



# Keuper Hydrogen Storage

## Non-material Change Application – Environmental Report

08 August 2022

Project No.: 0645211



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## Signature Page

08 August 2022

# Keuper Hydrogen Storage

## Non-material Change Application – Environmental Report

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## EXECUTIVE SUMMARY

This Environmental Report relates to the proposed non-material change to the Keuper Underground Gas Storage Facility Order 2017 (S.I. No. 2017/433), and relates to the introduction of hydrogen gas storage together with minor design changes.

Further consideration has been given to relevant environmental issues pertinent to the proposed changes, whereas others are clearly considered to be of no significance.

This report provides an update to relevant environmental considerations further to the Environmental Statement that forms part of the original Order, and concludes that there are no significant environmental impacts arising from the proposed changes.

## 1. INTRODUCTION

Keuper Gas Storage Limited (company number 08850140) of Bankes Lane Offices, Bankes Lane, PO Box 9, Runcorn, Cheshire, United Kingdom, WA7 4JE (known throughout this document as “KGSL”) is submitting an application for a non-material change to the Keuper Underground Gas Storage Facility Order 2017 (S.I. No. 2017/433) (the “DCO”), made pursuant to Schedule 6 of the Planning Act 2008 and Part 1 of the Infrastructure Planning (Changes to, and Revocation of, Development Consent Orders) Regulations 2011 (S.I. No. 2055). The proposed changes relate to the nature of gas stored and the siting and layout of one building and one compound within the Keuper Gas Storage Project (the “Project”) permanent development site, referred to henceforth as the “Site”.

The DCO authorises the development of a new underground gas storage facility in Cheshire and associated development. The DCO has been subject to the following correction since it was made on 15<sup>th</sup> March 2017:

- The Keuper Underground Gas Storage Facility (Correction) Order 2017 (SI 2017/820)

The 2017 Correction Order corrected issues identified in the DCO (as originally granted) following requests made under paragraph 1(6)(a) of Schedule 4 to the Planning Act 2008. The corrections have no relevance to the amendments proposed here.

The proposed amendment is for the storage of hydrogen gas rather than natural gas. The inclusion of hydrogen gas storage on site necessitates the inclusion of an option for an alternative gas connection compound (Work No. 12). This would be located further away from the national transmission system (natural gas) pipeline than currently proposed.

In addition to the proposals for the inclusion of hydrogen gas storage within the DCO, the wider design of the Project has evolved since the granting of the DCO consent originally. This design evolution has allowed the identification of a safer option away from neighbouring sensitive uses for the proposed siting and layout of one building (the Office, Control and Maintenance Building – Work No. 15) within the Site than was proposed in the original consent.

The inclusion of a second option for the location of the gas connection compound and the relocation of the Office, Control and Maintenance Building will therefore require a number of minor changes (updates) to the Certified Plans.

This report includes the results of an environmental screening exercise (chapter 3) and updated assessments for those environmental topics which may have the potential to give rise to any likely significant effects which are new or different to those reported in the certified ES, namely, Ecology (chapter 4), Air Quality (chapter 5), Greenhouse Gas (chapter 6), Landscape and Visual Impacts (chapter 7), Cultural Heritage (chapter 8), and Safety (chapter 9).





## 2.3 Relocation of Office, Control and Maintenance Building

The Office, Control and Maintenance Building Work No. 15 is listed in Table 1 of Requirement 2 in Schedule 2 to the DCO as one component of the gas processing plant Work No. 14 with dimensions 30m width by 40m length by 5m high.

The building is shown in outline only in the Works Plans, principally in Work Plan 13-03-01/HOL/24/510 which shows the above ground works. It is also shown in Work Plan 13-03-01/HOL/24/504 below ground works but only as the destination of the buried towns water supply pipeline (Work No. 17) and the buried sewer pipeline (Work No. 18) to the building.

It is intended to relocate the office building from its current close proximity to the gas processing plant to a greater distance which would also have safety benefits. The proposed new location had previously been identified and assessed from an environmental impact perspective as a construction carpark / construction laydown area.

From an environmental impact perspective, the new location was already designated and assessed for its impacts as a construction laydown area Work No. 16. Thus, the environmental impacts of the change are deemed to be negligible. Construction laydown and contractor car parking will be managed within the other designated areas and no additional laydown areas will be used other than those previously specified.

The Works Plans for the subsurface infrastructure indicates the inclusion of a buried water supply pipeline (Work No. 17) and a buried sewer pipeline (Work No. 18) from the public highway (King Street) to the office building. The route of both these buried services already pass close to the new location for the building and under the previously designated contractor carpark access road. To accommodate the new location of the building it is necessary to update the routing of these pipelines. Whilst the new route is slightly outside of the limits of deviation of the previous route, it is considerably shorter and therefore of lower impact. Furthermore, it is within the area designated for the contractor carpark / access road, thus was subject to the expectation of soil clearance and excavation work; and is of such a minor significance (narrow diameter pipelines) that the change is considered to be 'de minimis'.

## 2.4 Amendments to Wording in DCO

The primary change is to the definition of 'gas' within Part 1 (PRELIMINARY), Article 2 (Interpretation) of the DCO. The applicant proposes the substitution of the existing definition that strictly relates to 'natural gas' with one that includes hydrogen gas within the parameters of its definition.

Prior to this request, the applicant has undertaken extensive design studies and project development activities to satisfy itself that the change to the actual gas stored can be achieved without necessitating a change to the parameters of the Project as defined in Schedule 1 (Authorised Development) or Schedule 2 (Requirements) to the DCO, other than the location of the Gas Connection Compound.

Geostock, a specialist subsurface cavern engineering contractor and author of the original cavern design reports listed in the Certified Plans of Article 35 of the DCO has undertaken further design studies to demonstrate that the caverns are capable of accommodating hydrogen gas in place of natural gas without any safety or technical concerns.

For further technical details of the updated Geostock studies please refer to the following reports submitted as part of this application:

- The seismic survey report Revision A (document ref: 9.1);
- The sub-surface safety assessment report Revision B (document ref: 9.2); and
- The preliminary study of gas design capacity Revision B (document ref: 9.3).

## 3. ENVIRONMENTAL SCREENING

### 3.1 Introduction

This chapter sets out the screening exercise undertaken to assess whether the non-material changes described in chapter 2 have the potential to give rise to new or different likely significant effects compared to those reported in the certified ES.

### 3.2 Methodology

All environmental topics considered in the certified ES have been screened to determine whether there would be any new or different likely significant environmental effects arising from the proposed non-material changes. For ease of reference, these topics are:

- Ecology;
- Air Quality;
- Noise and Vibration;
- Water Quality and Resources;
- Ground Conditions;
- Landscape and Visual Impacts;
- Traffic and Transport;
- Cultural Heritage;
- Socio-economics;
- Greenhouse Gas; and
- Safety

Table 3.1 below sets out each topic in turn and describes any aspects of the proposed non-material changes which could give rise to new or different likely significant effects, against a summary of the original assessment presented in the certified ES. In considering the potential for new or different likely significant effects, the changes have been assessed in the context of the magnitude of the proposed change and the key differences between the consented Project and proposed changes and the conclusions of the certified ES.

New or different likely significant effects have been considered for construction and operation against the proposed non-material changes. Potential effects during decommissioning have not been described separately as they were considered to be no greater than construction, as per the assessment methodology reported in the certified ES. Where it is considered that there is no potential for new or different likely significant effects to arise, this is described in Table 3.1 below. Where further assessment is required to determine new or different likely significant effects these assessments are presented in chapters 4-6 of this report.

A search of the National Infrastructure Planning register of applications and a search of Cheshire West and Chester Council's planning applications register has been undertaken. It is considered that there are not any new applications that have been registered for Nationally Significant Infrastructure Projects or major planning applications that would be required to be considered in the assessment of cumulative effects. However, where relevant, potential new or different likely significant cumulative effects arising from the proposed changes will be assessed. These effects could arise as a result of ongoing works being undertaken at the same time as construction or operation of the Project.

**Table 3.1 – Assessment of Non-material Changes against Topics**

Topic/Change description	Potential for new or different likely significant environmental effects?	Screening appraisal	Updated assessment required?
Air Quality	No	The non-material changes proposed do not introduce new or different effects on the air quality.	Confirmation of no significant impacts provided in Chapter 5 of this Report
Noise and Vibration	No	The non-material amendment to add hydrogen does not result in any significant additional noise or vibration that would require assessment.	No updated assessment required.
Ecology	No	There is not a significant change in the ecological impacts, since those outlined in the 2015 ES. The addition of the storage of hydrogen and moving of buildings does not result in any significant change.	Confirmation of no significant impacts provided in Chapter 4 of this Report.
Ground Conditions	No	There are no additional significant ground works required for the proposed changes. Therefore there is no significant additional impact	No updated assessment required.
Landscape and Visual Impacts	No	The non-material amendment to add hydrogen and minor changes to the proposed development does not result in any significant additional landscape and visual impacts	Confirmation of no significant impacts provided in Chapter 7 of this report
Traffic and Transport	No	The non-material amendment to add hydrogen and minor changes to the proposed development does not	No updated assessment required

		result in any significant additional traffic and transport impacts	
Cultural Heritage	No	The non-material amendment to add hydrogen and minor changes to the proposed development does not result in any significant cultural heritage impacts	Confirmation of no significant impacts provided in Chapter 8 of this report
Socio-Economics	No	The non-material amendment to add hydrogen and minor changes to the proposed development does not result in any significant additional socio-economic impacts	No updated assessment required.
Greenhouse Gas	No	The non-material amendment to add hydrogen and minor changes to the proposed development does not result in any significant additional greenhouse gas impacts	Confirmation of no significant impacts provided in Chapter 6 of this report
Safety	No	The non-material amendment to add hydrogen and minor changes to the proposed development does not result in any significant additional safety impacts	Confirmation of no significant impacts provided in Chapter 9 of this report

## 4. UPDATED ECOLOGICAL ASSESSMENT

### 4.1 Introduction

This section presents an updated assessment of the likely significant effects on ecology from construction, operation and decommissioning of the Keuper Gas Storage Project.

### 4.2 Methodology

When considering the impacts of the new application upon ecology, the following factors were considered:

- Any change in the footprint of the site;
- Any change in layout of the components within the site; and
- Any change to the ecological impacts from air quality.

### 4.3 Summary of original assessment

An assessment of the likely significant effects on ecology from construction, operation and decommissioning of the Keuper Gas Storage Project were first published in the Environmental Statement (ES) (November 2015). Following publication of the ES, supplementary documents supporting the existing application were produced:

- **Great Crested Newt Surveys (2018) report** – the surveys were undertaken to update information regarding great crested newt populations at the site which could be impacted by any future proposed works. The surveys undertaken are considered comprehensive and to be aligned with best practice (Great Crested Newt Mitigation Guidelines, 2001).
- **Protected Species Assessment (2021) report**- the assessment focused on habitats crossed by a proposed new access road network which will be constructed across the site. This assessment considered species which may not be directly affected by the road route but may still be within its zone of influence. This included eDNA sampling of the ponds across the site during the peak season of activity for great crested newts. The findings indicated that the populations were similar to previous years.
- **Construction Environmental Management Plan (CEMP): Biodiversity Management Plan (BMP) (2021)** – this document focusses on the management plans required for the Construction Environmental Management of the Project addressing the issues specific to the Stage 1 site road construction only. The document states that in the future, the BMP will be updated with further information related to later Stages and Phases of the Project. A key mitigation measure in the CEMP is pre-construction surveys.

These reports provided an updated assessment of the status of protected species at the site and built on the appropriate mitigation and enhancement measures that were originally outlined in the ES. The CEMP and Protected Species Assessment report note that discussions with Natural England were conducted in regards to Protected Species Licensing for the European Protected Species great crested newt. The CEMP report states that it has been agreed that the full extent of the proposed access road works would be undertaken under Natural England's 'Great Crested Newt Cheshire District Level Licensing (DLL) Scheme'.

### 4.4 Updated Assessment

The option to include hydrogen gas storage does not require any change to the red line boundary (Order limits) of the site. In ERM's view, the changes in the layout of components within the Main Assessment Area are not considered to be significant or impact habitats of importance.

ERM note that the updated 2021 Protected Species Assessment report and the Biodiversity Management Plan and associated measures cover Phase 1 of the project for the road construction only and states that updates will be made to subsequent phases accordingly. However, the proposed compound and office building will be sited within laydown areas which were previously considered to be developed upon and which were assessed within the 2021 reports and original ES. ERM notes that the Order limits are not changing, however it is advisable that the new project ensures this BMP and the great crested newt licencing agreements with Natural England are sufficient to cover this new application.

ERM also recommend that the applicant consider including a Biodiversity Net Gain (BNG) assessment in future works. As of 2021, Cheshire West and Chester Council's Policy DM 44 supports development that delivers BNG and mandatory BNG as set out in the Environment Act is likely to become law in 2023. This will require a minimum 10% net gain to be delivered with future monitoring and management plans set out. It is recommended that the client conducts a BNG Assessment of the site (using the Biodiversity Metric 3.1 published in April 2022) to calculate the total habitat that will be lost for both permanent and temporary works. The Metric should then be used to identify appropriate restoration opportunities to provide the required net gain.

## 4.5 Conclusions

An air quality assessment of the new application (Chapter 5) concluded that the change from natural gas to hydrogen will not materially affect the emissions to air, and will not change the prediction that impacts on sensitive ecological receptors are negligible.

Overall, operating the site as a hydrogen storage facility instead of a natural gas storage facility is not considered to result in a significant difference to the impacts outlined in the 2015 ES. Associated mitigation measures and the updated protected species information in the Protected Species Report (2021) appear adequate to date given that the red line boundary has not changed. However, it is advised that the BMP and licensing situation with regard to great crested newts are reviewed given the BMP refers to Phase 1 of the project and to confirm that NE are satisfied with the licencing and mitigation proposed for the new scheme. The building and compound are proposed on construction laydown areas which do not introduce any new impacts or change the likely significant effects on ecology. The hydrogen compound will have a smaller footprint than the original design, as it will be built on a laydown area and part of the original proposed area will be retained as a green field.

## 5. UPDATED AIR QUALITY ASSESSMENT

This section details an updated air quality assessment based on the proposed non-material amendment to include hydrogen gas within the development. The assessment relates to the Keuper gas boilers being fired on hydrogen rather than natural gas. In the existing application, the impacts to air quality arising from the operation of these boilers was assessed, and in both cases the pollutants of interest are oxides of nitrogen (NO<sub>x</sub>) and nitrogen dioxide (NO<sub>2</sub>).

### 5.1 Methodology

Detailed dispersion modelling was utilised that included the design and location of the boiler stacks, flue gas characteristics and NO<sub>x</sub> emissions. Impacts were assessed on nearby sensitive human receptors, and ecological receptors within a 10km radius of the site. These were considered in the context of the existing baseline air quality environment. The existing application should be consulted for the details of this assessment.

### 5.2 Summary of original assessment

The existing assessment concluded that impacts on human receptors were negligible for NO<sub>2</sub>. The existing assessment also concluded that impacts on sensitive ecological receptors were negligible, for NO<sub>x</sub>, and also acid deposition and nutrient nitrogen deposition arising from emissions of oxides of nitrogen. Of note is that the nearest statutory designated habitats are located approximately 8.5km away.

### 5.3 Updated Assessment

When considering the new application, the following points are noted:

- Burning hydrogen instead of natural gas will not significantly change the emissions of NO<sub>x</sub>. The same emission limits apply, and using boilers specifically designed to burn hydrogen will result in an emissions profile that is not materially different from boilers burning natural gas.
- Hydrogen does not require preheat, so no boilers are required. Regen heaters are still to be utilised.
- The baseline for the sensitive human receptors is not materially different. The baseline NO<sub>2</sub> in the UK is generally remaining static or decreasing where there are no specific, large scale developments (such as new roads) in the immediate vicinity.
- The baseline for sensitive ecological receptors is immaterial, given that 95% of UK habitat sites exceed Critical Loads. Instead, the significance of impacts is based upon whether the impacts of the project are less than 1% of the Critical Load. In the current assessment impacts are substantially below 1% therefore changes in the baseline or tightening of Critical Loads (which has occurred on some sites) will not trigger a new significant impact.

On this basis, the change from natural gas to hydrogen will likely decrease impacts to air quality due to not requiring boilers for hydrogen use. There is therefore, no material affect the emissions to air, and the prediction that impacts are negligible will not change.

### 5.4 Summary / Conclusions

The burning of hydrogen rather than natural gas within new boilers specifically designed to burn hydrogen, will not significantly increase the emissions of NO<sub>x</sub>. Indeed, as hydrogen will not require preheat, there are no boilers and emissions will reduce. The baseline for sensitive human receptors will not be substantially different, particularly when considering that the baseline NO<sub>2</sub> in the UK

generally remains static or decreasing. The impact on sensitive ecological receptors from burning hydrogen will fall substantially below the 1% Critical Load therefore changes in the baseline or tightening the Critical Load will not generate a new significant impact. The emissions to air will not be materially affected by changing from natural gas to hydrogen, and will not change the prediction that impacts are negligible.



## 6. UPDATED GREENHOUSE GAS CONSIDERATIONS

### 6.1 Introduction

This section details an assessment of the potential for a significant change in emissions resulting from operating the site as a hydrogen storage facility rather than a natural gas storage facility.

### 6.2 Updated Assessment

The conclusion that there will be no significant change in emissions resulting from operating the site as a hydrogen storage facility instead of a natural gas storage facility is dependent on the following assumptions:

1. There is no gas pre-heating requirement for the hydrogen storage site.
2. Operational frequency and duration of use of dehydration system regeneration heaters is expected to be lower than for a natural gas facility.
3. Availability and maintenance of equipment in hydrogen service is the same as for natural gas service.
4. Operations and maintenance plan remains unchanged.
5. Periodicity of mode of operation of the site in terms of gas import and withdrawal remains unchanged.

The relevance of these to potential changes Scope 1 and Scope 2 emissions are discussed below.

#### **Scope 1 Emissions**

The design does not require pre-heating of hydrogen, therefore there will be no GHG emissions arising from combustion of fuel in gas pre-heaters.

The design intent for the hydrogen storage facility is to utilise electric heaters in the dehydration regeneration system, though with the option retained to use hydrogen fed heaters as an alternative. Depending on the relative water content of the hydrogen during withdrawal operations compared to that of natural gas, the regeneration heaters may be required with a different frequency, however GHG emissions arising from the combustion of fuel are expected to be lower for the hydrogen storage facility.

Any change in equipment availability and operations and maintenance frequencies and durations will influence site traffic movements and site uptime and therefore emissions generated.

Changes in the periodicity of mode of operation, i.e. between gas import and gas withdrawal mode, will dictate the operational hours that the gas processing plant equipment is in use, and therefore will affect the emissions.

As a hydrogen storage site, GHG emissions from fugitives and vents will be lower than for natural gas because Hydrogen has a lower Global Warming Potential (GWP) than natural gas

The design intent is to capture gas vented during maintenance activities as far as possible using a hydrogen compressor with the hydrogen being returned to the storage cavern, which would assist in reducing GHG emissions from vents.

#### **Scope 2 Emissions**

No change will be made to the power supply strategy, with compressors being electric drive, and process heat provided by hydrogen fed heaters. With additional electrical heating in the design of the hydrogen storage facility, scope 2 emissions may be higher than for the natural gas facility.

### 6.3 Summary / Conclusions

With no pre-heat requirement for hydrogen, and the lower GWP of hydrogen compared to natural gas, GHG emissions arising from the combustion of fuel and from fugitives and vents will be lesser as a hydrogen storage site than a natural gas storage site.

Factors such as frequency of use of regeneration heaters, changes in equipment availability, and variance in periodicity of mode of operation will have a material impact on the GHG emissions from the site.

Scope 2 emissions may increase with increased use of electrical heaters in the design compared with a natural gas storage site.

For these reasons it is considered that on balance there are no significant additional impacts in respect of greenhouse gas considerations that would occur as a result of the storage of hydrogen when compared with the original consented project.

## 7. UPDATED LANDSCAPE AND VISUAL IMPACT ASSESSMENT

### 7.1 Introduction

This chapter evaluates the effects of the proposed minor changes on the landscape and visual impact appraisal. This review was undertaken of the proposed non-material changes to the Development and any effect this may have on the original LVIA findings of the likely significant effects on landscape and visual amenity from the construction, operation, and decommissioning of the project.

The proposed non-material change relevant to this review includes the option to include hydrogen gas within the storage facility, an alternative connection compound location (Work No.12) situated further away from the national transmission system (natural gas) pipeline and the Site boundary, and a revised location for the siting of the office, control, and maintenance building (Work No. 15). Of the two options shown for the location of the natural gas compound and the hydrogen gas compound, only one would be chosen and finally built. These amendments to the original proposal are listed in full in Chapter 2 of this Report.

These changes only relate to the definition of development - all design parameters relating to height, Site boundaries, and general footprint of development, and the type, period, lighting, and timing of construction, operation, and decommissioning remain unchanged. Some materials of construction may change.

The basis of assessment, as previously employed, comprises two stages: solution mining to create the cavities below ground for gas storage, followed by the subsequent operation of the gas storage facility.

### 7.2 Methodology & Significance Criteria

The receptor sensitivity judgments and assessment of effects used in this appraisal have been based on the methodology outlined in Figure 14-1 of the Environmental Statement (Ref: EN030002).

Desk study and fieldwork were undertaken in April 2014 that defined the value, susceptibility, and sensitivity of visual receptors at key viewpoints. This was then used to inform the appraisal of the potential significance of the effects described in the LVIA. These value judgments have been used in this review for consistency of approach.

Appraisal methodology is based on current professional guidance from Guidelines for Landscape and Visual Impact Assessment: Third Edition (2013) referred to as GLVIA3<sup>1</sup>.

GLVIA requires the evaluation process to be as transparent as possible and although the methodology includes an element of professional judgment, tables are used for clarity.

An LVIA assesses the extent to which development would result in harm to the visual amenity of public rights of way (PRoW), public highways, and publicly accessible open spaces.

The review used the following drawings to assess any change to landscape or visual receptors:

- KGSP Final Landscaping Details Sheet 1 of 3 (DRWG NO.13-03-01/HOL/24/266 Rev B2);
- Gas Processing Plant and NTS Compound Area - Construction of Access Roads (DRWG NO. 13-03-01/HOL/24/263 Rev B2); and
- Gas Infrastructure Construction (DRWG NO. 13-03-01/HOL/24/264 Rev B2).

Viewpoints are chosen for their possible visual relationship to the Site such as proximity, or raised landform and features of importance i.e., national trails or statutory designation. Sixteen viewpoints were selected to illustrate potential visibility and the effects of development, and represent a wide range of receptors including those at the viewpoint but also others nearby at a similar distance or orientation.

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<sup>1</sup> GLVIA3 Third Edition (2013) [REDACTED] /Accessed: 26.05.2022

### 7.3 Baseline Conditions – Limitations and Assumptions

It is assumed that the previously assessed landscape and visual receptors around the Main Assessment Area remain unchanged and do not contain any new development and therefore new visual receptors which require a visual effects appraisal and that the baseline landscape context such as existing vegetation to be retained, statutory designations, and landscape character, remains unaltered.

### 7.4 Assessment of Potential Effects

The sixteen viewpoints previously assessed, and the likely changes to the previous assessment of effects are described below.

### 7.5 Construction & Decommissioning Effects

The method of construction would remain as previously described and no change is expected from the inclusion of hydrogen gas within the storage cavities, the requirements are identical. This is not assessed further.

Decommissioning would have similar temporary landscape and visual effects to the construction phase, although the landscape will have become more settled and the planting associated with the mitigation proposals would have matured and will provide additional screening or filtering of decommissioning activities for views from visual receptors. Following the completion of decommissioning, there will be no residual landscape or visual effects as all operational infrastructure relevant to the storage of gas will be removed and the land returned to agriculture. This is also not assessed further.

### 7.6 Completed Development Effects

The minor changes proposed to the layout and operation of the Development would have no additional landscape effects, although some potential changes to visual effects on receptors may be expected from the relocation of the office, control and maintenance building, and the gas connection compound. These changes in view would be mitigated by already proposed earth bunding, and supplementary planting as 7.7 below.

### 7.7 Mitigation Measures and Residual Effects

All trees and hedgerows removed to facilitate construction works (other than those removed to provide ongoing access) will be replaced with an equivalent upon completion.

Advance planting of low-level bunds and gapping up of perimeter hedgerows would be completed during the first stage of development, (already underway) to enable an effective vegetative edge to be established prior to operation. Additional woodland planting has been shown to the east of the site boundary adjacent to the where the office, control, and maintenance building has been moved, closer to Halfway House. This would provide some filtering of views to the built form in its revised location.

### 7.8 Summary of Effects

The only viewpoints likely to have a change in their residual effects from the non-material changes suggested following the existing proposed mitigation are viewpoints 2, 3, 6, and 12 which are in close proximity. All other viewpoints are either too distant for there to be a meaningful change in the view or have intervening built-form such as the GPP compound. This energy infrastructure which includes large-scale vertical elements would effectively screen the alternative gas connection compound and the office, control, and maintenance building. These viewpoints have been reviewed as follows:

**Table 7.1 - Effects on Visual Receptors: Operation Phase**

	Residual Effects
--	------------------

Viewpoint Ref.	Receptor Type & Sensitivity	Description of Effects	Magnitude of Change	Significance
2. View East from Drakelow Farm	Residential: High	View: The baseline view extends across a cluttered farmyard to field boundary hedgerows and trees beyond. There are telegraph poles present in the view. The intervening small polytunnel and other features in the farmyard mostly screen views towards Site approx. 300 m distant, although there are glimpsed views available above or through gaps. Only taller elements within the GPP would be visible from this viewpoint such as the 25 m cold and 20 m water heater vents would be visible above the intervening clutter and vegetation. On-demand security lighting will minimise effects and the additional light will be barely discernible in the context of the existing illumination associated with the infrastructure at Stublach.	Previously: Small	Previously: Minor
			Review: Small - No change	Review: Minor - No Change
		Lighting: The alternative compound location would be screened by the bunding and intervening built form of the GPP compound and would have no discernible effect from this viewpoint	Previously: Negligible	Previously: Not significant
			Review: Negligible - No Change	Review: Not Significant - No Change
3. View South from Restricted Byway RB7 near Drakelow Hall Farm	PRoW: High	View: The baseline view extends across a field with a balancing pond and low earthworks bund visible adjacent to an existing wellhead and gas compressor station which are mostly screened from view. Pylons are a visual detractor and are seen emerging above field boundary vegetation.  Following construction activities, the landscape would take on a more settled appearance, and gapping up of hedgerows will filter views of most of the operational features within the GPP, apart from the taller vents and new power lines. These introductions are similar to the existing landscape context of power infrastructure already present in the view. The alternative compound location would be screened by the proposed vegetated bunding and intervening built form of the GPP compound and would have no discernible effect from this viewpoint	Previously: Small	Previously: Minor
			Review: Small - No Change	Review: Minor - No Change
		Lighting: Not assessed previously	Previously: N/A	Previously: N/A
			Review: N/A	Review: N/A

6. View East from the A530 Kings Street near Halfway House	Public Highway: Low	<p>View: The baseline view is directed through gaps or filtered views through thinner sections of roadside boundary vegetation to a field used for sheep grazing with mature field boundary hedgerows and scattered trees forming a backdrop. Pylons are visible in the distance.</p> <p>This is a transient and oblique view and the road user would be concentrating on the direction of travel. However, if the NTS compound is moved to the alternative location adjacent to the GPP compound the visual effects on this viewpoint from the gas processing compound would be slightly reduced as it would be located behind the proposed woodland planting and a vegetated bund. The taller elements of the GPP would be visible above existing and proposed screening vegetation but most built-form would be at least partially filtered by the already proposed additional and the linear woodland screen planting and bunding.</p>	Previously: Small	Previously: Not significant
			Review: Negligible/Small - Slight reduction	Review: Not significant - No Change
		Lighting: Not assessed previously	Previously: N/A	Previously: N/A
			Review: N/A	Review: N/A
12. View North-east from King's Street Hall, King's Street	Residential: High	<p>View: The baseline view extends across gently undulating farmland with well-trimmed and low hedgerows with scattered mature trees towards a vegetated skyline with farm infrastructure in the foreground. Moving traffic is visible on King's Street. Pylon towers (1.5 km distant) are visible emerging above intervening vegetation. The Development would be largely screened from view from this viewpoint but there may be glimpsed views of the revised gas connection compound and office location, partially screened by the proposed gapping up of field boundary hedgerows and vegetated bunding which would enclose their new locations, especially in winter. The taller elements of the GPP compound such as the emergency cold vent would be visible, seen in the context of the pre-existing pylon towers.</p>	Previously: Negligible	Previously: Not Significant
			Review: Negligible - No Change	Review: Not Significant Change
		Lighting: Low-level and on-demand security lighting associated with both the GPP compound and wellhead H501 may be discernible intermittently in the background above site boundary vegetation. However, this is in the context of a transport route that would have the headlights of passing cars	Previously: Negligible	Previously: Not Significant
			Review: Negligible - No Change	Review: Not Significant - No Change

		and occasional residential properties in the foreground and would have a barely discernible effect in this context.		
--	--	---	--	--

## 7.9 Statement of Significance

This review of the previously undertaken LVIA of KGSP has concluded that there are no additional residual visual or landscape effects associated with the proposed non-material amendments to the Development and possibly some very minor incremental visual benefits, although not sufficient to change the previous magnitude of change and significance grading which have remained unchanged and not significant.

## 8. UPDATED CULTURAL HERITAGE

### 8.1 Introduction

This chapter reviews the possible impact of the proposed non-material minor amendment on Cultural Heritage, reassessing the original 2015 Environmental Statement.

As per the non-material change application the changes identified that may potentially change the outcomes of prior assessment of Cultural Heritage are:

*Application Statement Section 1.2.2*

- The option to include an alternative location of the proposed gas connection compound, **Work No. 12**; and
- The relocation of the proposed Office Building, **Work No. 15**.

### 8.2 Methodology

In order to undertake a review and update of the 2015 ES chapter 11, the methodology employed for the original assessment was reviewed and deemed appropriate for use. As a result, this assessment will be conducted in adherence with the original ES. The review and revised assessment will consider the existing work and any new features identified as a result of the review for both construction and operational effects of the changes within the application (Work No. 12 and 15).

In summary, this includes:

*Study Area*

- Assessment area (within the Redline boundary)
- Study area (Redline boundary plus 250m)

*Data Sources*

- Modern and historical maps of the study area, including tithe maps (1836-51) and OS series maps, including the First Edition (1891);
- English Heritage (National Monuments Record) for information on World Heritage Sites, Scheduled Monuments, Listed Buildings, Registered Historic Parks and Gardens, and Historic Battlefields;
- Cheshire Historic Environmental Record (CHER); Cheshire and Chester Archives and Local Studies Library; the National Monuments Record, Swindon;
- Bodleian Library, Oxford; and
- Online sources including: MAGIC (Defra website), English Heritage's database of designated historic assets, the Cheshire Archives and Local Studies website and Google Earth for aerial photography.
- Other sources listed in the bibliography of the DBA (Cultural Heritage Annex A (ES 2015)).

*Field Survey*

- Site walkover carried out on April 8th 2014.

This involved visiting the site of the main elements proposed, including the wellheads and compressor station, to ascertain the presence or absence of archaeological features. In addition, nationally designated monuments in the study area were visited and their baseline setting was recorded.

*Baseline Development*



- Known cultural heritage assets within the study area and those within the surrounding area have been assigned site numbers which are listed in full in the Gazetteer (Cultural Heritage Annex B) (ES 2015).

Assessment Criteria

- The assessment of effects on Cultural Heritage assets is concerned with both physical (direct and indirect) effects and effects on setting.
- The criteria (set out in Figure 11.3 of ES 2015) has been used as a guide to decision- making but it must be noted that for all decisions concerning sensitivity and impact a degree of professional judgement and interpretation is required, particularly where the importance or impact magnitude levels are not clear or are borderline between categories (see Figures 8.1 and 8.3 for Effect tables).

**Figure 8.1 - Physical impact effects**

Overall level of effect

Significance of effect				
Receptor sensitivity	Magnitude of change			
	Negligible	Small	Medium	High
Low	Not significant	Not significant	Minor	Minor to moderate
Medium	Not significant	Minor	Moderate	Moderate to major
High	Not significant	Minor to moderate	Moderate to major	Major

**Figure 8.2 - Setting impact effects**

Levels of effect on Setting

Magnitude	Overall sensitivity		
	High	Medium	Low
Very large	Major	Major	Minor to moderate
Large	Major	Moderate to Major	Minor
Medium	Moderate to Major	Moderate	Minor
Small	Minor	Minor	Minor
Negligible	Not significant	Not significant	Not significant

### 8.3 Summary of Original Assessment

**Table 8.1 - Potential Physical Effects During Construction**

Asset	Impact	Asset sensitivity	Magnitude of change	Significance of Effect
Historic hedgerow between Newall and Rudheath historic parishes	New Sub-Station 132KV-32KV will require the removal of approximately 20m of historic hedgerow. This will represent a small percentage of the total length of hedgerow present.	Low	Small	Not significant
Historic hedgerow between Stublach and Rudheath historic townships.	H509 and H511. Associated pipelines will require the removal of approximately 100m of historic hedgerow. This will represent a small percentage of the total length of historic hedgerow present.	Low	Small	Not significant
Historic hedgerow between Stublach and Rudheath historic townships.	H518 and H519 and associated pipelines and access track will require the removal of approximately 50m of historic hedgerow. This will represent a small percentage of the total length of historic hedgerow present.	Low	Small	Not significant

Asset	Impact	Asset sensitivity	Magnitude of change	Significance of Effect
Historic hedgerow between Byley and Rudheath historic townships.	Wellhead H505 and access track and pipelines (connecting GMC3 with wellheads H506, H516, H517, H503, H518 and H519 to the north) will require the removal of approximately 70m of historic hedgerow. This will represent a small percentage of the total length of historic hedgerow present.	Low	Small	Not significant
Historic hedgerow between Byley and Rudheath historic townships.	Wellhead H510 and associated access track and pipelines will require the removal of approximately 30m of historic hedgerow. This will represent a small percentage of the total length of historic hedgerow present.	Low	Small	Not significant
Narrow ridge and furrow to east of Drakelow Hall Farm. Poorly preserved, disturbed by recent development.	Access track between Drakelow Lane and SMC3 and GMC3, and pipelines connecting the SMC3 and GMC3 with wellheads H509 and H511 to the north.	Negligible	Small	Not significant
Ridge and furrow to the west of Puddinglake	Access track and pipelines between wellhead H518 and H519 will impact a small area.	Low	Medium	Not significant
Broad ridge and furrow between Byley and Drakelow Gorse Farm	Wellhead H517, and access tracks and pipelines between H503, H517 and H506	Low	Medium	Minor
Broad ridge and furrow to north east of Yatehouse Green ('Wheat Field')	Wellhead H504 and associated access track and pipelines.	Low	Medium	Minor

**Table 8.2 - Potential Effects on Setting**

Asset	Description of Impact	Setting sensitivity	Magnitude of change	Significance of effect
Site 17: Drakelow Hall moated site, fishponds and moated enclosure SM	Views of the GPP and wellhead H508 to the west will be heavily restricted by intervening vegetation surrounding the SM and within intervening field boundaries and surrounding ponds. However, taller elements within the GPP, such as the emergency cold vent, will be visible above this (similar views are described in <i>Chapter 14 Landscape and Visual</i> for viewpoint 3). The GMC3 will also be perceptible to the southeast, although views will be heavily filtered by intervening vegetation (similar views are described in <i>Chapter 14 Landscape and Visual</i> for viewpoint 4). These operational elements of the Project will be visible alongside pre-existing infrastructure of a similar nature. However there will be very little change from the existing DCO.	Medium	Small	Minor
Site 18: World War II defences of the former airfield of RAF Cranage SM	Vegetation lining Byley Road will heavily restrict views to the west. In addition views of wellheads H518 and H519 will be largely screened by hedgerow vegetation within the surrounding fields (similar views are described in <i>Chapter 14 Landscape and Visual</i> for viewpoint 11). Therefore the Project will be largely imperceptible from the SM. In addition large scale infrastructure, including Buchan Cement Works and the Byley Gas Processing Plant, is already clearly visible to the north.	Medium	Negligible	Not significant
Site 19: Grade 11 listed Rosebank House	The Project will be largely imperceptible from this location. The closest Project elements will be wellhead H518 and H519, approximately 350 m and 550 m away respectively. Wellhead H518 will be screened from view by intervening hedgerow vegetation, and wellhead H519 will be only partially visible through intervening hedgerow vegetation (similar views are described in <i>Chapter 14 Landscape and Visual</i> for viewpoint 11). In addition the setting of this listed building is more strongly associated with the nearby contemporary elements within its curtilage. Therefore, the Project will have a negligible impact on the setting to the west.	Medium	Negligible	Not significant

## 8.4 Conclusions

The proposed changes to the location of the gas connection compound (Work No. 12) and office building (Work No. 15) do not introduce any new or different impacts on the cultural heritage resource.

The conclusions from the 2015 ES associated with the existing DCO remain valid.

### Conclusions from ES 2015 (Section 11.6)

There are no nationally designated sites located within the assessment area, however three are located within the 250m buffer: Drakelow Hall moated site, fishponds and moated enclosure SM, World War II defences of the former airfield of RAF Cranage SM and the Grade II listed Rosebank House.

In addition, the assessment area contains a number of non-designated sites, including King Street Roman Road and a number of 18th – 19th century rural structures. None of these sites will be physically affected by construction activities associated with the Project.

The only physical impacts to known heritage assets will be on four areas of historic hedgerow and areas of ridge and furrow. These assets are of low sensitivity and the overall effects will be minor to not significant. An archaeological watching brief, including a full written, drawn and photographic record, will record historic boundaries where these are cut and/or removed by the proposals.

Four areas of archaeological sensitivity have been identified, however, which could potentially contain unknown archaeological features: the area to the west of Drakelow Hall moated site, fishponds and moated enclosure SM (site 17); the area to the east of King Street (site 1); the area to the south of 'Street Field' (site 11); and 'Brick Kiln Field' (Site 15). Unmitigated construction activities could potentially lead to significant effects in these areas. It has therefore been proposed that evaluation of these areas is carried out in advance of construction. If this work reveals significant buried remains, further mitigation, e.g. in the form of excavation and/or a watching brief, may be necessary in advance of construction. Assuming the implementation of the archaeological inspections, no significant residual effects are anticipated.

During operation no effects on setting have been identified. For the most part the elements of the operational scheme will be under 4m in height and will be largely screened from view by existing vegetation within field boundaries. Therefore, no mitigation is considered necessary.

## 9. UPDATED SAFETY ASSESSMENT

### 9.1 Introduction

A Hazardous Substances Consent (HSC) assessment and risk assessment were undertaken to determine the risks associated with introduction of hydrogen to the project.

The safety assessments have concluded that:

- The Land Use Planning Assessment is expected to result in a “Do Not Advise Against” response; and
- Risks identified are at a level that is “As Low As is Reasonably Practicable” (ALARP).

### 9.2 The Facility

Keuper Gas Storage Limited (KGSL) is planning to modify the Keuper Underground Gas Storage Facility development to include the storage of hydrogen. This Keuper Gas Storage Project will consist of 19 salt cavities, situated between approximately 500 and 700 m below ground.

The cavities will be connected to underground mains (via Gas Marshalling Compounds), allowing for a transfer of hydrogen between the storage cavities and the Gas Processing Plant (GPP). The total gas stored on site, including ‘cushion’ gas, will be up to approximately 70,000 tonnes. The cavities have been developed specifically for this purpose, and using proven solution-mining techniques.

The hydrogen storage cavities operate in the maximum pressure range of 100 to 126 barg and have storage capacity of approx. 400,000 m<sup>3</sup> each. The cavities are operated in a regime known as “dry” storage, by keeping a static reservoir of brine at the bottom of the cavity, above which hydrogen is stored by allowing the pressure to vary as gas is added or withdrawn. In practice the cavities will be operated (and controlled locally) between each cavity’s minimum and maximum operating pressure. These pressures vary from cavity to cavity due to the different depths of the cavities across the field.

Two gas marshalling compounds (GMC3 and GMC3a) are included in the design to allow all cavities to be fed from either the buried main pipeline or the buried first gas fill supply line. This configuration avoids the needs to extend the first gas fill supply line to each individual wellhead (i.e. reducing the amount of pipework required between the GPP and the storage cavities) and allows the flexibility to de-brine some cavities while operating others. GMCs consist only of buried, branched pipelines with valves. There is a minimum cover of 1.1 m provided by the soil excavated for the pipeline construction surfaced with stone. All pipework joints including connections to valves are fully welded. The valves have sheathed, extended stems to allow them to be operated from the surface. As such, the GMCs are simply branched sections of the underground pipework network. OREDA<sup>2</sup> provides the number of incidents of external leakage of process medium from equipment, including valves, indicating a failure rate for an external leak of a valve does not contribute significantly to its overall failure rate (i.e. contribution of <10%). Hence, the potential for failure at the compounds is no different to any welded joint in the pipework network, or any other underground gas pipework network. The compounds will be fenced to restrict access to the valve handles. This access restriction further limits the potential for any inadvertent damage relative to a typical underground gas piping system.

The Gas Processing Plant (GPP) is used to treat and meter the gas coming in and out of the cavity. The GPP can dehydrate, cool, heat and adjust the pressure depending on the mode of operation.

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<sup>2</sup> SINTEF, 2015 [OREDA 2015]. Offshore Reliability Data, 6<sup>th</sup> Ed.

The GPP has a maximum operating capacity of 34 Msm<sup>3</sup>/day and includes the following process systems:

- Gas metering;
- Gas cooling;
- Gas compression and after cooling;
- First gas fill compression and after cooling;
- Pressure let-down and flow control; and
- Gas dehydration system.

### 9.3 Implications of Hydrogen Storage

The hydrogen storage facility is expected to be very similar to the natural gas storage facility, with some differences due to the change of fluid. Hydrogen is a more reactive molecule with low gas density, which has implications for material and equipment selection. Given a loss of containment, hydrogen can form flammable mixtures with air, resulting in a jet flame and thermal radiation effects in the immediate vicinity, or the formation of a flammable cloud and a flash fire.

There are no foreseeable changes in hydrogen gas. If air is allowed to enter the cavities or pipework in sufficient quantity, there may be the potential for combustion in the presence of an ignition source. Efforts will be taken to minimise air ingress during activities, and nitrogen purging facilities will be available.

However, no significant changes of physical state or chemical reactions in hydrogen gas that take place during the storage operation. Potential changes in conditions, such as increased moisture content from residual brine in the cavity, temperature changes due to equalisation with the bulk salt temperature, or increased levels of hydrogen sulphide in the gas exiting the cavity due to sulphate-reducing bacteria, have been considered and if confirmed plausible, incorporated in the design. A corrosion inhibitor may be required to be injected into the gas stream to protect against possible corrosion from the moisture content of the gas existing in the cavities; however, the specific substance has not been selected and it is not anticipated to create any physical or chemical changes to the hydrogen gas.

### 9.4 Summary / Conclusions

Compared to natural gas, hydrogen is a more reactive molecule with a low gas density, which has implications for material and equipment selection. Given a loss of containment, hydrogen can form flammable mixtures with air, resulting in a jet flame and thermal radiation effects in the immediate vicinity, or the formation of a flammable cloud and a flash fire. However, the overall assessments for the facility indicate that the overall safety risks associated with hydrogen are comparable to natural gas.

The plant is designed and will be constructed, operated and maintained to appropriate national and internationally recognised standards. Hazard evaluation has been carried out in a logical, semi-qualitative manner. This process has been supported by Hazard Identification (HAZID) and risk assessment studies. It is expected that the risk assessment studies will be refined in the later stages in the KGSP design process.

Those events that could be major accidents have been identified and linked with possible causes. The preventative and control measures have been listed, and measures to minimise the consequences have been analysed. A robust management of major accident hazards will need to be in place throughout the overall project phases. ERM is producing a Pre-construction Safety Report, in order to support a demonstration that a robust management of major accident hazards is in place prior to the

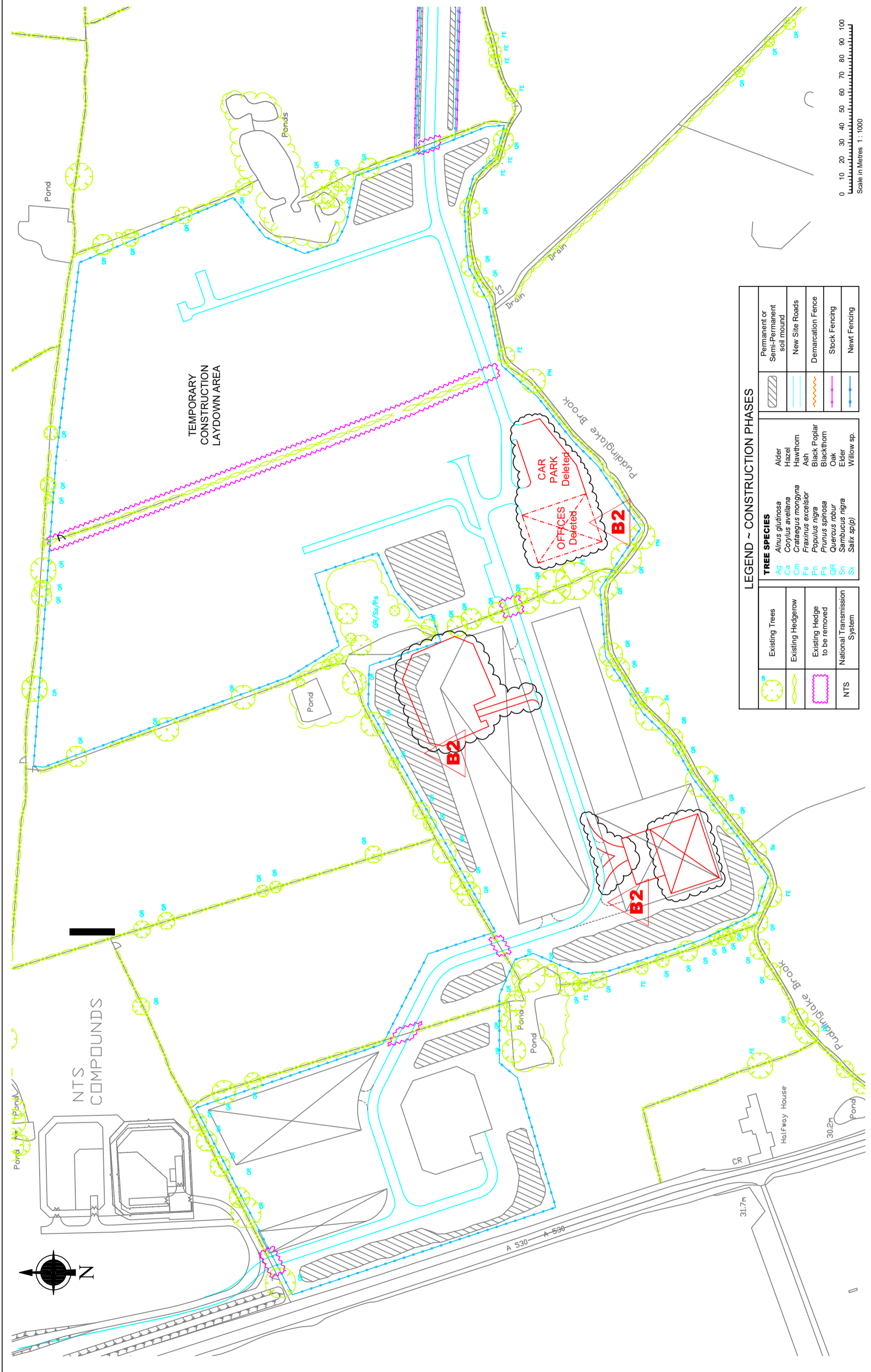
start of construction. It is expected that the safety report will be refined in the later stages in the KGSP design process.

To conclude, it is considered that there are no material safety impacts arising from the proposed storage of hydrogen and the minor design changes when compared to the existing DCO and the storage of natural gas.



## APPENDIX A – PLANS AND FIGURES





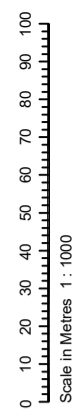
<b>HOLFORD BRINEFIELD - KGSP PROJECT - GAS PROCESSING PLANT AND NTS COMPOUND AREA - CONSTRUCTION OF ACCESS ROADS</b>		SCALE <b>1:1000</b>
DATE 02/02/2015	APPROVED BY C	PROJECT NO.
DRN BY Alan Skeehorn	WORKS C	APPLICATION NUMBER <b>EN030002</b>
CHECKED BY RDS	DATE 02/02/2015	DRAWINGS NO. <b>13-03-01/HOL/24/263 P1 B2</b>
TELE	EXT	
<p style="text-align: center;"><b>WARNING</b></p> <p style="text-align: center;">THIS DRAWING HAS BEEN GENERATED USING C.A.D. AUTHORIZED COPYING AND MICROFILMING IS PERMITTED BUT UNDER NO CIRCUMSTANCES SHOULD REVISIONS BE MADE TO THE DRAWING EXCEPT BY UPDATING THE C.A.D. MASTER IMAGE. IF ANY DOUBT EXISTS PLEASE CONTACT HOLFORD DRAWING OFFICE FOR CONFIRMATION OF CURRENT DRAWING STATUS.</p>		
<p style="text-align: center;"><b>KEUPER GAS STORAGE LIMITED</b></p> <p style="text-align: center;">BRINE AND WATER SECTION, NORTHWICH SITES, HOLFORD BRINEFIELD, LOSTOCK GRALAM, NORTHWICH, CHESHIRE, CW9 7TD.</p>		
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RDS 25/02/2022	RDS 26/10/2015	CHKD DATE
<b>ALTERATIONS</b>		

**LEGEND ~ CONSTRUCTION PHASES**

	Existing Trees		Permanent or Semi-Permanent soil mound
	Existing Hedgerow		New Site Roads
	Existing Hedge to be removed		Demarcation Fence
	National Transmission System		Stock Fencing
			Newt Fencing

<b>TREE SPECIES</b>	
Ag <i>Alnus glutinosa</i>	Alder
Ca <i>Corylus avellana</i>	Hazel
Cm <i>Crataegus monogyna</i>	Hawthorn
Fe <i>Fraxinus excelsior</i>	Ash
Ph <i>Populus nigra</i>	Black Poplar
Ps <i>Prunus spinosa</i>	Blackthorn
QR <i>Quercus robur</i>	Oak
Sn <i>Sambucus nigra</i>	Elder
Sx <i>Salix sp(p)</i>	Willow sp.



NTS COMPOUNDS

TEMPORARY CONSTRUCTION LAYDOWN AREA

A 530 A 530

31.7m

30.2m

Pond

Pond

Pond

Pond

Ponds

OFFICES Deleted

CAR PARK Deleted

B2

B2

B2

B2

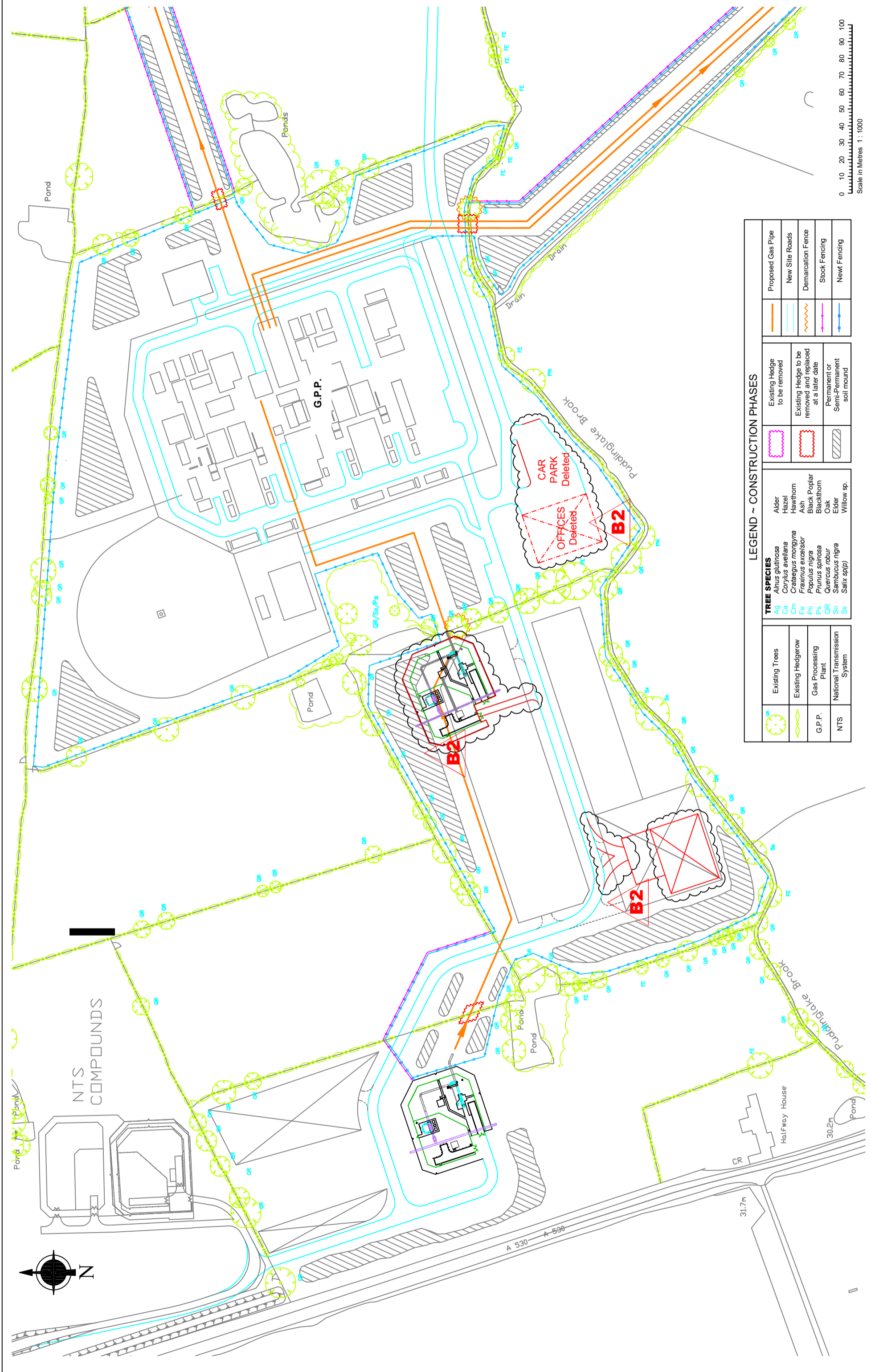
Drain

Drain

Puddinglake Brook

Puddinglake Brook

Halfway House



**LEGEND ~ CONSTRUCTION PHASES**

	Existing Trees	<i>Alnus glutinosa</i>	<i>Alder</i>		Proposed Gas Pipe
	Existing Hedgerow	<i>Corylus avellana</i>	<i>Hazel</i>		New Site Roads
	Gas Processing Plant	<i>Crataegus monogyna</i>	<i>Hawthorn</i>		Demarcation Fence
	National Transmission System	<i>Fraxinus excelsior</i>	<i>Ash</i>		Stock Fencing
		<i>Populus nigra</i>	<i>Black Poplar</i>		New Fencing
		<i>Prunus spinosa</i>	<i>Blackthorn</i>		
		<i>Quercus robur</i>	<i>Oak</i>		
		<i>Sambucus nigra</i>	<i>Elder</i>		
		<i>Salix sp(p)</i>	<i>Willow sp.</i>		

0 10 20 30 40 50 60 70 80 90 100  
Scale in Metres 1 : 1000

**HOLFORD BRINEFIELD - KGSP - GAS PROCESSING PLANT AND NTS COMPOUND AREA - GAS INFRASTRUCTURE CONSTRUCTION**

TITLE	HOLFORD BRINEFIELD - KGSP - GAS PROCESSING PLANT AND NTS COMPOUND AREA - GAS INFRASTRUCTURE CONSTRUCTION				PROJECT No.	EN030002	SCALE	1:1000
B2	Submission for 2022 Amendment Order	DATE	25.02.2022	APPROVED BY	ACC. No.	EN030002	WORKS	FLAID REF.
B1	FOR DCO APPLICATION	DATE	26.10.2015	CHECKED BY	INST	RDS	APPLICATION NUMBER	EN030002
REV	ALTERATIONS	CHKD BY		DATE	02.02.2015	RDS	DRAWINGS No.	13-03-01/HOL/24/264
							REVISION	A1
							REV	B2

**KEUPER GAS STORAGE LIMITED**  
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**LEGEND**

- - - EXISTING HEDGEROW ENHANCEMENT BY HOLFORD GAS STORAGE PROJECT (EGN)
- - - EXISTING HEDGEROW ENHANCEMENT BY STUBLACH GAS STORAGE PROJECT (STORENGY)
- - - PROPOSED HEDGEROW ENHANCEMENT BY KGSP
- - - ALTHOUGH COVERED BY HGSL, HEDGEROW AROUND G.P.P. TO BE FURTHER ENHANCED BY KGSP
- - - PROPOSED NEW HEDGEROW BY KGSP
- - - PROPOSED PERMANENT SOIL MOUND WITH LANDSCAPE PLANTING AROUND WELL-HEAD COMPOUNDS BY KGSP
- PROPOSED NEW TREES
- EXISTING HEDGEROWS AND TREES
- AREAS TO BE PLANTED UP WITH GENERAL PURPOSE MEADOW MIX
- H50x □ WELL-HEAD COMPOUND WITH 50m SQUARE PERIMETER FENCE
- THE ORDER LIMITS
- PROPOSED ACCESS ROAD
- NEW UNDERGROUND PIPELINE ROUTES
- G.P.P. = GAS PROCESSING PLANT
- NTS = NATIONAL TRANSMISSION SYSTEM

**NOTE:**  
 ALL HIGHLIGHTED HEDGEROWS SHOWN THUS TO BE 'GAPPED UP' AS NECESSARY WITH STANDARD HEDGEROW MIX PLUS HEDGEROW TREES AS DESCRIBED BELOW

**NEW HEDGEROW, LANDSCAPE AND 'GAPPING-UP' PLANTING SCHEDULE**

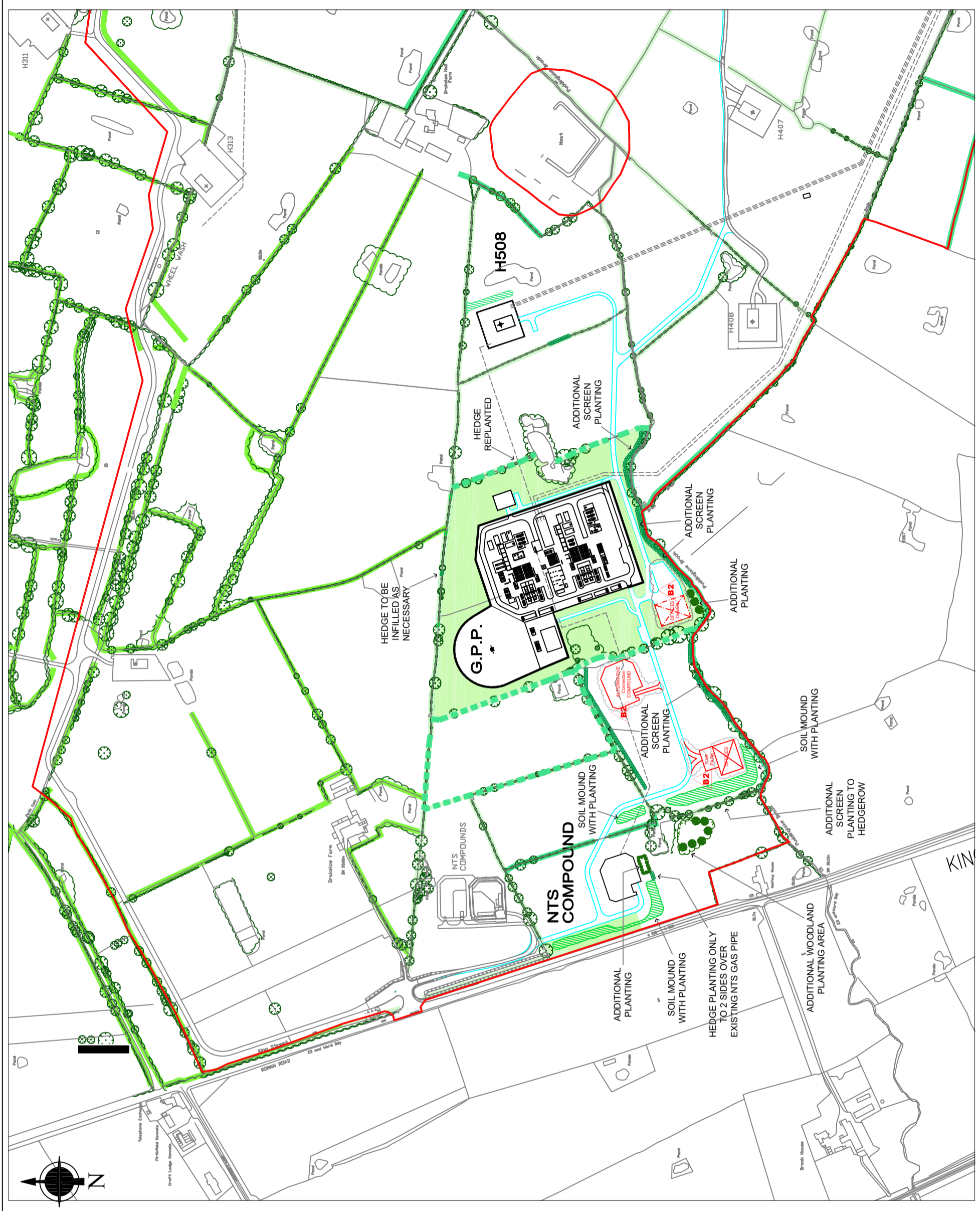
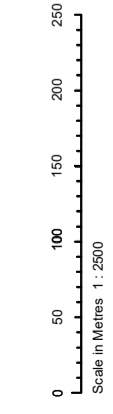
Hedgerow Planting	
Species	Size and Description
<i>Crataegus monogyna</i>	400-500mm transplant
<i>Acer campestre</i>	400-600mm transplant
<i>Ilex aquifolium</i>	400-600mm containerised
<i>Prunus spinosa</i>	400-600mm transplant
<i>Corylus avellana</i>	400-600mm transplant

To be planted at 5 plants per linear metre within double staggered row in groups of 10-15 plants along hedgerow. Hedgerow trees should replace plants at an average of 10 metre intervals.

**Smaller gaps should include at least one hedgerow tree where there are no adjacent existing trees.**

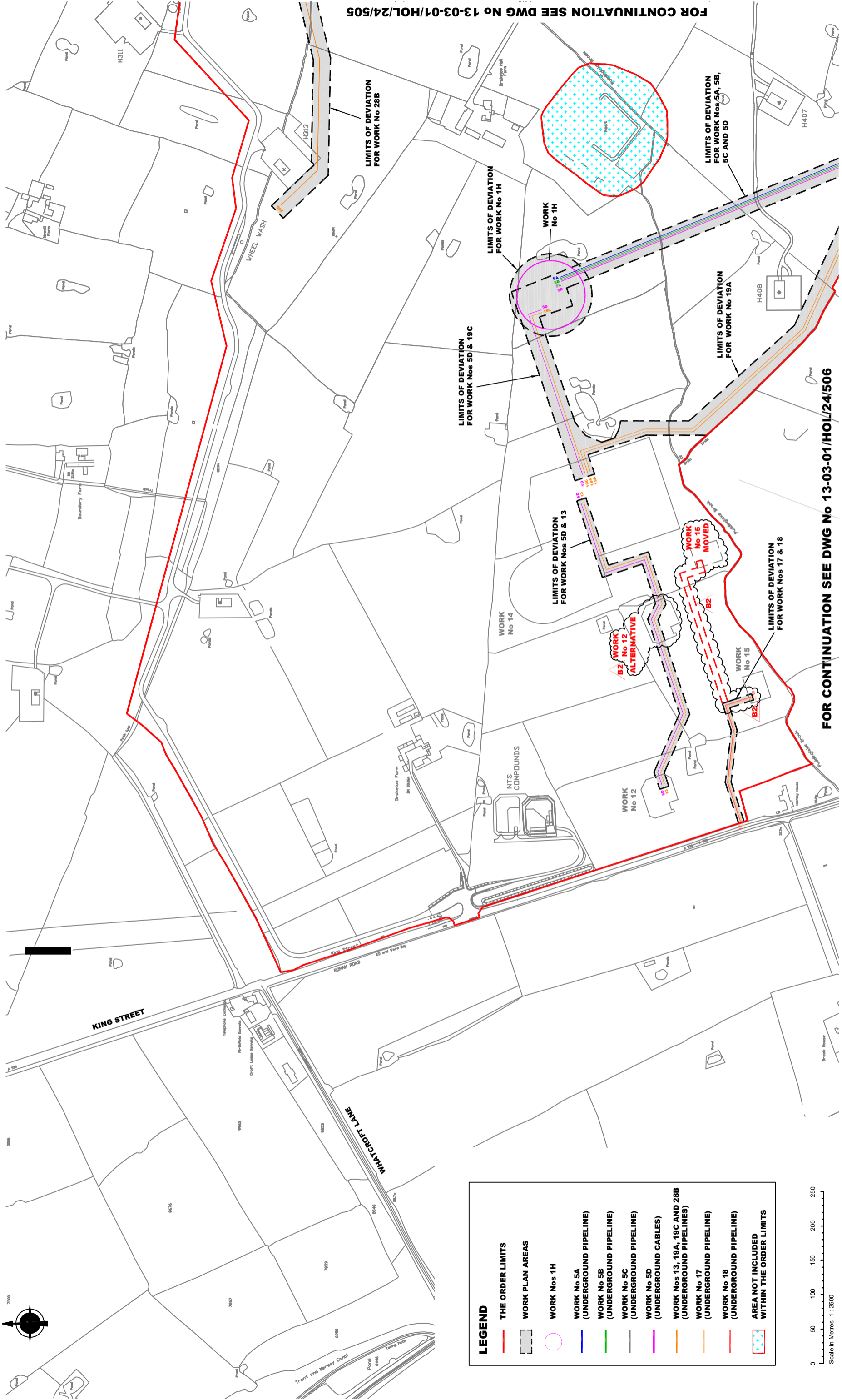
Hedgerow Trees	
Species	Size and Description
<i>Fraxinus excelsior</i>	Feathered whips, 1.2m
<i>Quercus robur</i>	Feathered whips, 1.2m

All trees to be supplied in bags (bare root) except where a rootball is specified. Gapping up and hedgerow infill planting will include hedgerow tree planting as appropriate in the gaps.

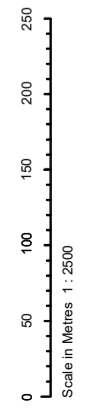


**HOLFORD BRINEFIELD - KGSP - FINAL LANDSCAPING DETAILS - SHEET 1 OF 3**

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<p>DATE: 02/02/2015          CHECKED BY: RDS          DATE: 02/02/2015</p>	<p>DATE: 02/02/2015          INST: E          TELE: EXT:</p>	<p>APPROVED BY: G          ACC. No.:</p>	<p>PROJECT No.:</p>
<p>DRN. BY: Alan Skelthorn</p>	<p>WORKS: PLANT REF</p>	<p>SCALE: 1:2500</p>	<p>SIZE: A1</p>
<p>BRINE AND WATER SECTION, NORTHWICH SITES,          HOLFORD BRINEFIELD, LOSTOCK GRALAM,          NORTHWICH, CHESHIRE, CW9 7TD.</p>	<p><b>KEUPER GAS STORAGE LIMITED</b></p>	<p>APPLICATION NUMBER: EN030002</p>	<p>DRAWING No. 13-03-01/HOL/24/266</p>
<p>REV</p>	<p>ALTERATIONS</p>	<p>B2 Submission for 2022 Amendment Order</p>	<p>PI B2</p>
<p>B1 FOR DCO APPLICATION</p>	<p>25/02/2022</p>	<p>26/10/2015</p>	<p>CHKD DATE</p>



LEGEND	
	THE ORDER LIMITS
	WORK PLAN AREAS
	WORK Nos 1H
	WORK No 5A (UNDERGROUND PIPELINE)
	WORK No 5B (UNDERGROUND PIPELINE)
	WORK No 5C (UNDERGROUND PIPELINE)
	WORK No 5D (UNDERGROUND CABLES)
	WORK Nos 13, 19A, 19C AND 28B (UNDERGROUND PIPELINES)
	WORK No 17 (UNDERGROUND PIPELINE)
	WORK No 18 (UNDERGROUND PIPELINE)
	AREA NOT INCLUDED WITHIN THE ORDER LIMITS



**HOLFORD BRINEFIELD - KGSP - BELOW GROUND WORKS PLAN [REGULATION 5(2)(J)] - SHEET 4 OF 9**

DATE	02/02/2015	APPROVED BY	ACC. No.	PROJECT No.	SCALE	1:2500
CHECKED BY	DP	DATE	02/02/2015	WORKS	FLAIRT REF	EN030002
TELE		EXT.		GEOG. AREA(S)	DRAWING No.	13-03-01/HOL/24/504
REV					SIZE	A1
					REV	B2

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 BRINE AND WATER SECTION, NORTHWICH SITES,  
 HOLFORD BRINEFIELD, LOSTOCK GRALAM,  
 NORTHWICH, CHESHIRE, CW9 7TD.

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REV	CHG'D BY	DATE	ALTERATIONS
B2	RDS	25/02/2015	Submission for 2022 Amendment Order
B1	DP	25/02/2015	FOR DCO APPLICATION

FOR CONTINUATION SEE DWG No 13-03-01/HOL/24/505

FOR CONTINUATION SEE DWG No 13-03-01/HOL/24/506



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