercial Impact
<ul style="list-style-type: none"> <li>Wells are designed to operate under steady state conditions. Starting/stopping wells increases the pressure/temperature cycling and fatigue loading, leading to component failure and/or well integrity issues</li> <li>The wells have been verified to 2,000 cycles [REDACTED]</li> </ul>	<ul style="list-style-type: none"> <li>Intervention and workovers required to return wells to operational status</li> </ul>	<ul style="list-style-type: none"> <li>Additional 2 workovers [REDACTED] per regulatory period. This is an assumption that continued cycling will increase workover frequency. At present 4 workovers overall are carried over field life. An increase of 50% (2 workovers) has been selected as a reasonable estimate to cover tubing and packer fatigue and additional safety valve cycling.</li> <li>[REDACTED]</li> </ul>
<ul style="list-style-type: none"> <li>Increase in number of HP Compressor starts due to dispatchable user only</li> </ul>	<ul style="list-style-type: none"> <li>Replacement of compressor before design life is exceeded.</li> </ul>	<ul style="list-style-type: none"> <li>Including performance and mechanical testing. Additional compressor would add [REDACTED] to the total costs depending on whether the compressor will fail within the 25 year operating life</li> <li>[REDACTED]</li> <li>[REDACTED]</li> <li>[REDACTED]</li> </ul>

		<ul style="list-style-type: none"> <li>Alternatively, instead of replacement of a compressor, sparing philosophy may be altered where more sparing will be required in order to maintain compressors during a dispatchable user only scenario. This will be an optimisation that can only be made with actual operating experience.</li> </ul>
<ul style="list-style-type: none"> <li>Increase start/stops and general wear and tear of HP Compressors</li> </ul>	<ul style="list-style-type: none"> <li>Increase in planned maintenance for HP Compressors.</li> </ul>	<ul style="list-style-type: none"> <li>CAC 4 cost submission currently shows a spend of [REDACTED] (annualised) from year 3 of operation. Impact could be early intervention, pre-year 3 and/or increased annualised costs based on failure modes.</li> <li>TOTAL = [REDACTED] across the lifetime of the asset</li> </ul>
<ul style="list-style-type: none"> <li>Possible reduction/increase in Energy costs for HPC's on lower flows in general.</li> </ul>	<ul style="list-style-type: none"> <li>Overall, lower flowrates should result in less compression demand and hence reduced energy costs. However, dependent on flow regime (NZT Power flowrates and use of enhanced delivery mode as part of CCS network code offer) it could result in 2*HPC's having to be run in greater recycle and hence inefficient use of energy.</li> </ul>	<ul style="list-style-type: none"> <li>Current estimates with government significantly underestimate the energy costs and outturn costs are expected to be significantly higher. Therefore, any reduction in cost of energy due to H2T deselection could compensate for the underestimated initial cost of energy.</li> </ul>

### 10.3 Alternatives considered

The alternative considered in this scenario would be to not complete well intervention work and to not complete compressor maintenance. This would increase the risk of significant downtime which would adversely affect availability of the network. It is therefore recommended to complete additional maintenance of the offshore wells and onshore compressors as above to preserve availability of the T&S System.

## 11 Other Effects

### 11.1 Effect on System Response Times

During operation, and in accordance with the CCS Network Code, NEP must offer two system response services:

- A standard response service, where renominations (or scheduling) of CO<sub>2</sub> delivery from users are locked 3 hours before delivery; and
- An enhanced response service, where renominations are locked 30 minutes before delivery.

During the development of the CCS Network Code, the renomination times considered an operating scenario of no users online and ramping up for NZT only (0-2.55 MTPAi). The requirement to deliver these response services was therefore incorporated into the design basis. During detailed design, the NEP COSA team will create a full chain dynamic system model including vendor information to validate that both response services can be delivered.

Therefore, at this time there is no change to the above NEP response times, subject to validation during detailed design, due to H2T and BOC being discontinued as users.

## 12 Licence Implications

Assuming Ofgem alignment with NEP's proposals, we have summarised the necessary licence changes below.

### 12.1 FSD adjustments

NEP anticipates the only allowance adjustments to be made at this time are to Capex, per the following:

**Table 11: Summary of Capex Changes in FSD**

Item	Proposed Adjustment (Real 24, per CAC4)	Proposed Adjustment (Real 21, per FSD)
Removal of H2T and BOC Spur Lines	-£6.8m	-£5.74m
Additional engineering to re-validate the T&S system	+£2m	+£1.69m
<b>Total</b>	<b>-£4.8m</b>	<b>-£4.05m</b>

### 12.2 APDP Updates

NEP proposes a series of updates to the APDP consistent with the proposals in this paper, including:

- Planned Initial Users definition to be updated to remove BOC and H2T.
- BOC spur line and H2T pipeline to be removed from the definition of the "Approved T&S Network".
- Requirements for 4MPTAi capacity to be adjusted to 2.55 MTPAi in multiple APDP locations.
- Adjusting the Obligated Network Capacity Maximum Flow Rate from 4.21MTPAi to 2.55MTPAi .

### 13 Supporting Documentation

- [REDACTED]
- Proposed APDP drafting
- [REDACTED]





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