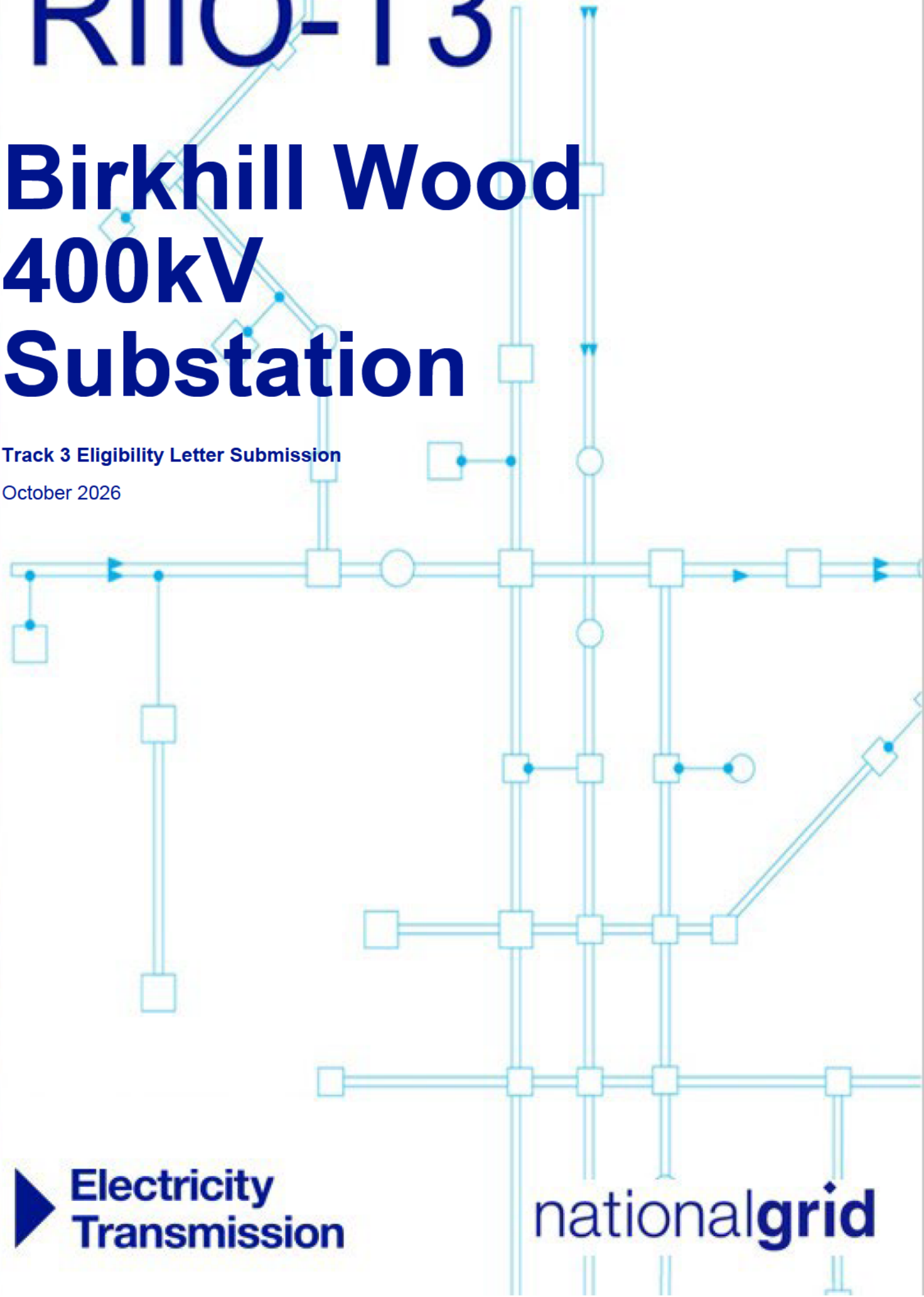
RIIO-T3

Birkhill Wood 400kV Substation

Track 3 Eligibility Letter Submission

October 2026



Electricity Transmission

nationalgrid

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Reference and summary table

Field	Description
Project name	Birkhill Wood 400kV Substation
TO's preferred re-opener track	Track 3 Eligibility Letter Submission
RRP References	NGT600023, NGT500019, NGT300186, NGT600004, NGT300384, NGT300177, NGT300222, NGT300221, NGT300178, NGT400214, NGT600070, NGT600071
BPDT / Scheme reference number	NGT500536
Load Board reference	NGET Birkhill Wood - Site Strategy
Investment driver(s)	This project has two interrelated investment drivers: • **Customer connections:** providing the additional 400kV substation capacity required for [redacted] offshore-wind connections, with provision for the offered but not yet contracted [redacted] connection. • **Wider network reinforcement:** providing the northern connection point for the separately funded ASTI CGNC North Humber to High Marnham reinforcement, which will create an additional export route for generation connecting in the North Humber area. This submission seeks funding only for the Birkhill Wood substation scope. The North Humber to High Marnham overhead-line reinforcement and its wider works remain within the separate ASTI CGNC project.
Project outputs	Birkhill Wood will connect [redacted] of offshore wind by 2033 and providing the northern connection point for the North Humber–High Marnham reinforcement to increase B8 boundary transfer capability. This will be achieved through the delivery of a new [redacted] (including 2 spare bays), 400kV SF_6-free GIS substation near Creyke Beck,
Short list of strategic options considered	4 main options were shortlisted for detailed analysis: • **Option E-5:** A new [redacted] 400kV SF6-free GIS substation • **Option E-6:** A new [redacted] AIS wrap around 400kV substation • **Option E-7:** New 400kV AIS substation south of the 4ZR overhead line

Field	Description
	• **Option E-8:** New 400kV AIS substation north of the 4ZR overhead line
Preferred solution and explanatory narrative on the rationale	E-5 is the preferred option because its smaller footprint and lower delivery and consenting risks enable [redacted] of offshore wind to connect up to three years earlier than E-7/8 (and up to four years earlier than E-6), bringing forward substantial avoided-carbon benefits for consumers.
PASE alignment	The preferred solution for this investment is option E-5: a new [redacted] 400kV SF_6-free GIS double-busbar substation. E-5 is non-PASE aligned because it uses a 400kV SF_6-free GIS double-busbar configuration that falls outside the PASE baseline design. More detail on PASE compliance is provided in Section 3.5
Costs (23/24 prices)	Total project cost: [redacted]
Delivery year	[redacted]
Extension cost (applicable only to substations)	New substation so not applicable
Applicable reporting tables	BPDT 10.5 ET Pipeline log, RRP E1.11_ET Pipeline Log, EI.11b_ET3 Pipeline Log, E1.2_Environmental Scorecard
Interactive projects	ASTI CGNC North Humber to High Marnham (NHHM) is a new double-circuit 400kV overhead-line reinforcement connecting two substations that are being delivered as separate investments: • Birkhill Wood 400kV substation, near Creyke Beck, provides additional capacity for generation connections in the area and the northern connection point for NHHM; and • High Marnham 400kV substation provides the southern connection point for NHHM. NHHM provides the additional network transfer capability required to export generation connecting in the North Humber area. Each substation includes two feeder bays to connect the NHHM double circuit. The Birkhill Wood feeder bays and associated substation interfaces form part of the Birkhill Wood scope, while the overhead-line reinforcement remains within the separately funded ASTI NHHM project.
Historic funding interactions	NGET has received bridging funding in RIIO-T2 for [redacted] (in 23/24 prices)

Field	Description		
Spend apportionment	T2 (FY 2022-2026):	T3 (FY 2027-2031):	T4+ (FY 2032- 2037+):
	[redacted]	[redacted]	[redacted]

Executive summary

Project summary

Birkhill Wood is a RIIO-ET3 load-driven project that will deliver a new 400kV substation near Creyke Beck to meet 6.87 GW of contracted offshore wind connection requirements. It will establish a separate generation connection node and provide the northern 400kV connection point for the North Humber to High Marnham ASTI project, which will provide the additional transfer capability required to export the connected generation across the wider transmission system. The preferred solution has been developed as part of a coordinated Humber connection strategy and retains proportionate flexibility for potential future connections without relying upon them to justify the investment.

The preferred compact [redacted] SF_6-free GIS solution avoids major utility diversions, flood-risk areas and extensive enabling works, reducing delivery risk and supporting earlier realisation of consumer benefits. The solution also preserves future flexibility through provision for additional bays.

Submission purpose

We are seeking Ofgem's approval, under the Load Related Re Opener (Special Condition 3.18 of the RIIO ET3 licence), to progress the Birkhill Wood 400kV Substation as a Track 3 EL investment and approval of Pre Construction Funding (PCF).

This submission proposes Track 3 EL Load Re-Opener process for assessment. The track proposal has been discussed with Ofgem.

Project need

The investment is required to provide 400kV connections for 6.87 GW of contracted offshore wind generation to four windfarms [redacted] All four customers have received Gate 2 designation as part of Connections Reform.

Following the connections reform process, NGET has taken the strategic decision to relocate [redacted] connection from the proposed Wanless Beck substation to Birkhill Wood, as part of a reassessment of the Humber connection strategy. This removes the need to progress Wanless Beck as a separate substation.

By accommodating the relevant customer connection within an enlarged Birkhill Wood design, NGET has rationalised the previously identified in-flight investment portfolio, avoiding construction of an additional GIS substation and its associated land, planning, environmental and delivery requirements.

The existing Creyke Beck node cannot accommodate this additional generation, meaning that a separate 400kV connection node is required. Birkhill Wood provides that node, while North Humber to High Marnham (NH-HM) provides the additional transfer capability needed to export the connected generation across the wider transmission system.

In order to unlock green power benefits for consumers, connecting these large-scale wind farms to the grid as soon as possible has been a critical factor in our design decisions and selection of the preferred option. Benefits include:

- Enabling delivery of the of the Birkhill Wood interface required for ASTI North Humber to High Marnham (NH-HM) in 2031. The four-year programme advantage of GIS over AIS enables CGNC to realise its benefits earlier, avoiding an [redacted] of cumulative constraint costs associated with a four-year delay;
- connection of the three confirmed offshore wind farms in support of the Government's Clean Power ambitions connecting at Birkhill Wood and, together with NH-HM, their ability to access their full transmission entry capacity, with provision retained for [redacted]; and
- earlier connection and export of low-carbon generation, bringing forward the associated decarbonisation and wider system benefits.

The construction programme has therefore been developed to make the Birkhill Wood customer and NHHM interfaces available at the earliest practicable dates.

Optioneering to date

We undertook a multifactor optioneering process to identify the most economic and efficient solution to the identified need. We assessed five strategic approaches: do nothing, market-based, whole-system, reuse or extension of existing assets, and new build. This included three existing-substation alternatives and a range of new-build configurations and locations.

Given the scale of clean power connecting at Birkhill Wood, 6.87 GW, deliverability has been a key priority in our optioneering. We balanced this against engineering, environmental, cost and consumer value, and stakeholder and consenting considerations.

The optioneering assessment was undertaken in two stages because the only potentially viable AIS option identified by the original siting study required the diversion of a major gas pipeline, creating significant technical and delivery challenges. The February 2023 study assessed locations within 2 km of Creyke Beck and 500 m either side of the existing [redacted] 400kV route, balancing proximity to the offered connection location, feasible overhead-line routing and the need to limit additional network infrastructure.

To determine whether a less constrained AIS alternative was available, we commissioned an expanded siting study in July 2026. This targeted assurance exercise complemented, rather than replaced, the original study by widening the search corridor to 2 km either side of the [redacted] route and considering locations further east. It identified four additional potential AIS locations for inclusion in the wider project optioneering, of which two were progressed to detailed assessment. Further detail is provided in Section 3.2.

Four complete project options were progressed for detailed qualitative and quantitative assessment: E-5, a new SF_6-free GIS substation at the original preferred site; E-6, an AIS wraparound solution at the original preferred site; and E-7 and E-8, two AIS alternatives identified through the expanded siting study. Option E-5, the preferred solution, is the selected design option at the selected site, supported by the optioneering assessment and the referenced layouts/Single Line Diagrams (SLDs) in Section 3.

[1] Discounted value using 3.5% discount rate, rebased from 2025/26 to 2023/24 price base

Table 1: Summary of options

Option	Details	Drivers met?	New site?	AIS/ GIS?	Shortlist?	Preferred solution?
Stage 1: Initial Siting Study (February 2023)						
Option A	Do nothing counterfactual option	No	No	NA	No	NA
Option B	Market-based solution	No	No	NA	No	NA
Option C	Non-transmission, whole systems solutions	No	No	NA	No	NA
Option D-1	Utilise existing 400kV AIS substation customers requested connection node Creyke Beck whilst providing a GIS or AIS extension for additional bays	Yes	No	GIS	No	GIS
Option D-2	Utilise neighbouring 275kV substation to Creyke Beck, Hedon 275kV GIS substation, whilst providing a GIS or AIS extension for additional bays	No	No	AIS/GIS	No	AIS/GIS
Option D-3	Utilise neighbouring 400kV substation to Creyke Beck Thornton AIS 400kV substation, whilst providing a GIS or AIS extension for additional bays	Yes	No	AIS/GIS	No	AIS/GIS
Option E-1	New substation build, AIS or GIS at Garthorpe Tee point in the South Humber region,	Yes	Yes	AIS/GIS	No	AIS/GIS
Option E-2	New substation build, AIS or GIS at Fenwick Tee point in the South Humber region,	Yes	Yes	AIS/GIS	No	AIS/GIS
Option E-3	New 400kV AIS or GIS built using a staged construction approach on the [redacted]	Yes	Yes	AIS/GIS	No	AIS/GIS

Option	Details	Drivers met?	New site?	AIS/ GIS?	Shortlist?	Preferred solution?
	Creyke Beck to Thornton 400kV OHL					
Option E-4	New 400kV AIS built using North South configuration connecting [redacted] Creyke Beck to Thornton 400kV OHL	Yes	Yes	AIS	No	AIS
Option E-5	New 400kV GIS substation connecting to the [redacted] Creyke Beck to Thornton 400kV	Yes	Yes	GIS	Yes	GIS
Option E-6	New 400kV AIS Wrap around substation connecting to the [redacted] Creyke Beck to Thornton 400kV OHL	Yes, with delivery concerns	Yes	AIS	Yes	AIS
Stage 2: AIS options identified as part of expanded siting study (July 2026)						
Option E-7	New 400kV AIS built using North-East South-West configuration, South of [redacted] connecting [redacted] Creyke Beck to Thornton 400kV OHL	Yes	Yes	AIS	Yes	AIS
Option E-8	New 400kV AIS built using North-East South-West configuration, North of [redacted] connecting [redacted] Creyke Beck to Thornton 400kV OHL	Yes	Yes	AIS	Yes	AIS
Option E-9	New 400kV AIS built using North South configuration, South of [redacted] connecting [redacted] Creyke Beck to Thornton 400kV OHL	Yes	Yes	AIS	No	AIS
Option E-10	New 400kV AIS built using North-East South-West configuration, South of [redacted] connecting [redacted] Creyke Beck to Thornton 400kV OHL	Yes	Yes	AIS	No	AIS

Cost estimates

Based on the latest Cost Book (2023/24 prices) and early project estimates, the preferred option, Option E-5, has an estimated total cost of [redacted] including risk and contingency. Pre Construction Funding of [redacted] is requested to [redacted]

The cost for other shortlisted options (excluding risk and contingency) are:

- Option E-5: [redacted]
- Option E-6: [redacted]
- Option E-7: [redacted]
- [redacted]Option E-8: [redacted]

Indicative delivery programme

The project is scheduled to deliver offered connection dates between 2030 and 2033, including to facilitate the expected operation date for NH-HM in 2031. [redacted] Cost apportionment and final efficiencies will be confirmed through the Project Assessment stage.

1. Introduction

1.1 Birkhill Wood 400kV Substation

This submission, coupled with its Annexes and Cost Benefit Analysis (CBA), is made under the Load Re-Opener and Price Control Deliverable (Special Condition 3.18 of the RIIO ET3 Licence) for the Birkhill Wood 400kV substation

The application seeks the following determinations from Ofgem:

- approval of project eligibility under the Load Re-Opener and Price Control Deliverable (Special Condition 3.18)
- confirmation that the project should proceed via Track 3 of the re-opener process; and
- approval of Pre Construction Funding (PCF) under Special Condition 3.15 (Pre Construction Funding Reopener, Price Control Deliverable).
- The investment is primarily driven by the requirement to provide compliant 400kV connections for [redacted] of contracted offshore wind generation. Birkhill Wood will also provide the northern connection point for North Humber to High Marnham, although that reinforcement performs a distinct role by providing additional transfer capability across the wider network.
- Subject to Ofgem confirming eligibility, needs case and PCF applicability, we will continue project delivery and intend to submit a Project Assessment in line with the re-opener process in the October 2027 window.

Eligibility, Project Track Statement and PASE

The project qualifies under Special Condition 3.18 as a load-driven investment scheduled for delivery within the RIIO-ET3 period. NGET has received bridging funding in RIIO-T2 for £2.1m (in 23/24 prices).

The investment is driven by contracted customer connections. The existing 400kV AIS Creyke Beck cannot accommodate an additional 6.87 GW of customer connections. The investment is therefore load-driven and triggered by contracted customer requirements and completion dates. Track 3 EL is appropriate as the preferred solution is not PASE aligned and has a materiality greater than £300m. However, due to the mature optioneering presented in this submission, we invite Ofgem's review of the optioneering and preferred solution. This track proposal has been discussed with Ofgem.

This project is not PASE aligned. Further detail is provided in PASE alignment in Section 3.5.

Preconstruction funding request

Under Special Condition 3.15 of the Electricity Transmission licence, this investment qualifies for allowances of [redacted] (23/24 prices), which is equal to 8.2% of its total forecasted cost [redacted] at the time of this Load Re-Opener Eligibility Letter submission).

Based on our current forecast we have provided below breakdown of costs amounting to [redacted] (23/24 prices) as part of this submission. This equates to [redacted] of the latest total forecast project costs.

Table 2 below summarises the activities covered by the application of these PCF allowances based on our current progress of PCF and EEW spend. This position will be updated as we continue to mature this investment and ultimately reconciled at Project Assessment stage of the re-opener.

We confirm that no PCF activity included in this submission has been funded through baseline allowances, other re openers, or alternative licence mechanisms.

[redacted]

1.2 Background

Chronology of investment

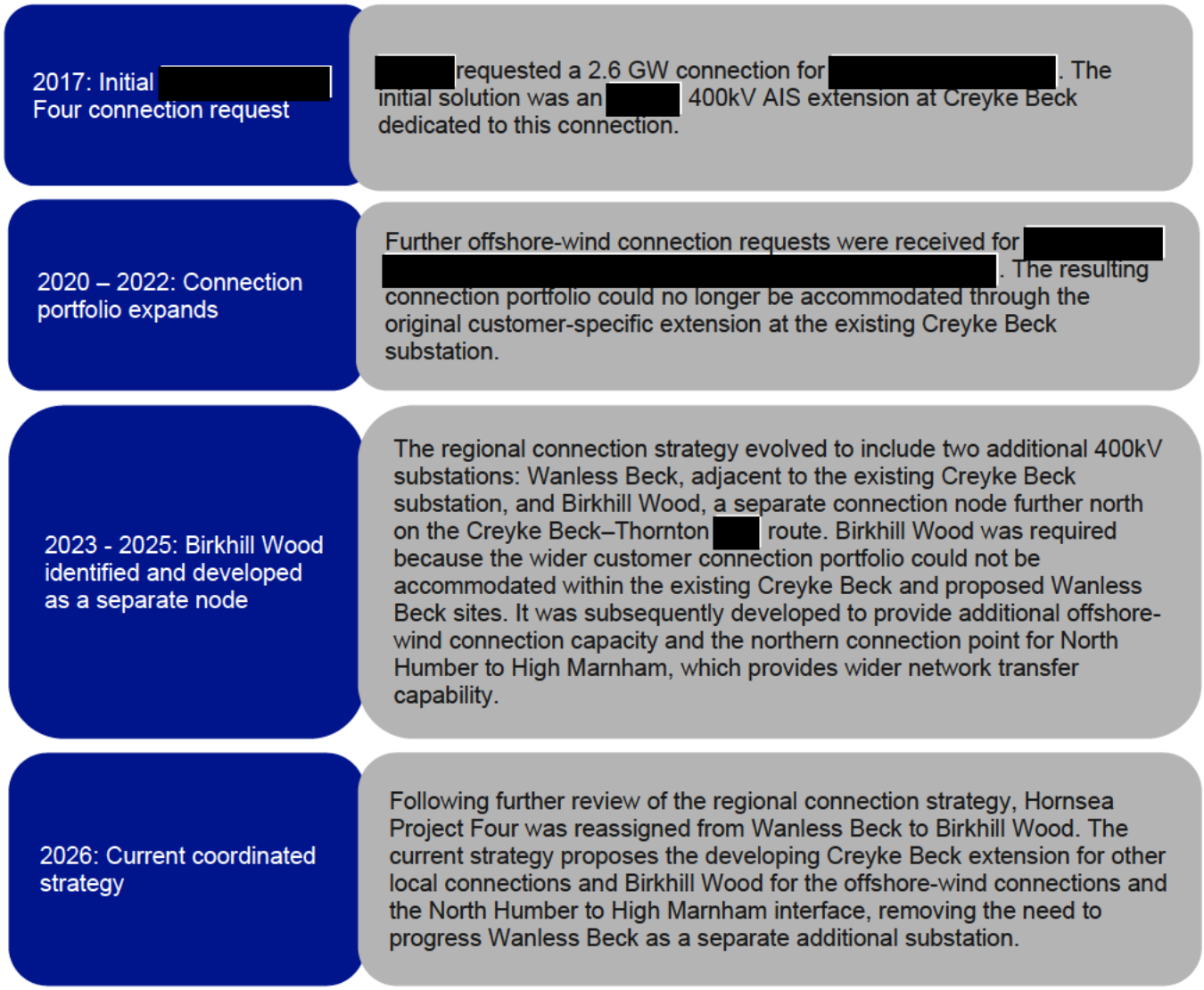
Creyke Beck is the principal North Humber connection point on the existing network for large-scale offshore wind. This because of its relative proximity to the North Sea enables shorter and more efficient onshore cable routes, while providing access to the established 400kV transmission network.

It already connects [redacted]. Since 2017, has experienced sustained growth in connection requests across offshore wind, solar, storage, CCGT and interconnectors. The resulting volume of generation cannot be accommodated at the existing Creyke Beck substation, including 7.4 GW of Gate 2 clean-power applications seeking connection between 2030 and 2033.

This has created the need for a new connection node, with Birkhill Wood providing the additional 400kV substation capacity required for the offshore wind projects that cannot be accommodated at Creyke Beck.

The customer connections drivers, siting study and high-level optioneering considerations are provided in Figure 1.

Figure 1: Summary of chronology



Regional and network context

Strategic energy context: Humber is the UK's largest industrial decarbonisation cluster and one of the country's highest-emitting regions. It has set an ambition to reach net zero by 2040, supported by the Humber Industrial Cluster Plan.

Major programmes include Zero Carbon Humber and Humber Zero, which aim to deploy carbon capture, utilisation and storage (CCUS) and low-carbon hydrogen at scale across refineries, power stations and industrial sites. The region also forms part of the East Coast Cluster, a government-supported Track-1 CCUS programme linking Humber and Teesside to offshore CO_2 storage.

In parallel, major offshore wind developments, including Dogger Bank, are increasing renewable generation connected through the wider Humber area. These developments are expected to increase both local electricity demand and wider transfer requirements, reinforcing Humber's role as a clean energy hub of growing national importance.

Transmission network context: The Humber transmission network sits on a key 400kV north–south corridor, supporting major power transfers from Scotland and the North Sea towards demand centres further south. It also includes legacy 275kV infrastructure serving established generation in the north of the estuary. Key nodes include Creyke Beck, Killingholme and Grimsby.

As renewable generation and industrial demand grow, the existing network remains central to system operation, but higher power flows are increasing operational complexity and strengthening the case for targeted reinforcement.

NGET's network strategy: RIIO-T3 to 2031 and beyond: NGET's strategy in Humber is based on phased reinforcement of the 400kV network to manage rising north–south transfers and support the connection of new generation and decarbonised industrial demand.

During RIIO-T3, planned works include new 400kV substations in the wider Creyke Beck and Grimsby areas, together with a new 400kV double-circuit link from Humber to the East Midlands, expected around 2031. This reinforcement is intended to address projected transfer limitations on the B8 boundary and improve the network's ability to transport offshore wind and other low-carbon generation.

These investments are being progressed as low-regret measures under the wider strategic transmission programme. Beyond 2031, further options remain under consideration, including additional export routes from the North Humber 275kV network if future need is demonstrated. Overall, the approach is evidence-led and phased, with investment timed to system need and coordinated with adjacent network developments to support resilience, operability and longer-term optionality.

Distribution network interaction: NGET has considered the embedded-generation connection applications affecting Creyke Beck in coordination with the relevant DNO. The current connection solution proposes limited intertripping and does not require additional high-voltage infrastructure or accommodation within the Birkhill Wood design. On the present assessment, these connections do not alter the need for, or scope of, Birkhill Wood.

Hornsea Project Four connection strategy: In July 2026, following further development of the regional connection strategy, NGET decided to relocate [redacted] connection from Wanless Beck to Birkhill Wood.

Accommodating the connection at Birkhill Wood removes the need to progress Wanless Beck as a separate substation and rationalises the previous three-substation strategy around Creyke Beck, its proposed AIS extension and the new Birkhill Wood GIS substation.

Benefits of the revised approach: The relocation provides significant technical, operational and commercial benefits:

- Improved connection delivery**:** It enables an AIS extension to be developed on non-operational land at Creyke Beck to accommodate other contracted customer connections, which will be subject to a future Load Reopener submission within RIIO-ET3. This supports consumers by enabling required connections through a more deliverable and coordinated network solution.
- **Reduced Creyke Beck scope:** Reassigning Hornsea Project Four to Birkhill Wood reduces the connection scope required at Creyke Beck. The earlier solution had to accommodate [redacted] alongside the wider customer portfolio, requiring a larger development for which the AIS alternatives had material footprint, flood-risk and consenting constraints. The remaining customer requirements can therefore be progressed through a smaller AIS extension on the non-operational land at Creyke Beck, removing the need for Wanless Beck as a separate GIS substation.
- **Reduced GIS and substation scope:** It reduces the number of in-flight investments, new substations and GIS installations required across the Creyke Beck area, while retaining the delivery and consenting advantages of the compact Birkhill Wood solution. By avoiding unnecessary network scope, this helps ensure expenditure remains proportionate, efficient and aligned to demonstrated system need.



Interactive projects

The successful delivery of Birkhill Wood is dependent on effective coordination with several interrelated projects that materially influence its scope, programme and deliverability.

Table 3: Interactive projects

Project	Details	Status
ASTI CGNC North Humber to High Marnham OHL	The relationship between Birkhill Wood and NH-HM is bidirectional. NH-HM enables full utilisation of offshore generation connected at Birkhill Wood, while Birkhill Wood provides the northern connection point required for the NH-HM reinforcement itself. The projects have therefore been developed as complementary components of a coordinated regional reinforcement strategy.	[redacted]
High Marnham substation	New 400kV AIS substation being built as the southern connection point for CGNC	[redacted]

Site background

Creyke Beck

The existing Creyke Beck site comprises:

- an NGET-owned outdoor 400kV AIS substation; and

a Northern Powergrid-owned indoor 132 kV GIS substation.

The 400kV substation was originally constructed in the 1960s and converted from a mesh-corner to double-busbar configuration in 2003. Northern Powergrid's 132 kV substation was rebuilt as GIS in 2013.

The existing 400kV substation comprises [redacted], including:

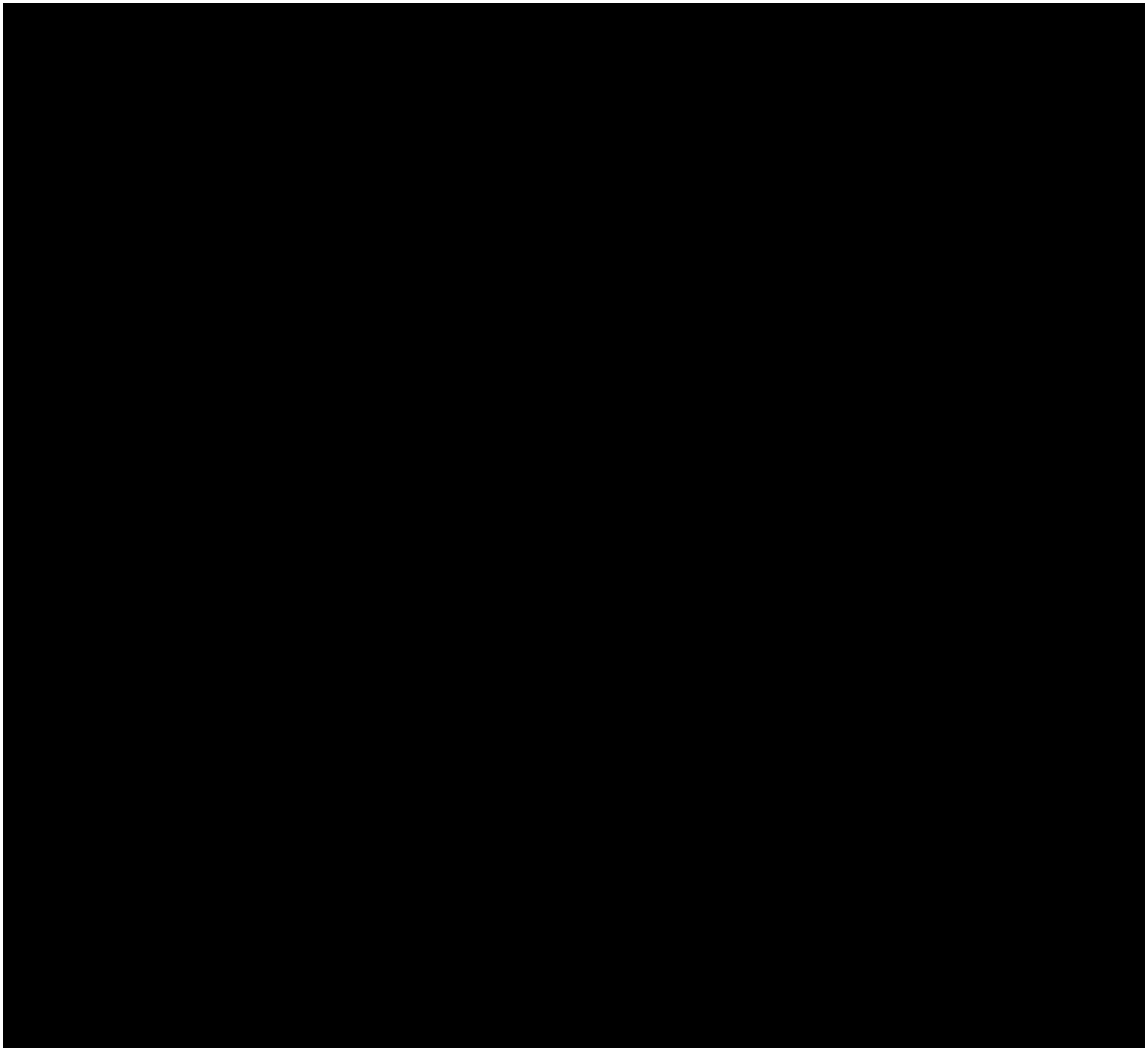
- [redacted] 400kV overhead-line feeder circuits;
- [redacted] 275kV overhead-line feeder circuits, supported by [redacted] 400/275kV 750 MVA SGTs;
- [redacted] 400/132 kV SGTs supplying the adjacent Northern Powergrid GIS substation;
- [redacted] 2,400 MW outdoor GIS generator bays for Dogger Bank A and B; and
- [redacted] 400kV bus sections and couplers.

Approximately [redacted] of surrounding non-operational land is reserved for the Creyke Beck AIS extension, which is being developed to accommodate contracted generation and storage connections with Gate 2 status following connections reform. Figure 3 below shows a 3D representation of the existing Creyke Beck site and connecting OHL configuration.

The land surrounding Creyke Beck is heavily constrained by multiple landownership interests and [redacted] limiting the area available for development, as illustrated in Figure 3.

[redacted]





Birkhill Wood

Birkhill Wood is proposed approximately [redacted] from Creyke Beck, connecting to the existing Creyke Beck to Thornton 400kV overhead line ([redacted]). A permanent access road is planned to serve both Birkhill Wood and the Creyke Beck AIS extension.

[redacted]

Historical funding

In the T2 LR baseline, NGT20041 [redacted] was allocated £2.1m (in 23/24 prices) of bridging funding for a scheme that was starting in T2 with its expected output to be delivered in T3. As per the FDs ET Annex 3.33 "Bridging allowance in the baseline to fund the RIIO-ET2 part of costs for projects already identified and assessed. This will be subject to true-up at either RIIO-T2 closeout or the setting of RIIO-T3."

Early Asset Write Offs (EAWO)

Due to Birkhill Wood being a new substation, no early asset write off is anticipated including taking into consideration the existing Creyke Beck 400kV substation and remote ends at Thornton and High Marnham.

2. Drivers and need case

This section explains the drivers for the investment. Table 4 summarises this position.

Table 4: Investment drivers

Summary of drivers		ACL date
Generation (Total 6.87 GW)	• [redacted] Two windfarms connecting [redacted] in total; representing a large-scale renewable generation connection driver that exports low-carbon electricity to the transmission network, supporting increased renewable integration and wider decarbonisation objectives. • [redacted] windfarm • [redacted] windfarm	[redacted] has a Staged ACL: [redacted] • [redacted] in [redacted] (Non-firm) and [redacted] (firm). • No ACL date has been confirmed for [redacted] at the time of writing, but [redacted] state their intention for a T-4 CFD, implying a connection date [redacted]

2.1 Customer

Table 5 provides an overview of customer connections, relative to this investment and the impacts of Connections Reform. A map showing customer locations is provided in Figure 7.

The customer ACL dates presented in this submission reflect the P6 Programme. The testing and setting of ACL dates for customer contracts within scope of connections reform is ongoing throughout 2026. Confirmation of agreed ACL dates will therefore be presented in the next stage of submission which is the Project Assessment.

Table 5: Details of customers with contracted connections

Customer name	Project name	Technology type	Embedded generation	MW size	Voltage (kV)	Connection date	Connections Reform gate
[redacted]	[redacted]	Wind Offshore	N/A	[redacted]	400kV	[redacted]	Gate 2 Phase 2
				[redacted]	400kV	[redacted]	Gate 2 Phase 2
[redacted]	[redacted]	Wind Offshore	N/A	[redacted]	400kV	[redacted]	Gate 2 Phase 1
				[redacted]	400kV	[redacted]	Gate 2 Phase 1
[redacted]	[redacted]	Wind Offshore	N/A	[redacted]	400kV	[redacted]	Gate 2 Phase 2
[redacted]	[redacted]	Wind Offshore	N/A	[redacted]	400kV	[redacted]	Gate 2 Phase 1

[redacted]

The confirmed investment need comprises the 4.27GW [redacted] and the Birkhill Wood interface required for North Humber to High Marnham. The additional [redacted] associated with [redacted] has been offered but is not currently treated as a confirmed contractual investment driver. The preferred design retains provision to accommodate [redacted] should it proceed, but the need for Birkhill Wood does not depend on that outcome.

[redacted] final status and delivery requirements remain uncertain. As the customer position develops, NGET will reassess the associated connection scope and delivery sequence and will retain only those elements supported by confirmed customer and network requirements. The updated customer position and its effect on efficient project scope will be presented at the Needs Case stage.

[2] Statement can be found at this URL: [redacted]

As customer status and connection dates are confirmed through Connections Reform, NGET will reassess the delivery sequence and efficient scope, retaining only those elements supported by confirmed customer and network requirements.



2.2 Asset health

Though the selection of the preferred load-driven intervention may affect how we manage the health of interfacing assets, there is currently no asset health driver directly associated with this scheme.

3. Optioneering

We have applied a staged, multi-factor optioneering process to identify the preferred option.

1. We start by determining the most suitable strategic option. Strategic optioneering determines the *type* of investment we should develop.
2. We then consider a longlist of technical options within each investment *type,* down selecting to a shortlist of options.
3. We then consider a shortlist of technical options, selecting a preferred option based on a qualitative balanced scorecard of considerations: Engineering, environmental, deliverability, economic/consumer value and consenting/stakeholder.
4. We then assess quantitatively all shortlisted options in a CBA to determine which technical option provides greater Net Present Value.

We then consider the outputs of both step 3 and 4 to provide a final preferred option.

Siting studies inform decisions on whether options should be rejected or progressed. Although this document presents the process sequentially, siting work is often undertaken in parallel with the assessment of longlisted and shortlisted options.

3.1 Strategic options

In line with our standard optioneering process, we considered the following broad strategic options:

Table 6: Strategic direction setting

Option	Description
Option A: Do nothing	This option involves making no changes and therefore doing nothing to facilitate the connection of customers.
Option B: Market based solution	This option involves accommodating increased customer demand through the procurement and use of ancillary services only.
Option C: Non-transmission, whole systems solution	This option involves addressing the identified need without constructing new transmission assets, instead relying on coordinated interventions across the wider electricity system.
Option D: Make use of existing assets.	This option involves making use of existing infrastructure such as substations and could include extension or uprating
Option E: New build	Facilitating the requested connection by building a new substation.

Further detail regarding this process is provided in Section 3.3.

Due to licence and contractual obligations and the inability to facilitate connection requests, Options A, B and C were discounted early in our optioneering process. As detailed below, our initial high-level assessment concludes that Option D would be unfeasible due to the volume of generation required to be accommodated and that the drivers could only be effectively met by building a new substation, Option E.

A descriptive rationale for rejection or progression from the longlist is explained in Table 9.

3.2 Siting

In some investment cases, such as new build substations, the assessment of the proposed investment location is usually contained in the Siting Study. As noted earlier in this document, in practice, this assessment is undertaken in parallel with the down-selection of technical solutions. Its position before the qualitative assessment of the preferred solution reflects the linear structure of this submission, rather than the way the work was carried out in practice.

As strategic option E would require a new site, a siting study was conducted to locate the most suitable location in the Creyke Beck vicinity. Creyke Beck already accommodates [redacted], with adjacent non-operational land reserved for further generation and storage connections.

Birkhill Wood was identified as a separate 400kV connection node because the wider offshore-wind portfolio could not be accommodated within the existing Creyke Beck substation and adjacent development land. Following the subsequent reassignment of Hornsea Project Four from Wanless Beck to Birkhill Wood, Wanless Beck was no longer required as a separate additional substation. The current strategy therefore consolidates the customer requirements across the Creyke Beck extension and Birkhill Wood.

Two siting studies were conducted to identify the preferred site for the Birkhill Wood substation. The scope of both siting studies and their respective preferred site for both AIS and GIS technology is presented below.

Table 7: Explanation of the two siting studies conducted at Birkhill Wood

Study	Purpose	Scope	Outcome
Initial Siting Study, February 2023	Identify a suitable location for Birkhill Wood within the original Creyke Beck search area	Seven sites assessed for GIS and AIS feasibility	Original Site 5 identified for GIS; AIS wraparound across Sites 5 and 5a retained
Expanded Siting Study, July 2026	Robustness check to identify any materially better AIS location and establish credible counterfactuals, without reopening the E-5 siting decision.	Seven sites assessed for the larger AIS footprint	Expanded Study Option 5 identified as the strongest alternative-site AIS location
Combined conclusion	Establish credible locations for detailed optioneering	Results of both studies considered together	GIS and AIS options progressed to the longlist and shortlist

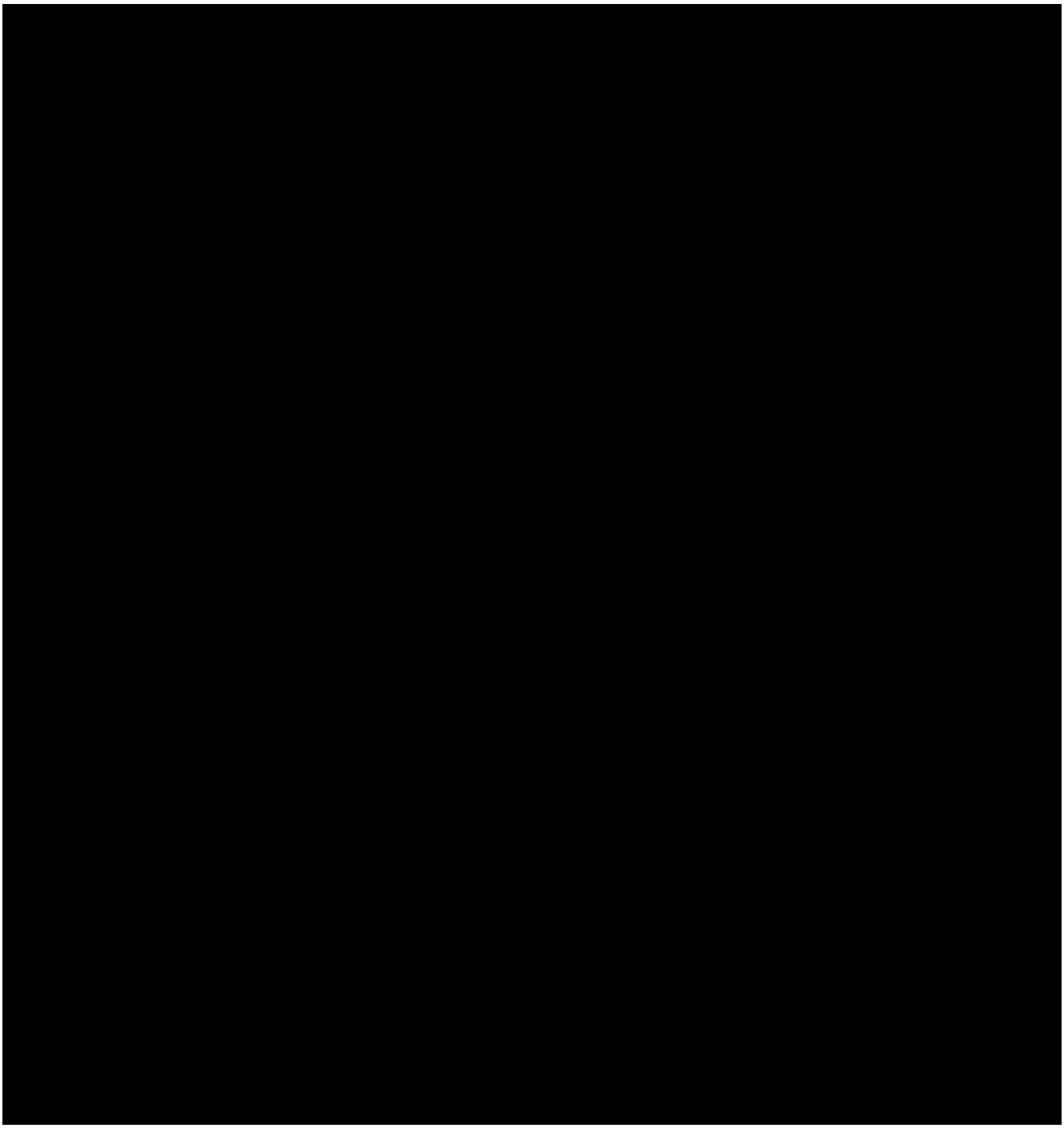
The scope of the study was bound by our statutory duties and planning policy requirements such as but not limited to; the Electricity Act 1989, the Horlock rules, the National Planning Policy Framework (NPPF) as well as National Policy Statements (NPS).

Initial Siting Study: February 2023

NGET undertook the Initial Siting Study to identify a suitable location for Birkhill Wood close to the existing Creyke Beck to Thornton [redacted] overhead-line route. The study assessed seven sites within the original search area against environmental, planning, socio-economic, safety and technical criteria, including land availability, proximity to the transmission network, customer cable routing, flood risk, constructability, consenting, cost and programme.

The study identified Site 5 as the preferred location for a GIS solution. An AIS wraparound arrangement extending across Sites 5 and 5a was also retained for further assessment. However, the larger AIS footprint interacted with flood-risk areas and buried infrastructure, including the [redacted].

The study area and seven sites are shown in Figure 8.



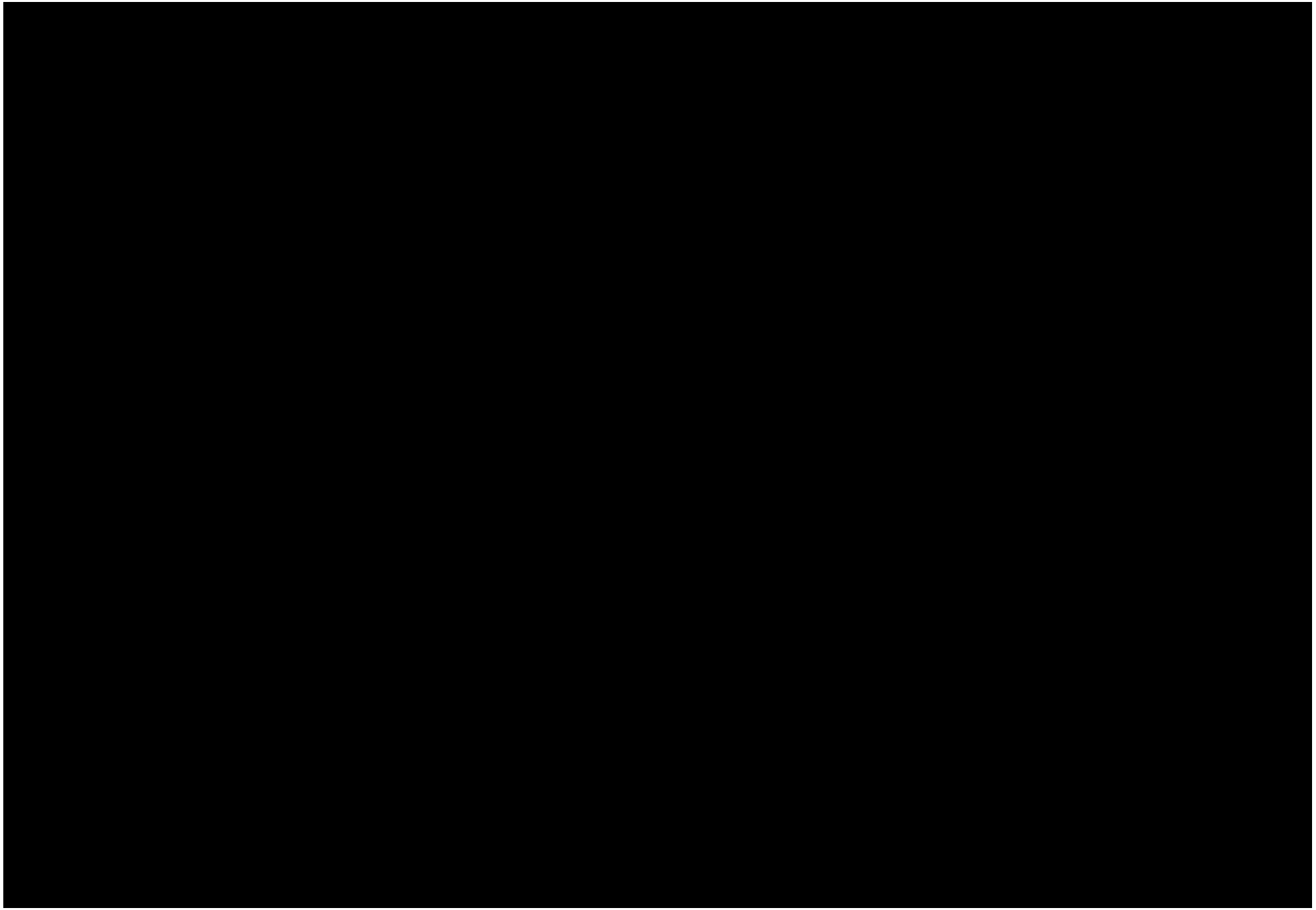
Expanded Siting Study: July 2026

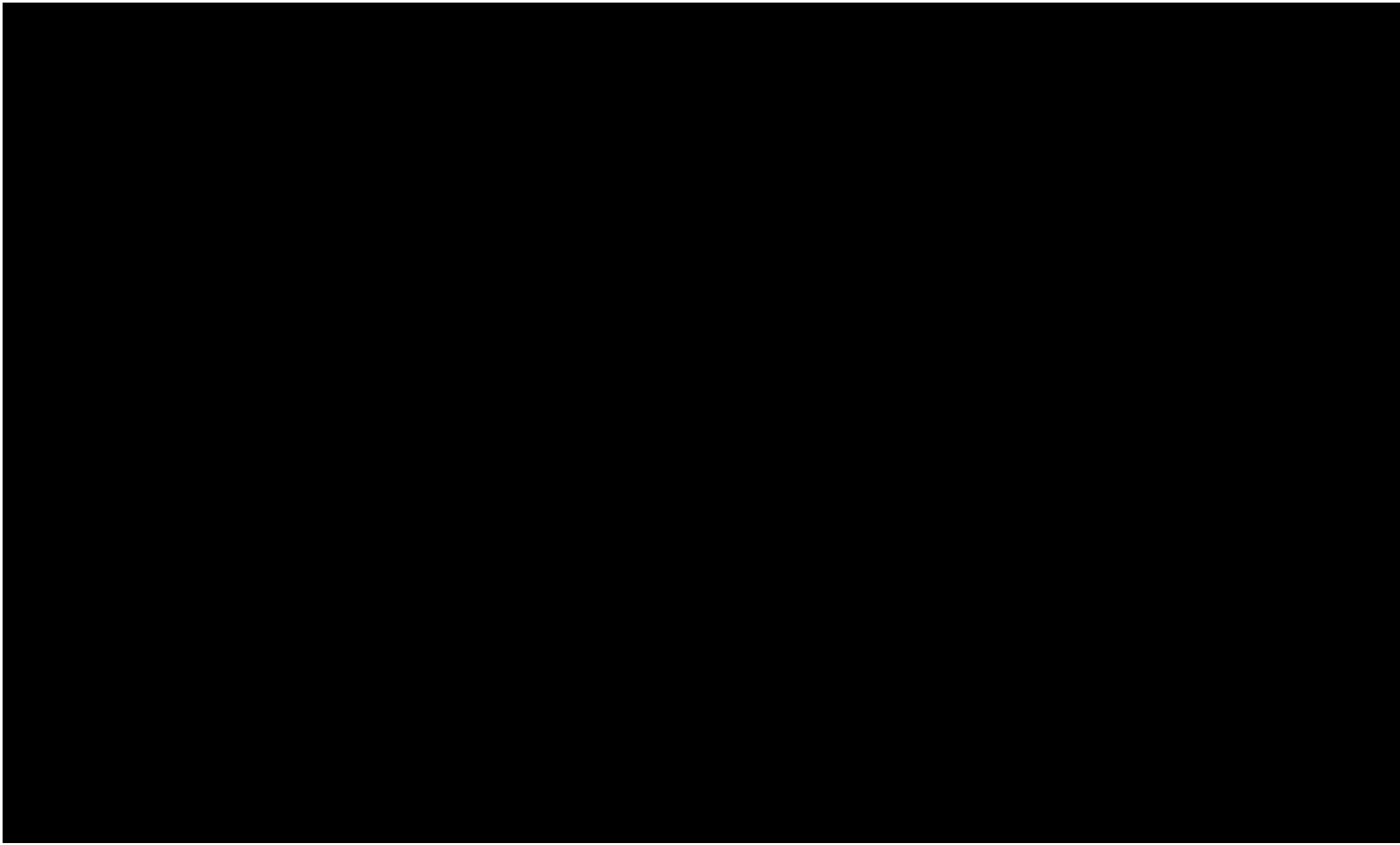
By July 2026, NGET had selected Original Study Site 5 and had progressed the E-5 GIS solution on the basis of the Initial Siting Study and subsequent project development. NGET commissioned an Expanded Siting Study as a robustness check to determine whether the original search area had omitted a materially better AIS location.

The expanded study widened the search area along the [redacted] route and identified and appraised seven potential sites against relevant environmental, planning and technical constraints. Its purpose was to test the continuing robustness of the E-5 decision and establish credible AIS counterfactuals, rather than to restart the original site-selection process**.** Seven sites were identified as illustrated in Figure 9 overleaf.

Options 1 to 3 were discounted because of significant interaction with planned infrastructure and environmental constraints. Options 4 to 7 were shortlisted for further assessment:

- **Option 4:** southwest of Bishop Burton and northwest of Walkington;
- **Option 5:** northeast of Walkington and approximately 30 m south of the [redacted] overhead line;
- **Option 6:** southwest of Bishop Burton and immediately north of Little Wood; and
- **Option 7:** northeast of North Newbald and southeast of Sancton.





The study identified Expanded Study Option 5 as the strongest alternative AIS location. This finding confirmed that AIS remained technically feasible outside the original search area but did not identify an alternative that provided a materially better overall outcome than E-5 once the additional land, consenting, civil engineering and programme requirements were considered.

From the original Siting Study, 7 sites were evaluated to consider both AIS and GIS solutions, with Site 5 being preferred for a GIS solution. No sites were identified that would avoid the buried constraints for an AIS option.

From the July 2026 Siting Study, 7 site options were evaluated to consider both AIS and GIS solutions, with Option 5 being preferred. Table 8 below shows the search area.

Table 8: Appraisal topics and RAG

	Initial Siting Study (February 2023)		Expanded Siting Study (July 2026)			
Site option	**Site 5**	**Site 5a**	**Option 4**	**Option 5**	**Option 6**	**Option 7**
Environmental						
Ecology						
Water						
Landscape and visual						
Historic environment						
Land quality						
Amenity						
Socio-economic						
Traffic, transport						
Economic activity						
Lanning and land						
Planning						
Land restrictions						
Technical						
Technical						

**Amber (lighter) = Constraints are likely to require further assessment but are also likely to be capable of resolution. Would not need to avoid.*
***Amber (darker) = Constraints are likely to require detailed assessment and/or mitigation and should be avoided if possible.*

Siting conclusion

The two studies served different purposes and should be read sequentially. The Initial Siting Study informed the selection of Original Study Site 5 and development of the E-5 GIS solution. The Expanded Siting Study was undertaken after that decision as a robustness check to determine whether a materially better AIS location had been missed and to provide credible AIS counterfactuals for assurance and regulatory comparison.

The expanded study did not identify an alternative that displaced E-5 as the preferred solution. Selecting E-7 or E-8 at the current stage would require NGET to discontinue the solution already in delivery and commence further site development, land, design and consenting activities. Switching at this current stage would materially delay the customer and NH-HM connection dates. Table 11 sets out the estimated connection-date impacts.

The comparative assessment of the GIS and AIS solutions at their respective preferred locations is summarised in Table 9 below.

3.3 Longlist of options considered

In line with our internal processes and Ofgem's Load Re-Opener Guidance, we have undertaken a proportionate multifactorial assessment of the options to identify the option that offers the best overall outcome for consumers.

Table 9: Assessment of longlist options

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
Stage 1: Longlist options identified as part of initial siting study (2023)				
A: Do nothing **Rejected**	NGET does not facilitate connections for multiple generation customers or establish a connection point in the Creyke Beck area for the 400kV North Humber to High Marnham (CGNC) OHL.	N/A	N/A - does not involve an infrastructure project	**Incompatible with our contractual and license obligations:** Compliant customer connections not delivered. North Humber connection node not available to facilitate CGNC.
B: Market-based solution **Rejected**	Increased customer demand is accommodated through the procurement and use of ancillary services.	N/A	N/A - does not involve an infrastructure project	**Incompatible with our contractual and license obligations:** Compliant customer connections not delivered. North Humber connection node not available to facilitate CGNC.
C: Whole systems solution **Rejected**	The customer connection is accommodated by a Distribution Network Operator (DNO) instead of NGET.	N/A	N/A - Engineering is not viable	**Engineering: Unviable to connect 6.87 GW of offshore wind through the DNO network:** NGET considered whether the identified need could be met through non-transmission solutions including alternative DNO connection arrangements, flexibility services or coordination with neighbouring transmission and distribution assets. Given the scale of the requirement (6.87 GW), the offshore generation location and the need to provide the North Humber connection point for NH-HM, no credible whole-system solution was identified that could provide an equivalent level of capacity, operability and strategic network capability. Consequently, a transmission-connected solution remained necessary.

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
Option D-1 **Rejected**	Creyke Beck is extended or rebuilt to accommodate the additional 6.87 GW of connections and facilitate the north humber connection of CGNC	N/A	N/A - Engineering is not viable	**Engineering: Unacceptable risk to network resilience and reliability by design:** Not progressed because the existing Creyke Beck substation has insufficient physical capacity to accommodate the full additional customer and network scope without material rebuilding and further concentration of infrastructure at an already constrained operational site.
Option D-2 **Rejected**	NGET provides connections for customers and connection node for CGNC to 275kV GIS Hedon substation, in the North Humber region which is located 13.5 km east of Creyke Beck towards the North Sea coast.	N/A	• Town and Country planning for a new 400kV substation at Hedon • DCO for new OHLs from Hedon back to Creyke Beck • Extended DCO for CGNC by c.13km	**Consumer/Economic Value: Disproportionate reinforcement work needed to connect 4.2GW into the 275kV network:** Connecting the additional generation at Hedon would require the existing 275kV substation to be rebuilt at 400kV, despite the investment being driven by new connections rather than an underlying need to replace the existing assets. It would also require additional overhead-line circuits to Creyke Beck and extend the CGNC route by approximately 13 km. These works would require material changes to existing consented schemes and further development consent, resulting in significant programme delay and disproportionate cost. This option however would provide the benefit of reducing the route length of customer onshore cabling by c.13km.
Option D-3 **Rejected**	NGET extends the existing 400kV AIS Thornton substation, in the North Humber region which is 28 km from Creyke Beck.	N/A	• Additional cable route lengths under DCO • Impact on Yorkshire Wolds ILA • Asset Health considerations of busbars at site. • Need to uprate substation to 63kA rating. Land restrictions for extension to the West due to a 3rd party	**Engineering and Consumer/Economic Value: Prohibitive cable route length of onshore customer cabling:** The Thornton substation is a 400kV AIS substation situated at an aerial distance of c.42 km from the North Sea, a further c. 22km in land than Creyke Beck, thereby more than doubling the length of onshore cabling required by each of the 4 windfarm connections. At c.£10m per km of underground transmission cabling, option would present a significant additional cost to the customer and ultimately the consumer, as due to CUSC

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
			development and to the East by a public highway	rules the cable would be deemed an infrastructure asset. The additional 22km of onshore cable routing would continue past Creyke Beck and through the designated Yorkshire Wolds Important Landscape Area.
Option E-1 **Rejected**	NGET builds a new 400kV double busbar substation at Garthorpe Tee point in the South Humber region, to convert the three ended double circuits to three double circuits feeding from / to this new substation	N/A	• Town and Country planning for a new 400kV substation / extension at Hedon • Additional cable route lengths under DCO	**Engineering and Consumer/Economic Value: Prohibitive cable route length of onshore customer cabling:** Garthrope Tee is situated at an aerial distance of c.45 km from the North Sea, a further c. 25km in land than Creyke Beck, thereby more than doubling the length of onshore cabling required by each of the 4 windfarm connections. The additional cable route length would mean a DCO would be required, adding a significant delay to the programme. See Option D-3 commentary. Due to CUSC ruling, the cost of the additional cable length would be borne by the consumer. As this option provides no clear benefit but has a significant cost impact on the consumer, in combination with other justifications highlighted, we have ruled option E-1 out. The Garthorpe Tee location would present a reduced OHL route length as it is site further south than Creyke Beck but would also be a suboptimal solution for maximising the impact CGNC will have on increasing B8 boundary capacity by siting in series with the existing Creyke Beck – Keadby north-south transmission corridor
Option E-2 **Rejected**	NGET builds 400kV double busbar substation at Fenwick Tee point in South Humber region, to convert the three ended double circuits to three	N/A	• Town and Country planning for a new 400kV substation / extension at Hedon • Additional cable route lengths under DCO	**Engineering and Consumer/Economic Value: Prohibitive cable route length of onshore customer cabling:** Fenwick Tee is situated at an aerial distance of c.67 km from the North Sea, a further c. 47km in land than Creyke Beck, thereby more than tripling the length of onshore

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
	double circuits feeding from / to this new substation			cabling required by each of the 3 windfarm connections. See Option D-3 commentary. The Fenwick Tee location would present a reduced OHL route length as it is sited further south than Creyke Beck but would also be a suboptimal solution for maximising the impact CGNC will have on increasing B8 boundary capacity by siting in series with the existing Thornton – Drax north-south transmission corridor
Option E-3 **Rejected**	GIS or AIS Staged Construction. NGET uses a phased approach rather than constructing a new substation upfront.	N/A	New land and CPO planning application required. Planning consent will need phasing to reflect the phases of construction	This option involves building the substation to 16 bays initially by 2030 to accommodate [redacted] connections. Then followed by an extension of a further 2 bays to accommodate NH-HM by 2031 and finally a third extension a 1 bay to accommodate [redacted] by [redacted] **Economic / Consumer Value** A phased construction approach will introduce inefficiencies with supply chains. This approach also carries inefficiencies in design as feeder circuits will require reconfiguring to accommodate changing power flow dynamics between phases of construction and ensuring the substation remains SQSS complaint. **Deliverability**: As the customer connections dates and NH-HM expected operational dates are relatively close in timeframe there was no net benefit to phasing this project.

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
Option E-4 **Rejected**	A new [redacted] AIS substation 700m North of Creyke Beck, connecting to the [redacted] route North South of the OH spanning site 5 and 5A	**Layout:** 21_OMN_0001-BIRKHILL WOOD - NORTH TO SOUTH	• Developing with Flood Risk Zone 2 and 3 [redacted] • Town and country planning consent for new [redacted] substation • Section 37 OHL diversion • Adjacent residential dwelling	**Economic/Consumer Value and Environment: Excessive Utility Diversions:** This option requires 2 pipeline diversions - the [redacted] Options E-5 and E-6 are also impact by this constraint. This solution is also sited perpendicular to the Creyke Beck – Thornton / [redacted] Overhead Line alignment. Therefore, a significant temporary diversion is required of up to 6 spans, 2 kms, including removal of existing towers and adding additional cost and consenting risk to the programme.
Option E-5 **Taken forward**	A new [redacted] 400kV GIS SF_6-free substation, north of Cryke Beck to be built spanning sites 5 and 5a connecting to the [redacted] route near Creyke Beck.	**Layout:** 21_OMN_0004-BIRKHILL WOOD - GIS-SHT1	• Town and country planning consent for new 5 hectare substation • Section 37 OHL diversion • Adjacent residential dwelling	**Uses GIS technology to make the following deliverability improvements on Option E-4:** **Environmental:** Avoids needing to develop on Flood Zones 2 and 3. Development within Flood Zones 2 and 3 would require additional assessment and potentially further flood-resilience measures, increasing cost and delivery risk without providing a corresponding benefit over options located outside areas of higher flood risk. **Engineering**: Avoids [redacted] This solution is also sited parallel to the Creyke Beck–Thornton [redacted] overhead line alignment, minimising the length of the required diversion. The diversion would only need to remain in place during erection of the new terminal tower, rather than throughout the substation construction programme, reducing the cost and delivery programme of Option E-5.

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
Option E-6 **Taken forward**	A new [redacted] AIS Wrap Around substation 700m connecting to the [redacted] route, East West of the OH spanning Site 5 and 5A	**Layout:** 21_OMN_0003-BIRKHILL WOOD - WRAP AROUND	• Developing with Flood Risk Zone 2 and 3 [redacted] • Town and country planning consent for new 11.5 hectare substation • Section 37 OHL diversion • Adjacent residential dwelling	**As for Option E-4, however with the following deliverability improvements:** **Engineering:** The wraparound solution avoids diverting the [redacted] costs to the consumer, relative to Option E-4. However, the [redacted] **Environmental:** This option compared to other rejected AIS options has the lowest footprint overall and impacts less on the nearby Flood Zone 2 and 3. Development within Flood Zones 2 and 3 introduces additional flood-resilience, design and consenting requirements, increasing engineering complexity, cost and programme risk relative to options located outside areas of higher flood risk.
Stage 2: AIS options identified as part of expanded siting study (2026)				
Option E-7 **Taken forward**	New 400kV AIS built using North-East South-West configuration, South of [redacted] connecting [redacted] Creyke Beck to Thornton 400kV OHL	**Layout:** 21_OMN_0001-BIRKHILL WOOD - NORTH TO SOUTH	• Consenting/stakeholder: The proximity of a residential property, approximately 20m from the site, requires further assessment of potential noise and amenity effects. • Consenting/Stakeholder: The site partially overlaps the proposed [redacted] DCO boundaries, creating potential land-use and scheme-interface constraints.	**Engineering**: Provides sufficient land for the AIS footprint and future expansion, with the existing OHL crossing the site and enabling a potentially straightforward connection. **Environmental:** No material flood constraints, mapped priority habitat or Scheduled Monuments within 1 km.

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
			• Environmental: Development may require removal of several hedgerow sections, with priority woodland approximately 55 m south.	
Option E-8 **Taken forward**	New 400kV AIS built using North-East South-West configuration, North of [redacted] connecting [redacted] Creyke Beck to Thornton 400kV OHL	**Layout:** 21_OMN_0001-BIRKHILL WOOD - NORTH TO SOUTH	• Consenting/Stakeholder: The eastern half partially overlaps the proposed [redacted] DCO boundaries. • Environmental: The site comprises Grade 2 best and most versatile agricultural land and development may require partial removal of four hedgerows.	**Engineering:** Provides sufficient land for the AIS footprint and future expansion. Connection to the existing OHL approximately 30 m north is technically feasible and relatively straightforward. **Environmental:** Environmental constraints are manageable, with no mapped priority habitat or woodland within or adjacent to the site and no identified flood constraint. **Consenting/Stakeholder:** The nearest residential receptor is approximately 270 m away, providing reduced consenting risk relative to other AIS options E-7, E-9, and E-10.
Option E-9 **Rejected**	New 400kV AIS built using North South configuration, South of [redacted] connecting 4ZR Creyke Beck to Thornton 400kV OHL	**Layout:** 21_OMN_0001-BIRKHILL WOOD - NORTH TO SOUTH	• Environmental: Little Wood Ancient Woodland lies approximately 8 m south and a Local Wildlife Site is directly adjacent, creating significant ecological risk. • Consenting/Stakeholder: Ten Scheduled Monuments lie within 1 km, including five within the potential land-purchase area, with effects on their settings and interrelationships considered unavoidable. • Environmental: The site is wholly within Grade 2 best	**Engineering:** Provides sufficient land, expansion capacity and a potentially straightforward connection where the existing OHL crosses the northern extent. **Environmental**: Relatively flat terrain and established vegetation may provide some landscape screening. **Consenting/Stakeholder:** No identified overlap with other DCO projects or adjacent planning applications.

Option name and status (progressed/not progressed)	Technical Description	Relevant diagrams, layout or SLD reference	Consenting risk and environmental constraints	Rationale for rejecting or taking forward the option
			and most versatile agricultural land. • Consenting/Stakeholder: A public footpath is directly adjacent to the eastern boundary.	
Option E-10 **Rejected**	New 400kV AIS substation south of the [redacted] route, arranged on a north-east to south-west axis and connected into the Creyke Beck to Thornton overhead line.	**Layout:** 21_OMN_0001-BIRKHILL WOOD - NORTH TO SOUTH	• Consenting/Stakeholder: A Scheduled Monument lies approximately 5 m east and effects on the settings of nearby Bronze Age barrows would be unavoidable. • Environmental: Elevated and sloping topography, together with limited screening, could increase landscape and visual effects. • Consenting/Stakeholder: A residential receptor approximately 80 m west creates potential noise and amenity constraints.	**Engineering:** Provides sufficient land, expansion capacity and a potentially straightforward connection where the existing OHL crosses the northern extent. **Engineering:** Sloping topography may require significant cut-and-fill works. **Deliverability:** Construction access relies on narrow rural roads and is poorer than for the other options assessed.

Summary of our shortlisting rationale:

- We ruled out Options A, B and C because they could not provide compliant customer connections or the required northern connection point for the North Humber to High Marnham reinforcement
- We ruled out Options D-1 to D-3 on engineering and consumer-value grounds because the existing or neighbouring substations could not accommodate the required generation efficiently without unacceptable resilience risk, major reinforcement or substantially longer customer cable routes.
- We ruled out Options E-1 and E-2 on engineering and consumer-value grounds because their locations would require substantially longer customer cable routes and would not maximise the boundary-capability benefit of the North Humber to High Marnham reinforcement.
- We ruled out Option E-3 on economic and deliverability grounds because phased construction would introduce supply-chain, design and reconfiguration inefficiencies without providing a programme benefit
- We ruled out Option E-4 on environmental, consenting and consumer-value grounds because it would require diversion of both major pipelines and an extensive temporary overhead-line diversion.
- We ruled out Options E-9 and E-10 because their ecological, heritage, landscape, residential and construction constraints were materially greater than those of the more credible AIS alternatives, without any clear benefit over options E-7 and E-8.

We shortlisted four Birkhill Wood options:

- E-5: New 400kV SF_6-free GIS substation at the original preferred site
- E-6: New 400kV AIS wraparound substation at the original preferred site
- E-7: New 400kV AIS substation south of the [redacted] overhead line
- E-8: New 400kV AIS substation north of the [redacted] overhead line

Stakeholder influence on shortlisting

[redacted]

[redacted]

[redacted]

[redacted]

[redacted]

Planning and consenting:

Given the importance of timely delivery, NGET placed significant weight on planning and consenting risk when forming the shortlist, as these factors could materially affect the programme and the ability to meet the required connection dates. The initial siting study found that no AIS arrangement close to Creyke Beck could avoid all buried-infrastructure and flood-risk constraints. [redacted] and programme risk. For flood risk, encroachment into Flood Zones 2 and 3 requires additional flood-risk assessment, mitigation and Environment Agency consent.

It therefore retained E-6 as the most credible AIS arrangement at the original location, alongside the more compact E-5 GIS solution [redacted] which avoids both pipeline diversions and Flood Zones 2 and 3, thereby reducing the land take required subsequentially reducing planning and consenting risk. NGET has engaged with the Local Planning Authority on E-5 and has secured planning consent for this solution, providing greater certainty over its deliverability.

As the initial study did not identify an AIS solution free from significant constraints, NGET commissioned an expanded siting study across a wider area. This identified E-7 and E-8 as credible alternative AIS locations for further assessment, although both interact with proposed third-party development boundaries. NGET considered the cumulative effects of existing and planned development around Creyke Beck and assessed each candidate site against relevant landscape and visual constraints, including its relationship with the Yorkshire Wolds.

These considerations informed the shortlist and a targeted land-acquisition approach intended to minimise land take while accommodating the proposed transmission and generation developments.

3.4 Shortlisted options

The four shortlisted options for 400kV Birkhill Wood site strategy are:

- E-5: New 400kV SF_6-free GIS substation at the original preferred site
- E-6: New 400kV AIS wraparound substation at the original preferred site
- E-7: New 400kV AIS substation south of the [redacted] overhead line
- E-8: New 400kV AIS substation north of the [redacted] overhead line

Description of short-list options considered

Option E-5: New 400kV SF_6-free GIS substation at the original preferred site

Proposed works:

- Construct a new [redacted] 400kV SF_6-free GIS double-busbar substation approximately [redacted] north of the existing Creyke Beck substation, with a footprint of approximately 5 hectares.
- Connect the new substation to the Creyke Beck to Thornton [redacted] overhead line through a double-circuit turn-in and two new terminal towers.
- Install a temporary single-circuit diversion on temporary masts for approximately five months, enabling the terminal towers and substation to be constructed in parallel.
- Provide six incoming overhead-line circuits, customer cable connections, banked GIS circuits, bus-section and bus-coupler bays, together with provision for four future circuit bays, one additional bus coupler and one additional bus section.
- Construct a permanent access road from the A1079, a GIS building, modular ancillary buildings and associated internal access, cable, drainage and civil infrastructure.
- Raise the site by approximately 1.5 m to achieve suitable drainage falls and construct a balancing pond of approximately 850 m².

How it meets the driver:

- Provides the 400kV connection infrastructure required for the offshore wind generation connecting at Birkhill Wood and the northern connection point for the North Humber to High Marnham reinforcement.
- Provides additional bays for future network expansion while its compact design limits land take, civil works and enabling infrastructure.
- Allows overhead-line and substation works to be undertaken in parallel, supporting delivery of the required customer and network connection dates.

Drawings:

- Please see Appendix D for the SLD and layout drawings

Option E-6: New 400kV AIS wraparound substation at the original preferred site

Proposed works:

- Construct a new [redacted] 400kV AIS double-busbar wraparound substation approximately [redacted] north of the existing Creyke Beck substation, with a footprint of approximately 11.5 hectares.
- Connect the new substation to the Creyke Beck to Thornton [redacted] overhead line through a double-circuit turn-in.
- Permanently divert the double-circuit overhead line to the west of the proposed substation before substation construction begins.
- Provide six incoming overhead-line or cable circuits, customer cable connections, banked circuits, bus-section and bus-coupler bays, together with provision for four future circuit bays, one additional bus coupler and one additional bus section.
- Construct a permanent access road from the A1079 and undertake extensive civil works, including internal roads, cable ducts and troughs.
- Divert the SABIC pipeline, Park Lane public right of way and bridleway, and an existing watercourse.
- Raise the site by approximately 3 m, provide additional flood-attenuation land and construct an attenuation pond of approximately 2,400 m².
- [redacted] platform.

How it meets the driver:

- Provides the 400kV connection infrastructure required for the offshore wind generation connecting at Birkhill Wood and the northern connection point for the North Humber to High Marnham reinforcement.
- Provides additional bays for future network expansion, but requires the overhead-line and third-party diversions to be completed before the main substation construction can proceed.

Drawings:

- Please see Appendix D for the SLD and layout drawings

Option E-7: New 400kV AIS substation south of the 4ZR overhead line

Proposed works:

- Construct a new [redacted] 400kV AIS double-busbar substation approximately 7km north of the existing Creyke Beck substation, with a footprint of approximately
- Connect the new substation to the Creyke Beck to Thornton [redacted] overhead line through a double-circuit turn-in including 4 new towers
- Provide six incoming overhead-line or cable circuits, customer cable connections, banked circuits, bus-section and bus-coupler bays, together with provision for four future circuit bays, one additional bus coupler and one additional bus section.

- Construct a permanent access road from Walkington heads road and undertake extensive civil works, including internal roads, cable ducts and troughs.
- Cut approximately 475,331m3 of material and fill approximately 698,380m3 of material due to contour of the land

How it meets the driver:

- Provides the 400kV connection infrastructure required for the offshore wind generation connecting at Birkhill Wood and the northern connection point for the North Humber to High Marnham reinforcement.
- Provides additional bays for future network expansion

Drawings:

- Please see Appendix D for the SLD and layout drawings

Option E-8: New 400kV AIS substation north of the 4ZR overhead line

Proposed works:

- Construct a new [redacted] 400kV AIS double-busbar substation approximately [redacted] north of the existing Creyke Beck substation, with a footprint of approximately
- Connect the new substation to the Creyke Beck to Thornton [redacted] overhead line through a double-circuit turn-in including 4 new towers
- Provide six incoming overhead-line or cable circuits, customer cable connections, banked circuits, bus-section and bus-coupler bays, together with provision for four future circuit bays, one additional bus coupler and one additional bus section.
- Construct a permanent access road from Walkington heads road and undertake extensive civil works, including internal roads, cable ducts and troughs.
- Cut approximately 693,894m3 of material and fill approximately 618511m3 of material due to contour of the land

How it meets the driver:

- Provides the 400kV connection infrastructure required for the offshore wind generation connecting at Birkhill Wood and the northern connection point for the North Humber to High Marnham reinforcement.
- Provides additional bays for future network expansion

Drawings:

- Please see Appendix D for the SLD and layout drawings

The System Design Table (SDT) for each option is provided within Appendix B - System design table.

In appraising these 4 options, we undertook a proportionate, multi factor qualitative assessment to determine which option delivers the best overall outcome for consumers, while meeting the investment drivers. The results are summarised in Table 10.

3.5 Qualitative assessment of shortlist

Table 10: Multifactorial analysis

Option	Optioneering categories				
	Engineering	Environmental	Deliverability	Economic / consumer value	Consenting / stakeholder
Option E-5: New 400kV SF_6-free GIS substation at the original preferred site	✓ Safety by design: The siting and compact GIS design avoid disturbance to both pipelines. × Overhead line works: Requires a temporary single-circuit diversion between [redacted] on temporary masts for approximately six months while the new towers are constructed. ✓ Flood risk: Avoids the identified flood zones and does not require watercourse mitigation during construction. × Technology: GIS technology changes can constrain access to spares and result in long lead times for basic consumable components.	✓ Avoiding [redacted] reduces severe health, safety and environmental risks. NGET's environmental obligations and the Holford and Horlock guidelines do not support diverting an environmentally sensitive pipeline where lower-impact alternatives are available. ✓ The smaller GIS footprint minimises effects on existing habitats and allows Biodiversity Net Gain to be delivered on site. ✓ Avoids direct interaction with flood-risk zones, watercourses and aquatic habitats. ✓ Smaller land take reduces farmland loss and direct landscape effects. × The alternative insulating gas remains a greenhouse gas and	✓ The programme meets the required customer connection dates and the North Humber to High Marnham overhead-line programme. ✓ The temporary overhead-line diversion can be completed in parallel with substation construction. ✓ [redacted] or Park Lane diversion is required.	✓ Requires a less extensive and less intensive enabling-works programme. × Equipment faults may require longer outages, with potential costs arising from lost generation infeed. ✓ Compact footprint reduces land, civil, flood-mitigation and third-party interface costs	✓ The submitted Birkhill Wood development received planning consent in April 2026. Separately, NGET's option assessment identifies E-5's smaller footprint as reducing land and consenting interfaces relative to the AIS alternatives. × The substation footprint is approximately 230 m by 215 m, or 5 hectares, with 12 hectares of land required within a single field boundary affecting one landowner. ✓ The smaller footprint reduces the complexity of the land acquisition process.

Option	Optioneering categories				
	Engineering	Environmental	Deliverability	Economic / consumer value	Consenting / stakeholder
		requires disposal consideration.			
	Benefit	Neutral	Benefit	Benefit	Neutral
Option E-6: New 400kV AIS wraparound substation at the original preferred site	✓ Safety by design: [redacted] × [redacted]. × Overhead line works: Requires a substantial [redacted] diversion, including double-circuit operation through terminal towers during construction. × Flood risk: Encroaches into Flood Zone 3, requiring site raising and additional flood-compensation measures. × Climate adaptation: Requires enhanced flood-protection measures for AIS equipment, increasing cost and engineering complexity.	× The larger footprint has a greater effect on existing habitats and requires substantial additional land to achieve the statutory 10% Biodiversity Net Gain. × The site extends across watercourses and into Flood Zones 2 and 3, requiring flood-risk assessment, modelling and mitigation.	× The longer programme would delay customer connections and the North Humber to High Marnham overhead-line project by approximately 4 years. × The double-circuit overhead-line diversion must be completed before substation construction and is expected to take approximately 12 months. × [redacted] must also be diverted before construction. × Extensive civil works are required to mitigate development within the flood zone.	× [redacted] double-circuit overhead-line diversion, larger land requirement and diversion of Park Lane. ✓ Air-insulated equipment is generally less maintenance, although its outdoor installation exposes it to climatic wear. × Higher capital cost, driven by the larger footprint, civil works, land requirements and third-party diversions.	× The option requires 280% more land than E-5 and increases CPO complexity through multiple landowners and third-party requirements. - **The substation footprint is approximately 515 m by 225 m, or 11.5 hectares.** × Required diversions increase the risk of objections from statutory undertakers. × Diversion of the Park Lane bridleway requires complex land rights and diversion orders and may add more than 12 months to the programme. × Overhead-line diversions affect third parties, while the option's scale and visual effects are

Option	Optioneering categories				
	Engineering	Environmental	Deliverability	Economic / consumer value	Consenting / stakeholder
					expected to generate local opposition.
	Strong Detractor	**Detractor**	**Strong Detractor**	**Neutral**	**Strong Detractor**
Option E-7: New 400kV AIS substation south of the 4ZR overhead line	✓ Unlike E-4 at the original site, the expanded-study location avoids the [redacted]. ✓ Uses the same north-east to south-west **400kV** AIS configuration developed under Option E-4, providing the required double-busbar substation arrangement and capacity for future expansion.	✓ The site comprises predominantly arable land and is not within an area of significant flood risk. × The site includes Grade 2 best and most versatile agricultural land, resulting in permanent agricultural land loss. × Existing vegetation provides limited screening and the scale of the AIS development would remain prominent within the landscape	✓ Avoiding the major pipeline diversions associated with E-4 materially reduces construction complexity, third-party dependencies and programme risk. × The direct overhead-line interface may limit the extent of additional connection works.	× Greater existing gradients mean significantly more excavations and engineered fill to establish substation platform levels × However, the larger AIS footprint would require a substantial land area and associated civil, access and mitigation works. ✓ Air-insulated equipment is generally less maintenance, although its outdoor installation exposes it to climatic wear.	× Although this location [redacted] consenting risks associated with E-4, its residential proximity and DCO interfaces create material consenting and stakeholder risks. Changing DCO at this time risks adding a significant delay to the programme which is not acceptable. × The south-eastern extent of the site overlaps the proposed [redacted] boundaries, creating potential land-use and project-interface risks. ×
	Benefit	**Detractor**	**Neutral**	**Detractor**	**Strong Detractor**
Option E-8: New 400kV AIS	✓ Unlike E-4 at the original site, the expanded-study location avoids the	✓ The site comprises arable land and is not within an	✓ Avoiding the [redacted] diversions associated with E-4 materially reduces	× Greater existing gradients mean significantly more excavations and	× The eastern part of the site overlaps the proposed [redacted]

Option	Optioneering categories				
	Engineering	Environmental	Deliverability	Economic / consumer value	Consenting / stakeholder
substation north of the 4ZR overhead line	[redacted] ✓ Uses the same north-east to south-west **400kV** AIS configuration developed under Option E-4, providing the required double-busbar substation arrangement and capacity for future expansion. ✓ The existing [redacted] overhead line is approximately 30 m north of the site, enabling a technically feasible and relatively straightforward connection.	area of significant flood risk.	construction complexity, third-party dependencies and programme risk. - The local road network comprises narrow rural roads and would require appropriate construction traffic management.	engineered fill to establish substation platform levels [redacted] Reusing the E-4 AIS technical solution at this alternative site avoids the cost and risk associated with diverting the [redacted] ✓ The site provides sufficient land for future expansion, reducing the risk of avoidable future rework. × However, the larger AIS footprint would require substantial land acquisition and associated civil, access and mitigation works.	[redacted] CO boundaries, creating potential land-use and project-interface risks. ✓ This location avoids the pipeline, flood-zone and residential-proximity constraints associated with E-4 and E-7. The siting study therefore identifies it as the preferred AIS site and the option best suited for development.
	Benefit	Neutral	Benefit	Detractor	Benefit

Qualitative assessment output

Given the scale of clean power connecting at Birkhill Wood, NGET placed particular weight on timely deliverability in its optioneering, balanced against engineering, environmental, consumer-value and stakeholder/consenting considerations. Given this prioritisation, and based on the qualitative assessment above, we prefer Option E-5 because it:

- is expected to be delivered approximately four years earlier than E-6, enabling the Birkhill Wood interface required for NH-HM to be available in [redacted]. By enabling CGNC to realise its benefits earlier, this avoids an estimated [redacted] of cumulative constraint costs associated with a four-year delay;
- can be delivered approximately 2.5 to three years earlier than E-7 and E-8, bringing forward customer connections and the associated low-carbon generation benefits;

[redacted]

- avoids Flood Zones 2 and 3 and the associated watercourse, flood-mitigation and additional land requirements;
- has a substantially smaller footprint, at approximately [redacted] compared with [redacted] for E-6 and [redacted] for E-7 and E-8, reducing land acquisition, habitat, landscape and consenting impacts;
- allows the temporary overhead-line diversion and substation construction to proceed broadly in parallel, supporting timely delivery;
- avoids the significant cut-and-fill and platform-construction requirements associated with the more heavily contoured E-7 and E-8 sites.

The preference for E-5 therefore reflects the cumulative programme, engineering, environmental, consenting and delivery implications of the alternative AIS designs, rather than pipeline avoidance alone.

PASE alignment

The preferred option, E-5, is a new [redacted], including two spare bays, 400kV SF_6-free GIS double-busbar substation and is not PASE-aligned.

NGET assessed three credible PASE-aligned AIS alternatives:

- E-6 at the preferred Birkhill Wood site, and;
- E-7 and E-8 at alternative sites identified through the expanded siting study.

E-6 confirms that AIS is technically feasible at the preferred site and provides the direct PASE-aligned comparator to E-5. However, its approximately 11.5-hectare footprint, compared with approximately five hectares for E-5, would extend into Flood Zones 2 and 3 and require additional land, flood mitigation, civil works and [redacted] and an existing watercourse. Although E-6 is currently expected to avoid diversion of the [redacted], proximity to the live asset remains a material interface. Its overhead-line diversion and enabling works must also precede the main substation construction, resulting in a programme approximately four years longer than E-5. E-5's earlier delivery enables the Birkhill Wood interface required for NH-HM to be available in 2031 and allows CGNC to realise its benefits sooner. A four-year delay to those benefits would result in cumulative constraint costs of [redacted] This benefit is attributable to CGNC, with E-5 acting as the enabling interface, and is presented on that basis to avoid double counting with the separate ASTI assessment.

E-7 and E-8 demonstrate that AIS could be delivered at alternative locations, but their approximately 14.9-hectare footprints, more heavily contoured sites and associated earthworks introduce greater land, environmental, landscape, consenting and access impacts. Selecting E-7 or E-8 at the current stage of project development would require a material change from E-5, which is already in delivery, and would significantly delay the programme. Table 11 sets out the estimated impact on the relevant customer and NH-HM connection dates.

Table 11: Estimated connection-date impacts of selecting E-7 or E-8

Connection name	Current connection date	Connection date if we pivoted to AIS at this stage
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]
[redacted]	[redacted]	[redacted]

The assessment demonstrates that, although PASE-aligned AIS solutions are technically feasible, they would require materially more land, enabling works and third-party intervention and would be delivered materially later. These project-specific constraints provide a proportionate and evidence-led justification for E-5's departure from PASE.

On that basis, E-5 provides a robust and evidence led justification for a targeted departure from PASE, while remaining consistent with ETDP Principle S6, which allows AIS or GIS to be selected according to site-specific factors, and with Principles S5, S7 and S8 on climate resilience, space optimisation and connection interfaces.

3.6 Quantitative analysis of shortlist options

Cost estimates of shortlist options

To assess the shortlisted options, cost estimates have been created for quantitative economic comparison. All capex costs are derived from NGET's latest Cost Book (23/24 prices). Estimating Units Lines (EULs) have been used to generate cost estimates based on the scope of work and the new assets to be acquired for each option. For each EUL, we have applied a 13.8% contingency, based on historic project analysis, to account for unforeseen circumstances and to mitigate risks during implementation. At each stage of project development, there are uncertainties associated with construction, commercial, stakeholder and supply chain activities, as well as external events, which may impact cost and schedule outcomes. Consistent with the level of project maturity at EL/NC stage, the current estimate includes a 13.8% risk and contingency allowance. This allowance has been informed by National Grid's experience of previously delivered projects and the risk events encountered during delivery, providing a proportionate representation of project uncertainty at this stage. Detailed QSRA and QCRA assessments will be completed as part of Project Assessment to further quantify project-specific risks and update the allowance where appropriate.

Table 12: Cost estimate breakdown

Options	OHL (£m)	Cables (£m)	Substation (£m)	Total (exc. risk (£m))	Biodiversity (5%)	Total (incl. 13.8% risk (£m))
E-5: New GIS 400kV	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
E-6: New AIS 400kV wrap around	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
E-7: New 400kV AIS substation south of the [redacted] overhead line	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]
E-8: New 400kV AIS substation north of the [redacted] overhead line	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

Option E-5, a new [redacted] 400kV SF6-free GIS double-busbar substation on Site 5, is estimated at [redacted] including risk, contingency and biodiversity allowance, compared with [redacted] Although E-6 benefits from lower initial AIS equipment costs, its substantially larger footprint of c.11.5ha versus c.5ha for E-5 drives higher civil engineering, land acquisition, access, drainage, flood protection, security and construction overhead costs, as well as [redacted]

[redacted] E-6 also requires more complex overhead-line diversions and a longer construction programme, increasing project management, welfare and security costs.

By contrast, E-5's compact GIS design reduces land take, third-party interfaces, consenting and programme risk, and enables overhead-line works to proceed broadly in parallel with substation construction. On a like-for-like basis, E-5 therefore provides the lower-cost and lower-risk solution, delivering better value for consumers.

Cost Drivers

The project's cost estimates are based on current market conditions, with ongoing work to refine requirements. The baseline funding request is supported by strong confidence in cost assessments and thorough EUL (Estimating Units Lines) evaluations. According to the cost book, the primary factors influencing the costs of the shortlisted options are:

- Switchgear technology
- Overhead Line (OHL) works
- Avoiding diversion of the SABIC Ethylene Pipeline.
- Land acquisition
- Civil Works

Cost Benefit Analysis (CBA)

Purpose and approach

Our Cost Benefit Analysis (CBA) evaluates the economic efficiency and consumer value of the proposed transmission investments. This analysis aligns with Ofgem's Load Re-Opener Guidance and Submission Requirements.

The CBA process integrates monetised benefits such as constraint cost savings, system efficiency improvements, and consumer bill impacts, alongside a comprehensive Whole-Life Cost Analysis (WLCA) that captures capital expenditure, operational and maintenance costs, replacement cycles, carbon impacts, and future extendibility. This dual approach ensures a balanced assessment of both short-term economic benefits and long-term cost efficiency, avoiding the risk of asset stranding or future inefficiencies.

Our CBA considers:

- Robust optioneering and sensitivity testing: We have evaluated credible alternatives, including 'do nothing' and 'do minimum' scenarios, to confirm that the preferred solution delivers the optimal balance of technical performance, environmental impact, and economic benefit.
- Quantification of constraint cost reductions: Using system operator modelling outputs and historical data, we quantify expected savings from reduced system constraints, which translate into direct consumer bill benefits.
- Assessment of delay impacts: The financial consequences of potential project delays on constraint costs and consumer bills are modelled through risk-adjusted scenarios, providing a clear understanding of the value of timely delivery.

- Inclusion of socio-economic benefits: Where quantification is challenging, qualitative evidence supported by stakeholder engagement and regional development plans highlights the wider economic benefits, including job creation and inward investment.
- Consideration of non-monetised benefits: We explicitly identify benefits that are qualitative or not readily monetisable, such as enhanced system operability, resilience, and environmental improvements, ensuring full transparency of the value proposition.
- Alignment with policy and government targets including Net Zero and AI Growth Zones: The CBA reflects the influence of national and local policies, including Clean Power 2030, net zero commitments, and economic growth plans demonstrating how the investment supports the broader energy transition.

We have assessed consumer value by comparing the whole-life costs and benefits of five shortlisted connection and substation delivery options using Ofgem's RIIO-ET3 CBA template. The assessment is completed relative to a counterfactual and on a discounted basis over a 50-year appraisal period (2027–2076), consistent with the CBA methodology.

For each option considered, we have quantified:

- Initial CAPEX investment required
- Future end of life replacement cost

The supporting CBA model quantifies the costs and benefits for this project. Using the Ofgem RIIO-ET3 CBA template spreadsheet, the CBA compares the discounted cost and benefits for consumers for the following 2 shortlisted options.

- E-5: New 400kV SF_6-free GIS substation at the original preferred site
- E-6: New 400kV AIS wraparound substation at the original preferred site
- E-7: New 400kV AIS substation south of the [redacted] overhead line
- E-8: New 400kV AIS substation north of the [redacted] overhead line

CBA outcome

Lifetime Cost-Benefit Analysis: The lifetime costs and benefits refer to a 50-year period starting from 2027 until 2076.

Table 13: Lifetime CBA (2023/24 prices, central carbon pricing, discounted values)

Option	Initial investment (£m)	PV of lifetime costs (£m)	PV of monetised benefits (£m)	NPV (£m)
E-5: New GIS 400kV	[redacted]	[redacted]	[redacted]	[redacted]
E-6: New AIS 400kV wrap around	[redacted]	[redacted]	[redacted]	[redacted]
E-7: New 400kV AIS substation south of the [redacted] overhead line	[redacted]	[redacted]	[redacted]	[redacted]
E-8: New 400kV AIS substation north of the [redacted] overhead line	[redacted]	[redacted]	[redacted]	[redacted]

The discounted lifetime CBA results in Table 13 show that E-6 has an NPV of [redacted] This marginal modelled advantage must be considered alongside the material difference in deliverability between the options. Overall consumer value is determined by considering the quantitative results alongside the engineering, environmental and consenting assessment.

E-6 has a planned delivery programme approximately four years longer than E-5 and is also exposed to a greater number of sequential and third-party dependencies. These include prior overhead-line and enabling works, diversion of [redacted] and other infrastructure, additional land requirements, flood mitigation, more extensive civil works and associated consenting interfaces. The greater number and interdependency of these activities increase E-6's qualitative exposure to further delay because disruption to an enabling activity could affect the start or progression of subsequent works. By contrast, E-5's more compact design reduces these interfaces and allows the overhead-line and substation works to proceed broadly in parallel.

The current CBA does not include a probability-weighted adjustment for additional programme delay. NGET has therefore treated the greater E-6 schedule exposure as a qualitative risk rather than assigning an unsupported monetary value. Any delay beyond E-6's already later planned delivery date could further defer customer connections and the associated low-carbon generation and wider system benefits. Taking the marginal £4.2m NPV difference together with the materially different programme and risk positions, E-5 provides the stronger overall consumer-value and deliverability outcome.

This recommendation analysis is subject to confirmation through deliverability, consents/land, outage and risk considerations, and any CBA sensitivities (e.g. carbon price trajectories) set out in the assumptions below.

Assumptions of the CBA analysis

The CBA results are based on the following high-level assumptions (with sensitivities used to test robustness where appropriate):

- Appraisal period of 50 years (2027–2076), with costs and benefits discounted and presented relative to the counterfactual.
- Cost base: 2023/24 prices, aligned to the Ofgem RIIO-ET3 CBA template inputs (including treatment of replacement CAPEX and maintenance).
- Carbon: central base case carbon price applied for monetising construction carbon, SF6/alternative gas leakage and losses, with scenario testing for alternative carbon price trajectories.
- Benefits scope applied consistently across options; where option-specific benefits exist (e.g. constraints), the basis and evidence are documented and applied consistently.
- Key sensitivities considered (as applicable): timing/phasing, CAPEX uncertainty ranges, delivery/outage risk, and benefit parameter uncertainty (including losses and leakage assumptions).

Costs

Table 14: Summary of all additional Capex costs (2023/24 base prices)

Option	Initial works (£m)	Future replacement (40yr (£m))	Total costs (£m)
E-5: New GIS 400kV	[redacted]	[redacted]	[redacted]
E-6: New AIS 400kV wrap around	[redacted]	[redacted]	[redacted]
E-7: New 400kV AIS substation south of the [redacted] overhead line	[redacted]	[redacted]	[redacted]
E-8: New 400kV AIS substation north of the [redacted] overhead line	[redacted]	[redacted]	[redacted]

Benefits

The following benefits have been included within the CBA:

- SF6/Alternative gas leakage reduction
- Carbon cost of construction reduction
- Summary of all Benefits

Table 15 presents the summary of all (undiscounted) benefits, including environmental and non-environmental benefits, considering the central base case carbon price.

Table 15: Summary of all benefits

Option	Environmental benefits		Total benefits (£m)
	Carbon costs of construction (£m)	Gas leakage (£m)	
E-5: New GIS 400kV	[redacted]	[redacted]	[redacted]
E-6: New AIS 400kV wrap around	[redacted]	[redacted]	[redacted]
E-7: New 400kV AIS substation south of the [redacted] overhead line	[redacted]	[redacted]	[redacted]
E-8: New 400kV AIS substation north of the [redacted] overhead line	[redacted]	[redacted]	[redacted]

3.7 Preferred solution

NGET has selected Option E-5 as the preferred solution because it provides the strongest overall outcome for consumers across the quantitative and qualitative assessment. The discounted lifetime CBA shows that E-6 has a marginally higher NPV of [redacted], compared with [redacted] for E-5, a difference of [redacted] in 2023/24 prices. However, this small modelled advantage does not outweigh E-6's four-year longer delivery programme and greater engineering, environmental and consenting risks.

The preferred solution reflects the currently defined customer and network requirements and supports progression of E-5. [redacted] and any consequential changes to scope, physical separation, land, cost or programme, which are not included in the preferred scope at this stage.

Given the scale and strategic importance of the 6.87 GW of contracted offshore wind generation connecting at Birkhill Wood, NGET placed particular weight on timely and certain delivery, balanced against engineering, environmental, consumer-value and stakeholder and consenting considerations. E-5 enables this generation and the associated avoided-carbon and wider system benefits to be realised materially earlier.

E-5's compact GIS design has a footprint of approximately 49,450 m², compared with 115,875 m² for E-6. It avoids [redacted]

[redacted] Flood Zones 2 and 3, and the associated watercourse, flood-mitigation, land-acquisition and third-party approval requirements. It also avoids the extensive enabling and civil works required by the AIS alternatives and allows the overhead-line diversion and substation construction to proceed broadly in parallel.

The marginal NPV advantage of E-6 is therefore insufficient to compensate for its longer programme and greater delivery risk. E-5 offers the best overall balance of consumer value, deliverability, cost, engineering and environmental performance.

Project benefits and outputs

Table 16: Summary of outputs and benefits

Output and proposed PCD:	A new [redacted] 400kV SF6-free GIS substation at new site Birkhill Wood, [redacted] North of the existing Creyke Beck substation on the Creyke Beck to Thornton OHL [redacted] route. The substation will be the largest green generation node on the network connecting four offshore windfarms totally [redacted] between [redacted] Birkhill Wood is also the northern connection point for ASTI CGNC North Humber to High Marnham double circuit 400kV as part of the great grid upgrade this new OHL creates a vital third network corridor from the region and boosts the B8 boundary transfer capability.
Outputs and benefits	• **Future-proofed and lower-cost capacity:** Provides [redacted] for a future Hedon double-circuit OHL and c.800MW of additional generation, avoiding significant future rework, stranded assets and associated consumer costs. • **Increased network capability and offshore generation access:** Enables the 90km North Humber–High Marnham 400kV connection, creating a third regional corridor, increasing B8 boundary capacity and supporting over 7GW of contracted offshore generation at the Creyke Beck–Birkhill Wood hub. • **Improved resilience and operability:** Establishes an independent connection node that reduces single-asset dependency while improving switching flexibility, fault management, outage resilience and system-restoration capability. • **Faster, lower-risk delivery:** Provides the quickest programme for connecting CGNC and [redacted] of offshore wind, while [redacted] • **Reduced customer, environmental and landscape impacts:** significantly shortens offshore wind cable routes, reducing cost, land disturbance and ecological impacts, while a smaller footprint lowers capital carbon, biodiversity impacts, utility diversions, reinforcement needs and effects on the Yorkshire Wolds landscape.

4. Delivery

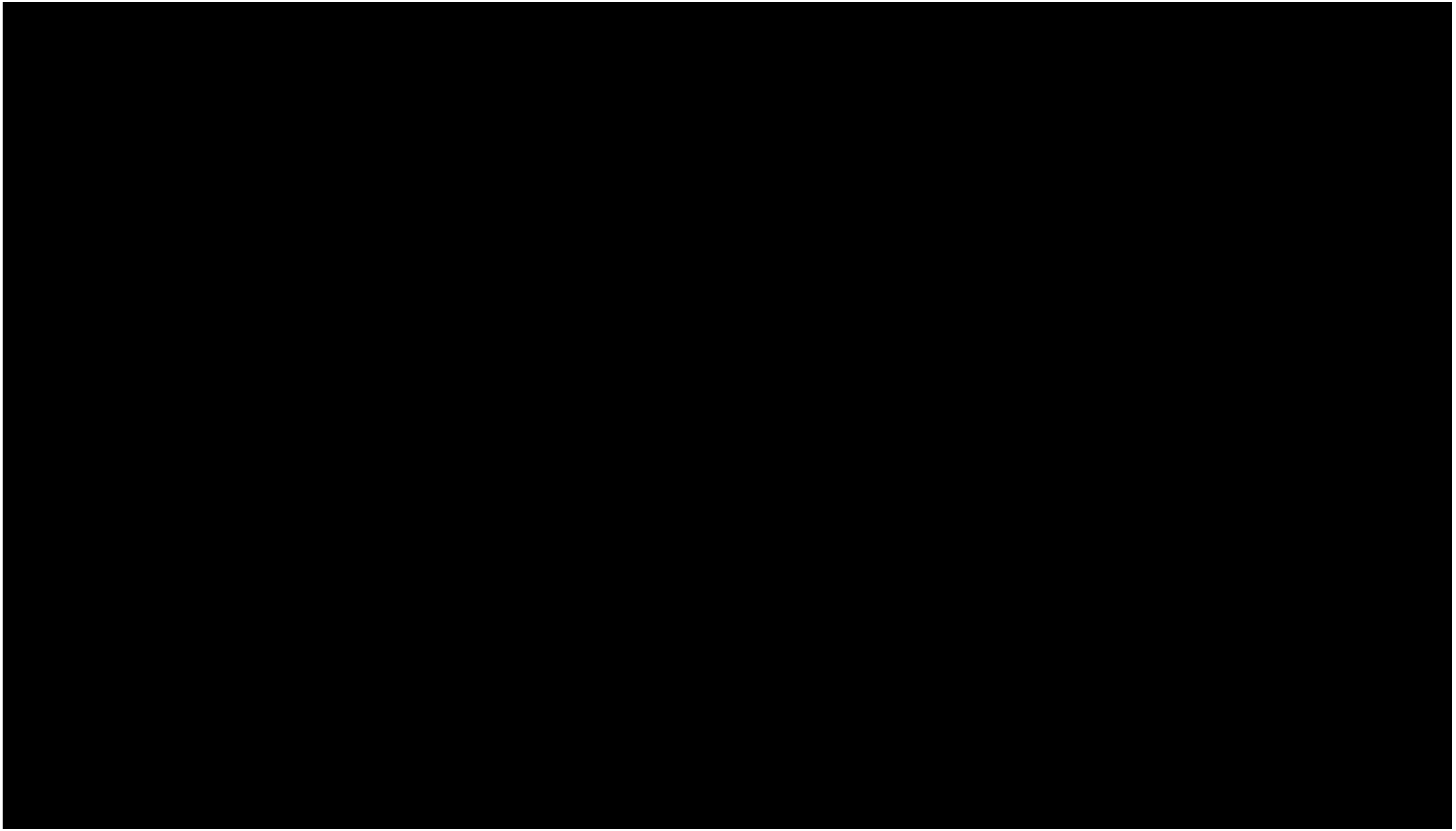
4.1 Delivery year and indicative timeline

The project programme is shown in Figure 11. This has been developed based on NGET's baseline durations to develop and construct similar project types. The key procurement milestones to ACL are set out in Table 17.

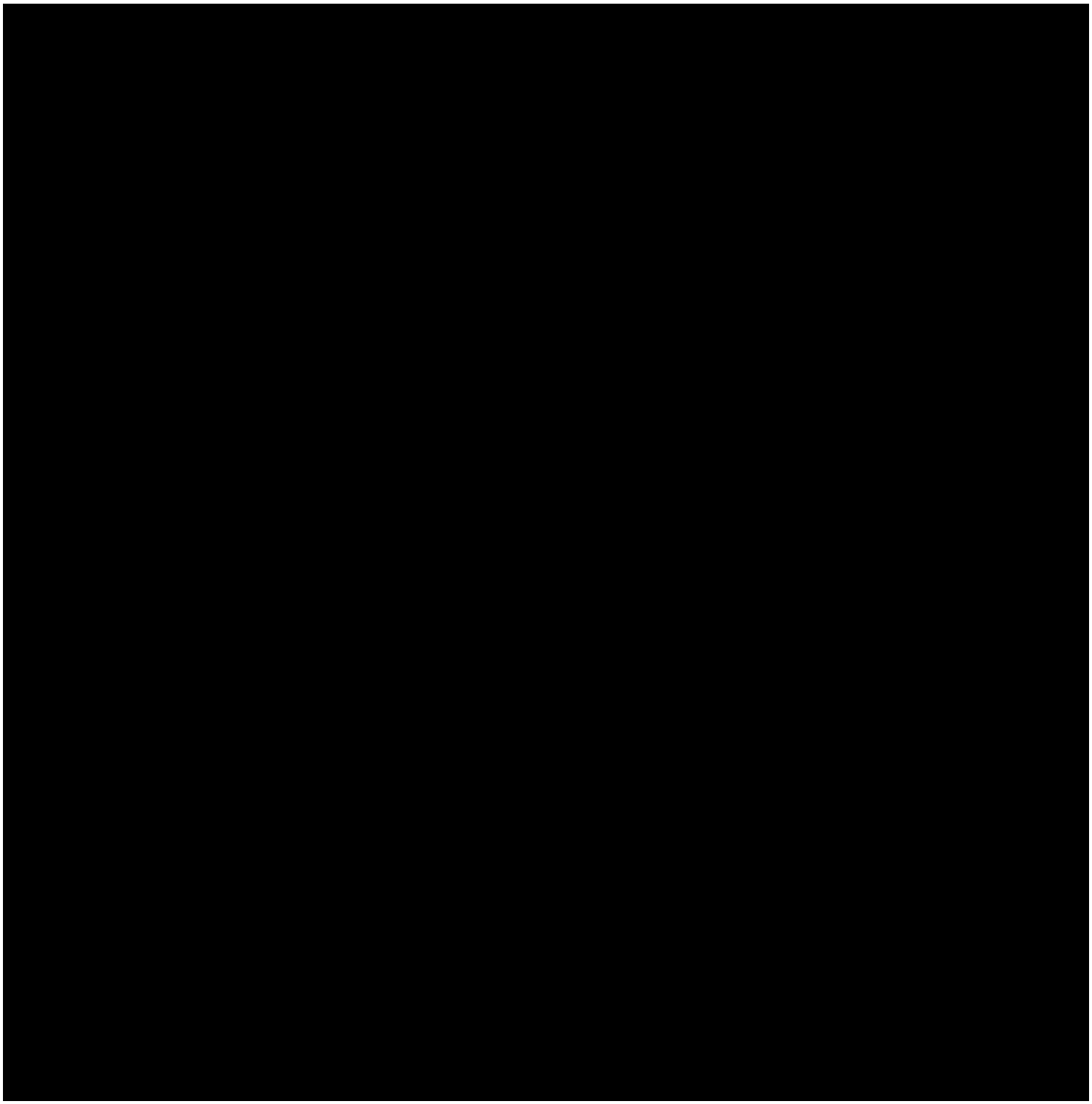
As briefly mentioned in the Executive Summary, key planning and procurement activities are in progress to ensure the project achieves its first ACL by [redacted] (as shown in Table 17).

Figure 9 details the high-level program for Option E-5. Key assumptions with this program are:

- Customer ACL dates are unchanged.
- Planning and land acquisition proceed without significant delay.
- Supply chain risks for GIS equipment are mitigated through early engagement.
- Parallel construction of overhead-line and substation is feasible.



4.2 Procurement and contracting strategy



4.3 Risks and risk management

An overview of current delivery risks is listed below along with mitigations. As risks continue to evolve, an updated detailed view of risk and mitigations will be supplied within the Project Assessment submission.

Table 18: Summary of risks and mitigations

Risk	Mitigation
Enabling works and programme: Potential delays in competition of access road off A1079 to enable build of Birkhill Wood	Access Road dependency has been added into the P6 schedule and updated in line with Access Road scheme progression.
Early Cost Estimation: There is a risk of increased cost of Birkhill Wood scheme due to unidentified events or risks which were not identified prior to the sanction leading to an increase in outturn costs and re-sanctions of the project.	More detailed work, alongside market engagement, will increase our confidence in the costs and reduce the need for contingency
Procurement and supply chain: Uncertainty around long lead items not being secured in time to deliver programme. Due to supply chain constraints, only GE and Hitachi can manufacture non SF6 GIS. Delays in manufacturer's producing the equipment will lead to schedule delays to programme.	Long lead items and their duration to manufacture, arrival at site have been identified and are included within the P6 schedule. Balfour Beatty to secure manufacturing slots in advance.
System access and outages: NG outages may not be available to meet planned project schedule if NESO are unable to provide outages in line with the project's schedule leading to inability to complete works to the project's baseline schedule and incurred contractor stand down costs	Early coordination with System Operations and maximising offline construction.

[redacted]

5. Conclusion

This submission outlines a preferred solution to the investment drivers. It seeks confirmation of eligibility under Special Condition 3.18, confirmation of eligibility of PCF under Special Condition 3.15 and confirmation of re-opener Track 3 EL.

Birkhill Wood is not solely a customer connection investment. It forms part of a coordinated regional transmission strategy across the Humber region, integrating offshore wind connections, boundary reinforcement and wider network operability requirements. The project has been developed alongside NH-HM, Creyke Beck Extension and wider ASTI reinforcement projects to ensure that customer connections and strategic network capability are delivered through a coordinated investment programme that maximises consumer value and minimises future rework.

The preferred option E-5 consists of a new GIS 400kV [redacted] GIS SF6-free, located [redacted] away from the existing Creyke Beck 400kV substation, on the [redacted] route. Two siting studies have been conducted with the proposed site; Site 5 for a GIS solution, as the optimal solution based on close proximity to the existing NGET transmission network

Table 19: Submission summary

Submission summary	
Main drivers	This project consists of one primary investment driver: • **Customer connections:** [redacted] Northern connection point for the planned ASTI CGNC North Humber to High Marnham double circuit overhead line route which will provide a new export route for the connecting generation in the area.
Preferred option	The proposed solution is Option E-5 A new [redacted] 400kV SF6-free GIS substation at new site Birkhill Wood, [redacted] North of the existing Creyke Beck substation on the Creyke Beck to Thornton OHL [redacted] route. The switchgear hall has been future proofed with space for a further [redacted]
Estimated cost and timing	• **Estimated capital cost:** [redacted] (23/24 prices, inc. Risk and contingency) • **PCF (8.2% of estimated capital cost):** [redacted] (23/24 prices)
Outputs	The preferred investment at Birkhill Wood will deliver key outputs for consumers and the wider network by facilitating [redacted] of low carbon generation and as the northern connection point for the new NHHL as part of the great grid upgrade this new double circuit 400kV OHL aims to address regional boundary constraints at Creyke Beck

Submission summary	
	The investment will enable the following outputs: • Four offshore wind farms at Birkhill Wood connecting from [redacted] of low-carbon energy. As part of the great grid upgrade the North Humber–High Marnham reinforcement addresses Humber boundary constraints and enables efficient export of offshore wind output onto the wider system. • These measures contribute to decarbonisation objectives aligned with the Government's offshore wind target of 50GW by 2030 of which the connection of three offshore wind farms via Birkhill Wood accounts for nearly 10%, making it the largest green generation node on the network. The design ensures efficient system operation and delivers enduring consumer value by supporting economic reinforcement and decarbonisation of the transmission network, consistent with whole-system planning principles. • Birkhill Wood is an integral part of NESO's HND and HNDFUE, supporting early stakeholder engagement and collaboration with customers, other transmission operators and addressing supply chain constraints to facilitate offshore wind and decarbonisation initiatives within the North Humber region.
Proposed PCD	Build a [redacted] 400kV SF6-free GIS substation on Site 5 to enable [redacted] offshore wind connections by [redacted].

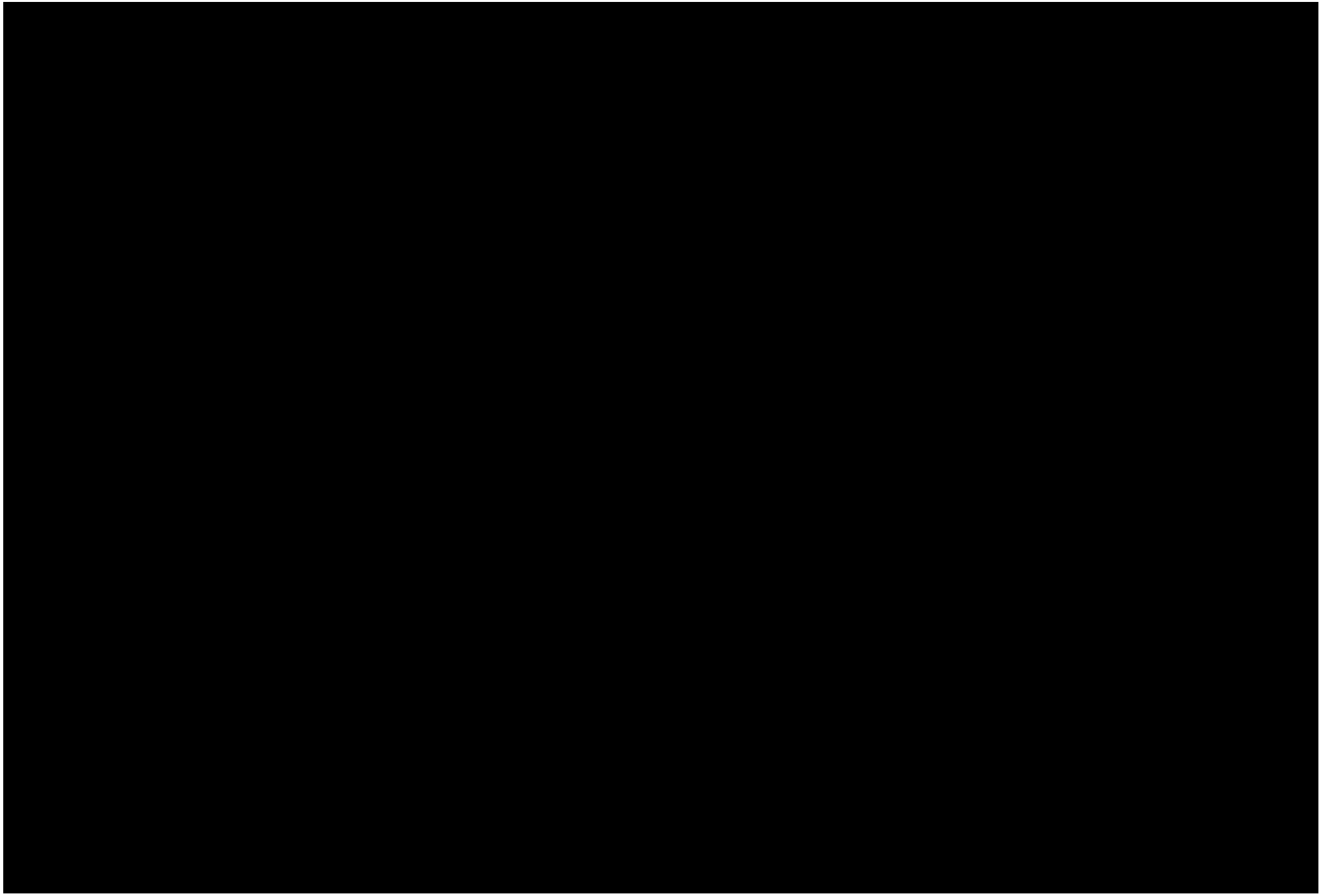
Appendix A
Glossary

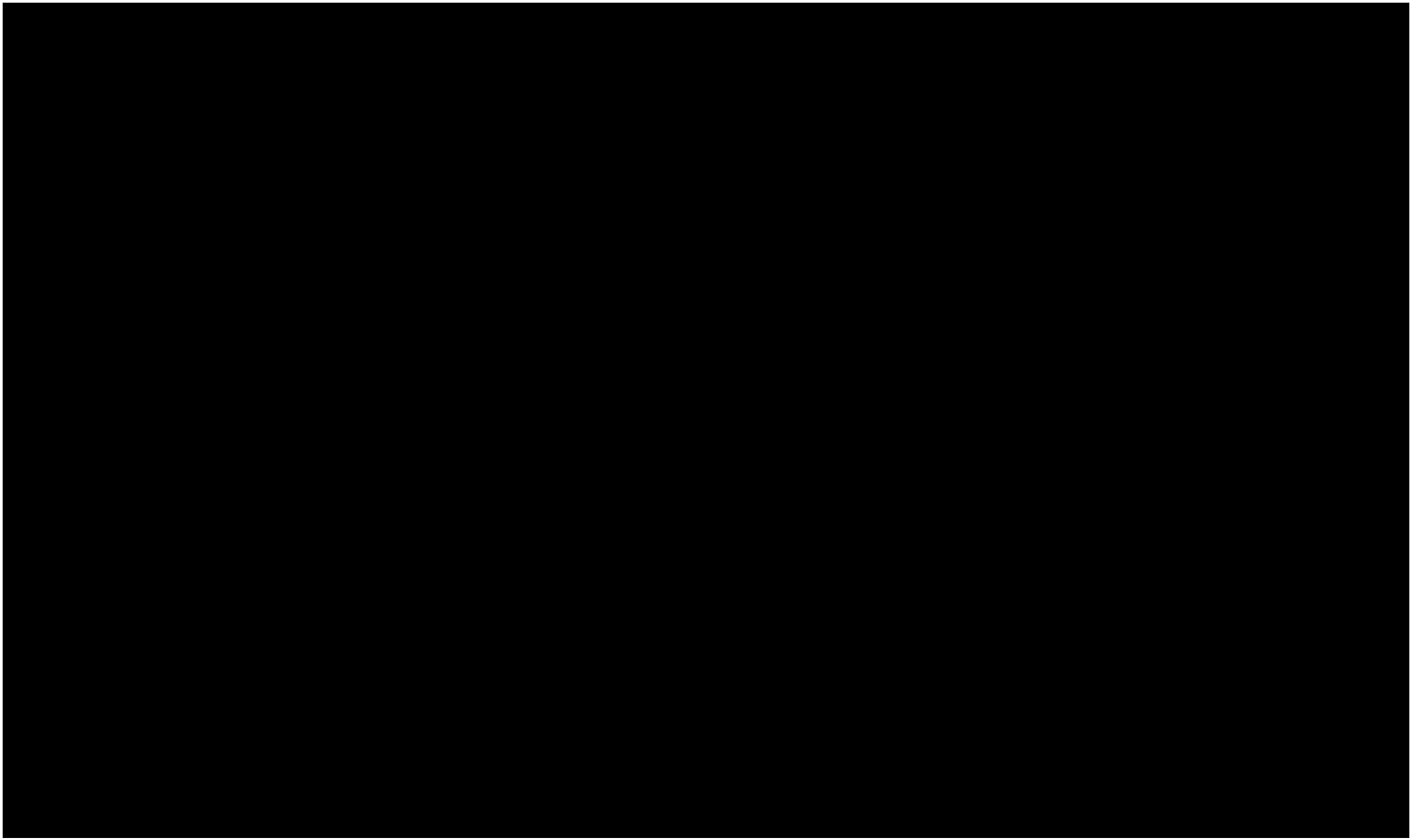
Table 20: Table of abbreviations and definitions

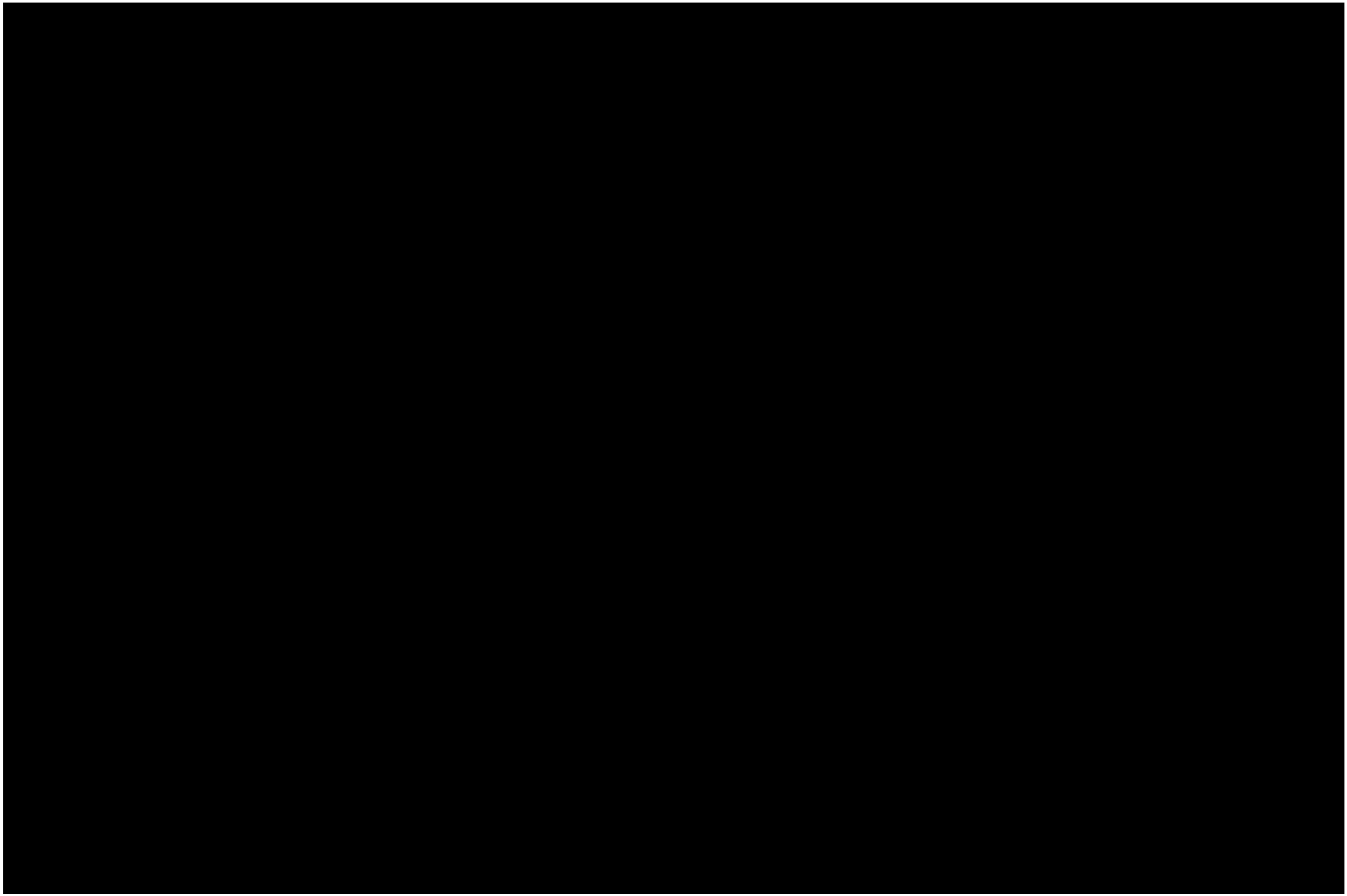
Abbreviation	Description
ACE	Advanced Commissiong Engineer
ACL	Available For Commercial Load
ACSR	Aluminium Core Steel Reinforced
AIS	Air Insulated Switchgear
APM	Advanced Procurement Mechanism
BESS	Battery Energy Storage System
BP	Business Plan
BPDT	Business Plan Data Template
CAI	Closely Associated Indirect
CBA	Cost Benefit Analysis
CPO	Compulsory Purchase Order
CSNP	Centralised Strategic Network Plan
DC	Direct Current
DCO	Development Consent Order
DC TC	Direct Current Time Constraint
DESNZ	Department for Energy Security and Net Zero
DISC	Disconnector
DLR	Docklands Light Railway
DNO	Distribution Network Operator
ECC	Estimated Cost of Construction
EEW	Early Enabling Works
EJP	Engineering Justification Paper
EoL	End-Of-Life
ESO	Energy System Operator
ET	Electricity Transmission

Abbreviation	Description
EU	European Union
EUL	Estimating Units Lines
ESW	Earth Switch
FEED	Front End Engineering Design
FES	Future Energy Scenarios
FY	Financial Year
G3	Green Gas for Grid
GEC	General Electric Company
GIB	Gas Insulated Busbar
GIS	Gas Insulated Switchgear
GLA	Greater London Authority
GW	Giga Watt
HDD	Horizontal Directional Drilling
HV	High Voltage
IEC	International Electrotechnical Commission
kW	Kilo Watt
LLTI	Long Lead Time Items
LTDS	Long-Term Development Statement
LV	Low Voltage
LVAC	Low Voltage Ac
M&E	Mechanical And Electrical
MITS	Main Interconnected Transmission Systems
MSIP	Medium Sized Investment Project
MVA	Megavolt-Amperes
MW	Mega Watt
NESO	National Energy System Operator
NETS	National Electricity Transmission System
NG	National Grid
NGED	National Grid Electricity Distribution
NGET	National Grid Electricity Transmission

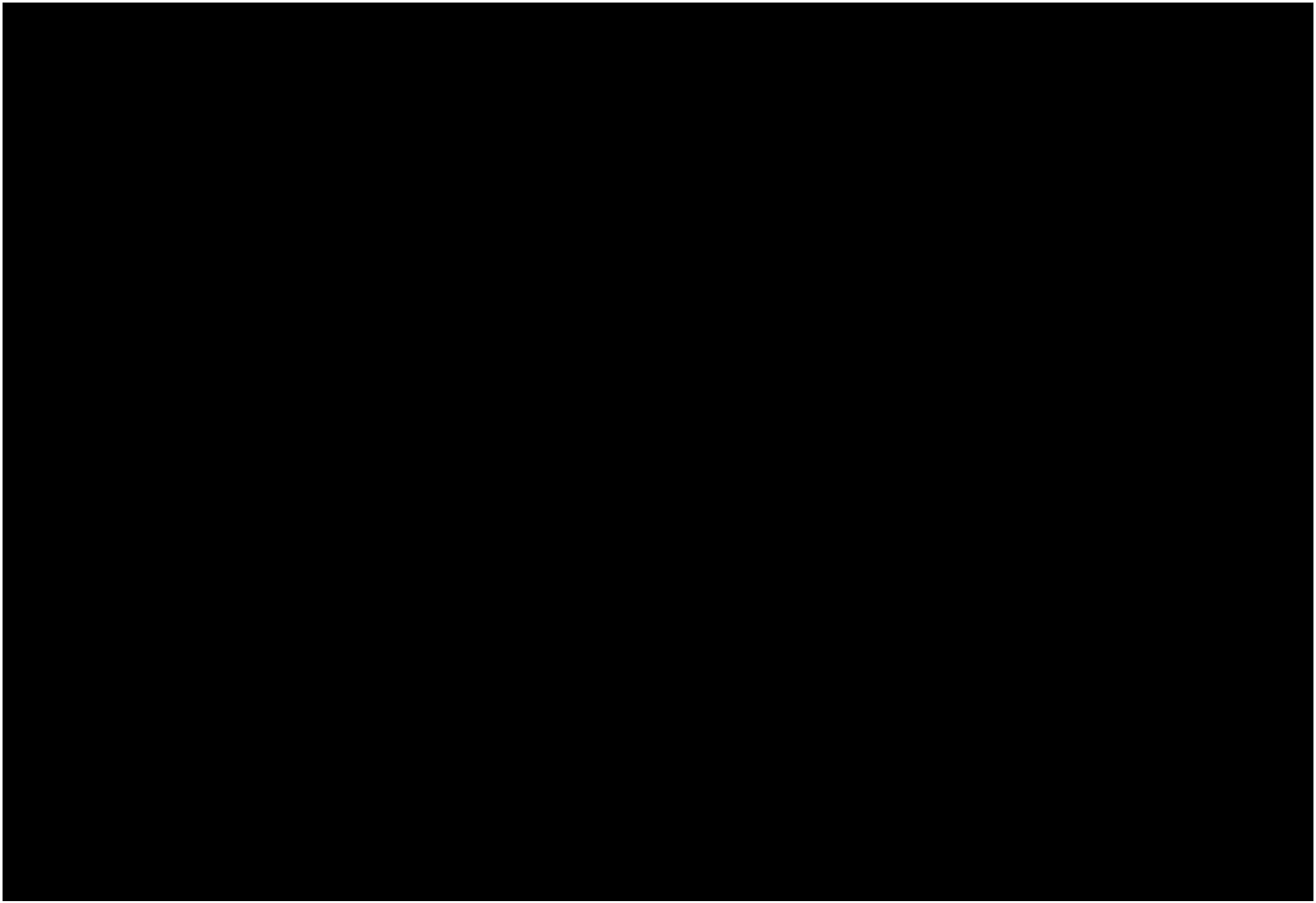
Abbreviation	Description
NOA	Network Options Assessment
NOMs	Network Output Measures
NPV	Net Present Value
OHL	Overhead Line
ORPS	Obligatory Reactive Power Service
PCD	Price Control Deliverables
PCF	Pre Construction Funding
SF6	Sulfur Hexafluoride
SAP	Senior Authorised Person
SGT	Super Grid Transformer
SLD	Single Line Diagram
SPV	Special Purpose Vehicle
SSMD	Sector Specific Methodology Document
SSSI	Site of Special Scientific Interest
STC	System Operator Transmission Owner Code
SuDS	Sustainable Drainage Solutions
TBC	To Be Confirmed
tCO2e	Tonnes of Carbon Dioxide Equivalent
TCPA	Town And Country Planning Association
TCSNP	Transitional Centralised Strategic Network Plan
TWB	Through-Wall Bushing
UK	United Kingdom
UKPN	UK Power Networks
UKPN EPN	Eastern Power Networks
UKPN LPN	London Power Networks
UKPNS	UK Power Networks Services
UXO	Unexploded Ordnance
VCA	Voltage Compliance Assessment
XLPE	Cross-Linked Polyethylene

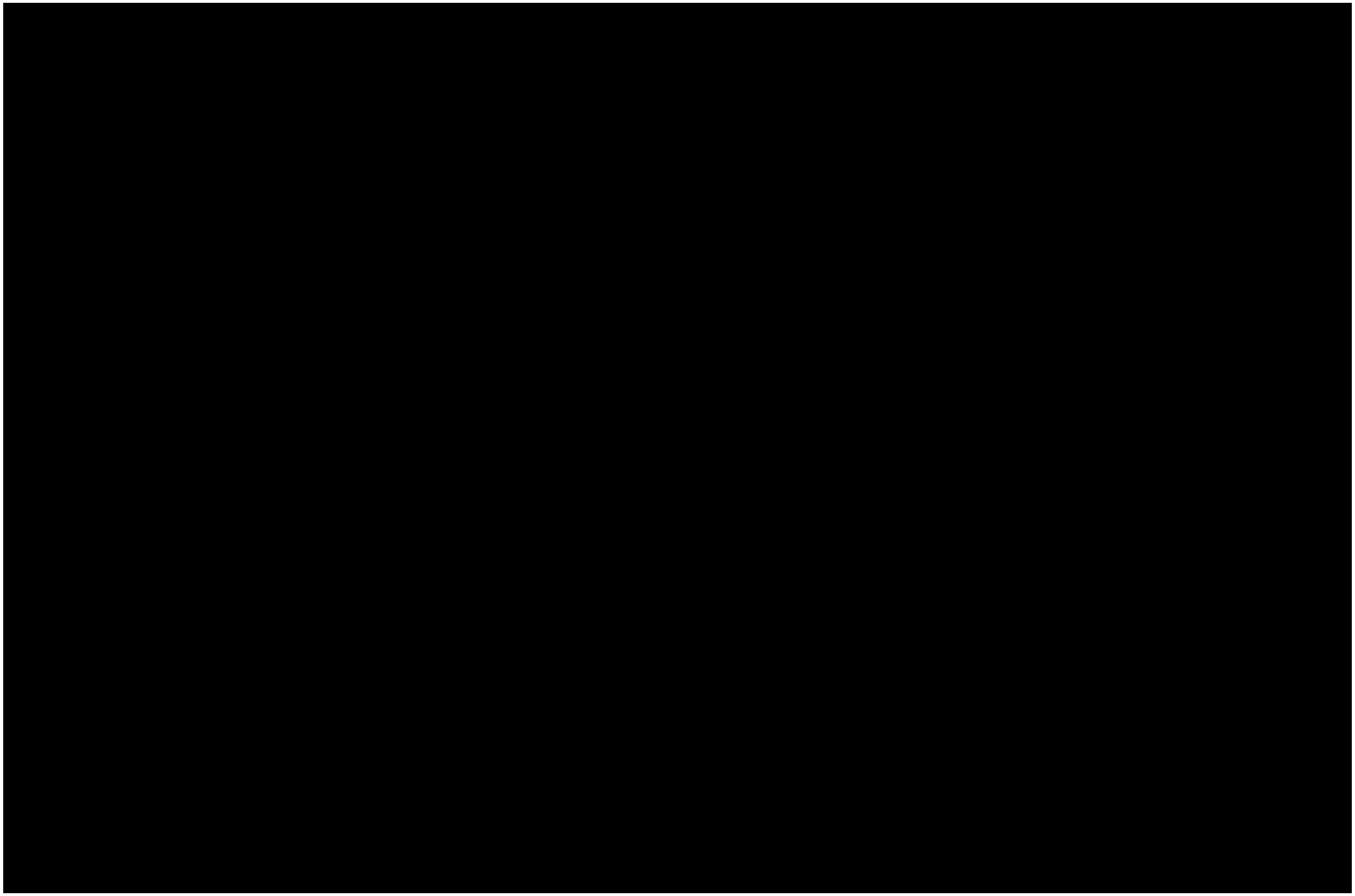


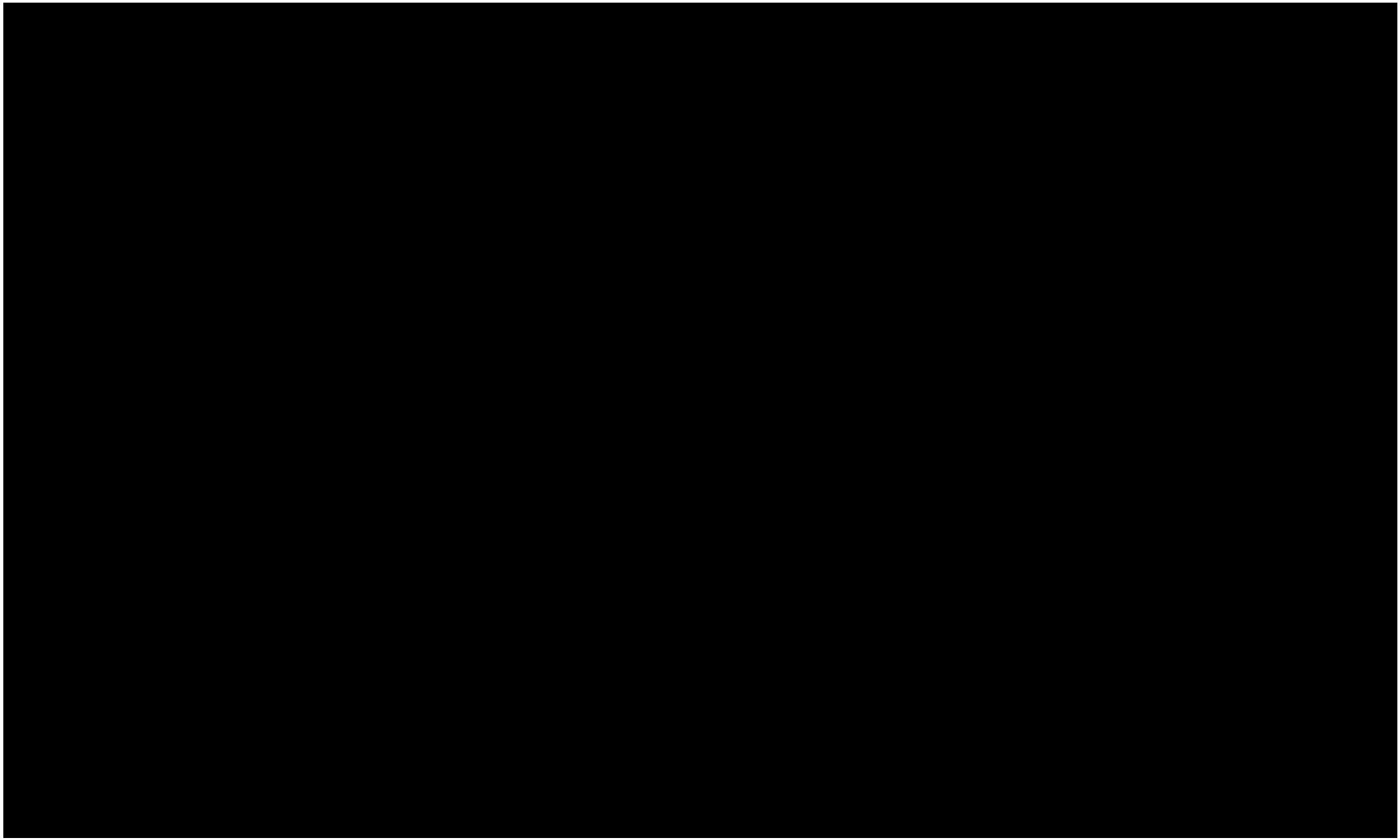


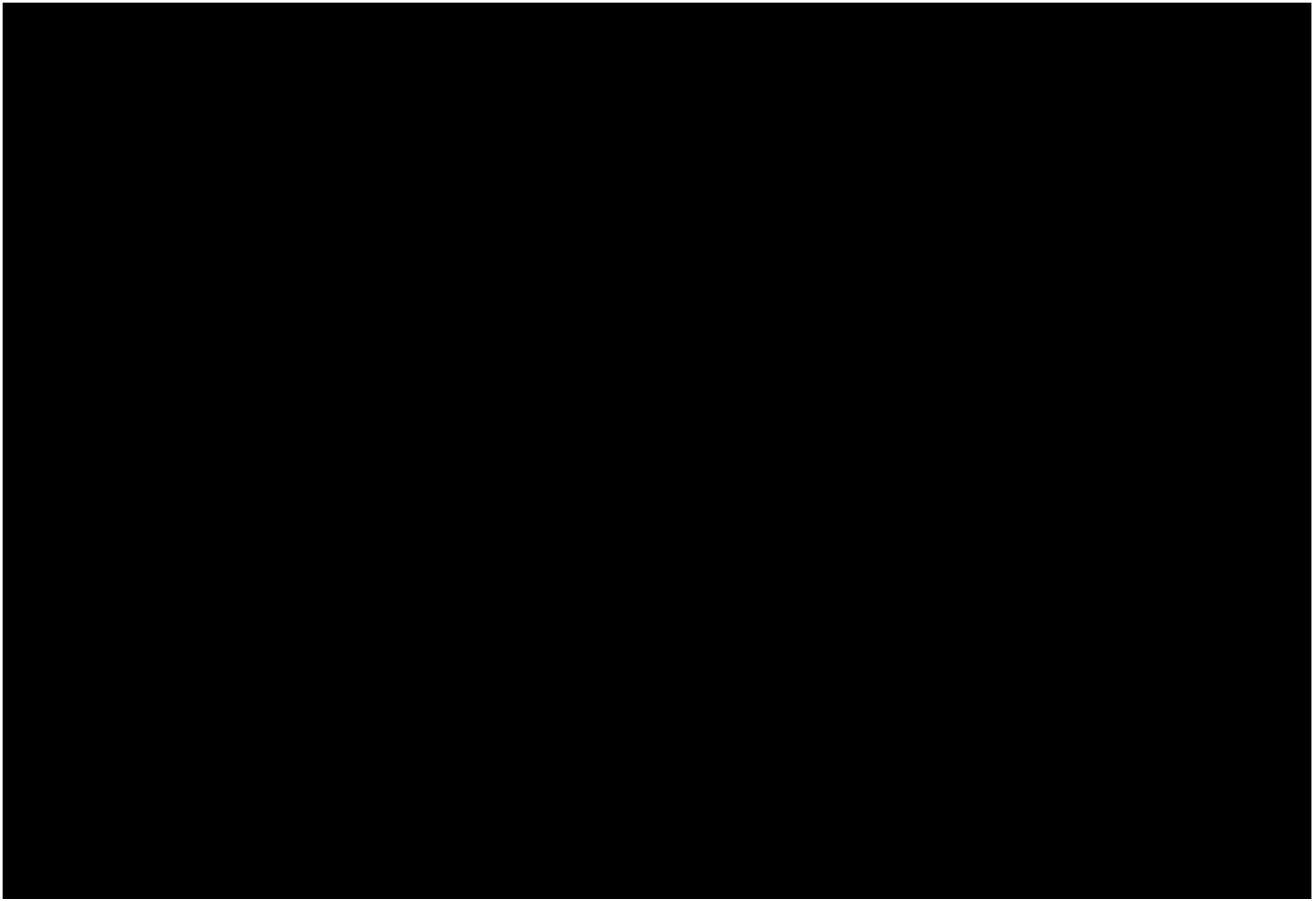


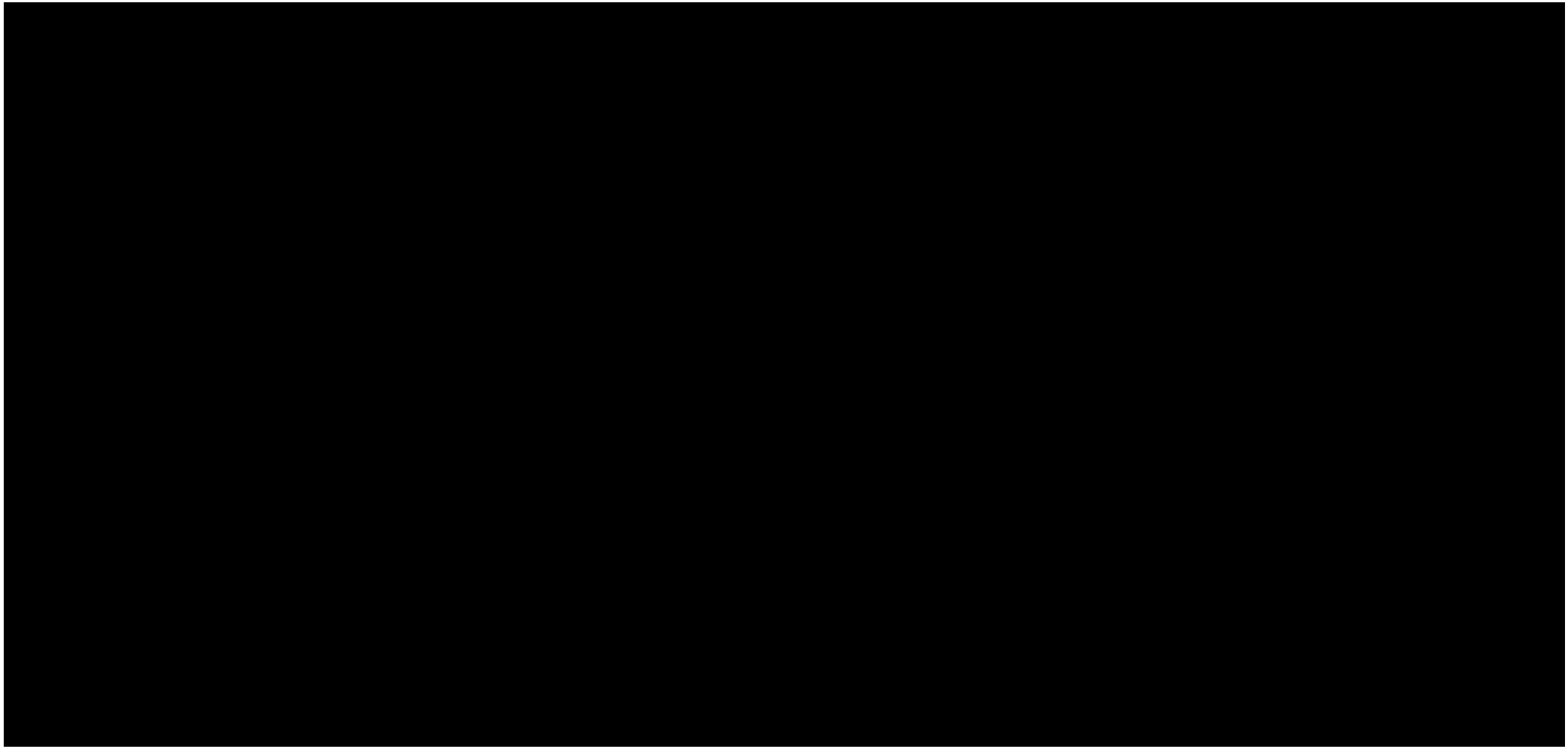


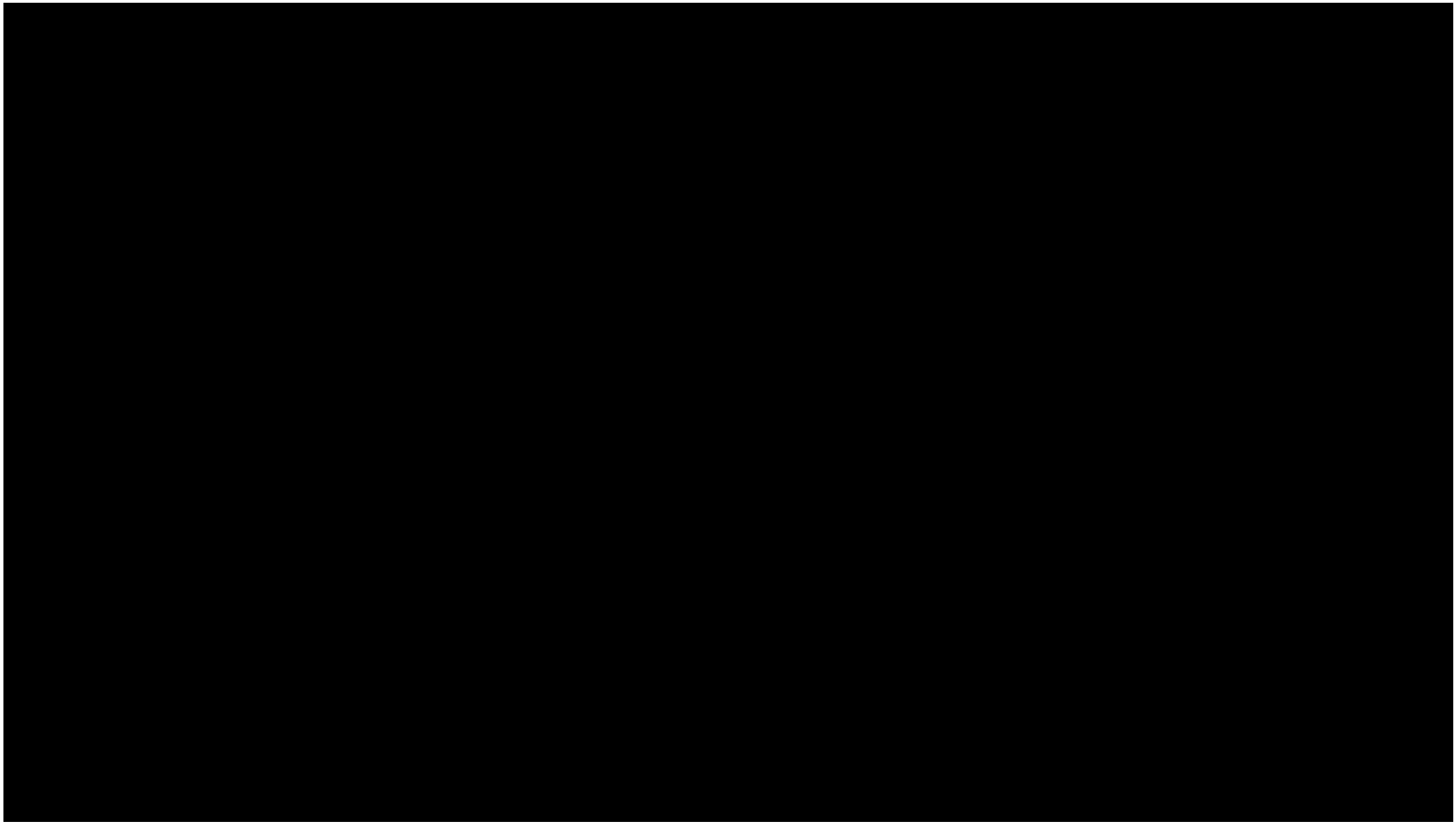


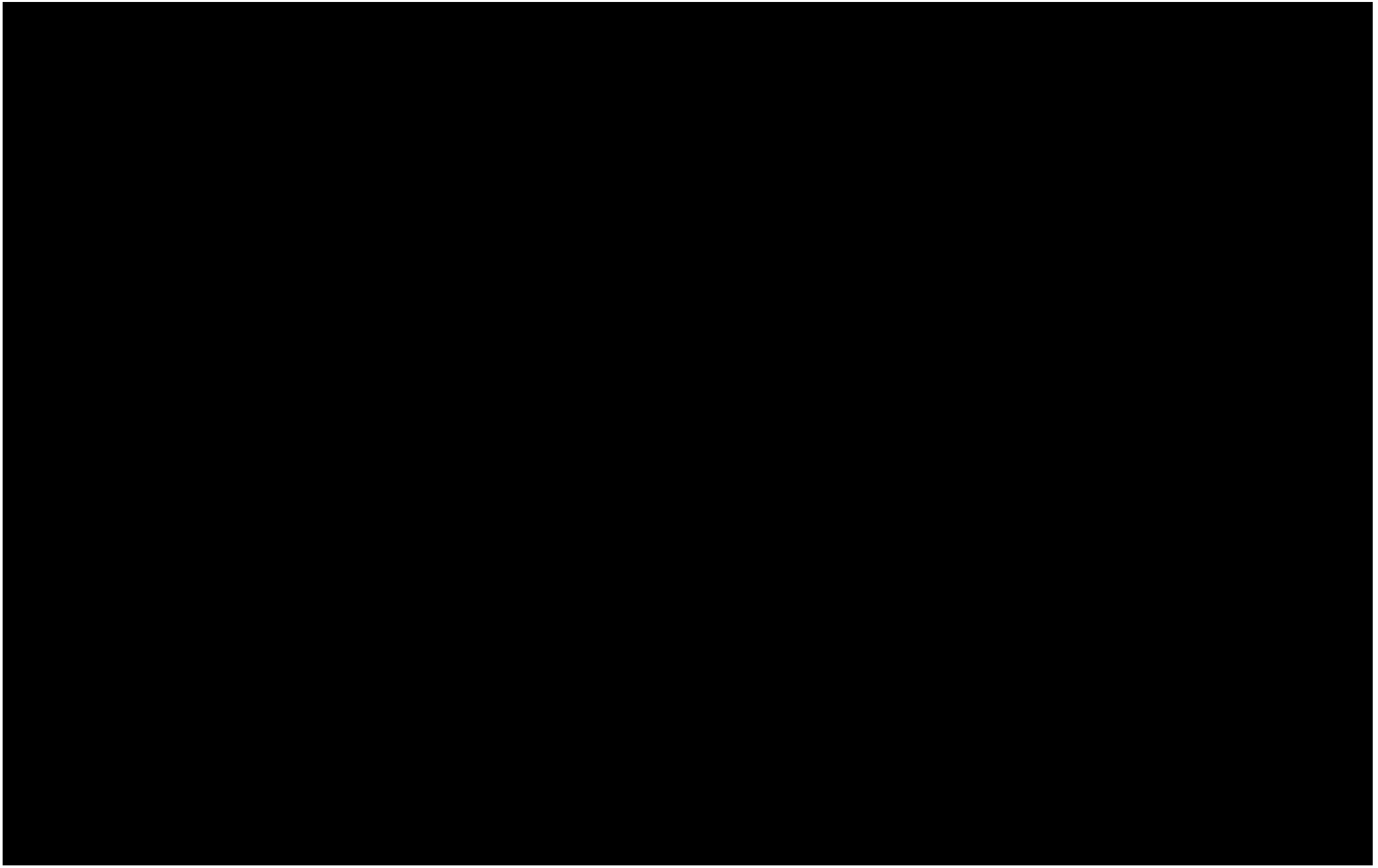


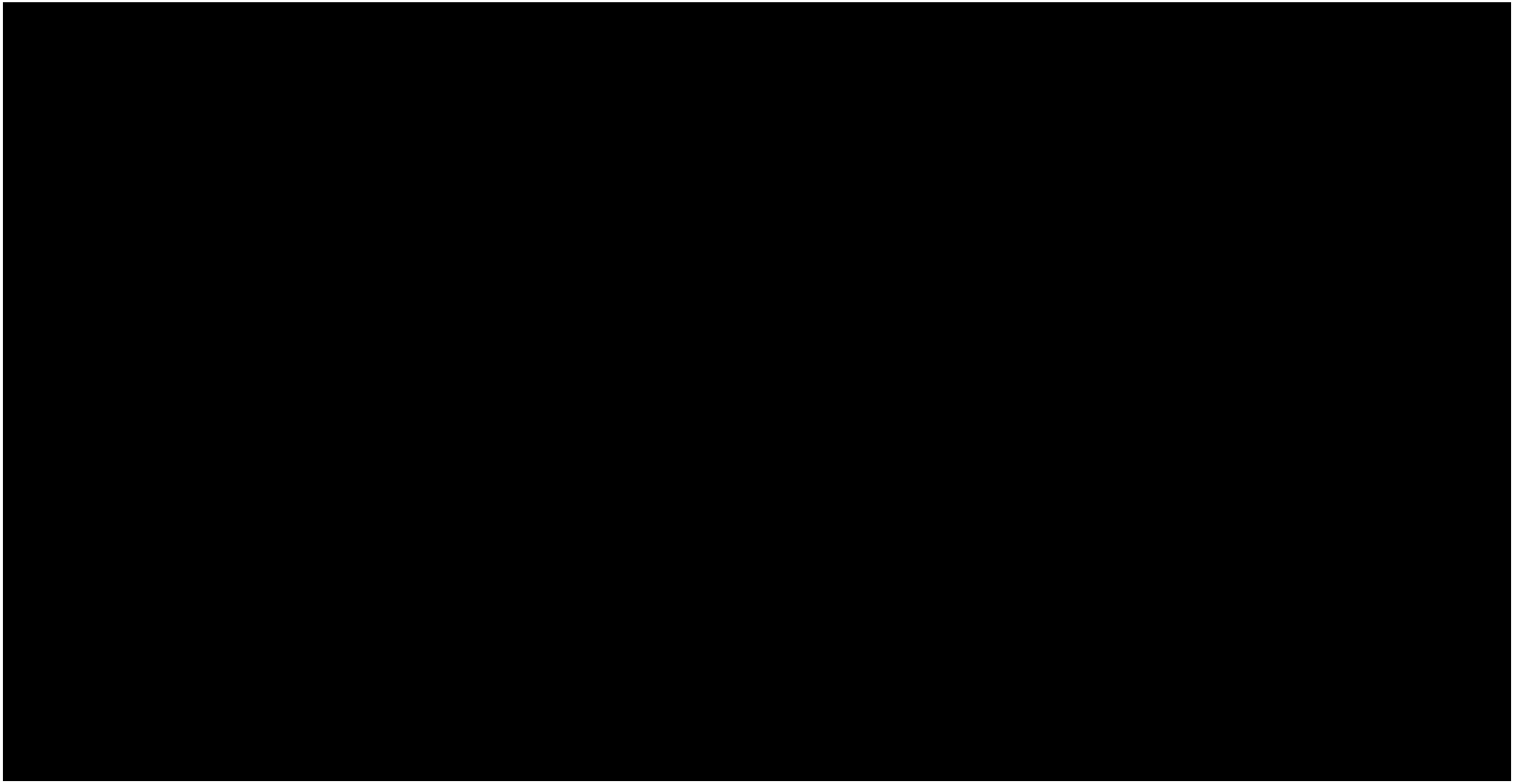












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