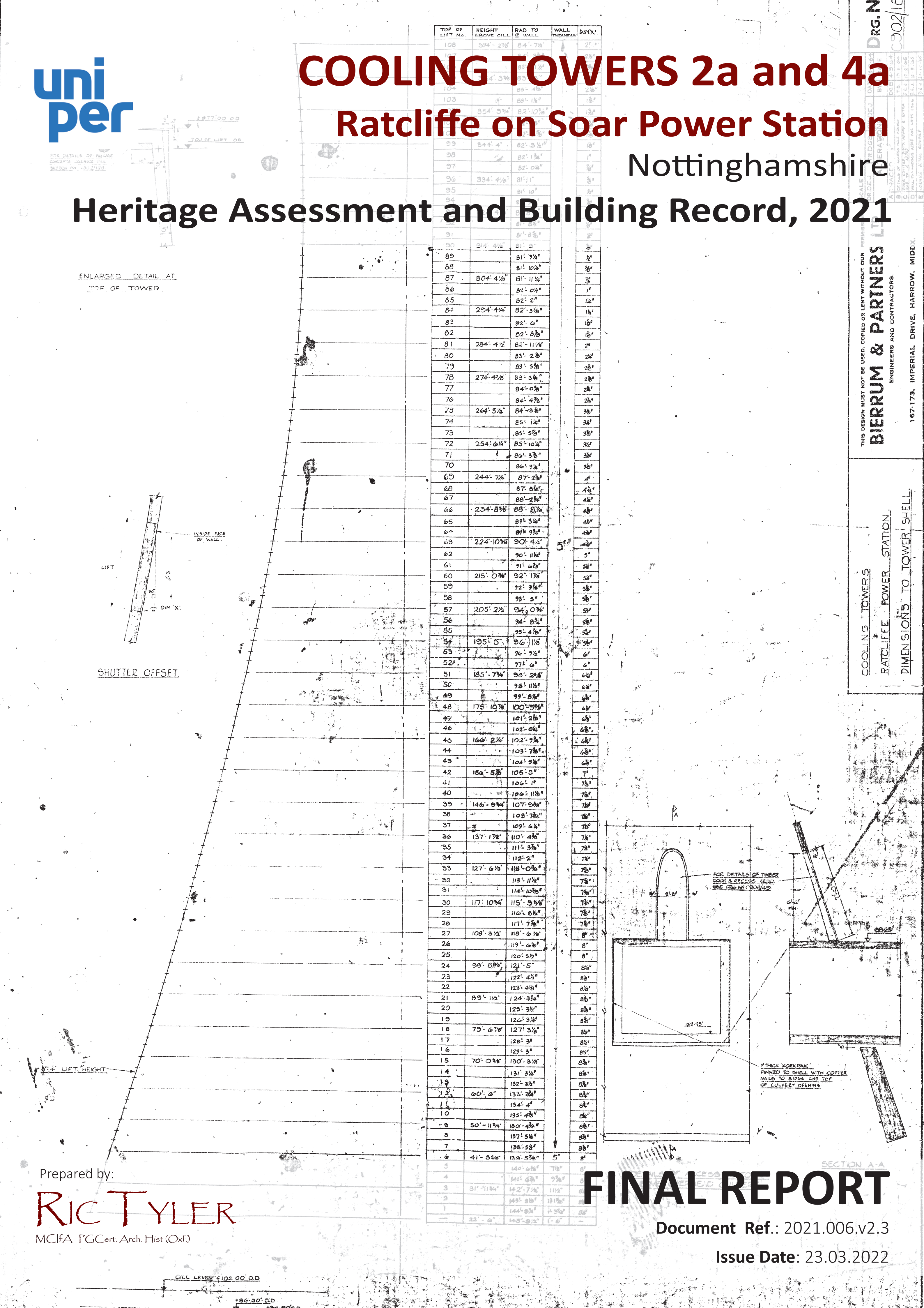
COOLING TOWERS 2a and 4a

Ratcliffe on Soar Power Station

Nottinghamshire

Heritage Assessment and Building Record, 2021



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MCIfA PGCert. Arch. Hist (Oxf.)

FINAL REPORT

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County:	Nottinghamshire
Planning Authority:	Rushcliffe Borough Council (RBC)
Waste Planning Authority:	Nottinghamshire County Council (NCC)
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Cover image: Extract of original Bierrum & Partners drawing of CT shell profile (Uniper Archive).

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COOLING TOWERS 2a and 4a
RATCLIFFE ON SOAR POWER STATION
Nottinghamshire, NG11 0EE

Heritage Assessment and Building Record, 2021

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Heritage Assessment and Building Record, 2021

Summary

The current report summarises the results of a programme of heritage assessment and associated building recording undertaken in November 2021 in respect of the two southernmost cooling towers (designated CT2a and CT4a) and associated circulating water (CW) structures at Ratcliffe on Soar Power Station, Nottinghamshire NG11 0EE (centred on NGR SK 49885 29675). The project was commissioned by, and undertaken on behalf of, Uniper as a part of compensation mitigation measures required by Nottinghamshire County Council (NCC) with respect to the construction of a new 'Energy from Waste' (EfW) facility, known as the East Midlands Energy Re-Generation (EMERGE) Centre, to be erected on designated Green Belt land neighbouring the main power station site to the north-east.

Current UK Government policy in respect of unabated coal-fired power plants requires the closure of remaining stations by 1st October 2024. While it is anticipated that the wider power station site at Ratcliffe will be subject to a full 'historic building record' in due course, the current record and assessment has been completed in response to a specific planning condition to enable development of the EMERGE Centre.

Ratcliffe was one of 13 oil- and coal-fired power stations based around the 500MW turbo-generator set built by the Central Electricity Generating Board (CEGB) during the 1960s. Released for construction in 1963, the plant was completed in 1967 and first commissioned in 1968. Together with nearby Cottam, and West Burton 'A', Ratcliffe is one of three such 'super-stations' of 2,000MW capacity within the lower Trent Valley. The power station comprises a standard grouping of structures based around the generating core of boiler house, turbine hall with attached control room, and precipitator block, served by a single, four-flue chimney to the north and a massive, enclosed 400kV switch-house located axially to the south. Cooling towers are arranged to the west of the main generation buildings, while an extensive coaling plant, associated stock area and enclosing rail loop are sited to the east.

Ratcliffe on Soar is furnished with a total of eight natural-draught cooling towers of hyperbolic profile, arranged in a single 'field' in two parallel lines of four, aligned north-south and staggered to form a double 'lozenge' pattern. The cooling towers currently under consideration, designated 2a and 4a, comprise the southernmost towers of each row. The towers were erected by specialist contractors Bierrum and Partners to British Standard (BS) specification and are essentially similar in form, though the external mantle of tower 4a was enhanced during the construction phase while tower 2a was subject to a phase of secondary re-strengthening in 1990, which saw the introduction of an additional concrete mantle to throat level and associated steel props to the base of the shell. As part of the Ratcliffe Environmental Upgrade, the distributor pipework, packing and drift eliminator elements of all towers on the site were replaced between 2009 and 2012. The associated CW pump house, fed by above ground return channels, incorporates a distinctive 'annular' moat design, similar to pumphouses at Ratcliffe's 'mother' station at Ferrybridge C, at Cottam and at Didcot 'A'.

While of historical interest and significance at a 'local' level, the cooling towers and wider power station site have been recently assessed by Historic England as being insufficiently innovative in terms of technology, planning or design to be deemed of 'special interest' within a national context, and thus not suitable for statutory listing. In the context of an ongoing, national programme of recording of this generation of power station sites, the current report presents a 'point in time' record of the Ratcliffe on Soar's southernmost cooling towers and will, once expanded to cover the wider site, add to a growing corpus of material on the 500MW unit programme as a whole.


Panoramic view of CT field looking north-west with CT2a/4a to foreground (left and right respectively); 02.11.2021.

COOLING TOWERS 2a and 4a
RATCLIFFE ON SOAR POWER STATION
Nottinghamshire, NG11 0EE

Heritage Assessment and Building Record, 2021

1 INTRODUCTION

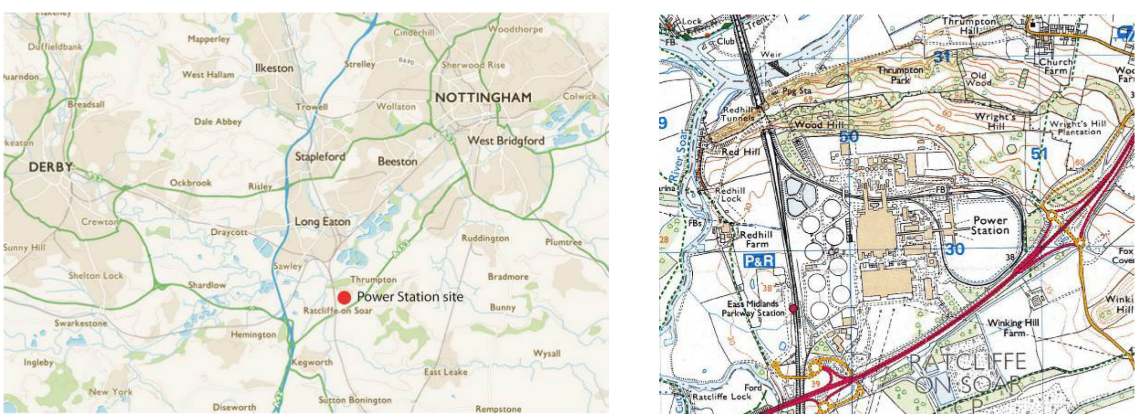
1.1 Introduction to the Project

1.1.1 The current report outlines the results of a programme of heritage assessment and building recording completed in November 2021 in respect of the two southernmost cooling towers (designated 2a and 4a) at Ratcliffe on Soar Power Station, Nottinghamshire, NG11 0EE. The project was commissioned by, and undertaken on behalf of, the station operators, Uniper.

1.1.2 The project has been logged with OASIS, the online grey-literature library of the Archaeology Data Service (ADS), ref. **rictyler1-502990**, where a copy of this report will be uploaded (see summary sheet at **Appendix C**). A copy of the report will also be lodged with the Nottinghamshire Historic Environment Record (HER).

1.2 Site Location

1.2.1 Ratcliffe on Soar Power Station is located on the south bank of the River Trent in south-west Nottinghamshire, close to its confluence with the Soar, hard on the border with Derbyshire to the north-west (with which the Trent here forms the county boundary) and with Leicestershire to the south-west (the county boundary formed by the Soar). It is located immediately north of the village of Ratcliffe on Soar and *c*.12km south-west of the county town of Nottingham (see inset below and Figure 1). It is located within the civil parish of Ratcliffe on Soar and the administrative district of Rushcliffe; it is centred on NGR SK 50135 30025. The complex occupies a level, flood-plain site at a level of *c*.40m AOD, with buildings and areas related to the station extending to a total area of *c*.285 acres (115ha).



Site location (based upon OS Explorer, sheet 260; © Crown copyright, 2015 (Licence No. **100050391**).

1.2.2 The station complex is accessed off the north side of the A453 'Remembrance Way',[1] formerly the main trunk road between Nottingham and Birmingham, and is served by the Midland Main Line rail line which skirts the station site to the west, with a dedicated coal delivery spur entering the site to the north-west.

1.3 Designations

Statutory Designations

1.3.1 Neither Ratcliffe Power Station nor any of its constituent buildings are statutorily or locally listed, nor do they lie within a designated Conservation Area. An assessment undertaken by Historic England in January 2017 (Case ID: 1444012;[2] see **Appendix A**) concluded that the site was not sufficiently innovative in terms of technology, planning or design to be deemed of 'special interest' within a national context, and thus not suitable for statutory listing. The assessment noted that, although of interest as one of a generation of power stations based around the 500MW generating unit commissioned in the 1960s, it does not meet the very high threshold necessary to justify designation for a site of its type and period.[3] The designation decision highlighted the following factors;

- Lack of architectural interest: the power station is insufficiently distinguished from the generality of such buildings; it was closely modelled on the earlier Ferrybridge Power Station (1961-66) and is, to a large part, based on standard designs;
- Lack of technological interest: the power station is one of a generation of similar sites and is not considered to carry major technological innovations;
- Rarity: the buildings, including the cooling towers, are of relatively common types which survive at many power station sites of this generation across the country.[4]

Non-Statutory Designations

1.3.2 Unlike contemporary stations at West Burton and Cottam, neither the wider Ratcliffe power station site, nor any of its component buildings and structures, are included on the Nottinghamshire Council Historic Environment Record (HER),[5] though the cooling towers currently under consideration can be adjudged to meet the criteria for interpretation as 'non-designated heritage assets',[6] as set out at paras. 9.14 and 9.15 of the Rushcliffe Local Plan (see §.1.4.7-8 below).

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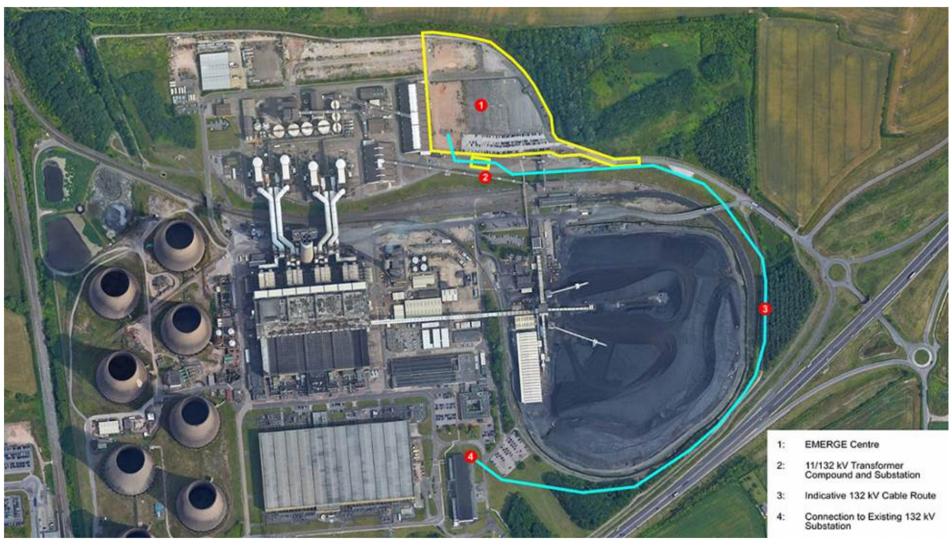
1 Known as such since March 2015, in honour of the 453 British servicemen and women who lost their lives in Afghanistan (info: https://www.bbc.co.uk/news/uk-england-nottinghamshire-31829181).
2 https://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=1444012&resourceID=7
3 See DCMS, 2010; Historic England, 2017b.
4 The 'rarity value' of hyperbolic cooling towers has increased significantly since the date of preparation of the HE assessment, with contemporary examples at a number of decommissioned stations having been subsequently demolished (Didcot, August 2019; Ironbridge, July 2020; Rugeley, June 2021; Eggborough, October 2021; Ferrybridge, ongoing). Of the pre-CEGB era towers, only those at Willington, Derbyshire survive.
5 Info: www.heritagegateway.org.uk
6 'Non-designated heritage assets' are buildings, monuments, sites, places, areas or landscapes identified as having a degree of significance meriting consideration in planning decisions because of their heritage interest, but which do not meet the criteria for designated heritage assets (NPPF, Annex 2).

1.4 Planning Context

1.4.1 In line with national government policy, and as part of a move towards Ratcliffe on Soar becoming a zero-carbon technology and energy hub for the East Midlands, Uniper confirmed in August 2021 that it is planning to cease coal-fired generation at the power station site in September 2024, after it has fulfilled its commitments under existing capacity market agreements, with one unit closing earlier, in September 2022.[7]

1.4.2 As a part of their move towards sustainable energy generation, in July 2020 Uniper submitted an application to Nottinghamshire County Council (ref. **8/20/01826/CTY**) and Rushcliffe Borough Council (ref. **20/01826/CTY**)[8] for the development of a new 'Energy from Waste' (EfW) plant, known as the East Midlands Energy Re-Generation (EMERGE) Centre,[9] on land to the north-east of the main power station site (see inset below). As a compensation mitigation measure for the construction of the new facility, to safeguard the permanence and openness of the designated Green Belt land on which it would lie, Uniper has agreed to the demolition (by the end of 2030) of the two southernmost cooling towers of the extant power plant, designated 2a and 4a (see key plan at §.1.4.3; Plate 1).[10]



Ratcliffe on Soar: General layout plan of proposed new 'EMERGE' EfW facility (image: © Uniper)

1.4.3 Nottinghamshire County Council, as the Waste Planning Authority (WPA), has issued planning conditions to ensure that the EMERGE Centre development in the Green Belt is offset by the demolition of cooling towers 2a and 4a. Condition 2 is worded as follows:

The development hereby permitted shall not be commenced until such time as:

a. Planning approval has been demonstrated to exist for the demolition of the two cooling towers.

b. A programme for the demolition for the two cooling towers has been approved in writing by the Waste Planning Authority (WPA).

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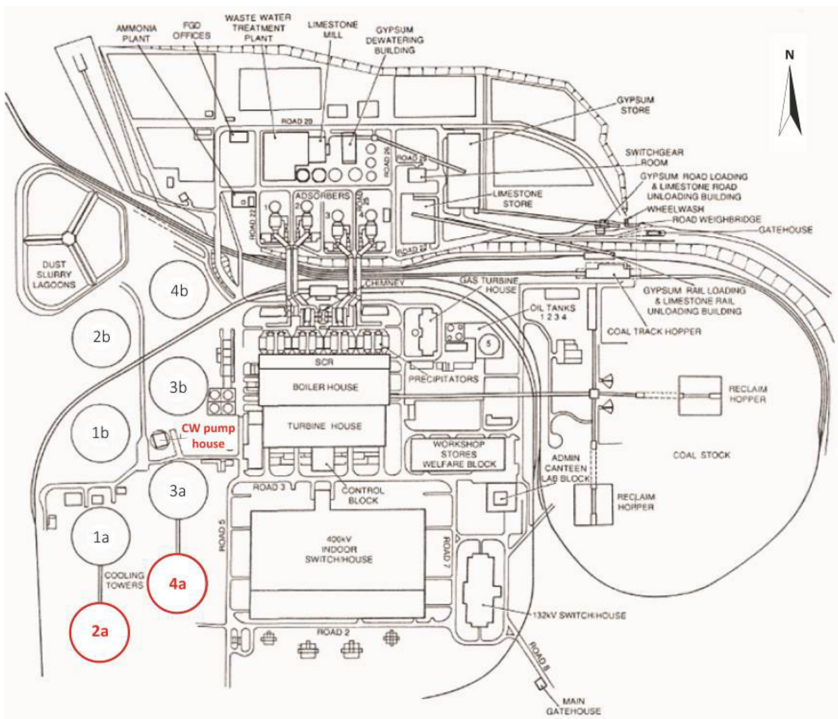
7 Info: https://www.uniper.energy/sites/default/files/2021-08/2021-08-04_pressrelease_uniper_confirmation_of_closure_ratcliffe_power_station_sept_24_with_one_unit_closing_earlier_in_sept_2022.pdf
8 https://planningon-line.rushcliffe.gov.uk/online-applications/applicationDetails.do?activeTab=summary&keyVal=QE6PNTNL0CB00
9 See https://www.uniper.energy/emerge#project
10 Uniper (2020) 'EMERGE Centre Planning Statement' pp.99-102; Axis (2020) 'Technical Note 2: EMERGE Centre development interface with proposed demolition of cooling towers'.

c. ***A record of the heritage asset of the two cooling tower structures to be demolished has been submitted to the WPA and approved in writing. The heritage record shall incorporate visual, descriptive and analytical information including the use of drawings to identify the cooling towers' location, age, history, materials, dimensions and use and incorporate arrangements for making the document publicly available including entry onto the historic environment record****.*

The demolition of the cooling towers shall take place in accordance with the agreed programme and timetable and be completed no later than 31st December 2030.

Reason*: The submission is required prior to the commencement of the development to ensure that appropriate arrangements are in place for the demolition of the two southernmost cooling towers to a satisfactory timetable and the heritage asset of these structures is appropriately recorded and thus ensure compliance with Rushcliffe Local Plan Part 2: Land and Planning Policy 21: Green Belt and Policy 28: Conserving and Enhancing Heritage Assets.*



Site key plan showing location of CTs 2a and 4a (bottom left)

1.4.4 Development of the EMERGE Centre cannot commence until the required supporting information for the related demolitions is in place. The present project is directed at meeting the immediate planning requirements related to the EMERGE Centre, and therefore focusses on cooling towers 2a and 4a and their immediate functional context, while it is understood that a wider study of the power station site as a whole will be undertaken in due course, in line with Historic England guidelines (Clarke 2016, 1).

Requirement for Work

1.4.5 The Historic Building Record was required under the terms of National Planning Policy Framework (NPPF, 2021; §.1.4.6) and the Rushcliffe Local Plan (Part 2), adopted October 2019 (§.1.4.7).

National Planning Policy Framework[11]

1.4.6 Government planning policy and guidance at a national level is set out in the Ministry of Housing, Communities and Local Government's *National Planning Policy Framework* (NPPF, 2021), section §.16 (p.54-57) of which addresses 'Conserving and Enhancing the Historic Environment' with the following paragraphs being pertinent:

Para 194:
In determining applications, local planning authorities should require an applicant to describe the significance of any heritage assets affected, including any contribution made by their setting. The level of detail should be proportionate to the assets' importance and no more than is sufficient to understand the potential impact of the proposal on their significance. As a minimum the relevant historic environment record should have been consulted and the heritage assets assessed using appropriate expertise where necessary. Where a site on which development is proposed includes, or has the potential to include, heritage assets with archaeological interest, local planning authorities should require developers to submit an appropriate desk-based assessment and, where necessary, a field evaluation.

Para. 205:
Local planning authorities should require developers to record and advance understanding of the significance of any heritage assets to be lost (wholly or in part) in a manner proportionate to their importance and the impact, and to make this evidence (and any archive generated) publicly accessible. However, the ability to record evidence of our past should not be a factor in deciding whether such loss should be permitted.

Rushcliffe Borough Council Local Plan (Part 2)[12]

1.4.7 Local planning guidance is set out by the Rushcliffe Local Plan (Part 2), adopted October 2019, wherein the Historic Environment is addressed at §.9 (p.111-116), with Policy 28 addressing the conservation and enhancement of heritage assets.

Policy 28:

1. Proposals that affect heritage assets will be required to demonstrate an understanding of the significance of the assets and their settings, identify the impact of the development upon them and provide a clear justification for the development in order that a decision can be made as to whether the merits of the proposals for the site bring public benefits which decisively outweigh any harm arising from the proposals.

2. Proposals affecting a heritage asset and/or its setting will be considered against the following criteria:

a) the significance of the asset;
b) whether the proposals would be sympathetic to the character and appearance of the asset and any feature of special historic, architectural, artistic or archaeological interest that it possesses;
c) whether the proposals would conserve or enhance the character and appearance of the heritage asset by virtue of siting, scale, building form, massing, height, materials and quality of detail;
d) whether the proposals would respect the asset's relationship with the historic street pattern, topography, urban spaces, landscape, views and landmarks;
e) whether the proposals would contribute to the long-term maintenance and management of the asset; and
f) whether the proposed use is compatible with the asset.

11 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/1005759/NPPF_July_2021.pdf
12 https://www.rushcliffe.gov.uk/media/1rushcliffe/media/documents/pdf/planningandbuilding/planningpolicy/lapp/adoption/Rushcliffe%20LP%20Part%202_Adoption%20version.pdf

1.4.8 With respect to 'non-designated heritage assets', as is the case here, the Rushcliffe local plan (para. 9.13) notes that, while not afforded any statutory protection, they nonetheless represent 'material considerations in the planning process and receive the full weight of both local and national planning policies. Therefore, where development would affect a non-designated heritage asset or would result in its demolition or loss, a balanced judgment on the acceptability of the proposal will be made, having regard to the scale of any harm or loss and the significance of the heritage asset.'

1.5 Scope of Work

1.5.1 Post-war coal-fired power stations represent a category of industrial heritage asset identified by Historic England as being 'highly threatened and increasingly rare' (Clarke 2013, 7) and, in the light of significant losses of this type of site over recent years, both general, thematic overviews (Clarke 2013, 2015) and detailed guidance notes on recording and archiving of associated materials (Clarke, 2016) have been published. Specifically, guidance notes recommend the compilation of detailed investigative records for individual power station sites, based upon 'description, analysis and interpretation of evidence embodied in the buildings, structures and designed and working landscapes, and in a range of documentary sources' (Clarke 2016, 2). It is highlighted within the guidance notes that recording should be undertaken to an 'appropriate and proportionate' level, sufficient to understand the history, operation and development of the site concerned.

1.5.2 As noted above, while a 'site-wide' assessment and record is ultimately envisaged,[13] the current report relates to the two southernmost cooling towers alone, forming part of a response to planning conditions related to the development of the EMERGE Centre. No formal project 'Brief' *per se* was issued in respect of the current study; the project has thus been undertaken in broad accordance with the published HE guidelines outlined above, and in line with studies previously completed by the current author at a number of contemporary station sites.[14]

1.5.3 In consultation with Mr. Jason Mordan (Senior Practitioner, Historic Buildings) of Nottinghamshire County Council,[15] the recording associated with the assessment was completed to a level broadly commensurate with a 'Level 2' 'descriptive record', defined by Historic England in '*Understanding Historic Buildings: A Guide to Good Recording Practice*' (HE, 2016; 26, §.5.2-3), as follows:

*'**Level 2** is a **descriptive record**... It may be made of a building which is judged not to require a more detailed record, or it may serve to gather data for a wider project. Both the exterior and interior of the building will be seen, described and photographed. The examination of the building will produce an analysis of its development and use and the record will include the conclusions reached, but it will not discuss in detail the evidence on which this analysis is based. A plan and sometimes other drawings may be made but the drawn record will normally not be comprehensive and may be tailored to the scope of a wider project'*

1.5.4 Also in consultation with NCC (see fn.15) and with Uniper,[16] it was further determined that a brief overview of the associated Circulating Water (CW)[17] system (return channels and CW pump house) be included in the study, to establish an immediate physical/functional context for the cooling towers under consideration, pending a fuller study of the wider site.

13 A. Devonish, Uniper (*pers. comm.*)
14 *viz*. Ironbridge 'B', Shropshire; Rugeley 'B', Staffordshire; West Burton 'A' and Cottam, Nottinghamshire; and Eggborough, North Yorkshire.
15 E-mail correspondence, R. Tyler/ J. Mordan (NCC), 05-07/10/2021.
16 E-mail correspondence, R. Tyler / A Devonish (Uniper), 14/07/2021.
17 Alternatively known as 'Cooling Water', both abbreviated as 'CW'; the former term will be employed within the current report.

1.6 Statement of Limitations

1.6.1 Due to the operational status of the power station, the interior of one cooling tower only (2a) was accessible at the time of fieldwork related to the current project. Despite evident historical modifications to tower 2a, from a review of historical records it can be safely assumed that the original internal arrangements of both towers were similar, and thus the limited internal access can be seen to have no significant negative impact upon the scope of the study and the validity of the record.

1.7 Acknowledgments

1.7.1 The project was commissioned by Mr. Anthony Devonish (Environmental Compliance) of Uniper Technologies Limited to whom thanks are extended for help and cooperation throughout, in particular for sourcing historical record drawings and associated materials. Thanks also to Mr. Alan Holmes, turbine engineer, and Mr. Tom Richardson of the maintenance team at Ratcliffe for facilitating accompanied site inspection for the purposes of recording. Thanks also to Mr. Jason Mordan (Senior Practitioner, Historic Buildings) at Nottinghamshire County Council.

1.7.2 Site recording and report preparation have been undertaken by Mr. Ric Tyler MCI*f*A.

2 AIMS AND OBJECTIVES

2.1 Project Objectives

2.1.1 The Chartered Institute for Archaeologists (CI*f*A 2020, 6) has stated that 'the preservation of historic buildings and areas of architectural or historic interest is a fundamental aspect of the Government's commitment to the environmental stewardship for the effective protection for all aspects of the historic environment. <u>As part of a proposal to alter or demolish a historic building, it is important to have a record of the structure as found</u>.'

2.1.2 Historic England (HE) recognises the important role that the generation of power stations including Ratcliffe on Soar has played in meeting the nation's energy needs during the course of the twentieth century, together with their high technological interest and wider landscape impact (Clarke 2016, 1). To complement initial thematic work (see §.2.1.4), HE have indicated that further, detailed records are needed for individual sites, especially for those power stations that have closed or are facing closure and ultimate demolition (ibid.).

2.1.3 The objective of the historic building record at Ratcliffe was thus to provide a detailed visual record of the structures concerned and to generate a descriptive, interpretive and illustrative account of the same, including a summary of their character, date and techniques of construction, together with a discussion of their origin, history and development in the context of the evolution of the site as a whole.

2.1.4 All work was undertaken in accordance with Historic England's '*Understanding Historic Buildings: A Guide to Good Recording Practice*' (HE, 2016) and with reference to recently published, thematic guidance notes, *viz*. '*20th-century Coal- and Oil-Fired Electric Power Generation: Introductions to Heritage Assets*' (Clarke, 2015) and '*England's Redundant Post-War Coal- and Oil-Fired Power Stations: Guidelines for Recording and Archiving their Records*' (Clarke, 2016).

2.2 Presentation of this Report

2.2.1 Following a summary of project methodology and approach at section §.3, and an overview of the general historical context of the power station at section §.4, the cooling towers and associated CW system structures are described at section §.5. An assessment of 'heritage values' are presented at section §.6, and results briefly discussed at §.7, with a list of sources/bibliography included at section §.8. A series of drawings, derived from site archives, and a selection of site record photographs are reproduced at the end of the current report, cross-referenced to the building descriptions presented at section §.5.

2.2.2 As agreed in pre-fieldwork discussions with NCC and Uniper (see §1.5.3-4), the current report considers the two cooling towers alone, together with a brief overview of the associated circulating water (CW) system; it will not consider the broader power station site in any detail, as this will be addressed by a fuller, 'site-wide' record to be commissioned and prepared in due course.

3 METHODOLOGY

3.1 Documentary Research

3.1.1 To enable the recorded buildings to be placed within an established historical context, a targeted desk-based assessment was undertaken, principally comprising a review of readily available source material held by Uniper on site at Ratcliffe.[18] The site archive includes a collection of numerous original design and later drawings / documentation and CEGB black and white photographs documenting the original construction process. In addition, the multi-volume CEGB 'Ratcliffe Power Station Manual' contains a wealth of detailed information and illustrative materials pertaining to the operational aspects of the plant, relevant chapters and extracts of which have been referred to in the preparation of the descriptive account at Section §.5 below. Reference has also been made to a number of more general, contemporary CEGB publications, in particular the eight-volume series 'Modern Power Station Practice' (1971 edition).

3.1.2 A full list of sources consulted and bibliography is given below at §.8.

3.2 Historic Building Record

3.2.1 The historic building record comprised three elements, being principally photographic in nature supplemented by written recording and limited measured survey where necessary and as appropriate, as outlined below.

Photographic Record

3.2.2 The photographic survey comprised high-resolution digital coverage using a digital single-lens reflex (DSLR) camera. The record extended to include both general and detail shots, contextual views and all accessible exteriors and principal interior spaces, together with visible structural and technical details. In line with Historic England guidance, the use of oblique and three-quarter views was favoured over systematic, 'perpendicular' coverage. All photographs were recorded on *pro-forma* recording sheets detailing subject, orientation, photographer and date (see **Appendix B**).

[18] A review of relevant materials held by The National Archives (TNA), the Nottinghamshire Archives (NA) will be undertaken as part of a future, site-wide study. No significant programme of documentary / archival research into the pre-power station site has been undertaken as part of the current study.

Written Record

3.2.4 A written account of the buildings was made as free text to accompany the drawn and photographic records. The recording covered the general and detailed arrangements of each building/structure, together with its character, date, materials and techniques of construction, and a summary of its origins, function and historical development as evident from a non-intrusive examination.

Drawn Record

3.2.5 The core of the graphic record of the cooling towers was based, so far as possible, upon the archival holdings, principally the extensive collection of drawings (plans, elevations, details, machinery etc.) and photographs held by Uniper on site at Ratcliffe. The drawn record presented within the current report is supplemented, where appropriate, by selected historical photographs and explanatory 3-dimensional projections/schematic diagrams, gleaned for the most part from original Power Station Manuals. No new measured survey was commissioned or undertaken as part of the current recording exercise.

3.2.6 Fieldwork was undertaken on Tuesday 02.11.2021.

4 HISTORICAL BACKGROUND AND CONTEXT

NB. It is beyond the scope of the current project to present a detailed historical background to the wider power station site as a whole; such a study will be presented as part of a site-wide assessment and record of the power station to be completed at a later date. A brief contextual summary, based upon secondary sources, is presented here. However, to allow the recorded structures (cooling towers) of Ratcliffe on Soar to be evaluated and considered within a broad historical context.

4.1 The National Context of Electricity Generation in the 20th century[19]

4.1.1 In the years prior to the 'Electricity (Supply) Act' of 1919, the pattern of electricity supply in Britain at a national level was highly unstructured, with numerous, disparate private and municipal companies, operating predominantly small-scale stations (less than 50MW output), generating at a range of differing voltages and frequencies, with a resultant diversity in both extent (scope) and quality of supply. In this context, and following the First World War, the Electricity Supply Committee recommended the setting up of an 'Electricity Commission' and a number of 'Joint Electricity Authorities' (JEAs), together with measures amounting to an effective 'nationalisation' of the generation and transmission network. Although the latter of these proposals were rejected by Parliament, the first two were broadly enacted under the terms of the 1919 Act and the resulting JEAs oversaw the creation of a number of so-called early 'super-stations'.

4.1.2 Further to the recommendations of the 1925 'Weir Report', a further 'Electricity (Supply) Act' of 1926 saw the formation of the Central Electricity Board (CEB), designed to bring the industry under the overall control of a central, public corporation. The wide diversity in the size and arrangement of generating stations persisted, however, remaining predominantly small in scale, though with limited experimentation with larger (60/75MW) generating sets, specifically at Battersea 'A' (commissioned, 1933) and Barking 'B' (commissioned, 1939). The

19 Based largely upon Clarke (2013 and 2015).

CEB was also to establish the first, synchronised AC 'National Grid', a 4,000 mile network of overhead lines built over an eight-year period from 1927 to 1935, operating primary distribution at 132kV (Clarke 2015, 6). Initially operating seven virtually independent systems, the grid was fully integrated for the first time over the winter of 1938/9 (Cochrane 1990, 3-4).

Nationalisation

4.1.3 The post-war, 1947 'Electricity Act' replaced the CEB with a new body, the British Electricity Authority (BEA), a nationalised authority with a remit for England, Wales and the south of Scotland, which came into operation on 1st April 1948. The BEA merged over 500 separate generation and supply companies (JEAs, local authorities and private concerns),[20] consolidating them into 14 'Area Boards' and 12 'Generating Divisions', the former with responsibility for retail distribution and the latter for generation and transmission. A degree of standardisation ensued, and between 1948 and 1952 some 5,800MW of plant was installed at 66 stations, in the form of 30 and 60MW units. By the later 1950s, however, larger sets were being introduced, with six 100MW turbo-generators being installed at Castle Donnington, Leicestershire (commissioned, 1956-8), while High Marnham in Nottinghamshire (commissioned 1962) was furnished with five, 200MW sets, the resulting output of 1,000MW making it the largest station in Europe at the time. In tandem with the introduction of these larger plants, a number of smaller, less efficient stations were decommissioned and closed down.

4.1.4 The late-1950s witnessed further restructuring within the industry; the BEA was replaced in 1955 by the short-lived Central Electricity Authority (CEA) holding a remit extending to England and Wales only, with the separation off of the Scottish area boards, before the 'Electricity Act' of 1957 saw the dissolution of the CEA, to be replaced by the Central Electricity Generating Board (CEGB). The CEGB operated over five geographic regions (North-East, North-West, Midlands, South-West, and South-East) with 'Generating Divisions' based on 'Grid Control Centres' at Newcastle, Leeds, Manchester, Nottingham, Birmingham, Bristol and two near London (East Grinstead and St. Albans) and a National Control Centre based in London (CEGB 1967, 18). Three regional 'project groups' (North, Midlands and South) were concerned with station construction, while the Transmission Group oversaw the provision of overhead power lines. An extensive Research and Development section had laboratories at Leatherhead, Marchwood and Berkeley.

4.1.5 The pattern of increasing generator size, begun under the auspices of the BEA during the earlier 1950s, continued, with increasing use of 275, 300, 350 and 375MW sets; the dramatic growth in the size of associated power stations was accompanied by the creation of a new, 400kV 'super-grid' from 1963 (Stratton 1994, 69), with heavy duty, quad-conductor lines having triple the carrying capacity (1800MVA per circuit) of the 275KV lines (CEGB 1971a, 8).[21]

The 500MW Unit Programme

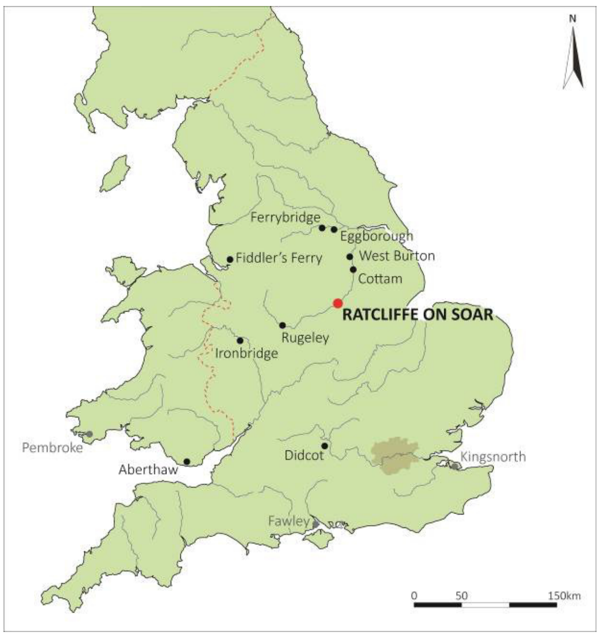
4.1.6 By the early 1960s, the 500MW, single-shaft unit became the standard turbo-generator for a new generation of 'super-stations', arranged largely in combinations of two (1,000MW) or four (2,000MW); of the 13 major new oil- and coal-fired plants based upon the 500MW unit released for construction between 1960 and 1964

[20] The BEA inherited nearly 300 power stations, but a lot of the plant was over 25 years old with many sets generating at less than 8MW (Cochrane 1990, 5).

[21] The advantages of the improved grid were three-fold. Firstly, by interconnecting the capacity between areas it provided security against normal operating hazards; secondly it enabled power stations to be located closer to the coalfields and thirdly, it enabled base load to be supplied by the most economic plants, with more expensive stations supplying 'top-up' during periods of peak demand (CEGB 1971b, 6-7).

(see inset below), all but three (Aberthaw 'B', Ironbridge 'B' and Rugeley 'B') were of 2,000MW output.[22] The core aim of the expansion programme was economical, to focus generation on a smaller number of 'super-stations', each with an increased capacity based upon the largest units then available, thereby reducing the cost per unit of energy generated.

4.1.7 The physical size and requirements of the new generation of 'large-set philosophy' plants meant that traditional siting, close to areas of high demand (major cities and industrial areas), was no longer realistically feasible and, with a view to maximising efficiency (and taking advantage of the improved distribution grid), the new plants were built in more isolated, rural locations near major rivers and close to the main coalfields or, in the case of oil-fired stations, on estuaries close to refineries (Cochrane 1990, 13). The valleys of the Trent in Nottinghamshire / Derbyshire (see §.4.2.3) and the Aire in Yorkshire, bordering the Yorkshire, Derbyshire and Nottinghamshire coalfields, experienced particularly intense development.



KEY

Coal-fired 'super-stations' released for construction, 1960-64 (in chronological order of commissioning)

Ferrybridge 'C', W Yorks.*	2000MW; commissioned 1966
West Burton 'A', Notts.	2000MW; commissioned 1967
Eggborough, N Yorks.*	2000MW; commissioned 1967
Didcot A, Oxfordshire*	2000MW; commissioned 1967
Cottam, Notts.*	2000MW; commissioned 1968
Ratcliffe on Soar, Notts.	**2000MW; commissioned 1968**
Ironbridge B, Shrops.*	1000MW; commissioned 1967
Aberthaw, S Wales*	1500MW; commissioned 1971
Fiddler's Ferry, Cheshire*	2000MW; commissioned 1971
Rugeley 'B', Staffs.*	1000MW; commissioned 1972

Oil-/dual-fired 'super-stations' released for construction, 1960-64.

Pembroke, S Wales*	2000MW; commissioned 1968
Fawley, Kent*	2000MW; commissioned 1971
Kingsnorth, Kent*	2000MW; commissioned 1973

(**NB**. stations marked with * have closed

Plan of 13 coal- and oil-/dual-fired 500MW-unit 'super stations' released for construction by CEGB in England and Wales, 1960-64

The 'Amenity Clause'

4.1.8 The monumental scale of the new buildings prompted a growing concern as to the potential impact they could have upon their environmentally sensitive landscape settings and these considerations were addressed by Section 37 of the 1957 Act, aka. the 'amenity clause', which required that:

'In formulating or considering any proposals relating to the functions of the Generating Board or of any of the Area Boards (including any such general programme as is mentioned in subsection (4) of section eight of this Act), the Board in question, the Electricity Council and the Minister, having regard to the desirability of preserving natural beauty, of conserving flora, fauna and geological or physiographical

[22] The 500MW-unit programme was to lead to the final technical development of the CEGB's 'large-set' philosophy, *viz*. the 660MW turbo-generator unit, used at Drax in North Yorkshire (x6) and Grain in Kent (x5), the latter, oil-fired.

features of special interest, and of protecting buildings and other objects of architectural or historic interest, shall each take into account any effect which the proposals would have on the natural beauty of the countryside or on any such flora, fauna, features, buildings or objects'.[23]

4.1.9 It had been recognised by Michael Shepheard (Chief Architect of the CEGB, quoted in Clarke 2013, 15) that, as among the largest of man-made structures, the new generation of power stations would inevitably have little or no 'inherent scale relationship' with their physical environment, and that the size and massing of the principal generation buildings meant that they would represent features of 'landscape significance', appreciated primarily from middle to long-range viewpoints (*ibid*.). Pioneering architectural modelling was extensively used to assess the impact of the new stations on the landscape from a variety of viewpoints and, while sites were generally developed to a standard template dictated by the technical requirements of the 500MW-unit programme, the detailed design of specific plants, and the relative siting of their component structures, was undertaken by the CEGB in collaboration with 'high-calibre' architectural practices (see Table 1, column 3, below). Moreover, significant input from landscape architects/consultants was widely incorporated throughout both design and implementation stages (see Table 1, column 4, below). The scale of the principal structures meant, however, that any associated landscaping served only to create a 'base-setting' above which the main buildings were perceived to rise, with trees essentially forming 'ground cover planting' to screen the lesser elements of a complex such as smaller buildings, storage tanks etc. (BEI 1991, 293-4).

Power Station	Date Built	Consultant Architect	Landscape Architect
Aberthaw 'B', S Wales	196?-71	n/k	n/k
Cottam, Nottinghamshire	1964-70	Yorke, Rosenberg and Mardall	Kenneth and Patricia Booth
Didcot 'A', Oxfordshire	1965-70	Frederick Gibberd and Partners	Sir Frederick Gibberd
Eggborough, North Yorkshire	1962-67	Sir Percy Thomas and Son (George Hooper)	Brenda Colvin
Ferrybridge 'C', West Yorkshire	1961-67	Building Design Partnership	---
Fiddler's Ferry, Cheshire	1967-71	Gordon Graham; Architect's Design Group	in-house
Ironbridge 'B', Shropshire	1963-68	Sir Percy Thomas and Son (Alan Clark)	Kenneth Booth
Ratcliffe on Soar, Nottinghamshire	**1963-67**	**Building Design Partnership**	**in-house**
Rugeley 'B', Staffordshire	1964-70	LK Watson and HJ Coates	Colvin and Moggridge
West Burton 'A', Nottinghamshire	1961-67	Rex Savidge and John Gelsthorpe; Architects' Design Group	Derek Lovejoy Associates

Table 1: Architects and Landscape Architects of 1960s coal-fired super stations, alphabetical order (info. Clarke 2013, Appendix A).

4.1.10 Under the auspices of the 'amenity clause', proposed station locations and detailed designs were required to be submitted to and reviewed by the Royal Fine Art Commission (RFAC),[24] although the Commission's role, in terms of location at least, was purely advisory in nature and they held no power of veto over chosen sites.[25]

Reprivatisation

4.1.11 The CEGB remained the cornerstone of the British electricity industry for almost 40 years, though privatisation in the early 1990s under the terms of the 'Electricity Act' of 1989, saw its assets being broken up into three new companies; Powergen,[26] National Power[27] and the National Grid Company. With central government

[23] www.legislation.gov.uk/ukpga/Eliz2/5-6/48/enacted.
[24] The RFAC had been appointed by royal warrant in May 1924 to enquire into questions of public amenity or artistic importance referred to it by government departments or other public or quasi-public bodies (http://discovery.nationalarchives.gov.uk/details/r/C35; see also CEGB 1971a, 24).
[25] The relationship of the RFAC with the CEGB (and previously, with the CEA) was at times somewhat fractious, with Ministry of Fuel and Power Minutes from 1956 referring to the Commissioners as 'irresponsible nuisances' (TNA POWE 14/146; Minute M/55/435, 8th May 1956).
[26] Taken over by E.ON in 2002.
[27] Taken over by RWE in 2002, rebranded as RWE npower.

policy seeking to lessen dependence upon the domestic coal industry and encourage the development of smaller, gas-fired plants, the final years of the 20th century witnessed the decommissioning of many of the 1960s oil- and coal-fired plants, many of which had reached the end of their productive lives. Further, the early years of the 21st century saw a number of remaining plants opting out, on the grounds of financial non-viability, of meeting the clean air requirements of the European Large Combustion Plant Directive (Directive 2001/80/EC),[28] introduced to limit airborne emissions of pollutants such as sulphur dioxide and nitrogen oxides. At the time of preparation of the current report, Ratcliffe is one of only four still-operational coal-fired power stations in the United Kingdom,[29] with current government policy anticipating the final closure/adaptation of all remaining unabated coal plants by 1st October 2024.[30]

4.1.12 A move towards lower-carbon energy, driven by deepening concerns regarding anthropogenic global warming, has prompted a new generation of nuclear plants, with work by EDF underway at Hinckley Point 'C' in Somerset, while an accompanying phase of diversification has seen the construction of a range of smaller stations based on the combined cycle gas turbine process (CCGT), biomass and, increasingly, the exploitation of renewable energy sources such as wind, hydro, solar etc.

4.2 The Local Context: The Midlands Region of the CEGB

4.2.1 The Midlands Region of the CEGB, one of five established under the auspices of the 1957 Electricity Act (§.4.1.4), covered a geographical area of 11,000 square miles, and was responsible for 36 power stations, over 170 sub-stations and almost 2,000 miles of grid transmission lines (see inset below).[31] The region was sub-divided into two 'districts', West Midlands and East Midlands, with headquarters at Moseley in Birmingham and Barker Gate in Nottingham respectively.

4.2.2 Ever-increasing electricity usage in the years after World War II had seen demand doubling every eight years and by the winters of 1961-2 and 1962-3, shortfalls of 'crisis' proportions were being experienced.[32] New sites were identified and new and/or improved stations constructed; thereby the Midlands regional generation capacity quadrupled over the course of 14 years, from 4,000MW in 1957, rising to 8,000MW by 1966, 14,000MW in 1969 and 16,000MW by 1971. The region produced more than 25% of the electricity used in England and Wales and constituted the major part of the major CEGB construction programme of 'super-stations' commissioned during the 1960s.

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28 http://ec.europa.eu/environment/archives/industry/stationary/lcp/legislation.htm.

29 *viz*. West Burton 'A' (due to close in September 2022) and Ratcliffe on Soar in Nottinghamshire, Drax (Units 4-6; coal-firing to cease, 2022) and Kilroot in County Antrim, NI (dual-fired, coal-firing to cease). Overall, annual coal-fuelled electricity generation has dropped dramatically over recent years, with the closure of plants and the development of alternative sources, such that in 2020, a record low of *c*.5.2 terawatt hours was generated from coal (info: Department for Business, Energy and Industrial Strategy [BEIS]: 'Energy in Brief 2021').

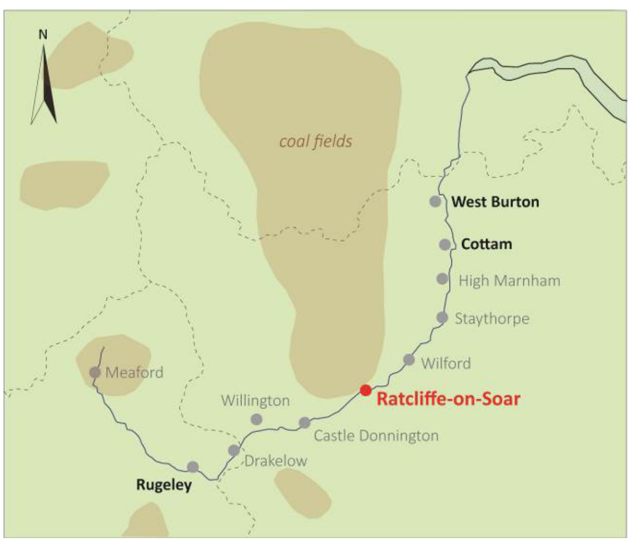
30 https://www.gov.uk/government/news/end-to-coal-power-brought-forward-to-october-2024

31 CEGB leaflet 'Ratcliffe on Soar Power Station': https://www.cegbmidreg.co.uk/ratcliffe/ratsleaflet/ratsleaflet01.htm

32 In 1948, the generating capacity of the Midlands Region as a whole was just 2,016MW, barely more than one of the future generation of 1960s 'super-stations'.

Extent of CEGB Midlands Region from contemporary leaflet (Ratcliffe highlighted)
(https://www.cegbmidreg.co.uk/ratcliffe/ratsleaflet/ratsleaflet06.htm)

4.2.3 A particularly dense concentration of stations were built in the 1950s and 1960s in the Trent Valley of Derbyshire, Nottinghamshire Staffordshire and Leicestershire, which became known as 'Megawatt Valley', the largest concentration of power generation in Europe at the time (Clarke 2013, 15; see inset below). Of the four 'super-stations' based around the 500MW set, as at Ratcliffe, West Burton 'A' and Cottam lie 63km and 58km respectively to the north-east of the site currently under consideration, with Rugeley 'B' in Staffordshire, sited 46km to the west-south-west.[33]



KEY

Historical coal-fired power plants:

Castle Donnington, Leicestershire	600MW; commissioned 1958, closed 1993/4.
Drakelow 'A', Derbyshire	240MW; commissioned 1955, closed 1984.
Drakelow 'B', Derbyshire	480MW; commissioned 1959/60, closed 1993.
Drakelow 'C', Derbyshire	1,450MW; commissioned 1964; closed 2003.
High Marnham, Nottinghamshire	1,000MW; commissioned 1962, closed 2003.
Meaford 'A', Staffordshire	120MW; commissioned 1948, closed 1974.
Meaford 'B', Staffordshire	240MW; commissioned 1957, closed 1990.
Rugeley 'A', Staffordshire	600MW; commissioned 1961/2, closed 1994/5.
Staythorpe 'A', Nottinghamshire	360MW; commissioned 1950, closed 1983.
Staythorpe 'B', Nottinghamshire	360MW; commissioned 1962; closed 1994.
Wilford, Nottinghamshire	30MW 316MW; commissioned 1925, closed 1981.
Willington 'A', Derbyshire	400MW; commissioned 1957, closed 1990s.
Willington 'B', Derbyshire	400MW; commissioned 1962, closed 1990s.

CEGB Coal-fired 'super-stations' released for construction, 1960-64:

Cottam, Nottinghamshire	2,000MW; commissioned 1969, closed 2019.
Ratcliffe-on-Soar, Notts.	**2,000MW; commissioned 1968, still operational**.
Rugeley 'B', Staffordshire	1,000MW; commissioned 1972, closed 2016.
West Burton 'A', Notts.	2,000MW; commissioned 1967, still operational.

Coal-fired power stations (historical and still operational) of the Trent Valley

33 West Burton 'A' remains operational at the time of preparation of the current report, with two units available to service existing capacity market commitments, though closure is scheduled for September 2022 (https://www.edfenergy.com/media-centre/news-releases/edf-confirms-west-burton-will-close-september-2022-two-years-ahead); Rugeley 'B' and Cottam closed in June 2016 and September 2019 respectively.

4.3 Ratcliffe on Soar Power Station

4.3.1 Ratcliffe on Soar power station was built for the East Midlands Division of the CEGB Midlands Region, based at Barker Gate, Nottingham, at a total cost of £80 million, one of a series of three broadly contemporary, 2,000MW 'super-stations' to be located on the south/west bank of the lower Trent Valley (see above). Project architects were Godfrey Rossant and J.W. Gebarowitz of the Building Design Partnership (BDP) with C.S. Allott & Sons as consulting engineers, the same design/construction team combination as at Ratcliffe's 'mother' station, Ferrybridge 'C' in West Yorkshire (see Scott, 2019), with which Ratcliffe shares a number of design characteristics. Construction of the power station commenced in late-1963 (see inset below), with a four-year construction programme running from 1963-67 (Clarke 2013, Appendix 1), and was first commissioned in 1968.


Power station site in October and December 1963 (CEGB photo refs. A122044 and A123418 respectively)

4.3.2 The Trent Valley location of Ratcliffe on Soar, together with Cottam and West Burton to the north, was the subject of extensive discussions and, though supported by the County Council, was initially objected to by both the Campaign for the Protection of Rural England (CPRE) and the Royal Fine Arts Commission (RFAC).[34] The RFAC's role in assessment of siting (see §.4.1.10) was purely advisory however and, in the absence of other significant objections, the plans were accepted by the Ministry of Power in September 1963.

4.3.3 The approved plans, based largely upon Ferrybridge 'C' (Clarke 2013; Appendix 1), placed the principal generation buildings to the centre of the site, with turbine hall, deaerator annexe, boiler house and electrical annexe contained within a single large, conjoined block, served by an attached control room, with electrostatic precipitators (ESPs) and single, four-flue chimney stack to the north and a massive, enclosed 400kV switch-house located axially to the south. A total of eight natural-draught, hyperbolic cooling towers were located within a single field to the west of the principal generation buildings, served by a single, annular CW pump house, while the extensive coaling plant with associated stock area and enclosing rail loop was located to the east (see inset below; Figures 2/3).

34 Five Nottinghamshire sites were considered by the RFAC, at West Burton, Cottam, Ratcliffe-on-Soar on the lower Trent, at Holme Pierrepont near Nottingham and at Market Warsop in the west of the county, close to the Meden Vale Colliery. RFAC minutes of 11th May 1960 (transcribed in Clarke 2013, Appendix 2) record that, while the latter two sites would not be opposed, the Trent Valley sites were considered to be 'extremely damaging to public amenity' and that the commission would 'deplore the erection of power stations in such completely unspoilt rural areas'.

'Bird's eye' aerial view of wider power station site looking north-west (image: © Uniper).

4.4 Cooling Towers: Functional and Historical Context

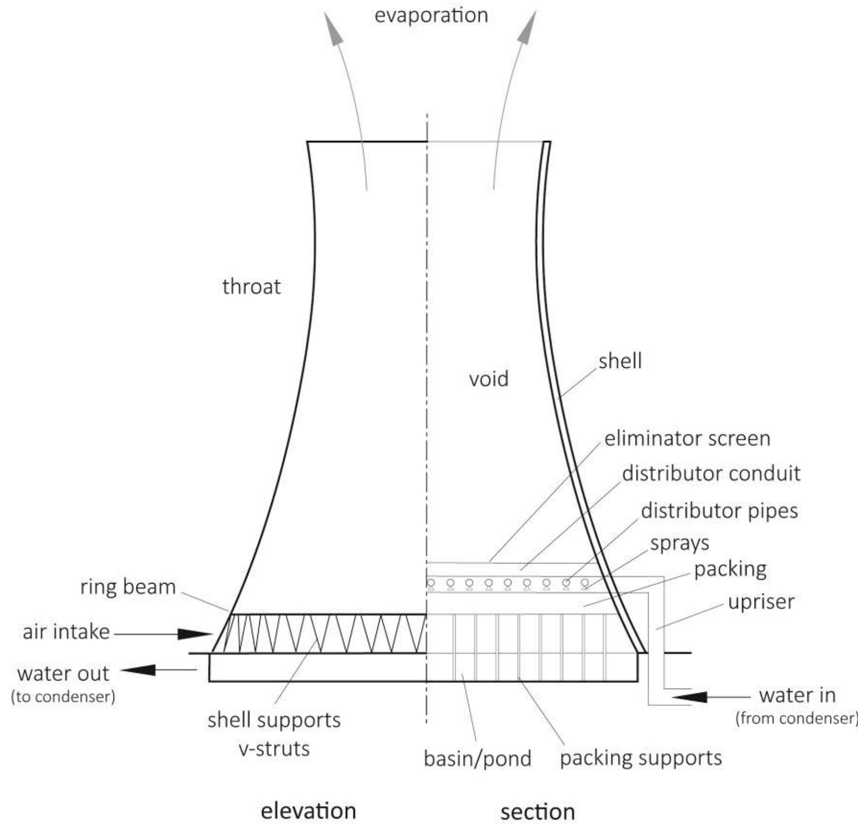
'The concrete cooling tower was the most emblematic component of mid-to-late 20th-century thermal power stations, both in Britain and in many other parts of the world.' (Clarke 2013, 25)

4.4.1 Apart from at coastal sites where 'direct-cooling' is employed (eg. Aberthaw, South Wales; see **Appendix D**), cooling towers form an essential feature of all power station layouts, forming part of the closed-circuit circulating water (CW) system for the generation units,[35] specifically supplying cooling water to the turbine condensers which functioned to condense the steam exhausted from the low-pressure (LP) turbines, while also providing the means for air and vapour release from the heaters and other plant associated with the condensate system. The CW system functions to cool and recycle water from the unit condensers via a closed system comprising natural-draught cooling towers, normally two per unit, before returning to the turbine hall via a CW pump house.

4.4.2 In simple terms, a cooling tower comprises a massive, largely empty 'shell' of reinforced concrete (RC) construction, raised upon a system of columns above a circular, basal collecting pond, framing a wide, horizontal air intake at the base (Figure 4; see inset below). At the base of the tower shell, a system of horizontal distribution pipes, spray nozzles and 'packing' units facilitates the cooling of water from the condensers by a process of heat exchange. Essentially, as the film of water works its way through the packing units, it meets the up-draught of air entering from the intake at the base of the tower and a process of heat transfer occurs, partly as the transfer of 'sensible' heat (due to the physical temperature difference between water and air) and partly by the evaporation of a small percentage of the water which rises through the tower as water vapour, taking with it its latent heat of evaporation. Water temperature typically drops by *c*.8.5°C - 10°C during its fall. Cooled water falls to, and is collected in, the basal pond before being returned via a system of return channels / culverts to a CW pump house, and onwards to the condensers to begin the process again.

35 The vast quantities of water circulating within an inland power station site exceeded the dry weather flow of most rivers.

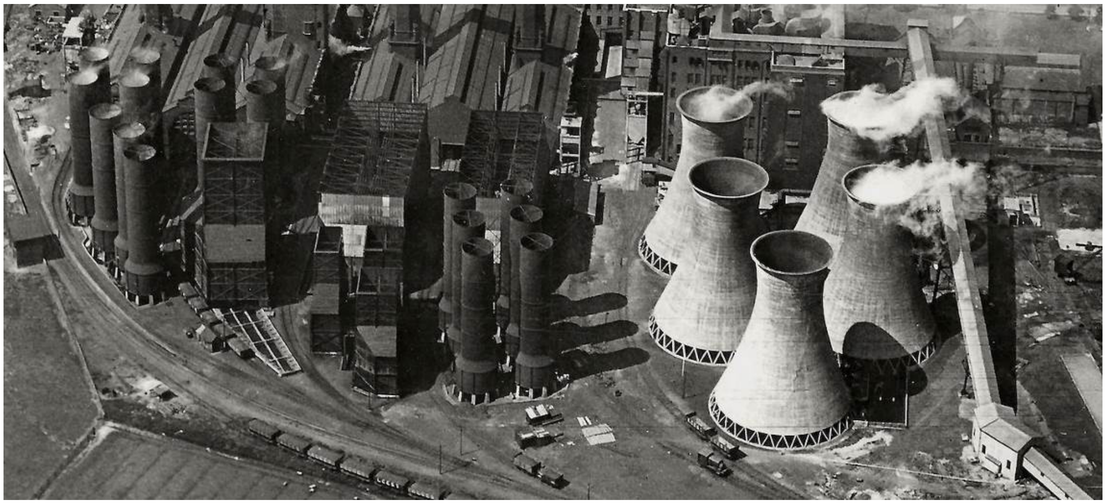
Around 2% of cooling water is lost to evaporation in the towers,[36] the shortfall being replenished from the local water source (at Ratcliffe, the River Trent).



Schematic diagram of (hyperbolic) natural-draught cooling tower

4.4.3 Cooling towers of the mid-20th century tended to take one of two forms, either of 'hyperbolic' or non-hyperbolic 'cone-toroid' profile, the latter used at Ironbridge 'B' and Ferrybridge 'C';[37] of these, the hyperbolic form, as used at Ratcliffe, was to become the dominant type (see Table 2 below). First developed in the Netherlands in the early years of the 20th century by Professor Frederick K. van Iterson and Gerard Kuypers, the first British examples were erected by Mouchel and Partners at Lister Drive Power Station in Liverpool in 1924 (now lost, demolished in 1972; see inset below). Although affording no obvious thermal advantage over a simpler, cylindrical form (CEGB 1971c, 311), the bi-directional curvature of the hyperbolic profile offered increased strength against wind force (CEGB 1963, 91).

36 At Ratcliffe, on average, amounting to *c.*13million gallons of water per day.
37 See Tyler, 2017 (p.45-47) and Scott, 2019 (p.50) respectively. The 'cone-toroid' profile is a variation on the standard hyperbolic form, combining a truncated lower 'cone' section extending to the throat, above which the shell flares with a curved 'torus' profile.



Mouchel's early (1924) hyperbolic CTs at Lister Drive, Liverpool (right), with adjacent cylindrical towers (left). (Source: https://mobile.twitter.com/osaumarezsmith; original image source not known).

4.4.4 Cooling towers associated with the 1960s generation of 'super-stations' were arranged in 'fields', either as single blocks, as at Ratcliffe (Figure 5), keeping the whole system as compact as possible, or in 'split' fields, as at Didcot 'A', West Burton 'A' and Fiddler's Ferry (see Table 2 above; **Appendix D**), and later at Drax. The former arrangements follow functional simplicity, while the latter examples reflect a desire to lessen the effect of visual 'blocking' and create a degree of interesting 'interplay' when the towers were observed from the middle distance. Colour was occasionally used, for example at Ironbridge 'B' (red ochre) and at West Burton 'A' (dark grey/yellow), both for aesthetic and practical reasons, though this is absent at Ratcliffe.

Station	Capacity	Cooling Towers				CT Contractor
		No.	*Shell Profile*	*Arrangement*	*Comments*	
Ferrybridge 'C'	4 x 500MW	8	Cone-toroid	Single field (2 rows of 4, offset)		Film Cooling Towers (Concrete) Ltd. (FCT)
West Burton 'A'	4 x 500MW	8	Hyperbolic	Split fields (2 x 4, lozenge / linear)	Use of colour (black / yellow)	Davenport
Eggborough	4 x 500MW	8	Hyperbolic	Single field (2 rows of 4)		Davenport
Didcot 'A'	4 x 500MW	6	Hyperbolic	Split fields (2 x 3, triangular)		FCT
Ratcliffe on Soar	4 x 500MW	8	Hyperbolic	Single field (2 rows of 4, offset)		Bierrum & Partners
Cottam	4 x 500MW	8	Hyperbolic	Single field (2 rows of 4)		Davenport
Ironbridge 'B'	2 x 500MW	4	Cone-toroid	Single field (4), linear	Use of colour (red/ochre)	FCT
Aberthaw 'B'	3 x 500MW	0	N/A	None (coastal, direct-cooled)	N/A	N/A
Fiddlers Ferry	4 x 500MW	8	Hyperbolic	Split fields (2 x 4, lozenge)		N/K
Rugeley 'B'	2 x 500MW	4	Hyperbolic	Single field (4), lozenge	Use of colour (red)	Bierrum & Partners

Table 2:
Comparative cooling tower details for 10 CEGB 500MW-unit, coal-fired super stations released for construction 1960-4 (chronological order of commissioning).

4.4.5 Following a high-profile CT collapse at Ferrybridge 'C', where three towers failed in high winds on 1st November 1965,[38] a nationwide programme of inspection and monitoring was instigated, with an ensuing programme of prioritised strengthening works (see Knight 2004, Appendix A). At a number of stations where tower construction was still under-way (Eggborough, Ratcliffe, Fiddlers Ferry, Ironbridge B and Cottam), specifications

38 See Shellard HC (1967) and Damjakob and Tummers (2004) for a discussion of the Ferrybridge collapse. See also https://api.parliament.uk /historic-hansard/lords/1965/nov/16/ferrybridge-c-power-station-cooling for transcript of parliamentary discussion of the incident, 16.11.1965.

were amended, enhancing the minimum shell width from 5in. to 7in., with double (two layer) reinforcement (Clarke 2013, 26), while where towers had already been completed, strengthening works were effected as required, for example by the application of an additional mantle to part or all of the shell height. A further collapse of a single cooling tower at Fiddler's Ferry, Cheshire in January 1984 instigated an internal CEGB 'Board of Inquiry' that recommended a nationwide review of the 139 CT structures then operated by the board.[39] The audit was undertaken in 1985-87 (Pope, Grubb and Blackhall, 1994), to identify towers considered to have increased potential for collapse due to shell deformation, and lead to a further programme of targeted strengthening works (Woolley and Van der Cruyssen, 1994).

5 BUILDING DESCRIPTIONS

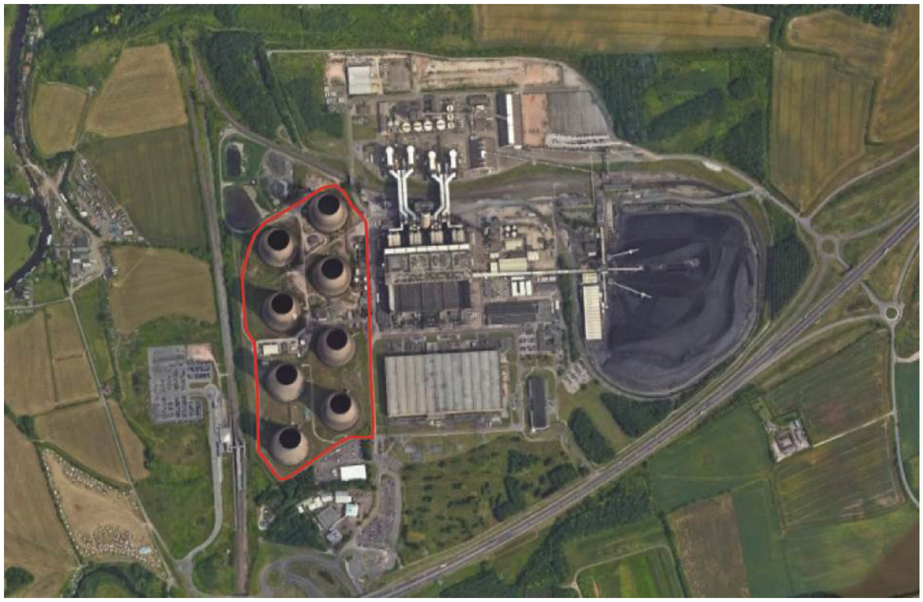
5.1 Circulating Water (CW) System

5.1.1 As cooling water passes through the turbine-unit condensers, its temperature is raised (typically between 8°C and 12°C; BEI 1990, 10) and this water needs to be cooled. The power station's circulating water (CW) system is designed to recycle cooling water from the unit condensers via a closed system of cooling towers (§.5.2) before returning to the turbine hall via the CW pump house (§.5.3). At full load, Ratcliffe's CW system was designed to supply 800,000 gallons per minute to the unit condensers,[40] giving a total capacity of *c*.48 million gallons per hour; each cooling tower is capable of cooling *c*.6.5 million gallons of water per hour. On average, 13 million gallons of water per day were lost to evaporation from the cooling towers, representing *c*.2% of total cooling water flow, with supply being made up from the Trent via a make-up water pump house (beyond scope of current study) sited adjacent to the Trent rail bridge *c*.½ mile to the north of the CW pumphouse.

5.2 The Cooling Towers

5.2.1 Ratcliffe on Soar is furnished with a total of eight natural-draught **Cooling Towers** (designated **1a-4b**) sited within a single 'field' of *c*.38½ acres to the west of the principal generation buildings (Plates 1-4), and arranged in two parallel rows of four, aligned north-south, offset to form a double 'lozenge' pattern (see inset below).[41] Towers 1a/b and 2a/b form the western row, 3a/b and 4a/b the eastern row; CTs 1a/b and 3a/b form an 'inner cluster' feeding directly to the CW pump house, CTs 2a/b and 4a/b form an outer group feeding via the inner cluster (see §.5.3). Towers 2a and 4a, currently under consideration, thus form the southernmost towers of the western and eastern rows respectively (Figure 5; Plate 1).

39 Of which 74 were of the largest, 375ft. high form, cooling the 500MW and 660MW unit stations.
40 Cooling water at the station is required principally for the removal of latent heat from the steam at the turbine condensers, though CW is also used for various other cooling purposes incl. oil, water and motor coolers.
41 The offsetting of the towers allowed the axes of the two rows to be sited closer to one another (380ft.), while maintaining the minimum spacing requirements between individual CTs (see below). At Cottam, for example, where towers are not offset, the axes of the double-row single CT field are set 480ft. apart.



Vertical AP of power station site with CT field to west of main generation buildings (image © Google Earth).

5.2.2 The towers were built to a British Standard (BS) specification by Bierrum and Partners of Harrow, Essex.[42] They are of reinforced concrete construction[43] and hyperbolic profile, standing to a height of *c*.375ft. (above pond cill),[44] with basal diameters of 291½ft. (at lower ring-beam, measured to centreline of shell), narrowing to 162ft. at the throat (330ft. above ground level) and opening again to 169ft. at the upper cornice (Figure 6). As built, shells were a maximum of 18in./20in. (2a/4a) thick at the lower ring-beam, narrowing to 5in./7in. (2a/4a) at a height of 20ft. above cill (see below), before widening again to 15in. at the upper cornice. Towers were spaced at a minimum 480ft. - 530ft. centres (see Figure 5) with a minimum clearance of *c*.150ft. (ie. half the basal diameter) between adjacent tower bases to allow adequate air flow (CEGB 1971a, 49). The construction of the cooling towers is recorded in a series of historical CEGB record photographs, a selection of which are reproduced at Figure 16.

5.2.3 Tower 2a at Ratcliffe (together with adjacent tower 1a to the north) were the first to be erected, evidently well advanced prior to the Ferrybridge collapse of 1965 (§.4.4.5; see inset below) and were thus originally furnished with a 5in. shell membrane (Knight 2004, 5; see Figure 6); the ensuing CEGB review concluded that the towers were not susceptible to the failure mode that had occurred at Ferrybridge, and no immediate modifications were made (Knight, 2012). The specification of tower 4a, shell construction yet to be commenced in November 1965 (see inset below), was modified during the construction phase, with a minimum shell width of 7in. employed. Towers 1a and 2a were subsequently re-strengthened, however, in 1990 following the review pursuant to the Fiddler's Ferry collapse of 1984, when an additional 7in. (178mm)[45] concrete mantle was

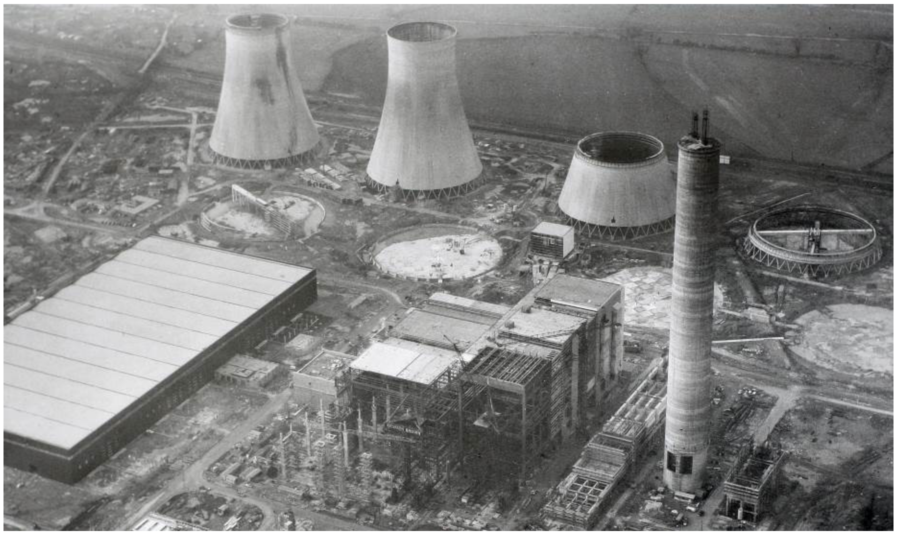
42 Founded by Danish engineer Hans Bierrum in 1938, Bierrum and Partners (part of the Beroa Technology Group, BTG) were responsible for the construction of all concrete cooling towers at power stations in the UK after 1965.

43 In England, tower shells were always built with concrete cast *in-situ*, raised in stages (*c*.3½ft. lifts) with shuttering supported on the concrete cast a few days earlier. Details of shell reinforcement at Figure 7. From a review of historical photographs, it would appear that shells were raised to air intake level contemporary with the erection of the interior section of the main distributor culvert; shells were then raised prior to packings and distributor pipework being inserted into the completed tower (see inset at §.5.2.7 below and Figure 16d). Distributor culverts were extended beyond the tower shell to connect to the upriser/stair access once the full height of the tower was completed.

44 The measurements employed in the current report follow the system current at the time of the structures construction and used in original design drawings, *viz*. Imperial units of feet/inches, with metric units used for more recent modifiactions.

45 50mm thicker than secondary mantles applied elsewhere nationally (Knight 2004, 6).

applied to approximately two thirds of the towers' height, rising from lower ring-beam to throat level,[46] with associated supplementary propping at the shell base.



Historical photograph showing early progress on CTs 1a/2a looking south-west
(CEGB photo ref. A159282, dated 01.03.1966; Uniper Archive image 1133.jpg)

5.2.4 Tower shells were originally supported on a repeating plan of V-pattern, rectangular-section RC raking struts (20 x 20in.; 36 sets in total to tower circumference),[47] extending between the head of the pond wall and the lower ring-beam of the shell (Figure 8; Plates 7/8). The introduction of the secondary concrete mantle to towers 1a and 2a in 1990 saw the insertion of additional 18in. diameter, raking steel props at the centre of each set of original V-struts (Plates 9-12), to support the additional external skin at ring-beam level (Plate 12). The horizontal air intakes formed at the base of the tower shells, designed to provide an adequate up-draught of air within the funnel of the tower, are 22½ft. in height, measured vertically from the head of the pond wall to the soffit of the shell's lower ring-beam (Figure 8; Plates 7/10).

5.2.5 Towers are furnished with 'anti-icing' ring mains at the head of the air inlet (Figure 10),[48] fed by pipes tapped off the main CW culvert upriser (Plates 15/16), whereby warm circulating water can be delivered by sprays to form a peripheral water 'curtain' through which cold air has to travel, thereby preventing the build-up of ice during extended periods of cold weather, the presence of which can both reduce the effective cooling capacity of the tower and cause mechanical damage.

5.2.6 Water is fed to the towers by means of 72in., below-ground feed pipes, one per tower, which rise as vertical, rectangular-section concrete uprisers external to the perimeter of the tower (Figure 9; Plate 17), the uprisers also forming a central 'closed well' for integral access stairs (Plate 18).[49]

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46 Compare Plates 13/14. Delamination between the original shell and the secondary mantle (Knight, 2012), was rectified by a programme of 'stitch and grout' repair (http://www.zenithstructural.com/wp-content/uploads/2014/04/5-Ratcliffe-Rev-A.pdf). Targeted works to address spalling of the external skins of CTs was ongoing at the time of fieldwork related to the current project.

47 The angle of the columns serves to resist the shearing force due to wind on the tower shell (CEGB 1971c, 299).

48 Original 18in. pipes with 1in. diam. holes at 7in. spacings (Station Manual R-2-6-6); largely renewed during 2009-2013 refit (see §.5.2.10; details at Knight 2014, Appendix A; figure A8).

49 This upriser/stair arrangement is similar to that used at Ferrybridge (see Scott 2019, 50; figs. 59/65), Fiddlers Ferry (see Evans 2021, Appendix B) and at Ironbridge 'B' (see Tyler 2017, 45; plate 212); of these stations, Ironbridge and Ferrybridge employed cone-toroid form for CT construction, though its use in combination with the hyperbolic profile at Fiddler's Ferry indicates that is does not seem to be a design factor. Alternative arrangements used at other stations incorporate uprisers (either vertical or inclined) rising within the footprint of the tower, with discrete access stairs formed of straight-flights or dog-leg plans, rising to cantilevered access platforms.

5.2.7 The interior of the towers is approached by means of the integral stairs rising around the concrete casing of the vertical feedwater upriser (Plates 17/18),[50] located in the case of CT2a/4a to the north-eastern quadrant, rising to a landing platform off which oval-headed doors (Plates 19/20)[51] open to the interior at the level of the packing/drift eliminator.[52] The return pipes extend horizontally from the head of the upriser across the full diameter of the tower as square distributor box-conduits (Figures 9/10), set *c*.35ft. above the pond base, perhaps best illustrated by historical photographs of the towers during construction (see inset below).

Aerial photograph of 'B' towers during construction, looking south, showing stages of progression
(CEGB photo ref. A1168183, dated 14.11.1966; Uniper Archive, IMG_0383.jpg)

5.2.8 The upper sides of the box-culverts also function as both external landing platforms and internal access walkways (Plate 21).[53] Perpendicular walkways formerly extended from the mid-point to connect with a circular walkway running around the perimeter of the shell (Figure 10),[54] though these were evidently removed when the tower packing was renewed (see §.5.2.10).

Cooling Pack

5.2.9 At the base of each tower shell is located the packing or 'cascading' structure (Figures 10/16d). The towers were originally of 'splash type' design, with multiple layers of triangular timber laths (Figure 12), though these were replaced in the late-1980s/early-1990s by thin film plastic pack media (Plate 26),[55] extending to the full internal area of the towers, except beneath the distributor conduit and supported by a dense network of vertical concrete columns (Figure 11; Plate 27), rising from the pond base and interconnected beneath packing level by a lattice of concrete beams (replaced 2009/10). The function of the packings is to physically increase the surface area of the water as a thin film to maximise the process of heat transfer during the cooling process.

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50 The interior of one tower only (CT2a) was accessed for the purposes of recording; functional details of other towers are assumed similar.
51 The form of the door avoids hard angles to corners which would result in stresses within the reinforced concrete shell membrane.
52 Extant doors are replacement, 1in. single-thickness softwood doors, ledged and braced; observations at other contemporary stations indicates double-thickness hardwood (teak) doors were normally used.
53 Distributor culverts are furnished with vents to each end (Plate 24); absent from original drawings, these are assumed secondary, though it has not been established when they were introduced.
54 The perimeter walkway survives at packing level, accessed via ladders sited adjacent to the access door (Plate 25).
55 Themselves renewed in 2009/2010 (see §.5.2.10).

The water is distributed over the full area of the tower by a total of 114 distributor pipes (Plate 28; PVC replacing asbestos originals in 2009/2010), set out at c.8ft. centres, extending perpendicularly to the box-conduit (Plate 29) above the level of the packings (Figures 9/10), where they are carried on support beams extending between the vertical packing/eliminator support columns (Figure 10 inset; Plate 28). Distributor pipes vary in both length and bore, dependent upon their location within the tower, to ensure constant pressure.[56] Regularly-spaced, pendant deflector-type nozzles to the lower side of the distributor pipes (*c*.4ft. centres)[57] spray water as a thin film over the packings below (Figure 10: Plate 30), while a drift eliminator screen above (Plate 23), formed of moulded PVC sections (replacing original timber units; Figures 13 and 14a/b), minimises the loss of fine water droplets carried by the up-draught of air. As the film of water works its way through the packings, it meets the up-draught air entering from the intake at the base of the tower and a process of heat transfer occurs (see §.4.4.2).

Collection Ponds

5.2.10 After passing through the packings, cooled water falls into the collection basins or 'ponds' at the base of each tower (Figure 10; Plate 31), *c*.310ft. in diameter and max. 7½ft. deep,[58] with a maximum capacity of 3 million gallons per tower, furnished with crowned bases to aid drainage. Cooled water from the collection ponds is returned, via 15ft. wide, above ground, open (though netted) concrete channels or culverts (Plate 32),[59] to the circulating water pumphouse (see below) for recirculation to the turbo-generator condensers, CTs 1a/b and 3a/b directly, CTs 2a/b and 4a/b via the inner cluster. Each tower was originally furnished with two, diametrically opposed silt sumps, set externally to the pond wall; these survive (redundant) to CT4a (Plate 34), though have been removed at CT2a (Plate 35), presumably associated with the introduction of the secondary mantle and additional propping.[60]

Distributor / Packing Refurbishment

5.2.11 As part of the Ratcliffe Environmental Upgrade, the performance and integrity of the cooling tower pack fill and distribution system was identified as an area requiring improvement and, as a result, a staged programme of packing refurbishment was effected to all cooling towers between 2009 and 2013 (Knight, 2014).[61] As the cooling tower collection ponds are connected in pairs, it was necessary to undertake the refurbishment work to two towers at a time, with towers 3a and 4a being upgraded in 2009, and towers 1a and 2a in 2010 (*ibid*., 1). In general, the works involved the replacement of the following elements:

- Drift eliminators (original timber screens replaced by PVC blades);
- Drift eliminator side frame;
- Distribution pipes and nozzles (asbestos original replaced by uPVC pipes);
- Pack fill media (secondary plastic units replaced with low-fouling film pack);[62]

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56 The pipes progressively increase in length and bore from the point of conduit entry to the tower to a maximum at the centre, then decrease to the end of the conduit (Station Manual, 2-6-6).

57 **NB**. original spray nozzles were mounted to the top of distributor pipes (Figure 14c).

58 Pond bases incorporate a drop of 2ft. from centre to perimeter to aid drainage (Figure 9).

59 Pedestrian access over return channel afforded buy a series of concrete over-bridges (Plate 33).

60 Though illustrated on original drawings (Figures 5/10) they are also absent to CT1a, perhaps suggesting the secondary props are supported by a simple ring foundation, the introduction of which would have necessitated the removal of the sumps.

61 Work undertaken by Promanex, the support services division of Costain (https://www.costain.com/news/news-releases/innovation-at-ratcliffe-power-station/).

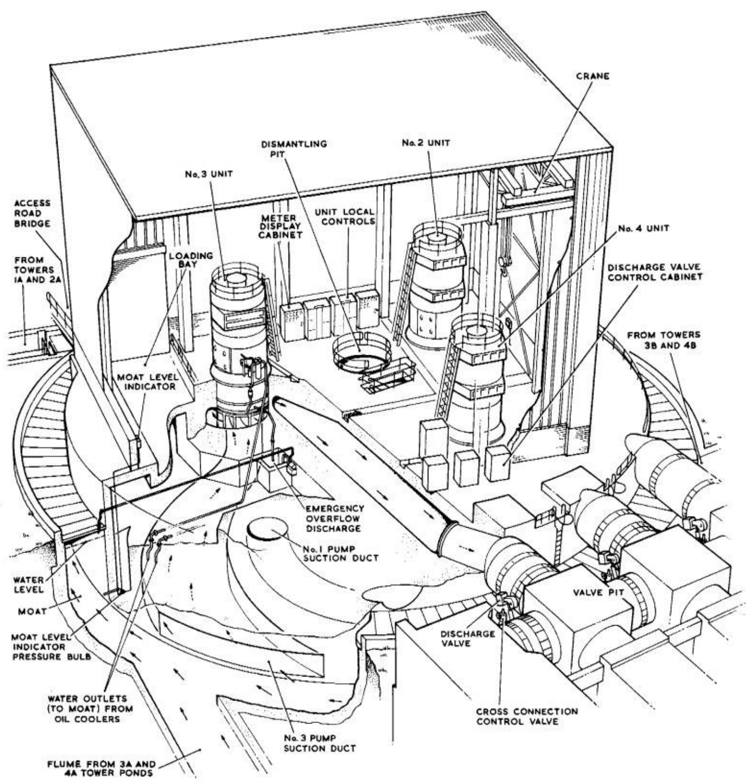
62 The replacement packing incorporated a 'blanked off' area (Plate 23) to the centre of the tower, approximately 13% of total area, thereby reducing the 'wetted' area to ensure a greater concentration of warm water per m^2 and an improved, consistent air flow (Knight 2014,1; details at Appendix A, figure A6).

- Pack support structure (new beams);
- De-icer pipework (asbestos original replaced by uPVC pipework);
- Pond hand rails (renewed).

5.2.12 Other contemporary works entailed the de-silting of the collection ponds and return channels, and the sealing of failed and suspect pond-floor joints; the refurbishment is recorded in a series of 'before', 'during' and 'after' photographs, a selection of which is reproduced at Figures 14/15 (see also Knight 2014, appendices B and C).

5.3 The Circulating Water (CW) Pump House

5.3.1 Central to the CW system is the **Circulating Water Pump House** (Figures 17-20; Plates 36/7), located to the eastern side of the cooling tower field, set centrally between towers 3a and 3b (Figure 17), at the junction of four above-ground return culverts from the inner cluster of cooling towers (1a/b and 3a/b).



CW Pumphouse: 3-Dimensional projection (Ratcliffe Station Manual R-2-6-3)

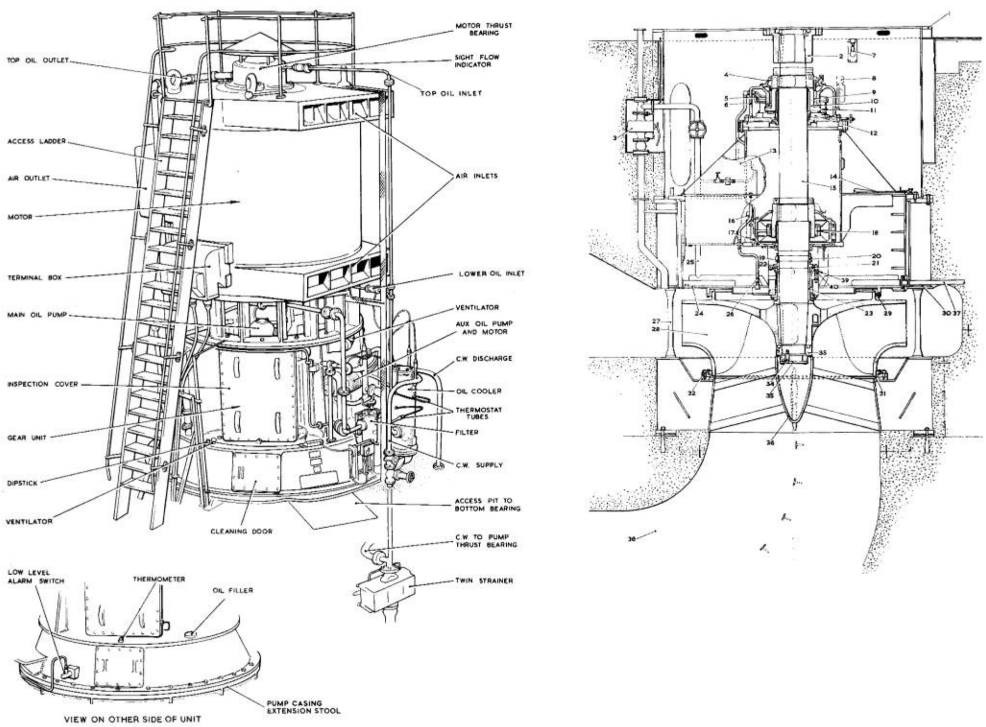
5.3.2 The structure is rectangular in plan (Figure 18), measuring 80ft. (N/S) x 62ft. (E/W) and standing 55ft. high to a flat roof, of steel-framed construction with lower walls clad in blue-grey engineering brick to a height of *c*.7ft, and upper walls clad in white, profiled-aluminium sheeting (original drawings specify BS colour 3/053); full-height vertical bands of Georgian-wired patent glazing to the southern bay of the west elevation (Plate 36; Figure 19)[63] and northern bay of the east elevation (Plate 37) light the interior.[64] The pumphouse is set on a

63 This bay incorporates a 15ft. wide, 22½ft. high roller door.

64 The term 'patent glazing' refers to a non-load bearing, two-edge support cladding system; its name relates to the number of patents that were taken out in the 19th and 20th centuries for different versions of the system. It supports its own weight, and provides resistance to wind and snow loading, but does not contribute to the stability of the primary structure of the building. 'Georgian-wired' glazing includes a

circular pedestal at the centre of a distinctive, annular 'moat' (Figure 18; see inset above), 10ft. wide and 125ft. in diameter,[65] which is fully enclosed and capped by concrete slabs (Plate 38).[66] The return culverts meet the outer wall of the moat tangentially (Figure 17), thereby imparting a clockwise movement around the moat (see below) while offset, shaped inlets to the inner wall serve the lower, suction pieces of the CW pumps. Four CW discharge pipes emerge from the pumphouse pedestal to the east (Figure 17; Plate 39), spanning the annular moat and returning cooled water to the unit condensers.

5.3.3 To the south-west angle, the moat is spanned by a 15ft.-wide access bridge (Plate 40) where a high, vertical roller door affords access to the interior of the pumphouse, opening onto a loading bay (Plate 41), set 32in. below the main pumphouse floor. Internally (Plates 42-46), the range comprises a single, unencumbered space, three bays (E/W) by four (N/S), generously lit by the patent-glazed bays to east and west, housing four Drysdale & Co. vertical-spindle, single-entry, centrifugal, concrete volute pumps (Figure 18), each with a capacity of *c*.210,000 gallons/min.. Associated motor and gearing units are visible above ground (Plates 44-5); the pump, gearing unit, and motor are co-axially mounted, set vertically one above the other (see inset below).[67] Control instrumentation is located to the east and west walls (CW pumps 1/4 and 2/3 respectively; Plate 46).



CW Pumphouse: detail of above ground motor/gearing unit (left) and pump (right); Station Manual R-2-6-3.

5.3.4 The pumphouse building is spanned by a high-level, 30-ton capacity, double-girder travelling crane by Lysaght's of Bristol (Plate 47), carried on north-south aligned runway beams set 45ft. above interior floor level,

welded steel mesh incorporated within the body of the semi-molten glass before it is passed between two rollers, one of which forms a pattern on the surface of the finished pane (info. https://www.pilkington.com/en-gb/uk/architects/helpandadvice/glassary).

65 The southern angles of the pumphouse pedestal are cantilevered out slightly above the annular moat.

66 Similar annular moat design CW pumphouses were included at Cottam, Ferrybridge 'C'and Didcot 'A' (see **Appendix D**).

67 Gearing units by David Brown Industries; motors by English Electric Co. Ltd.

required for any pump maintenance necessitating the removal of motor / gearing units; a dismantling pit is located adjacent to the Unit 2 motor/gearing unit (Plate 48).

5.3.5 As per the cooling towers, the construction progress of the CW pump house is recorded in a series of dated CEGB photographs, a selection of which are reproduced at Figure 21.

6 ASSESSMENT

6.1 The Cooling Towers and Power Station site within their Landscape Setting

6.1.1 On account of their massive scale and dominating presence in their landscape settings, cooling towers were to become the defining visual feature and 'iconic' symbol of the coal-fired power industry.[68] The open, largely level floodplain site of Ratcliffe on Soar, as with a number of contemporary sites, meant that the station and its component structures, and the cooling towers in particular, were destined to be exposed and clearly visible from both near and wider viewpoints; as Clarke notes (2013, 15), 'the enormity of the standard components precluded otherwise'. The grouping of the cooling towers at Ratcliffe into a single 'field' serves to increase their visual 'bulk',[69] particularly as seen from the west (Plate 4).

6.2 Outline Assessment of Heritage Values

6.2.1 Historic England's guidance on heritage assessment is set out in *Conservation Principles, Policies and Guidance for the Protection of the Historic Environment* (EH, 2008) which identifies a series of 'heritage values' against which a site's heritage significance should be assessed; *viz*. evidential, historical, aesthetic and communal.

Evidential Value

6.2.2 **Evidential value** derives from the potential of a place to yield evidence about past human activity and can be natural or man-made (EH 2008, 28). Very often archaeological deposits are of evidential value as they are the primary source of evidence for human activity for a particular place and period. However, other types of asset can also be of evidential value, in particular where the written or drawn record may be incomplete. Age is a strong indicator of relative evidential value, but is not paramount, while the evidential value of an asset tends to be diminished in proportion to the extent of its removal or replacement. There is a certain degree of overlap with historical value, discussed below.

6.2.3 The inherent evidential value of the wider power station site is high, comprising as it does a relatively complete (though modified) set of buildings and related plant representative of late-20th-century, coal-fired electricity generation, a building type that Historic England have recently identified as being 'highly threatened and increasingly rare' (Clarke 2013, 7). The cooling towers currently under consideration constitute integral, original elements of the wider power station site, the layout and original functionality of which remain readily 'legible' in presentational terms. The phases of historical modification evident within the two towers forming

68 The last towers of the type to be built were at Drax in North Yorkshire, erected in the early 1970s (https://www.heritagegateway.org.uk/Gateway/Results_Single.aspx?uid=1455878&resourceID=7).

69 At West Burton 'A', by contrast, the splitting of the eight towers into two discrete groups of four, a design feature also adopted at Fiddlers Ferry in Cheshire, resulted in a degree of interesting 'interplay' from the middle distance, with individual towers being momentarily obscured from selected angles.

the subject of the current study, while having removed significant original / early fabric (see §.5.2.10), themselves contribute towards an understanding of the evolution of cooling tower design and functionality in the later-20th / early-21st century. The physical evidence of the buildings themselves is greatly enhanced by the wealth of archival materials related to their construction and historical usage (original drawings, photographs, site manuals etc.).

Historical Value

6.2.4 **Historical value** derives from the ways in which past people, events and aspects of life can be connected through a place to the present (EH 2008, 28). It tends to be either *illustrative* or *associative*. Illustrative value relates to the manner in which a place may provide a tangible link to illustrate aspects of history or prehistory. This relies on visibility, and may relate to distinctiveness of a regional tradition or an aspect of social organisation. Associative value is concerned with links with a notable family, person, event, or movement. Buildings or designed landscapes may relate to a particular person and the way in which they were designed, laid out or furnished may reflect that person's personality or needs.

6.2.5 As one of a generation of 1960s 'super stations' based around the 500MW unit, the *illustrative historical* value of Ratcliffe on Soar power station site at both a national and a local level can be seen to be medium, and it is acknowledged that it represents an 'important testament to the scale and optimism of Britain's post-war nationalised electricity industry' (HE 2017, 3). Coming midway in the sequence of commissioned stations, however, Ratcliffe was not innovative in terms of its overall planning or in the design of the individual elements of the site,[70] including the cooling towers here under consideration, which are of generic form and standard design, with nothing of particular note in terms of technical or architectural innovation. The subsequent programmes of repair and modification, reflected here in the arrangements of tower 2a, are also a reflection of wider developments at a national scale.

Aesthetic Value

6.2.6 **Aesthetic value** derives from the ways in which people draw sensory and intellectual stimulation from a place (EH 2008, 30); it can be as a result of conscious design or can arise largely fortuitously as a result of the development and use of a place over time, or from a combination of the two factors. Where aesthetic value derives from conscious design, this may relate to aspects such as form, proportions, massing or of views and vistas, and the retention of the value relies on maintaining the integrity of the concept. Fortuitous aesthetic values may involve the apparently organic form of a rural or urban landscape and reflect the appearance of a place as it has developed over a period of time. Aesthetic value resulting from the passage of time on human works, the 'patina of age' may overlie the values of conscious design, and may enhance or detract from them.

6.2.7 As noted above, even allowing for the softening effects of contemporary landscaping and tree-planting, the cooling towers represent dominating and clearly visible features within the landscape (eg. Plate 2), accentuated by the adoption of the 'single field' arrangement, resulting in visual 'blocking', especially when observed from the west (Plate 4). The cooling towers at Ratcliffe were erected to a standard design, however, lacking for example the innovative use of colour as at West Burton 'A', Rugeley 'B' and, most notably, at Ironbridge 'B'.

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70 In Ratcliffe's case this is most readily evident by comparison with its 'mother' station at Ferrybridge in West Yorkshire, also by the Building Design Partnership, with which it shares a number of design characteristics and details (see Scott 2019).

6.2.8 The shear physical 'presence' of the power station and its cooling towers within the landscape for a period of *c*.50 years has inevitably resulted in it becoming prominent 'landmark' features and a focal point within the local area. Aesthetics are necessarily subjective, and the uncompromising industrial nature of the buildings means that, while for many they may represent both a familiar landmark and a physical manifestation of a significant moment in the development of the nation's industrial heritage, while for others the scale and form of the station buildings, 'imposed' upon their essentially rural, natural setting, represent an 'eyesore'. The former view has been historically articulated by organisations including the 20th Century Society, and specifically in relation to Ratcliffe in 2015, by the Nottingham Civic Society;[71] the latter response reflects a concern expressed from the outset of the project, as highlighted by the RFAC in initial discussions on the siting of the station (see §.4.3.2; fn. 34).

Communal Value

6.2.9 **Communal value** derives from the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory (EH 2008, 31). Communal values are closely bound up with historical (particularly associative) and aesthetic values, but tend to have additional and specific aspects. This may relate to commemorative or symbolic places, or places which contribute to a sense of identity. Communal values may tend to relate more to an activity associated with the place rather than the physical buildings themselves and is thus less reliant on the physical survival of historic fabric.

6.2.10 The *communal value* of industrial structures and complexes can be limited, and is often difficult to identify/quantify. The inherent nature of industrial sites means that, during their periods of operation, they tend to form largely 'closed' communities, with limited direct public participation or involvement. The dominant physical presence of the station buildings however (see 'aesthetic value', above), means their communal value should necessarily be assessed within a wider context, taking into account not only their contribution as a strong landscape feature contributing to a sense of 'identity' within the immediate area, but also as a significant employer within the local community for a period extending over a generation. As with aesthetic value, such assessments of communal value are, by their nature, subjective.[72]

7 DISCUSSION AND CONCLUSION

7.1 Discussion

7.1.1 Ratcliffe on Soar was built as part of a large-scale expansion of electricity generation at a national scale under the auspices of the nationalised Central Electricity Generating Board, one of ten coal-fired plants of 1,000 - 2,000MW capacity released for construction between 1960-64 based around the 500MW turbo-generator set (see **Appendix D**). The original plan comprised a standard group of power station buildings, incorporating coal handling plant with rail loop and storage area together with fuel conveyor system, generation core (boiler house/turbine hall) with ESPs and chimneys, circulating water system (cooling towers and CW pump house)

71 'Cooling Towers: Eyesores or sights for sore eyes?' (https://www.bbc.co.uk/news/uk-england-nottinghamshire-34861835).

72 Cooling towers in particular present a feature stirring often strong emotions, both positive and negative, within local communities. The dichotomy is well illustrated by a poll undertaken by the Shropshire Star prior to the demolition of the cooling towers at Ironbridge 'B' in 2019, which resulted in 68% of respondents voting in favour of retaining the structures as opposed to just 32% supportive of demolition. (https://www.shropshirestar.com/news/2016/10/11/ironbridge-power-station-two-thirds-of-readers-want-iconic-cooling-towers-to-be-saved/). See Clarke (2013, 27) for further discussion of aesthetic and communal values.

together with auxiliary plant, stores, workshops and administrative/welfare ranges. There is nothing intrinsically innovative in Ratcliffe's buildings themselves, either in terms of their architectural form and detailing, nor indeed in the processes that took place within, the latter dictated entirely by the engineering requirements of the 500MW programme. Indeed, as Clarke has noted (2015, 13), there was relatively little that a consultant architect could hope to achieve architecturally with the main structures of such a large-capacity plant.

7.1.2 The cooling towers at Ratcliffe, built to a standard specification, are typical and representative of the 'large-set' design philosophy of the 500MW-unit programme as a whole; as such, they are of historical interest and significance at a 'local' level though, as noted above, they have been previously assessed by Historic England as not being sufficiently innovative in terms of technology, planning or design to be deemed of 'special interest' within a national context.

7.2 Conclusions

7.2.1 The current programme of heritage assessment and building recording has allowed for a detailed study and record of the two southernmost of Ratcliffe on Soar's eight cooling towers, together with a brief overview of their associated CW system, in accordance with para. 205 of NPPF and in line with the aims and objectives set out prior to the commencement of work.

7.2.2 It is envisaged that the wider power station site will be the subject of a detailed study in due course; such a wider study, to which the current record will contribute, will present a detailed visual record of one of a series of coal-fired plants released for construction in the early 1960s. Together with records recently completed at West Burton 'A' and Cottam in Nottinghamshire,[73] Eggborough in North Yorkshire, Ferrybridge in West Yorkshire, Fiddlers Ferry in Cheshire, Rugeley 'B' in Staffordshire, and Ironbridge 'B' in Shropshire (see 'Bibliography' below), it will form part of a growing body of data on power stations of the era which, together, make a valuable contribution towards a broader understanding of the details and development of the 500MW unit programme as a whole.

7.2.3 A collection of primary and later archival materials are held on-site at Ratcliffe, including the original CEGB station manuals ('Blue Books'), various 'plant details' handbooks, original drawings and photographs of the construction process and documentation related to later phases of modification. Such materials represent an invaluable resource, both as a detailed record and as a source of information for further study and, once no longer required on-site for operational/administrative purposes, provision should be made to offer a selection thereof for ultimate deposition and long-term curation with an appropriate local and/or national repository,[74] in line with Historic England guidance (Clarke 2016, 9).

Ric Tyler MCI*f*A
23rd March 2022

73 Neither report yet in the 'public domain'.
74 eg. County Record Office; Historic England Archive; Archive of the Institution of Engineering and Technology (IET).

8 SOURCES AND BIBLIOGRAPHY

a) Primary Sources

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<u>*General*</u>

- CEGB Ratcliffe on Soar Power Station Manual; 'Part 6: Circulating Water System', digital (PDF) copy supplied for reference by Uniper.

<u>*Archived Drawings*</u>

- Collection of original CEGB / CS Allott & Son drawings, including original design schemes, held at Ratcliffe by Uniper. Selected, relevant images supplied in digital format by Uniper.

<u>*Archived Photographs*</u>

- Collection of photographs during construction phase (1963-67); selected images displayed at Ratcliffe power station.

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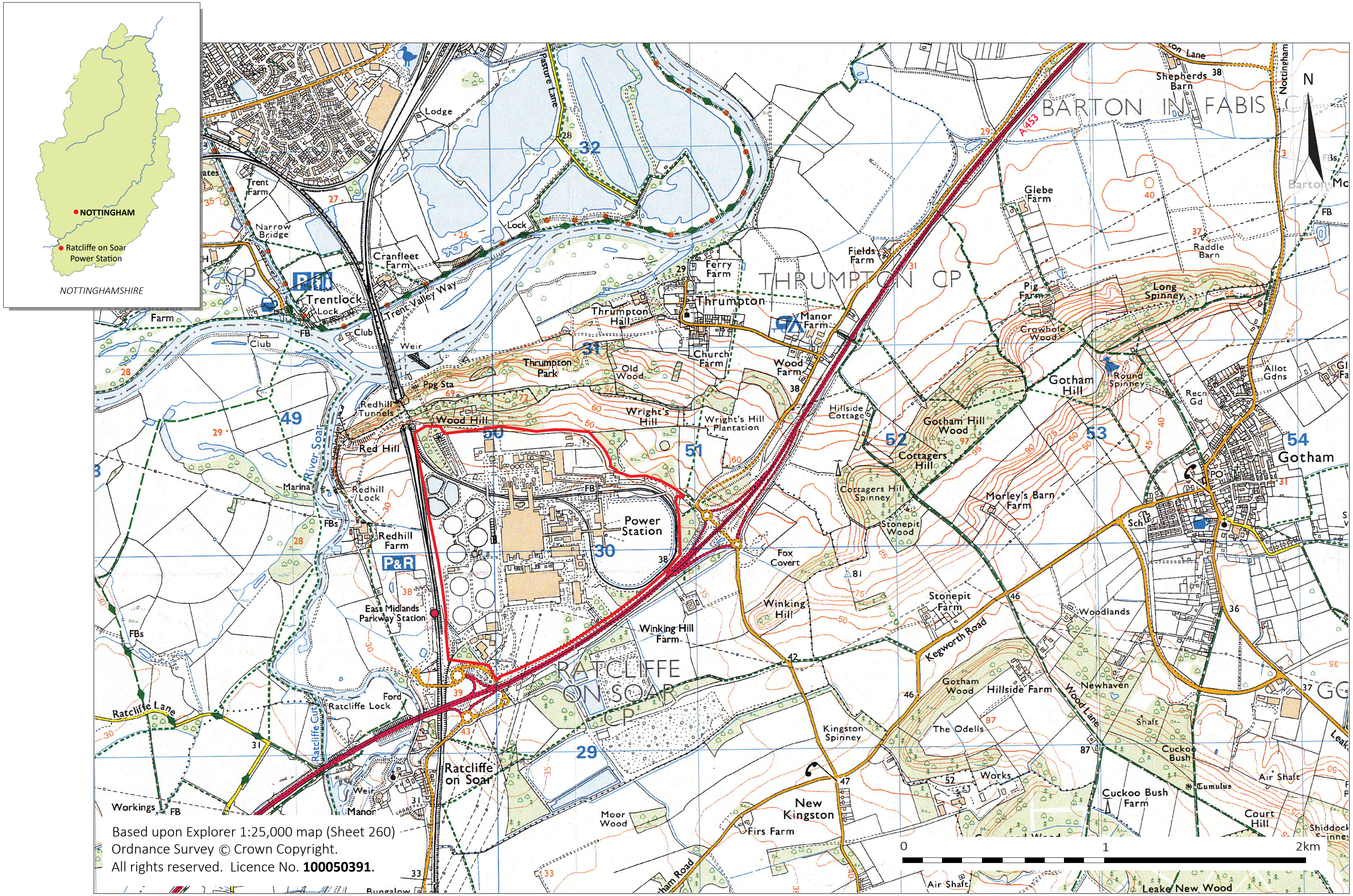

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Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 1: Site location

(image © Uniper)

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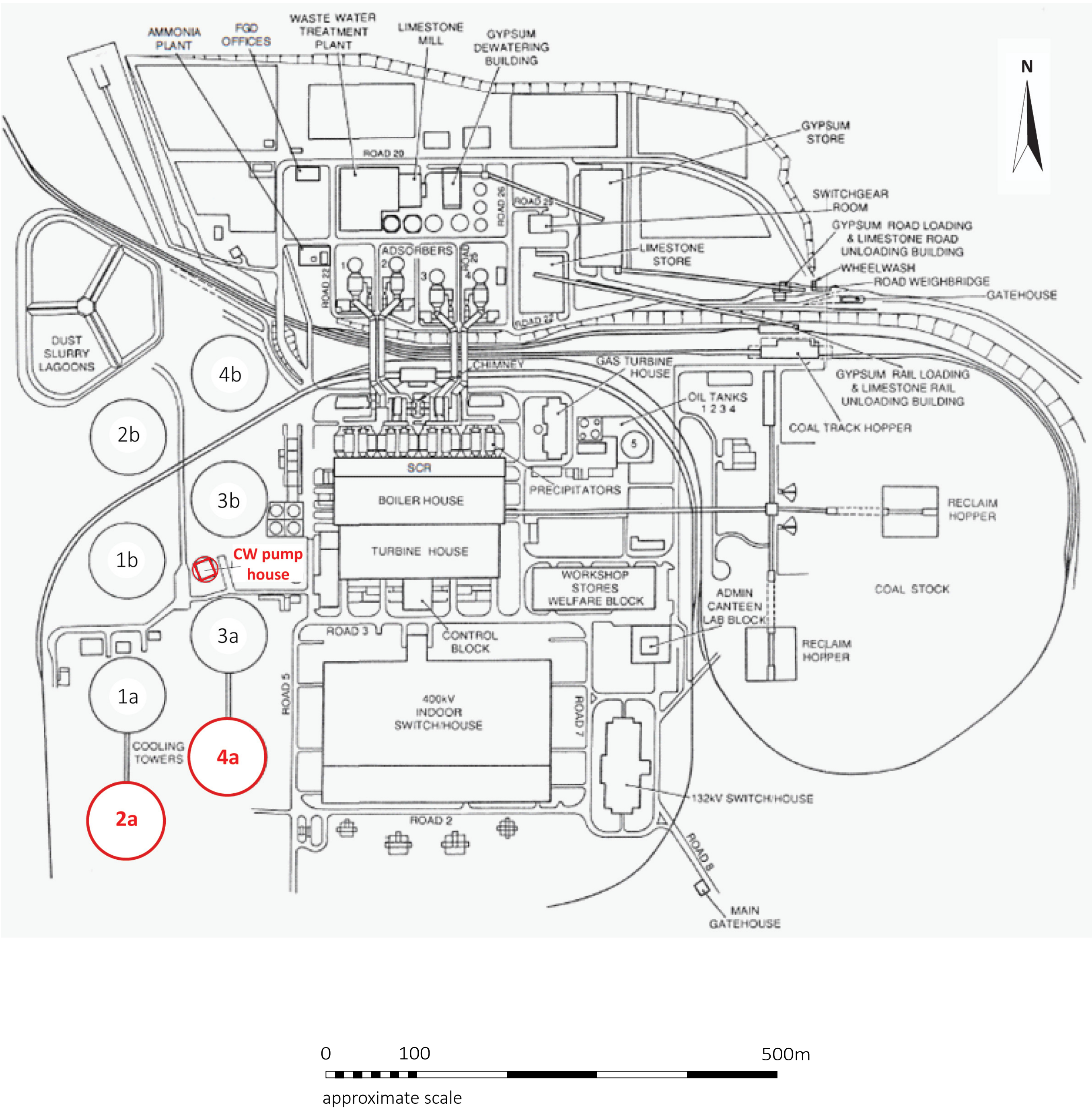
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 2: Aerial view of power station looking north-west



Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 3: Power station site plan showing location of cooling towers and CW pumphouse

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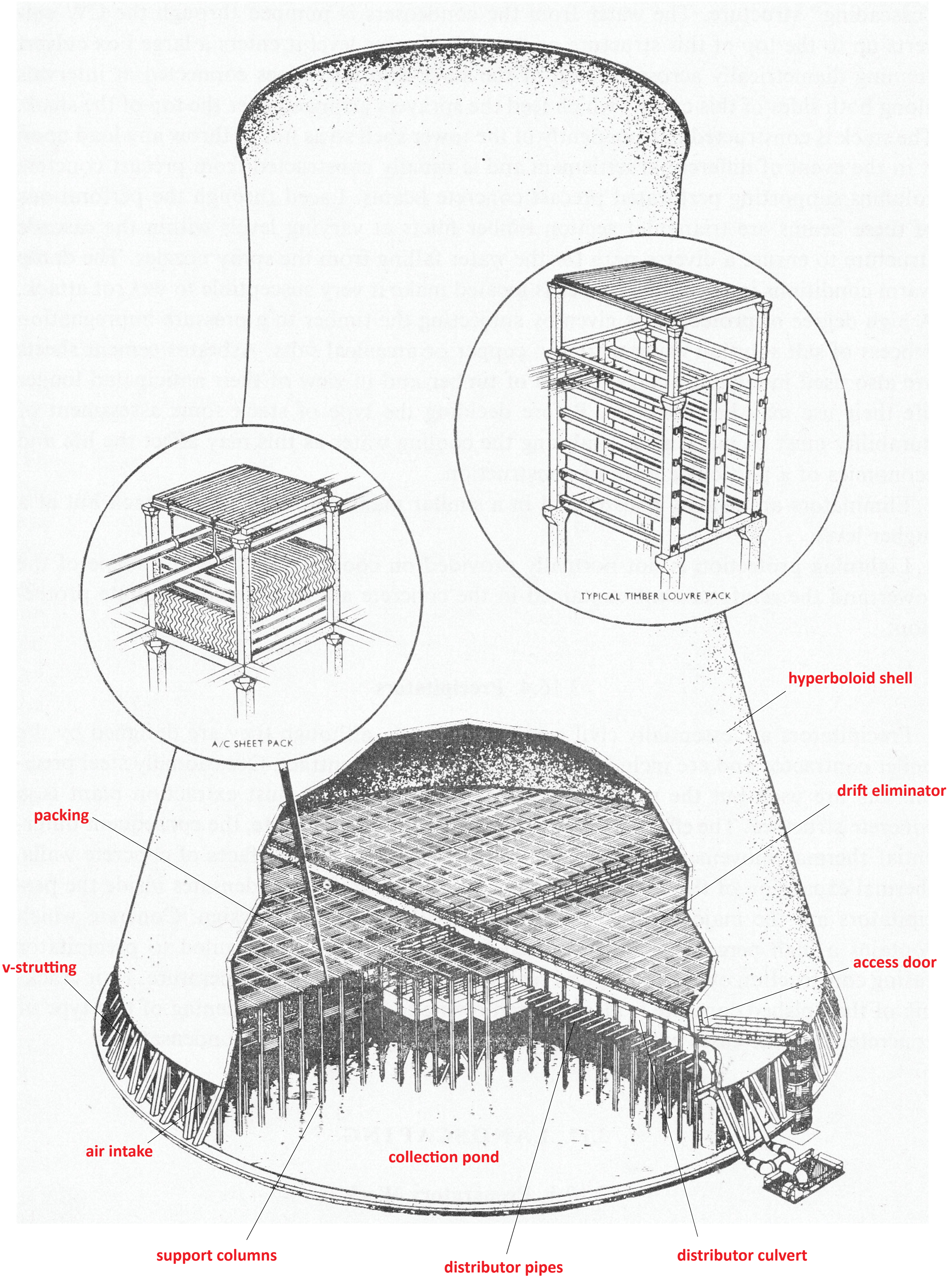

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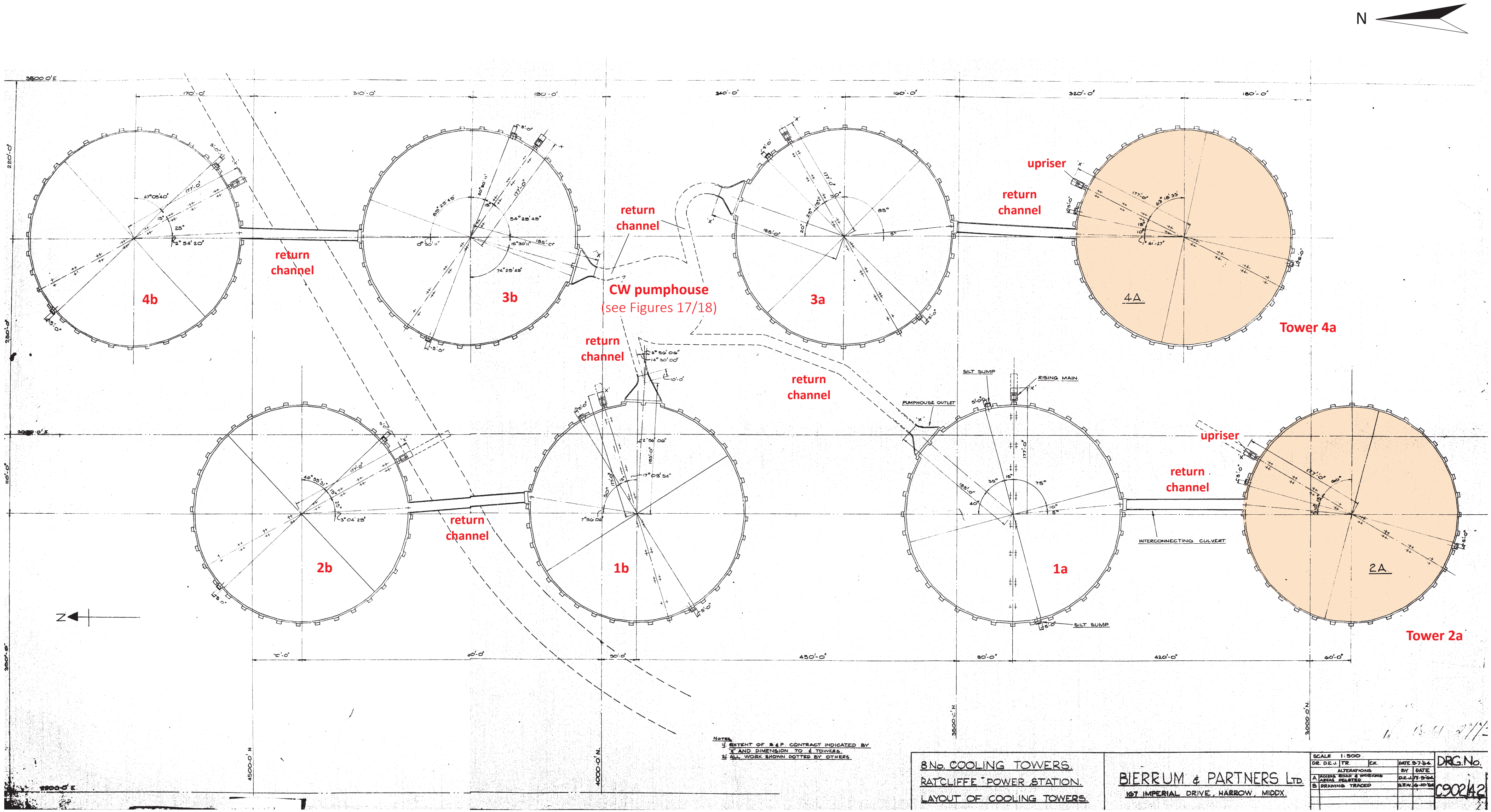
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 4: Representative arrangements of ‘typical’ hyperbolic colling tower
(CEGB 1971a, 247; fig. 3.16.3. **NB**. not Ratcliffe specific)



0 50 150m

Scale in metres

Scale in feet

0 100 500ft

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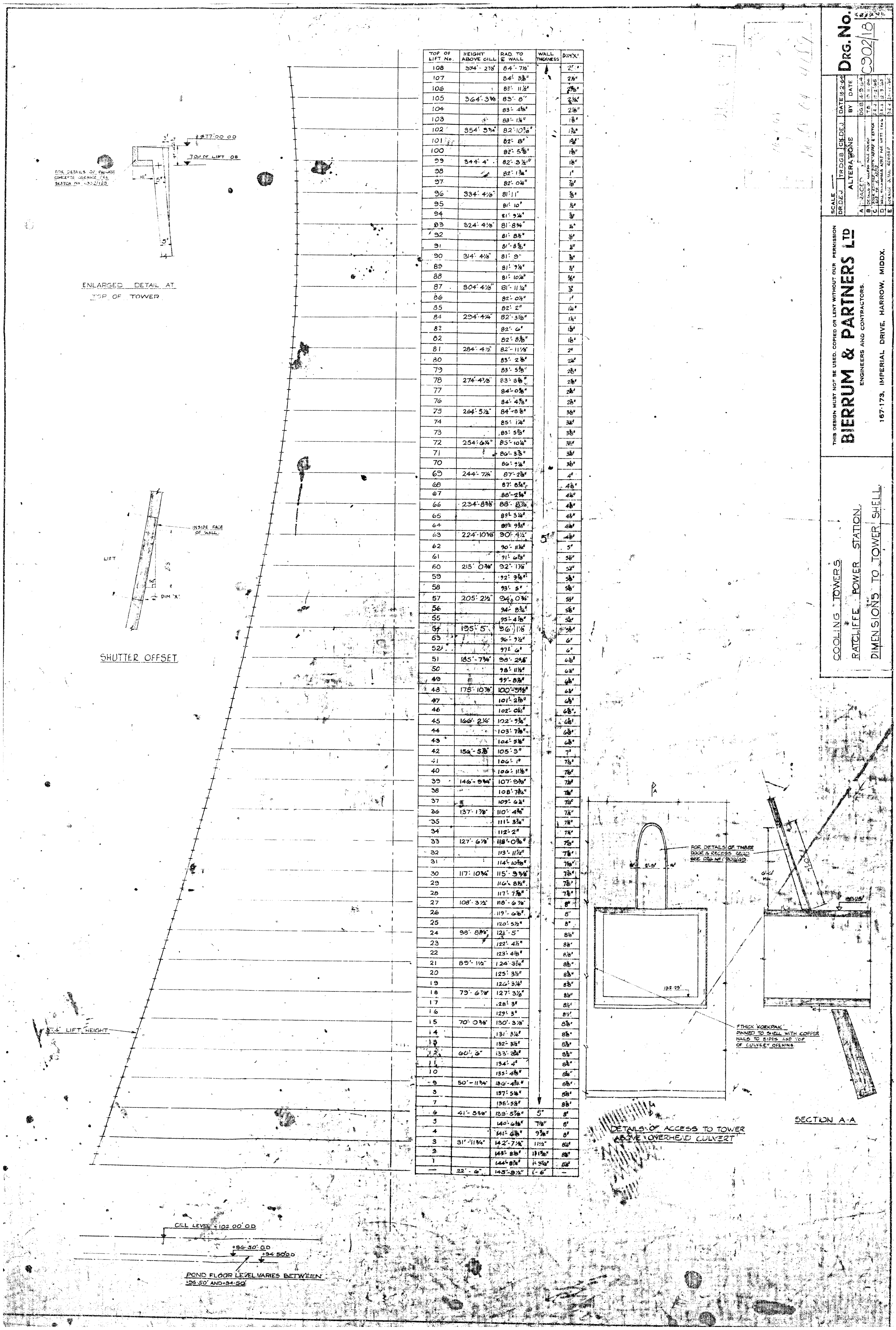
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire

Figure 5: Cooling tower field plan
(original Bierrum & Partners drawing, ref.C902/42, dated 03.07.1964; Uniper Archive)

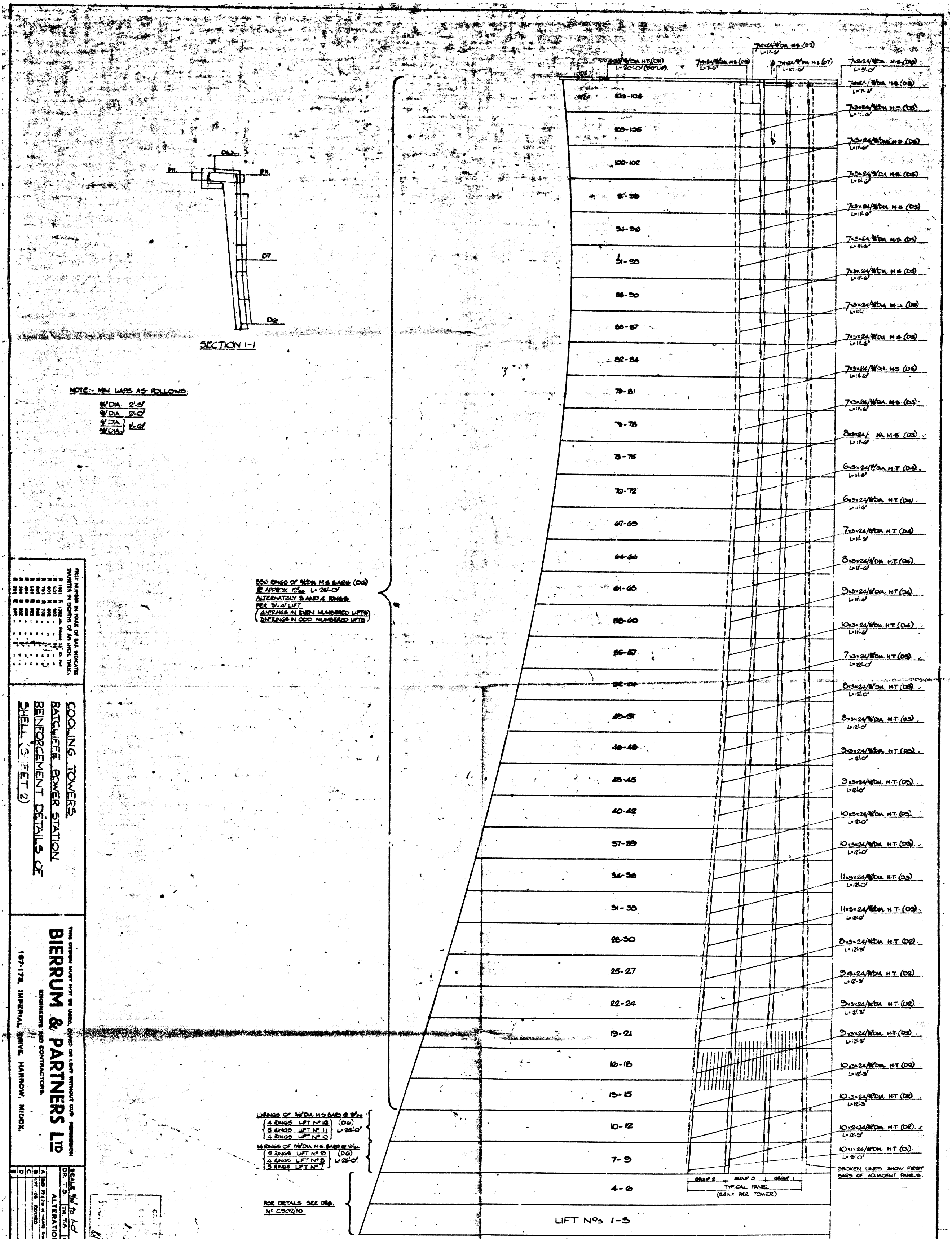


Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 6: Details of cooling tower shell profile

(original Bierrum & Partners drawing, ref.C902/18, dated 04.09.1964; Uniper Archive)



Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 7: Details of shell reinforcement
(original Bierrum & Partners drawing, ref.C902/31, dated 04.06.1964; Uniper Archive)

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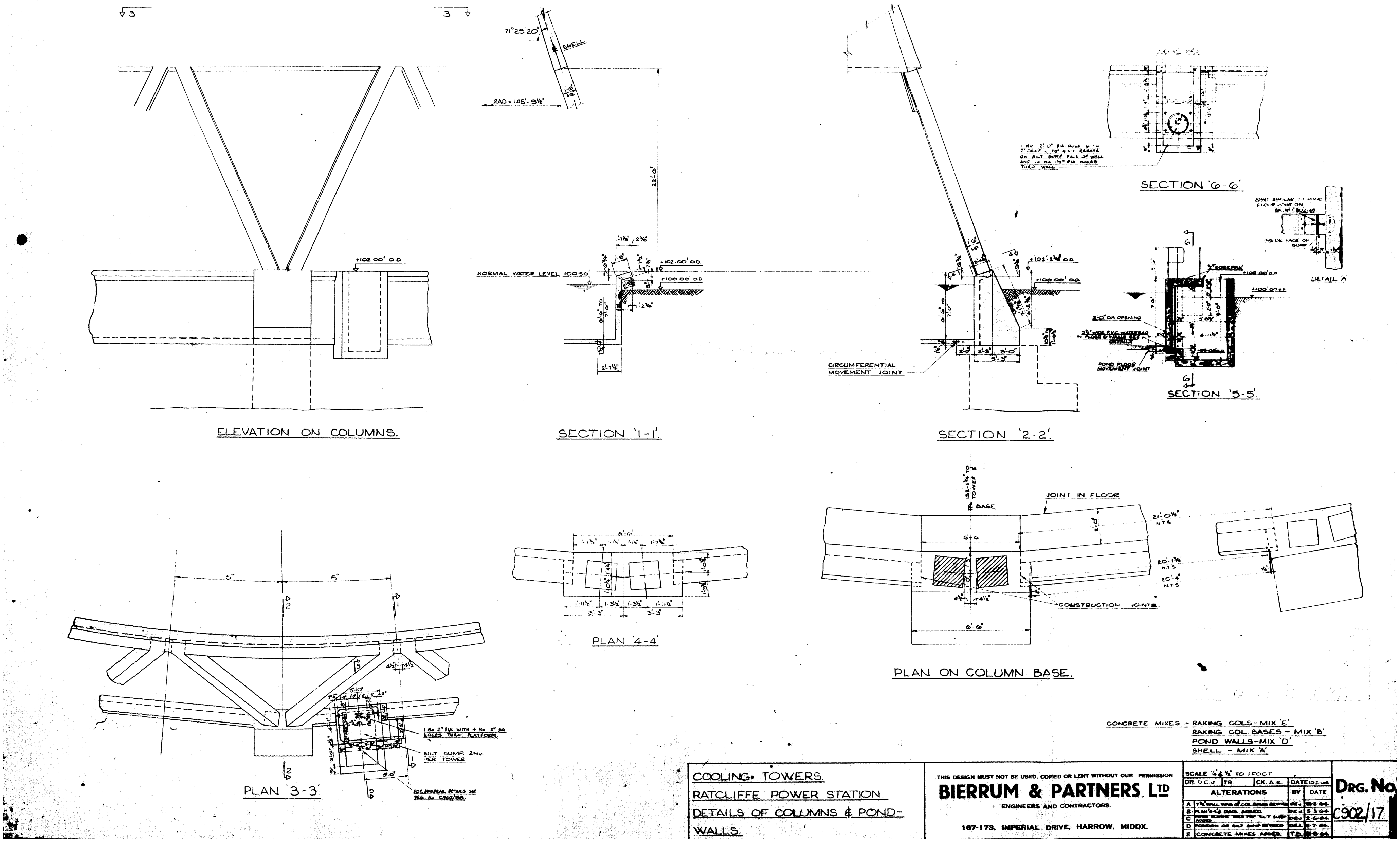

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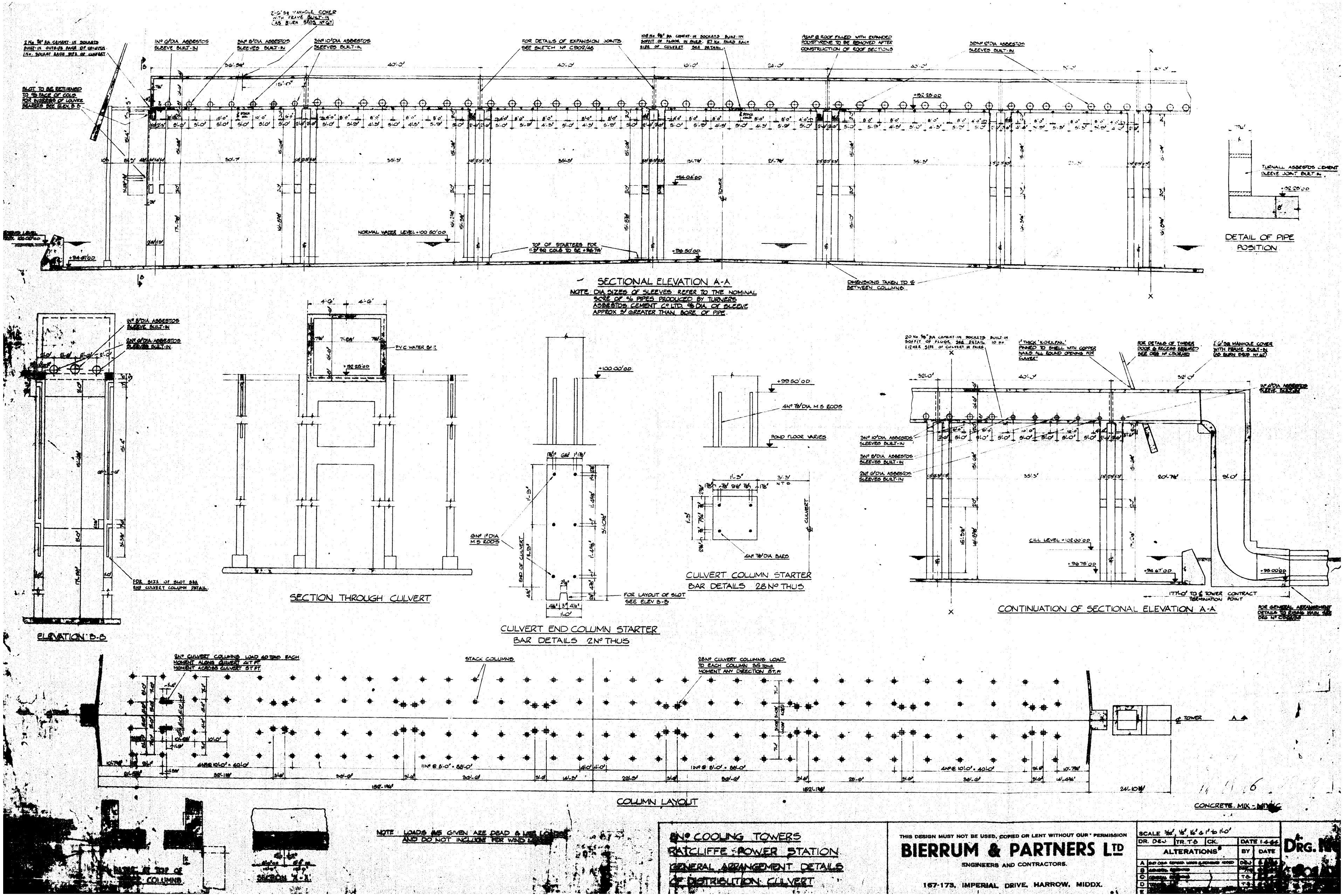
Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 8: Details of shell support structure

(original Bierrum & Partners drawing, re. C902/17 dated 10.02.1964; Uniper Archive)



Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 9: Details of distribution culvert

(original Bierrum & Partners drawing, dated 01.04.1964; Uniper Archive)

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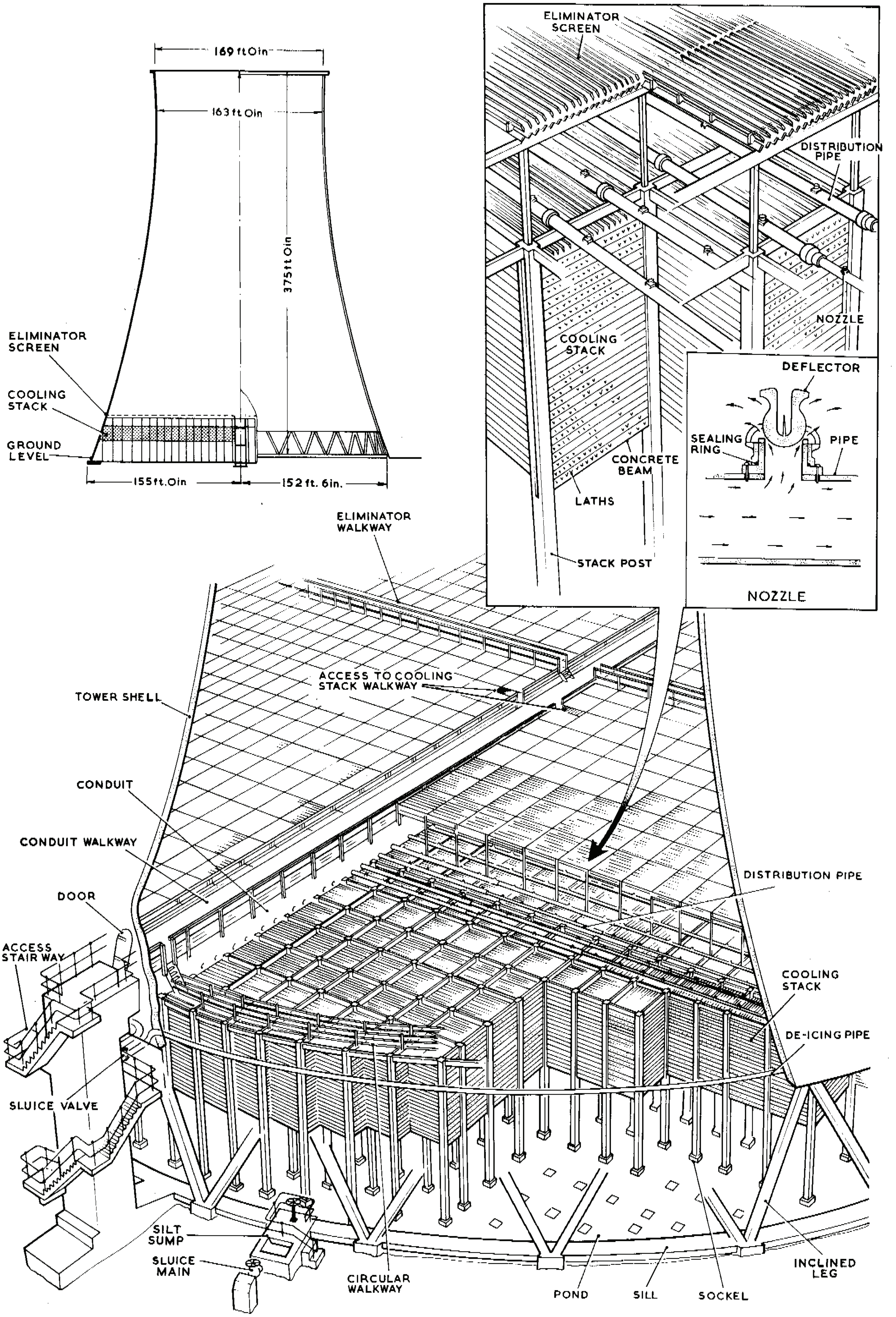

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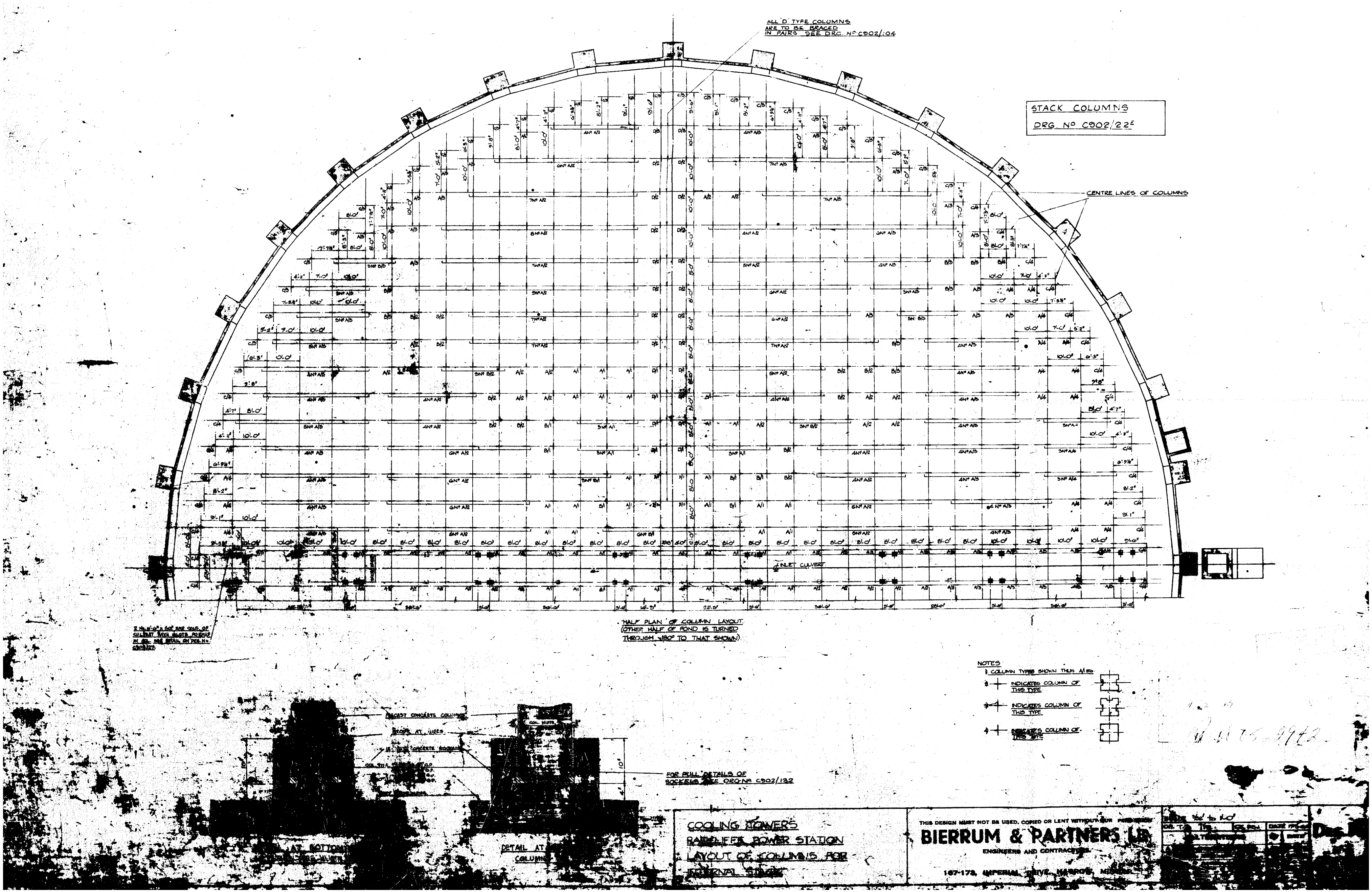
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 10: Details of 'cooling stack' at base of shell
(Ratcliffe Station Manual)



Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 11: Details of concrete column supports for packing / eliminator
(original Bierrum & Partners drawing, 1964; Uniper Archive)

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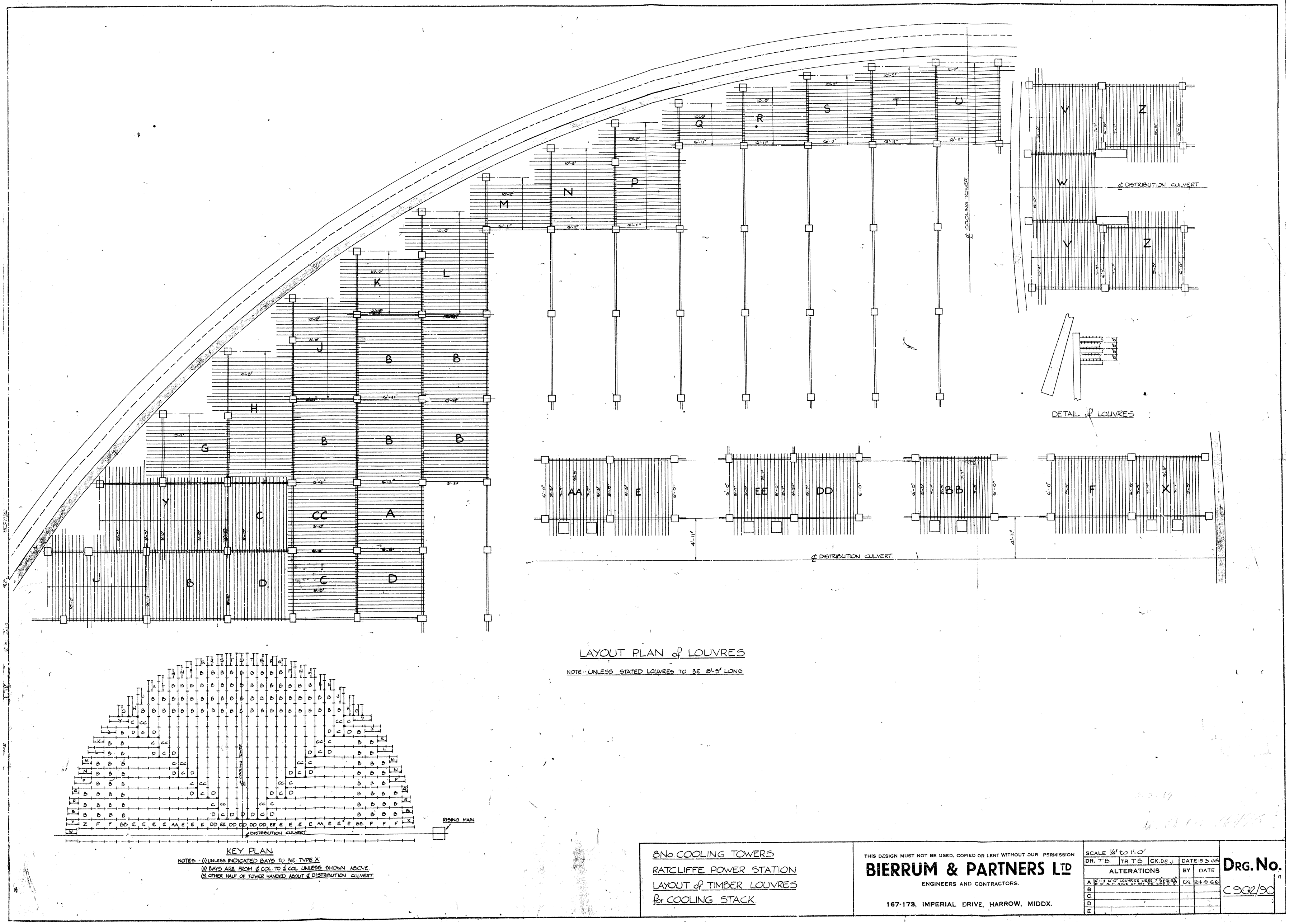

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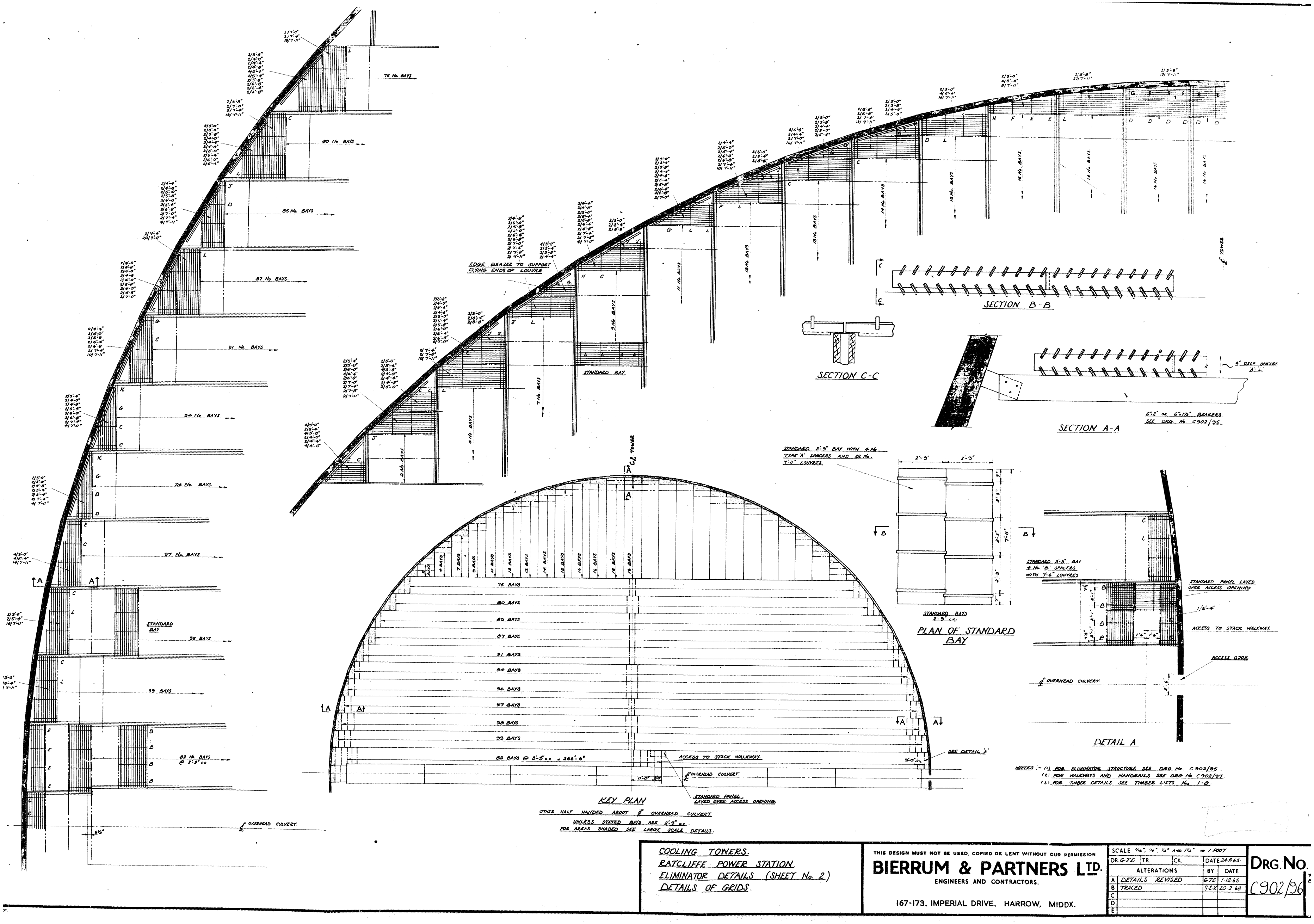
Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 12: Layout of timber louvres for cooling stack

(original Bierrum & Partners drawing, ref.C902/90, dated 15.03.1965; Uniper Archive)



Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 13: Details of original drift eliminator screen (original Bierrum & Partners drawing, re. C902/96 dated 24.08.1965; Uniper Archive)

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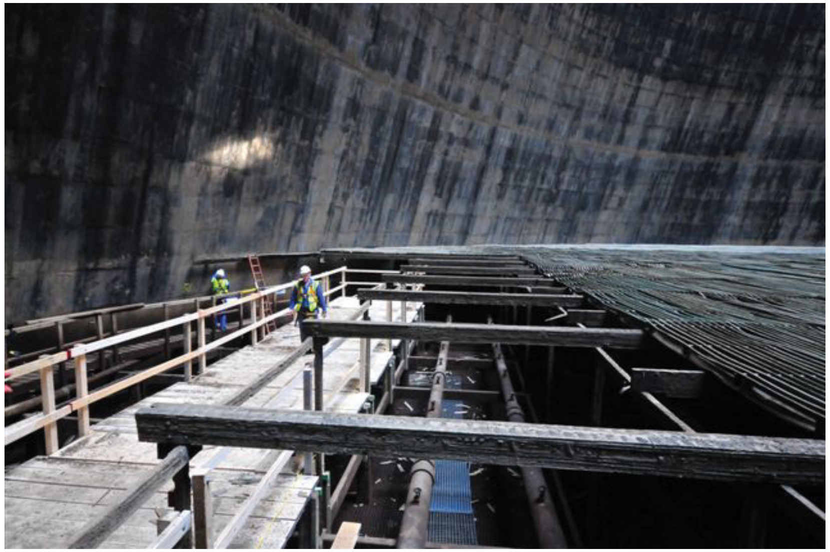
(**a**) timber drift eliminator prior to removal



(**b**) timber drift eliminator during removal

(**c**) original distributor pipework prior to removal (**NB**. sprays to top of pipes)

(**d**) previous (secondary) packing units during removal

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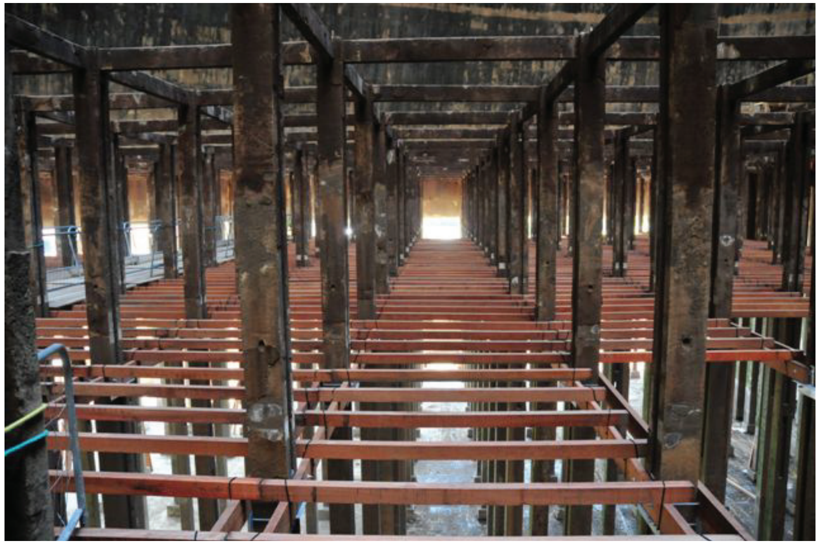
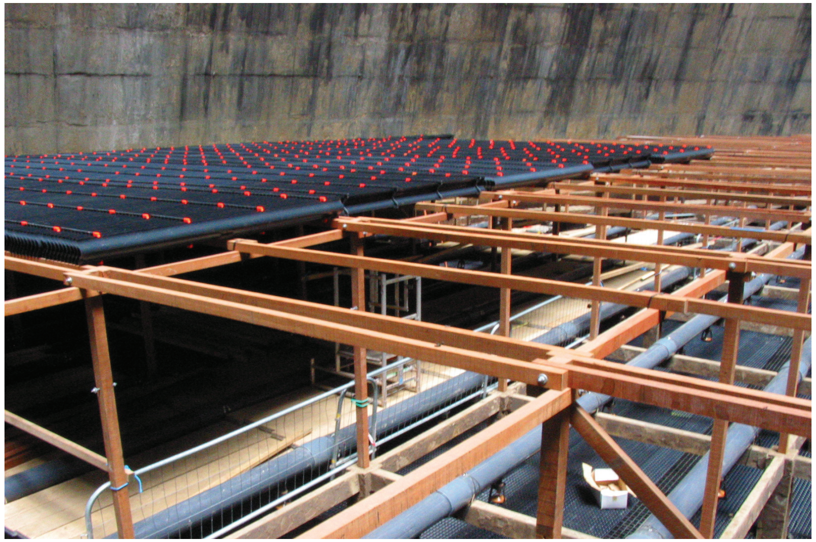
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 14: Cooling tower packing refurbishment (1)
(E.ON photos from Uniper Archive)



(**a**) new pack support beams *in-situ*



(**b**) new drift eliminator during installation

(**c**) new distributor pipework and drift eliminator *in -situ*

(**d**) completed refit

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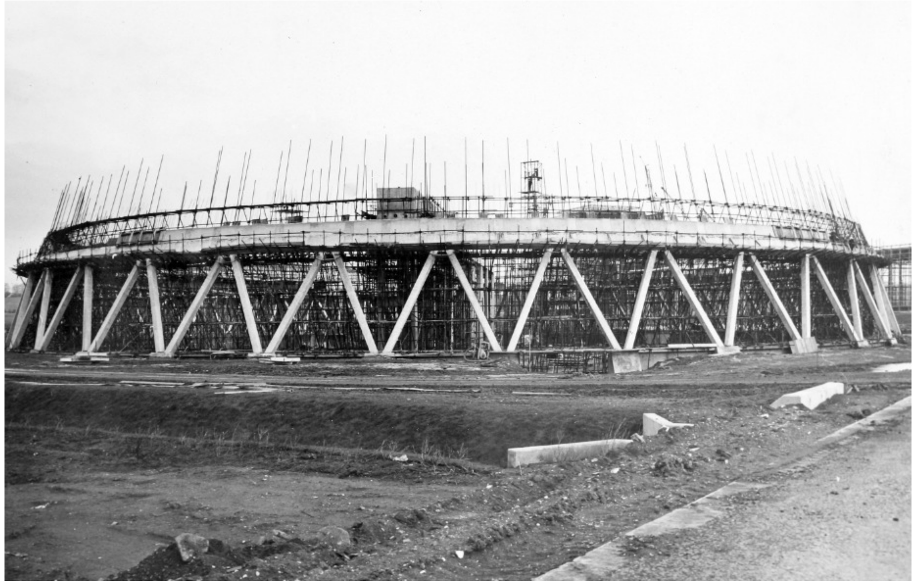
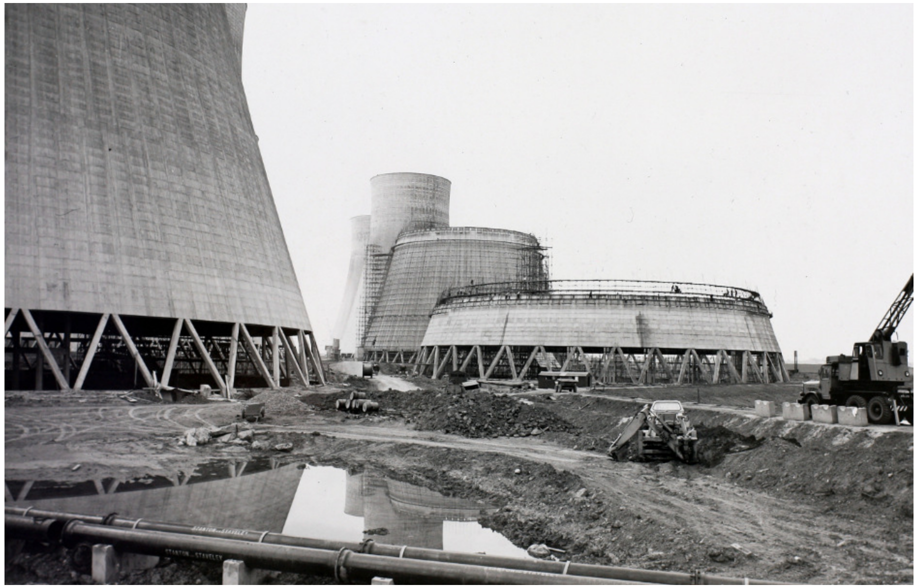
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 15: Cooling tower packing refurbishment (2)
(E.ON photos from Uniper Archive)

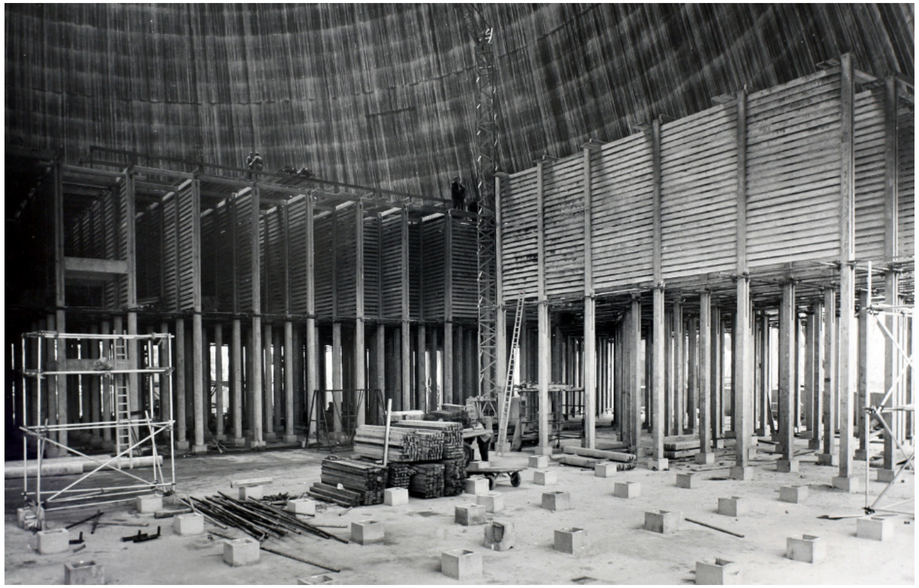
(**a**) Cooling tower field during groundworks, CEGB photo ref. A144027, dated 04.12.1964.



(**b**) Cooling tower 2a early in construction, CEGB photo ref. RAT.243, dated 15.04.1965.



(**c**) Cooling tower 2b/1b during construction, completed 1a / 2a in background CEGB photo ref. RAT.795, dated 06.07.1967.



(**d**) Cooling tower 4a during erection of cooling pack, CEGB photo ref. RAT.754, dated 14.04.1967.

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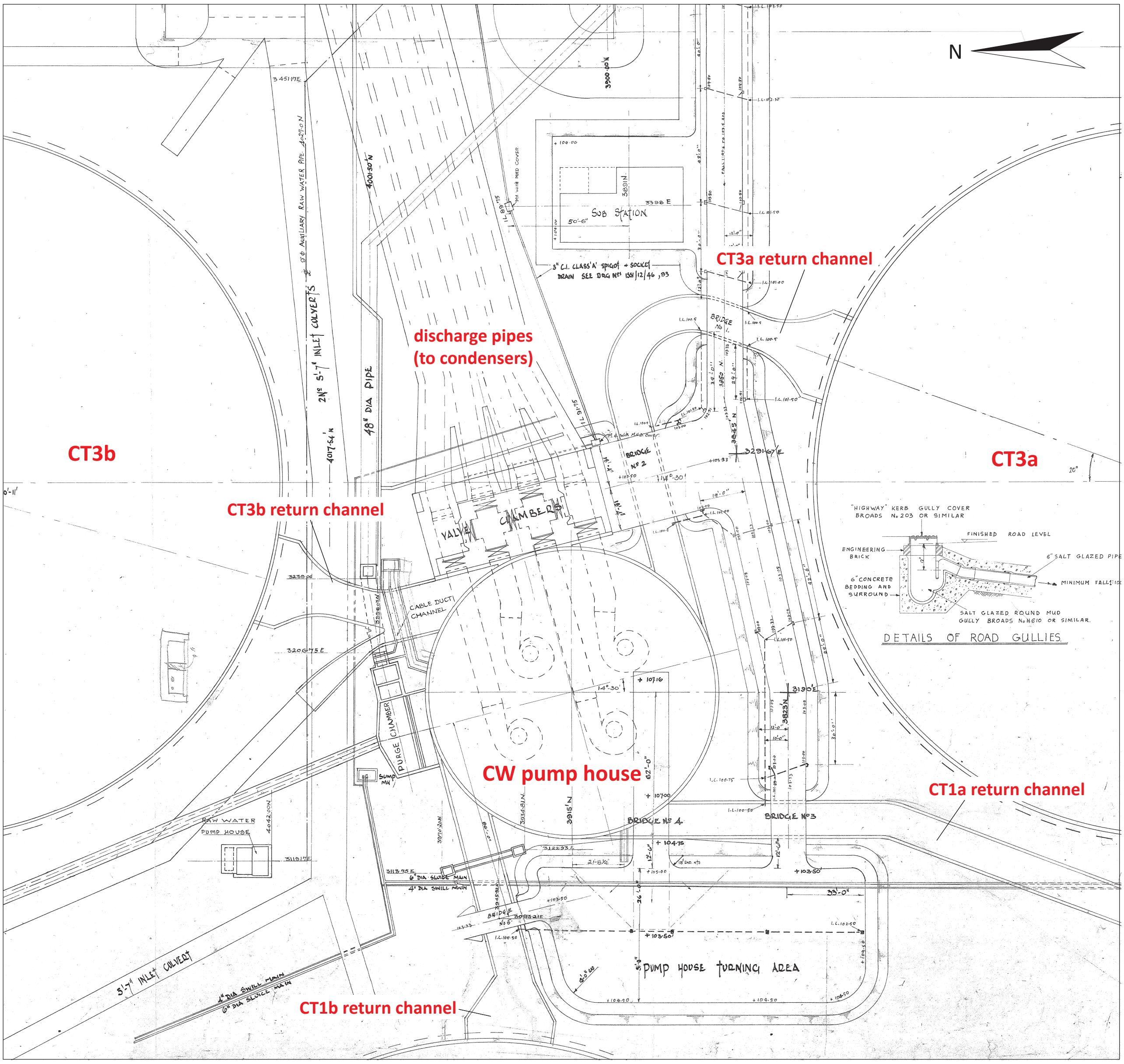
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 16: Cooling Towers: historical CEGB record photographs of construction process



0 50 100m

Approx. scale in metres

Approx. scale in feet

0 300ft.

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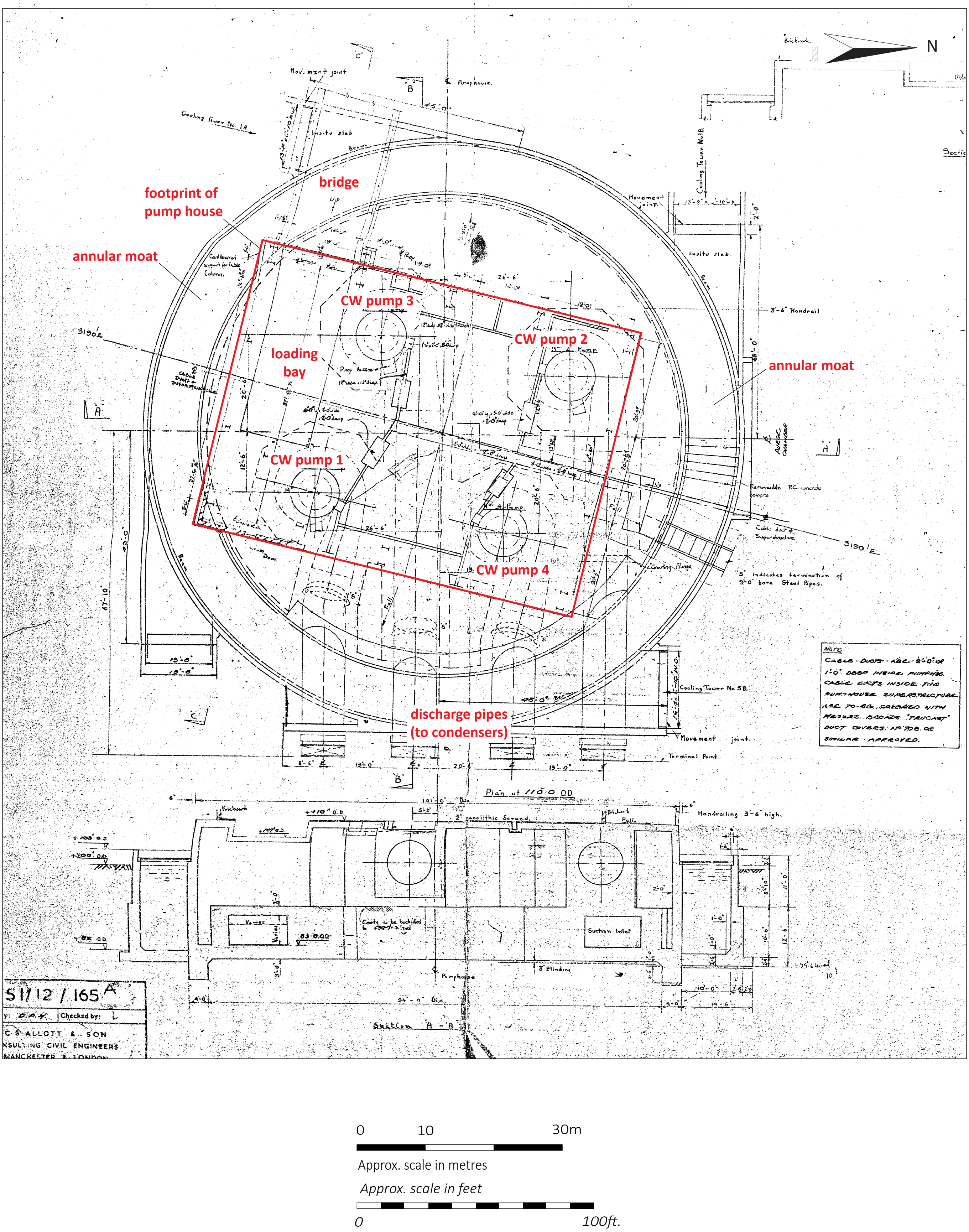
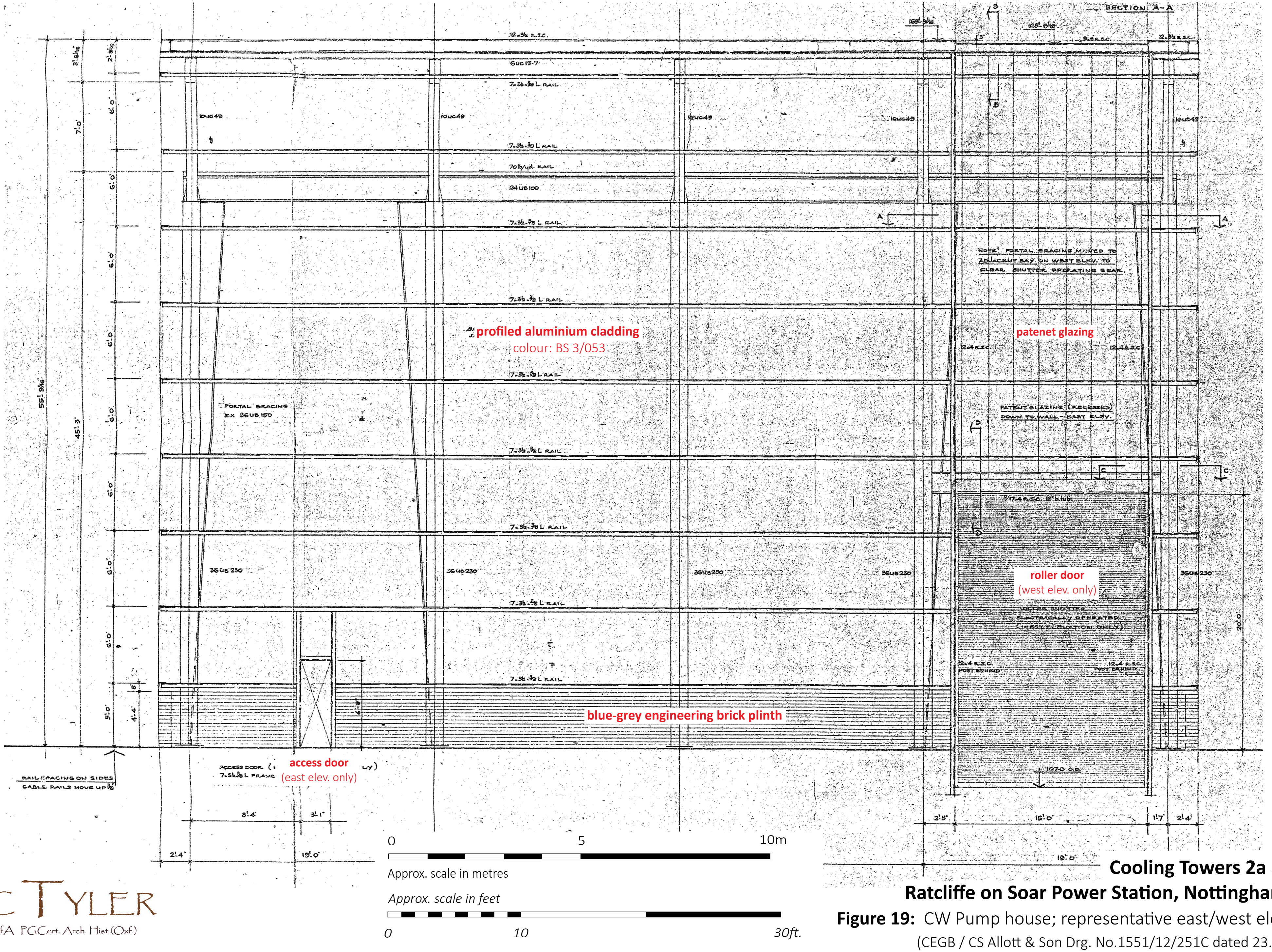
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire

Figure 17: Circulating Water pump house; general arrangements

(CEGB Drg. No. 1551/12/35D dated 09.01.1964)



Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 18: Circulating Water pump house; plan
(CEGB Drg. No. 1551/12/165A dated 09.11.1963)



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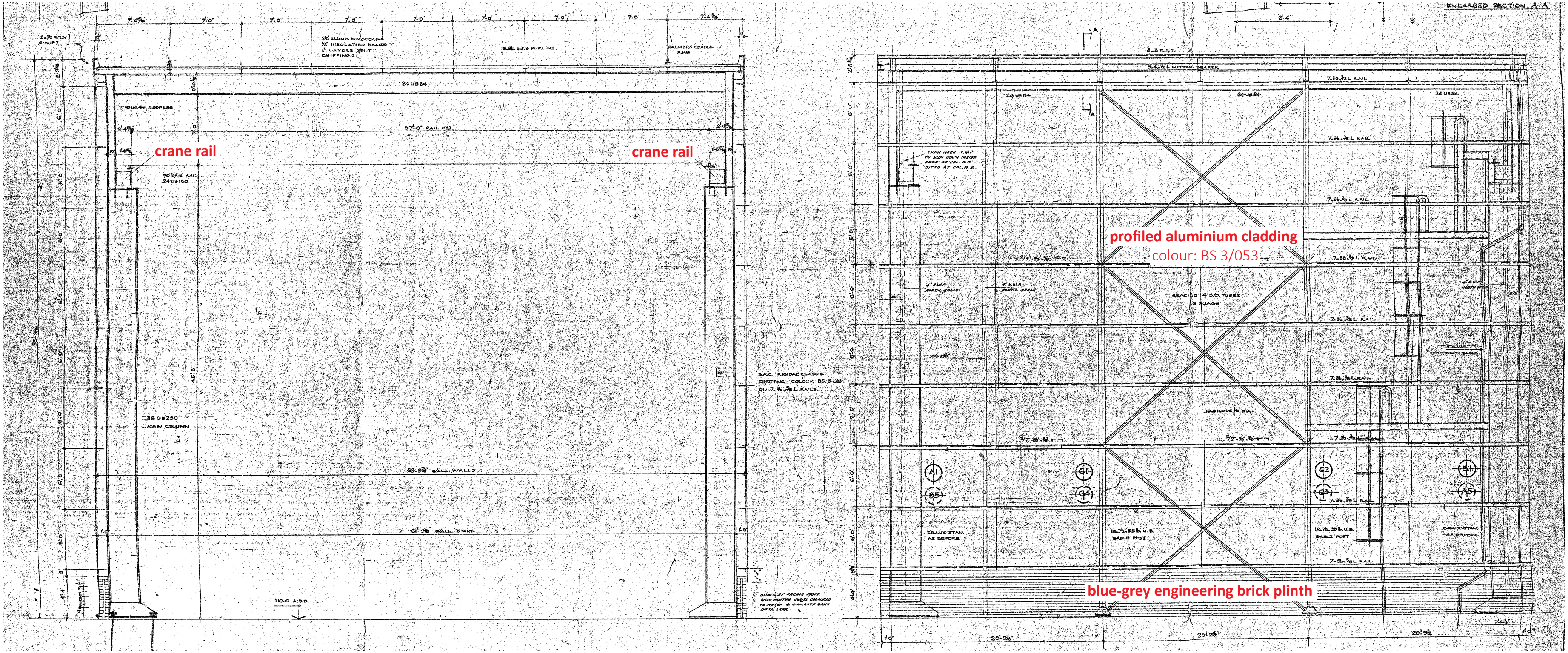
Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 19: CW Pump house; representative east/west elevation
(CEGB / CS Allott & Son Drg. No.1551/12/251C dated 23.09.1964)



(**a**) transverse cross section

(**b**) representative north / south elevation

0 5 10m

Approx. scale in metres

Approx. scale in feet

0 10 30ft.

Cooling Towers 2a and 4a

Ratcliffe on Soar Power Station, Nottinghamshire

Figure 20: CW Pump house; representative north/south elevation and cross-section

(CEGB / CS Allott & Son Drg. No.1551/12/250E dated 18.03.1964)

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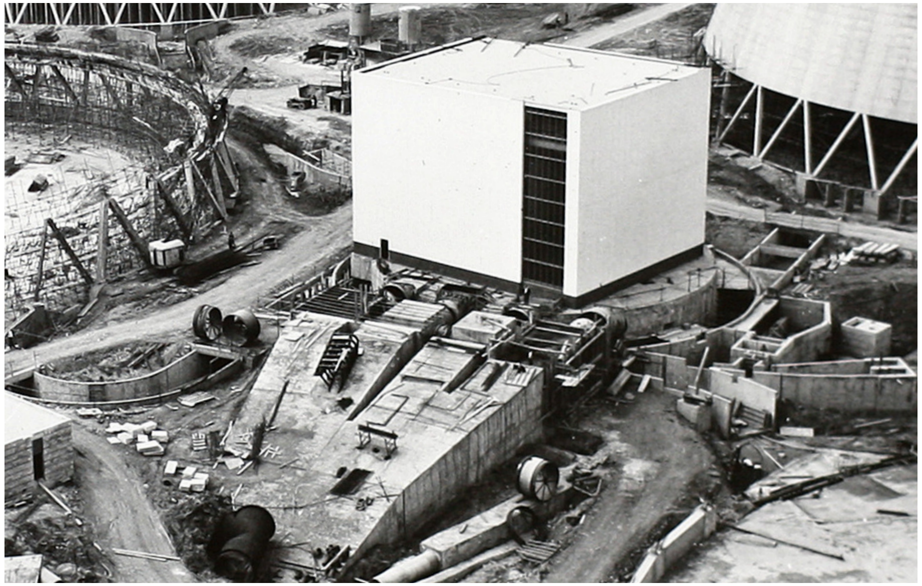
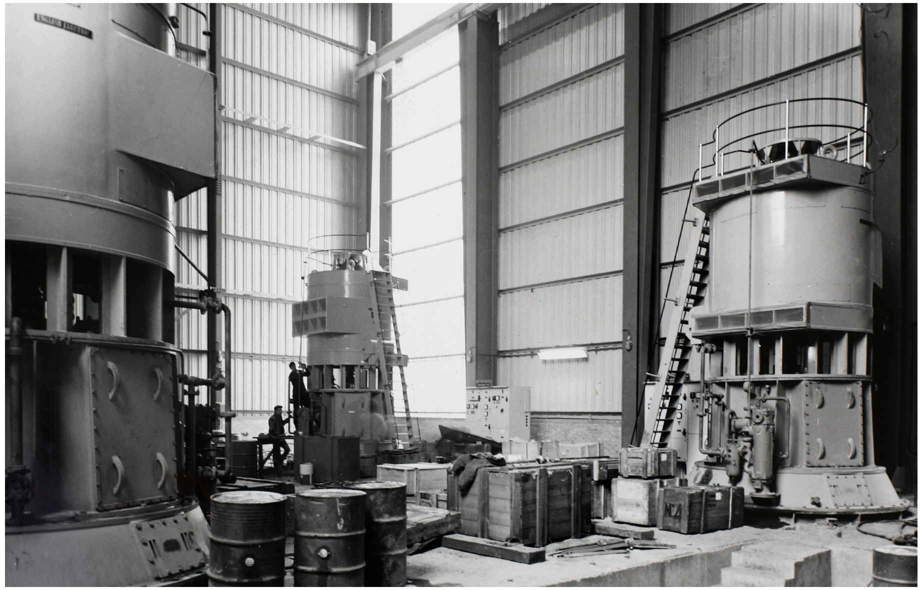
(**a**) CW pump house pedestal/moat/pipework under construction, CEGB photo RAT.275, dated 14.05.1965.

(**b**) CW pump house frame complete; CEGB photo ref. RAT.397, dated 15.10.1965.



(**c**) CW pump house, exterior cladding complete; CEGB photo ref. RAT.556, dated 02.06.1966 (cropped).



(**d**) CW pump house; fitting out of interior, CEGB photo ref. RAT.756, dated 14.04.1967.

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MCIfA PGCert. Arch. Hist (Oxf.)

Cooling Towers 2a and 4a
Ratcliffe on Soar Power Station, Nottinghamshire
Figure 21: CW pump house: historical CEGB record photographs of construction process

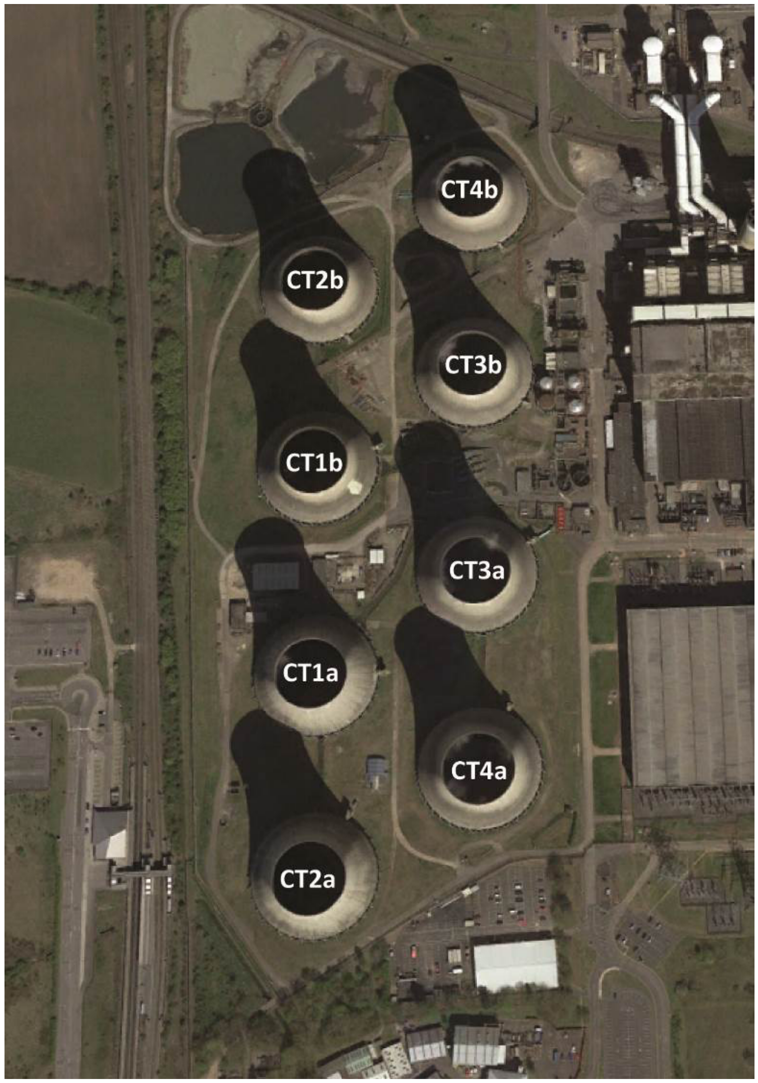

Plate 1: Vertical aerial photograph of cooling tower field (image: © Google Earth).

Plate 2: Medium-range view of cooling towers from A453 looking north-west from bridge over River Soar (Ratcliffe Cut).

Plate 3: Panoramic near-range view of cooling towers looking north from station access road (NGR: SK 49774 29348), Midland Main Line rail lines and East Midlands Parkway rail station of 2007-9 to left; CTs 2a and 4a to foreground (image: © Google Earth).

Plate 4: Near-range view of cooling towers from Redhill Marina (NGR: SK 49337 30028) looking south-east (image: © Google Earth).

Plate 5: Cooling tower 4a looking west.

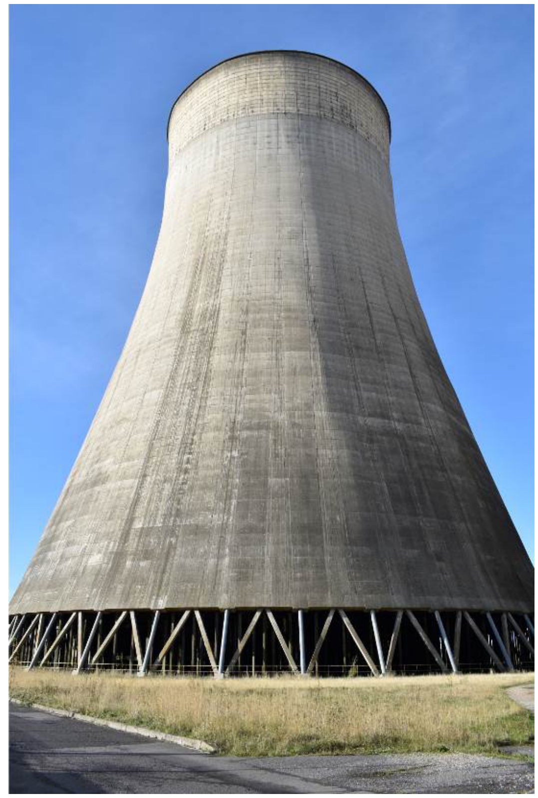

Plate 6: Cooling tower 2a looking north-west.

Plate 7: Primary V-strutting supports to air intake at base of cooling tower 4a.

Plate 8: Detail of V-strutting to CT4a.

Plate 9: Detail of V-strutting with added prop, CT2a.

Plate 10: Primary V-strutting with secondary prop (1990) to air intake at base of cooling tower 2a.

Plate 11: Base of secondary prop, CT2a.

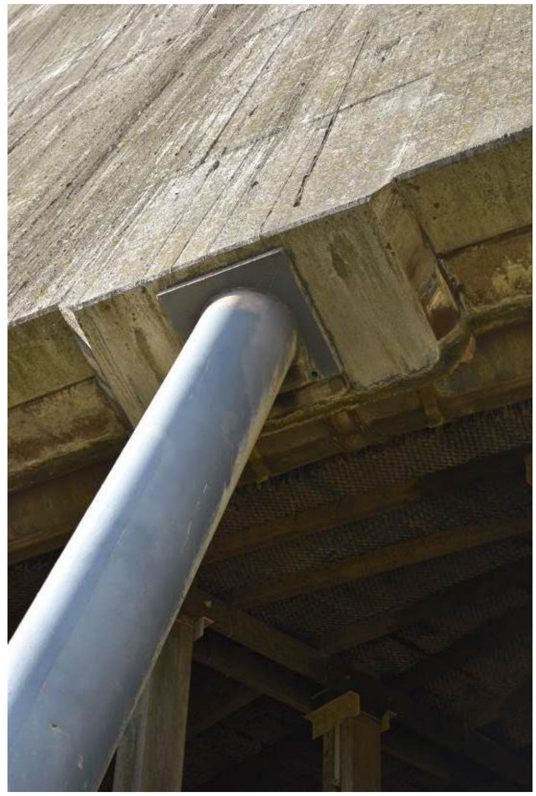

Plate 12: Head of secondary prop supports additional (1990) mantle.

Plate 13: Head of cooling tower 4a.

Plate 14: Head of cooling tower 2a with additional mantle (1990) to throat level.

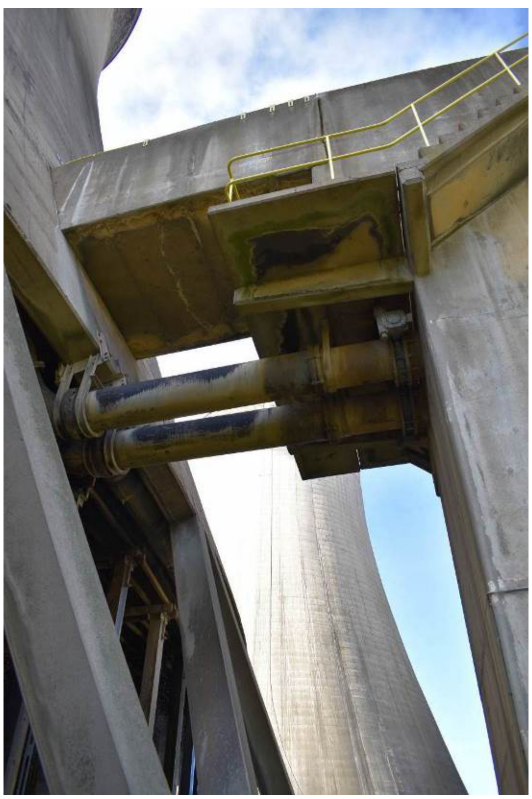

Plate 15: Detail of de-icer pipework feeding off main culvert upriser.

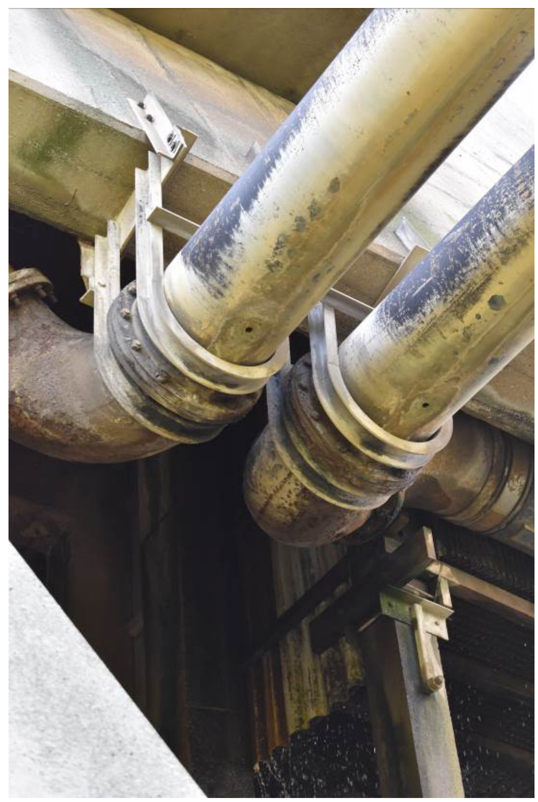

Plate 16: Detail of de-icer pipework.

Plate 17: CT4a access stair.

Plate 18: Detail of cantilevered concrete stair

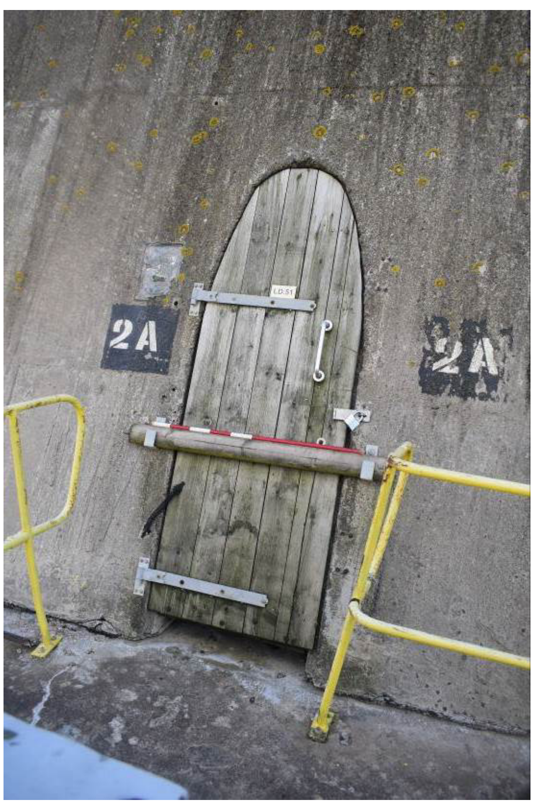

Plate 19: CT2a access door (closed).

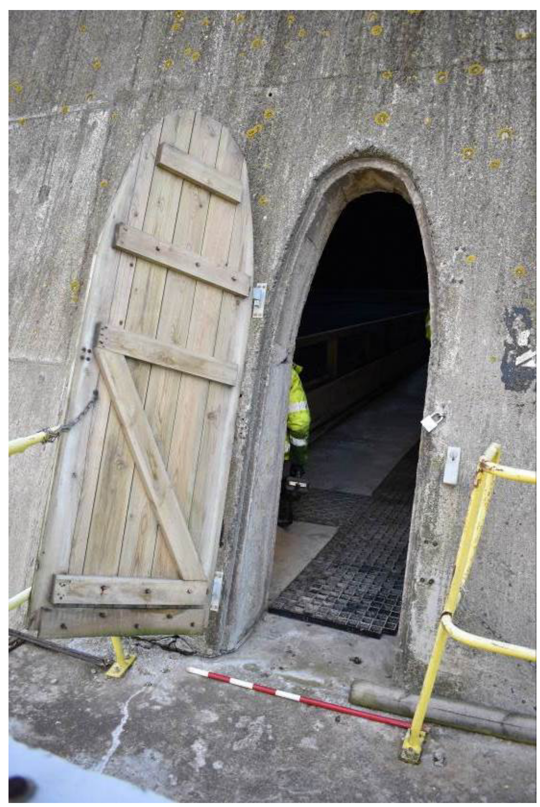

Plate 20: CT2a access door (open).

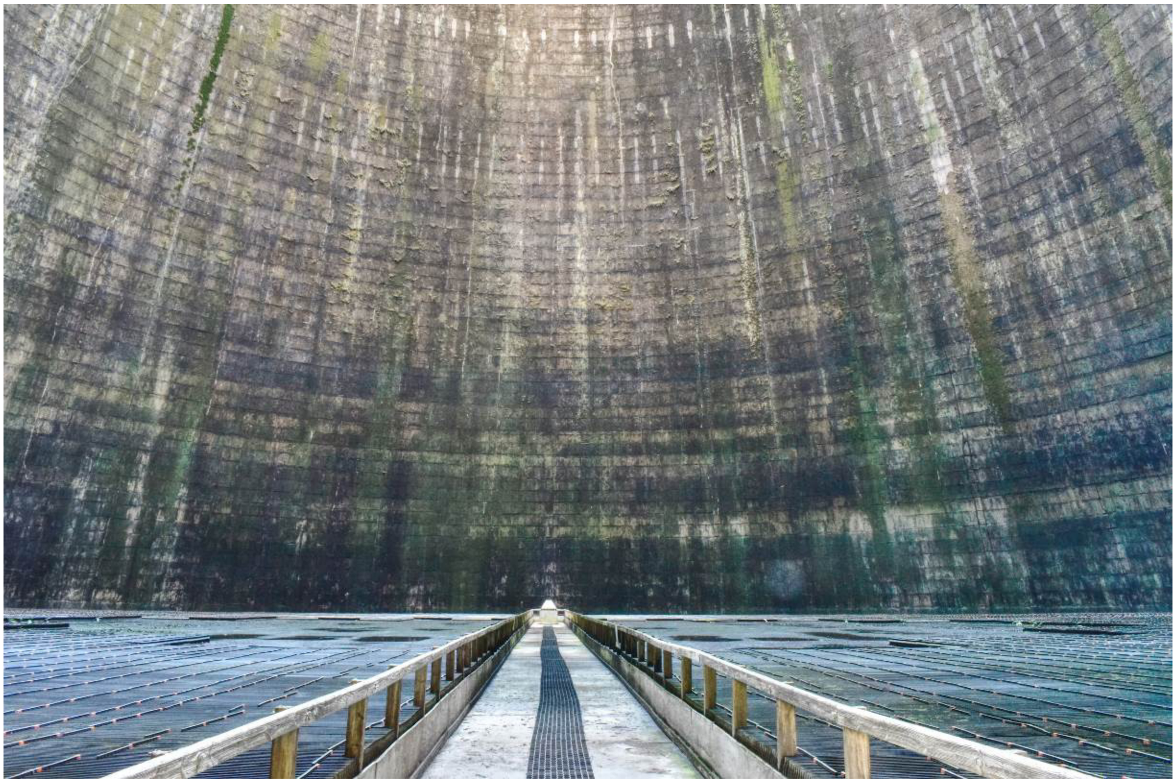

Plate 21: Cooling tower 2a interior at eliminator level, looking south-west along head of main distributor culvert.

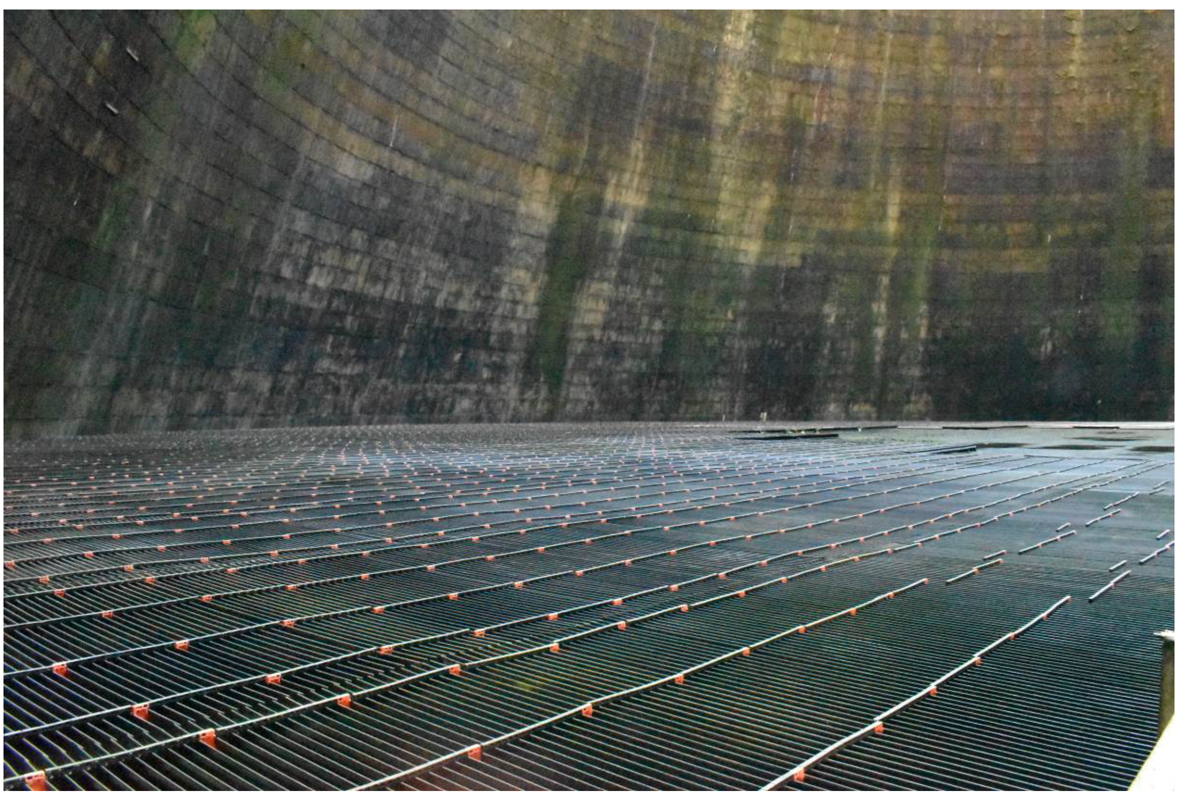

Plate 22: Cooling tower 2a interior; view over (renewed) drift-eliminator.

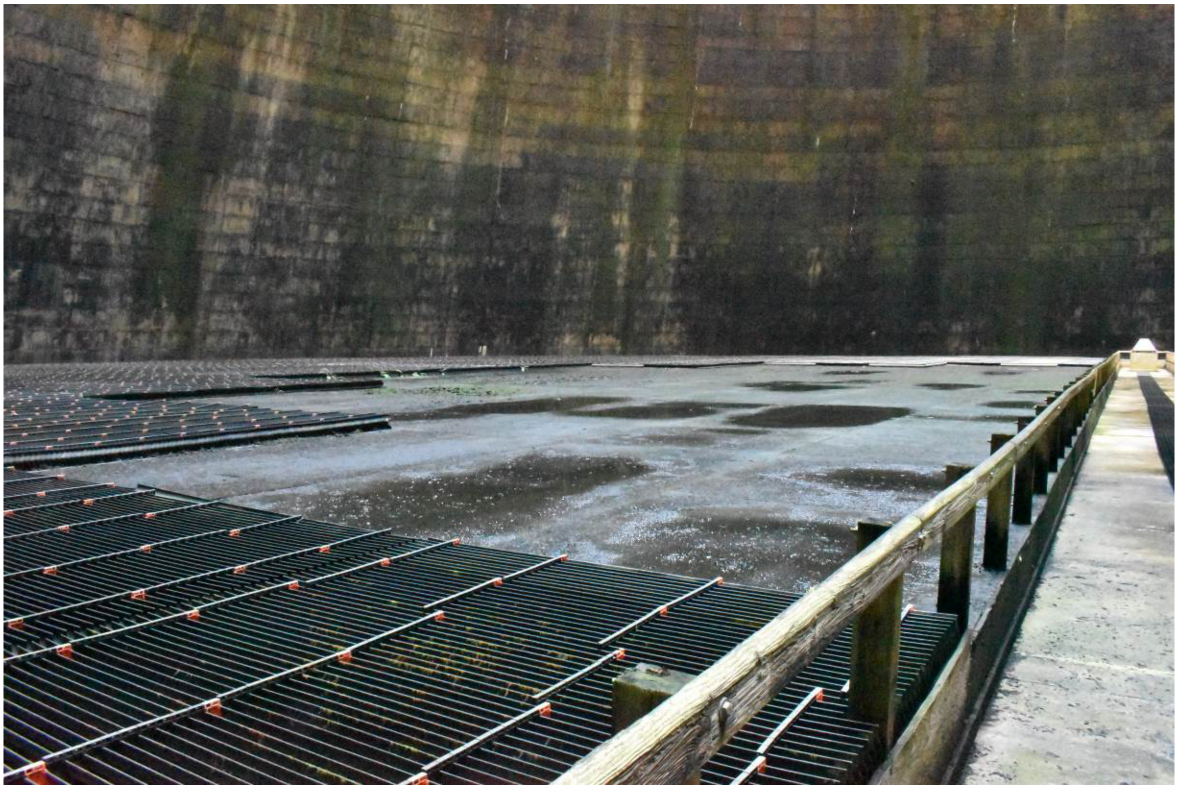

Plate 23: View over 'blanked off' area to centre of refurbished cooling pack.

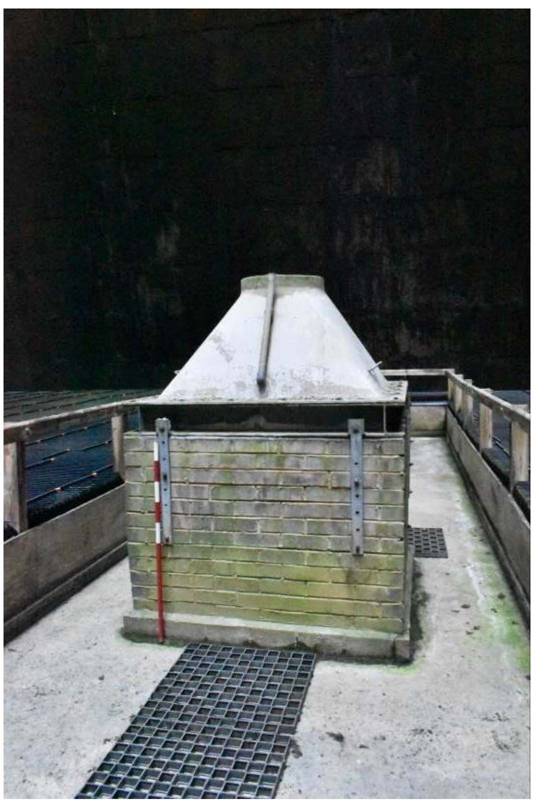

Plate 24: Vent to outer end of main distributor culvert.

Plate 25: Access point to packing level adjacent to door.

Plate 26: Soffit of (replacement) plastic packing units.

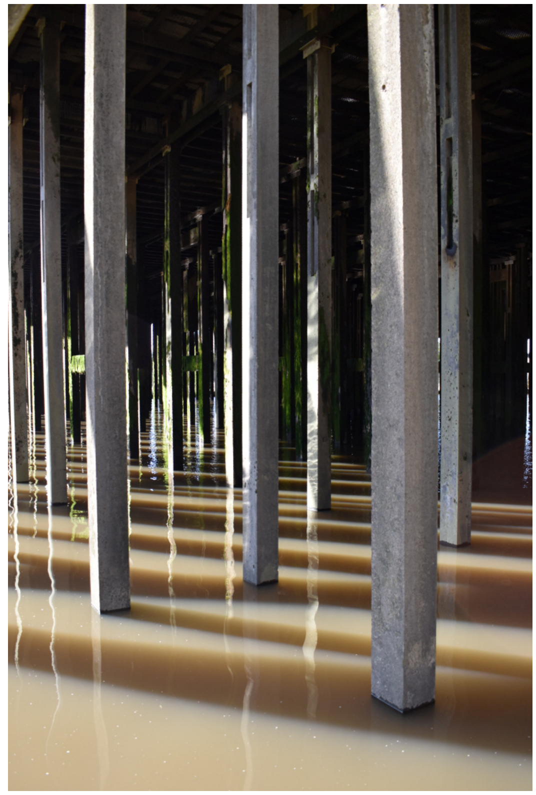

Plate 27: Packing support columns, CT2a.

Plate 28: Distributor pipes supported on concrete beams above packing and below drift eliminator.


Plate 29: Distributor pipes opening off main culvert.


Plate 30: Detail of (renewed) pendant spray head.

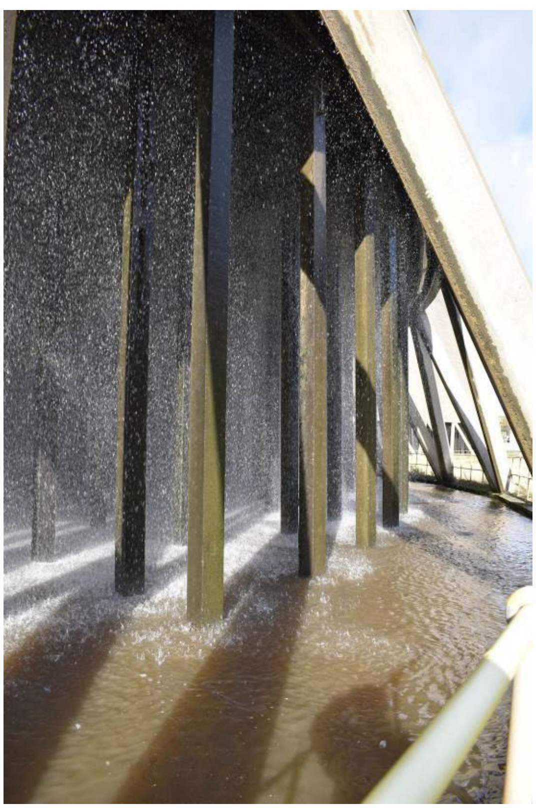
Plate 31: Water falling from pack to pond at CT4a.

Plate 32: Circulating water return channel (netted) between CT3a and CT4a, looking south.

Plate 33: Return channel CT3a / CT4a; pedestrian over-bridge.

Plate 34: Redundant silt sump to pond perimeter of CT4a.

Plate 35: Evidence for former silt pump at pond perimeter to CT2a.

Plate 36: CW pump house looking north-east (CT3b in background).

Plate 37: CW pump house looking west (CT1b in background).

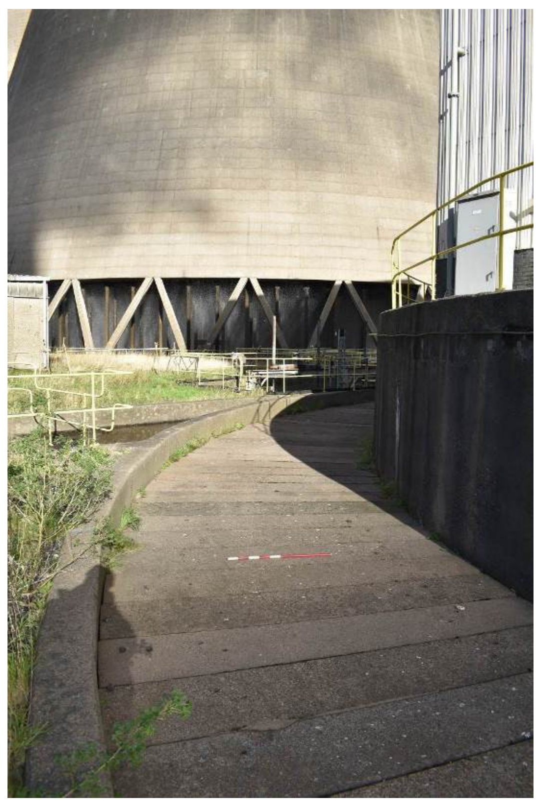

Plate 38: Detail of covered annular moat.


Plate 39: CW pumphouse discharge pipework with CT3a return channel to foreground.


Plate 40: Access bridge and door to south-west angle.


Plate 41: CW Pumphouse interior; loading bay.

Plate 42: CW Pumphouse interior; view looking south-east.

Plate 43: CW Pumphouse interior; view looking north-east.

Plate 44: CW pump No.1 gearing unit and motor (1).

Plate 45: CW pump No.1 gearing unit and motor (2).

Plate 46: Pump 1 and 4 control panels to east side of CW pump house.

Plate 47: Detail of 30-ton travelling crane (with inset of Lysaght's makers plate).

Plate 48: Dismantling pit and associated access stair adjacent to CW pump 2.

APPENDIX A: Historic England Assessment Report, 2017

Decision Summary

This building has been assessed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended for its special architectural or historic interest. The asset currently does not meet the criteria for listing. It is not listed under the Planning (Listed Buildings and Conservation Areas) Act 1990 as amended.

Name: Ratcliffe-on-Soar Power Station

Reference Number: 1444012

Location

Ratcliffe-on-Soar Power Station, Ratcliffe-On-Soar, Nottinghamshire, NG11 0EE

The building may lie within the boundary of more than one authority.

County: Nottinghamshire
District: Rushcliffe
District Type: District Authority
Parish: Ratcliffe on Soar

National Park: Not applicable to this List entry.

Decision Date: 25-Jan-2017

Description

Reasons for currently not Listing the Building

Historic England is assessing Ratcliffe-on-Soar Power Station for listing. It is currently due to close by 2025. This is part of a strategic approach to assessing power stations prior to decommissioning. The aim is to provide clarity and prevent planning delays, which could potentially result from listing applications received from the public at a late stage in the process. Historic England has also produced research and a set of best practice guidelines for recording later C20 power stations in order to support power companies in the decommissioning process (available at: https://historicengland.org.uk/research/current-research/assessing-significance/industry-and-infrastructure/power-stations/).

Ratcliffe-on-Soar Power Station is a coal-fired power station built in 1963-67 to the design of the consultant architects Godfrey Rossant and Jerzy Gebarowicz (Building Design Partnership). The assessment of Ratcliffe-on-Soar Power Station is set against the Principles of Selection for Listing Buildings (DCMS, March 2010) which state that particularly careful selection is required for buildings from the period after 1945. Our Listing Selection Guide for Utilities and Communications Structures (April 2011) expands on this and explains that utility buildings have to be assessed in terms of special architectural, planning, engineering and technological interest, as well as completeness, relative date and rarity.

Judged against the designation criteria, Ratcliffe-on-Soar Power Station is not recommended for listing for the following principal reasons: * Lack of architectural interest: the power station is insufficiently distinguished from the generality of such buildings; it was closely modelled on the earlier Ferrybridge Power Station (1961-66) and is, to a large part, based on standard designs; * Lack of technological interest: the power station is one of a generation of similar sites and is not considered to carry major technological innovations; * Rarity: the buildings, including the cooling towers, are of relatively common types which survive at many power station sites of this generation across the country.

CONCLUSION

Ratcliffe-on-Soar Power Station does not meet the criteria for listing. However, in recognition of the contribution it has made to England's energy needs and the profound impact on the surrounding landscape, the power station should be recorded prior to decommissioning as set out in the best practice guidelines (and in accordance with the National Planning Policy Framework).

SOURCES

Clarke, J, 20th-Century Coal and Oil-Fired Electric Power Generation, Historic England Introduction to Heritage Assets (2015), available at https://HistoricEngland.org.uk/images-books/publications/iha-20thcentury-coal-oil-fired-electric-power-generation/ Clarke, J, 'High Merit': existing post-war coal and oil-fired power stations in context, (2015), available at https://historicengland.org.uk/images-books/publications/high-merit-post-war-coal-oil-fired-power-stations/

National Grid Reference: SK5025930163

This copy shows the entry on 20-Oct-2021 at 10:25:53

APPENDIX B: Register of Project Photographs

NB: All photographs taken with Nikon D3500 digital SLR camera. Photos highlighted in **BOLD** at Column 1 are reproduced as plates within the current document with associated plate references listed at Column 2.

Photo No.	Plate No.	Subject	Orientation	Date	Photographer
DSC_0002		Cooling tower 4a looking west	→ W	02.11.21	R Tyler
DSC_0003*	**5**	Cooling tower 4a looking north-west	→ NW	02.11.21	R Tyler
DSC_0004		Eastern row of CT field (2b/1b to foreground), looking north-west (landscape)	→ NW	02.11.21	R Tyler
DSC_0005		Eastern row of CT field (2b/1b to foreground), looking north-west (portrait)	→ NW	02.11.21	R Tyler
DSC_0006*	**7**	Primary v-strutting to air intake of CT4a	detail	02.11.21	R Tyler
DSC_0007*	**8**	Primary v-strutting to air intake of CT4a	detail	02.11.21	R Tyler
DSC_0008		Packing support columns and falling water, CT4a	detail	02.11.21	R Tyler
DSC_0009		Packing support columns and falling water, CT4a	detail	02.11.21	R Tyler
DSC_0010*	**31**	V-strutting, pack support columns and falling water, CT4a	detail	02.11.21	R Tyler
DSC_0011		Western row of CT field (2a/1a to foreground), looking north (portrait)	→ N	02.11.21	R Tyler
DSC_0012		De-icer ring and water falling from packing of CT4a	↑	02.11.21	R Tyler
DSC_0013		Looking up shell of CT4a (landscape)	↑	02.11.21	R Tyler
DSC_0014		Looking up shell of CT4a (portrait)	↑	02.11.21	R Tyler
DSC_0015*	**17**	Concrete upriser / access stair CT4a	→ W	02.11.21	R Tyler
DSC_0016		Concrete upriser / access stair CT4a	→ NW	02.11.21	R Tyler
DSC_0017*	**15**	CT4a; detail of de-icer feed pipework	↑	02.11.21	R Tyler
DSC_0018		CT4a; detail of de-icer feed pipework	↑	02.11.21	R Tyler
DSC_0019*	**16**	CT4a; detail of de-icer feed pipework	↑	02.11.21	R Tyler
DSC_0020		CT4a; detail of de-icer feed pipework	↑	02.11.21	R Tyler
DSC_0021		Water falling from packing of CT4a	detail	02.11.21	R Tyler
DSC_0022		Water falling from packing of CT4a	detail	02.11.21	R Tyler
DSC_0023		(CT1a looking west)	→ W	02.11.21	R Tyler
DSC_0024		CW return channel opening off pond of CT4a	→ SW	02.11.21	R Tyler
DSC_0025*	**33**	Pedestrian overbridge to CT4a/3a return channel	→ NW	02.11.21	R Tyler
DSC_0027*	**32**	CW return channel opening off pond of CT4a (landscape)	→ S	02.11.21	R Tyler
DSC_0028		CW return channel opening off pond of CT4a (portrait)	→ S	02.11.21	R Tyler
DSC_0029		CT2a looking south-west	→ SW	02.11.21	R Tyler
DSC_0030		(Concrete upriser / access stair CT1a)	→ NW	02.11.21	R Tyler
DSC_0031		(Concrete upriser / access stair CT1a)	→ N	02.11.21	R Tyler
DSC_0035*	**6**	CT2a looking west	→ W	02.11.21	R Tyler
DSC_0036		CT2a looking west	→ W	02.11.21	R Tyler
DSC_0037*	**10**	Primary v-strutting and secondary props to air intake of CT2a	detail	02.11.21	R Tyler
DSC_0038*	**9**	Primary v-strutting and secondary props to air intake of CT2a	detail	02.11.21	R Tyler
DSC_0039*	**11**	Detail of block footing to base of secondary prop, CT2a	detail	02.11.21	R Tyler
DSC_0040*	**12**	Detail of head of secondary prop, CT2a, supporting additional, 1990 mantle (portrait)	↑	02.11.21	R Tyler
DSC_0041		Detail of head of secondary prop, CT2a, supporting additional, 1990 mantle (landscape)	↑	02.11.21	R Tyler
DSC_0042		Primary v-strutting and secondary props to air intake of CT2a	detail	02.11.21	R Tyler
DSC_0043		Packing support columns, CT2a	detail	02.11.21	R Tyler
DSC_0044*	**26**	Soffit of plastic packing units, CT2a	↑	02.11.21	R Tyler
DSC_0045*	**27**	Packing support columns and falling water, CT4a	↑	02.11.21	R Tyler
DSC_0046		Looking north along centre-line of CT field (landscape)	→ N	02.11.21	R Tyler
DSC_0047		Looking north along centre-line of CT field (portrait)	→ N	02.11.21	R Tyler
DSC_0048		Looking north along eastern row of CT field	→ N	02.11.21	R Tyler
DSC_0049		Looking north along western row of CT field	→ N	02.11.21	R Tyler

DSC_0050		Detail of head of secondary prop, CT2a, supporting additional, 1990 mantle (landscape)	↑	02.11.21	R Tyler
DSC_0051*	**35**	CT2a; evidence for former silt sump	detail	02.11.21	R Tyler
DSC_0052		Redundant silt sump to SW quadrant CT4a (landscape)	detail	02.11.21	R Tyler
DSC_0053		Redundant silt sump to SW quadrant CT4a (portrait)	detail	02.11.21	R Tyler
DSC_0054*	**34**	Redundant silt sump to SW quadrant CT4a (landscape)	detail	02.11.21	R Tyler
DSC_0055		Redundant silt sump to SW quadrant CT4a (penstock valve)	detail	02.11.21	R Tyler
DSC_0056		Redundant silt sump to SW quadrant CT4a (landscape)	detail	02.11.21	R Tyler
DSC_0057		Water falling from packing of CT4a	detail	02.11.21	R Tyler
DSC_0058		CT4a silt sump, sluice main valve (by Hopkinsons of Hudderfield)	detail	02.11.21	R Tyler
DSC_0059*	**14**	Head of CT2a showing additional (1990) mantle	↑	02.11.21	R Tyler
DSC_0061		De-icer pipework, CT2a	↑	02.11.21	R Tyler
DSC_0062		Soffit of packing units, CT2a	↑	02.11.21	R Tyler
DSC_0063*	**18**	Detail of cantilvered access stair, CT2a	detail	02.11.21	R Tyler
DSC_0064		De-icer pipework, CT2a	↓	02.11.21	R Tyler
DSC_0065		Detail of de-icer supply, hand-operated sluice valves	detail	02.11.21	R Tyler
DSC_0066		CT1b seen from access slab of CT2a	→ NE	02.11.21	R Tyler
DSC_0067		Return channel (CT2a-1a) from access slab of CT2a	↓	02.11.21	R Tyler
DSC_0068		Access door to CT2a, open	detail	02.11.21	R Tyler
DSC_0069*	**20**	Access door to CT2a, open	detail	02.11.21	R Tyler
DSC_0071*	**21**	View along top of distributor culvert, CT2a (landscape)	→ SW	02.11.21	R Tyler
DSC_0072		View along top of distributor culvert, CT2a (portrait)	→ SW	02.11.21	R Tyler
DSC_0073		View along top of distributor culvert, CT2a (portrait)	→ SW	02.11.21	R Tyler
DSC_0074		View along top of distributor culvert, CT2a (portrait)	→ SW	02.11.21	R Tyler
DSC_0076*	**22**	CT2a; view across drift eliminator screen	→ E	02.11.21	R Tyler
DSC_0077*	**23**	CT2a; 'blanked off' area to centre of drift eliminator	→ S	02.11.21	R Tyler
DSC_0078		CT2a; 'blanked off' area to centre of drift eliminator	→ S	02.11.21	R Tyler
DSC_0079		CT2a; detail of drift eliminator screen	detail	02.11.21	R Tyler
DSC_0083		View along top of distributor culvert, CT2a (portrait)	→ NE	02.11.21	R Tyler
DSC_0084		Vent to SW end of distributor culvert	→ SW	02.11.21	R Tyler
DSC_0085*	**24**	Vent to SW end of distributor culvert	→ SW	02.11.21	R Tyler
DSC_0086*	**25**	Access stair to packing level	detail	02.11.21	R Tyler
DSC_0090		Access stair to packing level, adj. doorway	→ NE	02.11.21	R Tyler
DSC_0091		CT2a, packing level; view over distributor pipes	→ S	02.11.21	R Tyler
DSC_0092		CT2a, packing level; detail of pendant spray head	detail	02.11.21	R Tyler
DSC_0093		CT2a; detail of distributor pipes opening off main culvert	detail	02.11.21	R Tyler
DSC_0094*	**29**	CT2a; detail of distributor pipes opening off main culvert	detail	02.11.21	R Tyler
DSC_0095*	**28**	CT2a, packing level; view over distributor pipes	→ S	02.11.21	R Tyler
DSC_0096		CT2a, packing level; view over distributor pipes	→ S	02.11.21	R Tyler
DSC_0097*	**30**	CT2a, packing level; detail of pendant spray head	detail	02.11.21	R Tyler
DSC_0098		CT2a, packing level; view over distributor pipes	→ S	02.11.21	R Tyler
DSC_0100		CT2a, packing level; view over distributor pipes	→ S	02.11.21	R Tyler
DSC_0101		CT2a, packing level; view over distributor pipes	→ S	02.11.21	R Tyler
DSC_0103		CT2a, packing level; head of support column	detail	02.11.21	R Tyler
DSC_0104		CT2a, packing level; head of support column	detail	02.11.21	R Tyler
DSC_0105*	**19**	Access door to CT2a, closed	detail	02.11.21	R Tyler
DSC_0106		Vent to NE end of distributor culvert	→ SW	02.11.21	R Tyler
DSC_0107		CT2a looking west	→ W	02.11.21	R Tyler
DSC_0108		CT2a looking west (with 4a to foreground)	→ W	02.11.21	R Tyler
DSC_0109*	**13**	Head of CT4a	↑	02.11.21	R Tyler
DSC_0110		CW pump house; general view (portrait)	→ NE	02.11.21	R Tyler
DSC_0111*	**36**	CW pump house; general view (landscape)	→ NE	02.11.21	R Tyler
DSC_0112		CW pump house; general view (landscape)	→ NW	02.11.21	R Tyler
DSC_0113*	**37**	CW pump house; general view (portrait)	→ NW	02.11.21	R Tyler
DSC_0114		CW pump house; discharge pipework to east elevation	→ NW	02.11.21	R Tyler
DSC_0115*	**39**	CW pump house; discharge pipework to east elevation	→ NE	02.11.21	R Tyler
DSC_0116		CW pump house; detail of annular moat	detail	02.11.21	R Tyler
DSC_0117*	**38**	CW pump house; detail of annular moat	detail	02.11.21	R Tyler

DSC_0118		CW pump house; access bridge over annular moat	→ NE	02.11.21	R Tyler
DSC_0119		CW pump house; access bridge (portrait)	→ NE	02.11.21	R Tyler
DSC_0120*	**40**	CW pump house; view across bridge to roller door	→ E	02.11.21	R Tyler
DSC_0121		CW pump house; detail of annular moat (south side)	→ E	02.11.21	R Tyler
DSC_0122*	**41**	CW pump house; loading bay to south side	→ E	02.11.21	R Tyler
DSC_0124		CW pump house; general interior view looking NW	→ NW	02.11.21	R Tyler
DSC_0125*	**42**	CW pump house; general interior view looking NW	→ NW	02.11.21	R Tyler
DSC_0126*	**44**	CW pump 1; gearing unit and motor	→ N	02.11.21	R Tyler
DSC_0127		CW pump 1; gearing unit and motor	→ N	02.11.21	R Tyler
DSC_0128*	**45**	CW pump house; general interior view looking SE	→ SE	02.11.21	R Tyler
DSC_0129*	**48**	Dismantling pit adj. CW pump no.2 (landscape)	→ NW	02.11.21	R Tyler
DSC_0130		Dismantling pit adj. CW pump no.2 (portrait)	→ NW	02.11.21	R Tyler
DSC_0131		Dismantling pit adj. CW pump no.2 (portrait)	→ NW	02.11.21	R Tyler
DSC_0132		Dismantling pit adj. CW pump no.2 (portrait)	→ NW	02.11.21	R Tyler
DSC_0133		Instrumentation panels to west side of CWPH	detail	02.11.21	R Tyler
DSC_0134		30-ton overhead travelling crane	↑	02.11.21	R Tyler
DSC_0135*	**47**	30-ton overhead travelling crane	↑	02.11.21	R Tyler
DSC_0136		30-ton overhead travelling crane (makers plate)	detail	02.11.21	R Tyler
DSC_0137		30-ton overhead travelling crane (detail)	↑	02.11.21	R Tyler
DSC_0138*	**46**	Instrumentation panels to east side of CWPH	detail	02.11.21	R Tyler
DSC_0139		Detail of instrumentation panel	detail	02.11.21	R Tyler
DSC_0140		Detail of instrumentation panel	detail	02.11.21	R Tyler
DSC_0142*	**43**	CW pump house; general interior view looking NE	→ NE	02.11.21	R Tyler
DSC_0143		CW pump house; general interior view looking NE	→ NE	02.11.21	R Tyler
DSC_0144		General view of CTs from 400kV access road	→ W	02.11.21	R Tyler
DSC_0145		General view of CTs from 400kV access road	→ W	02.11.21	R Tyler
DSC_0146		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0147		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0148		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0149		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0150		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0151		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0152		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0153		General view of CTs from car park	→ NW	02.11.21	R Tyler
DSC_0154		General view of CTs from Redhill Marina access road	→ E	02.11.21	R Tyler
DSC_0155		General view of CTs 1a/2a from Redhill Marina access road	→ SE	02.11.21	R Tyler
DSC_0156		General view of CTs 1a/4a from station access road	→ N	02.11.21	R Tyler

APPENDIX C: OASIS Project Summary Sheet

OASIS PROJECT Ref. rictyler1-502990		
Project Details		
Project Name	**Cooling Towers 2a and 4a, Ratcliffe on Soar Power Station, Nottinghamshire**	
Project Type	Heritage Assessment and Building Record (Level 2)	
Monument Type	Power Station: Modern (1901 to present)	
Short Description	A programme of heritage assessment and building recording (Level 2) was undertaken in November 2021 in respect of the two southernmost cooling towers and associated circulating water (CW) structures at Ratcliffe on Soar Power Station, Nottinghamshire. The project was undertaken as a part of compensation mitigation measures associated with the construction of a new 'Energy from Waste' (EfW) facility, known as the East Midlands Energy Re-Generation (EMERGE) Centre, to be erected adjacent to the main power station site. Ratcliffe was one of 13 oil- and coal-fired power stations based around the 500MW turbo-generator set built by the Central Electricity Generating Board (CEGB) during the 1960s; released for construction in 1963, the plant was completed in 1967 and first commissioned in 1968. Ratcliffe is furnished with a total of eight natural-draught cooling towers of hyperbolic profile, arranged in a single 'field' in two parallel lines of four, staggered to form a double 'lozenge' pattern. The cooling towers under consideration (designated 2a and 4a) comprise the southernmost towers of each row. The towers were erected by specialist contractors Bierrum and Partners to British Standard (BS) specification and are essentially similar in form, though the external mantle of tower 4a was enhanced during the construction phase, while tower 2a was subject to a phase of secondary re-strengthening in 1990, when an additional concrete mantle to throat level and associated steel props to the base of the shell were introduced. The distributor pipework, packing and drift eliminator elements of all CTs were replaced between 2009 and 2012. The associated CW pump house, fed by above ground return channels, is of a distinctive 'annular' moat design, similar to the pumphouse at Ratcliffe's 'mother' station at Ferrybridge 'C'. While of historical interest and significance at a 'local' level, the cooling towers and wider power station site have been recently assessed by Historic England as being insufficiently innovative in terms of technology, planning or design to be deemed of 'special interest' within a national context. The current study presents a 'point in time' record of the Ratcliffe on Soar cooling towers and will, once expanded to cover the wider site, add to a growing corpus of material on the 500MW unit programme as a whole	
Associated Reference Codes	Rushcliffe Borough Council: Planning Application No.: **20/01826/CTY**	
Project Dates	02.11.21 – 15.11.21	
Previous Work	Yes: DBA undertaken as part of Environmental Statement (Uniper, 2020; Section 13)	
Future Work	Yes: Site-wide study of power station upon decommissioning	
Project Location		
Site Location	Ratcliffe on Soar Power Station, Nottinghamshire NG11 0EE	
Site Co-Ordinates	SK 50135 30025 (point)	
Study Area	*c*.10a (of total 115ha power station site)	
Height	*c*.30m AOD	
Project Creators		
Name of Organisation	Ric Tyler MCI*f*A (Buildings Archaeologist)	
Project Brief originator	No brief issued	
Project Design originator	No 'Project Design' issued (approach and methodology approved in advance with Nottinghamshire CC)	
Project Manager	Ric Tyler	
Project Supervisor	Ric Tyler	
Project Sponsor	Developer (Uniper)	
Significant Finds	n/a	
Project Archives	**Intended final location of archive**	**Content**
Physical	n/a	n/a
Paper	n/a	n/a
Digital	n/a	n/a
Bibliography		
Tyler R, 2021. 'Southernmost Cooling Towers, Ratcliffe-on-Soar Power Station, Nottinghamshire: Heritage Assessment, 2021'. R. Tyler Rep. No. **2021.006** <u>Report Format</u>: A4 digital (PDF) report; 34 pages text; 21 figures; 48 colour plates; four appendices.		

APPENDIX D: Gazetteer of 500MW unit coal-fired power stations

1. ABERTHAW 'B', S WALES

NGR: centred on ST 02451 66270

Construction dates: 196?-71
Commissioned: 1971
Status: closed March 2020

CEGB:
Architects:
Engineers:
Landscape Architects:

Aberthaw Power Station *is located at Limpert Bay near the villages of Gileston and West Aberthaw in the Vale of Glamorgan, on the South Wales coast 18km south-west of Cardiff. Aberthaw 'A' was built from 1957 and first supplied power to the grid on 7th February 1960, although it was not officially opened until October 1963. It operated until 1995 and has subsequently been demolished, the last elements being the two chimney stacks, demolished on 25th July 1998. Aberthaw 'B' was constructed in the late 1960s and opened in 1971; comprising three turbo-generators with a combined output of 1,500MW, it was one of the smaller stations of the 500MW-unit programme.*

- Site included on National Monuments Record of Wales (NMRW), ref. **269878**.

Operational History:
CEGB (1968-1990); RWE npower

Details:
- 1,500MW capacity comprising x3 500MW turbo-generator sets, longitudinal alignment.
- Boilers by Foster Wheeler.
- Single, three-flue stack.
- No CTs (coastal location, direct cooled).

Major modifications
FGD added from 2006.

- **Historic Building Record Report**: n/k

2. COTTAM, NOTTINGHAMSHIRE

NGR: centred on SK 81290 79140

Construction dates: 1964-68
Commissioned: 1967-8
Status: closed September 2019

CEGB: East Midlands Division, Midlands Project Group
Architects: Yorke, Rosenberg and Mardall (YRM)
Engineers:
Principal Contractor: Balfour Beatty Ltd.
Landscape Architects: Kenneth and Patricia Booth
Cost: *c*.£80m

Cottam Power Station *is located on the west bank of the River Trent in north-eastern Nottinghamshire, hard on the border with Lincolnshire (the river here forming the county boundary), 11.5km east of Retford and 47km north-east of the County town of Nottingham. Built between 1964-8, the station was commissioned in stages between 1967-8 and officially opened in April 1969. Together with West Burton 'A' and Ratcliffe on Soar, 7km to the north and 58.5km south-west respectively, Cottam is one of three broadly contemporary, still operational coal-fired 'super stations' based around the 500MW turbo-generator unit located in the Lower Trent Valley.*

- Site included on Nottinghamshire County Historic Environment Record (HER), ref. **M17773**.
- Assessed by Historic England in December 2017 (Case ID No. **1452750**) as not meeting criteria for statutory listing.
- Certificate of Immunity from Listing issued (ref. **1453882**).

Operational History:
CEGB (1968-1990); Powergen (1990-2000); London Power Company /EDF Energy (2000-2019)

Details:
- 2,000MW capacity comprising x 4 500MW sets (English Electric), transverse alignment.
- Radial condensers.
- Boilers (face-fired) by John Thompson/Clarke Chapman.
- Drag-link feeders and horizontal-spindle PF ball mills (4 per unit).
- Single, four-flue stack by Tileman and Co. (650ft.).
- x 8 hyperbolic CTs by Davenport, arranged in single 'field' (2 parallel rows of 4).
- Common CW pump house with annular moat / tangential return channels.
- Open 400kV switch yard (axial).
- Gas Turbine House originally with x4 English Electric turbines (removed) powered by Rolls-Royce 'Avon' engines.

Awards:
Awarded the 'Hinton Cup', the CEGB's 'good housekeeping award', in 1981/2

Major modifications
Oil Overburn added mid 1970s; Biomass co-firing, early 2000s; FGD added to all four units, 2002-7.

- **Historic Building Record Report**: Tyler R (2018a)

3. DIDCOT 'A', OXFORDSHIRE

NGR: centred on SU 51133 91798

Construction dates: 1964-68
Commissioned: 1968
Status: closed 2013

CEGB: Midlands Project Group
Architects: Frederick Gibberd and Partners
Engineers: CS Allott and Son.
Principal Contractor:
Landscape Architects: Sir Frederick Gibberd
Cost: £104m

Didcot 'A' Power Station *is located to the north of the town of Didcot in central southern Oxfordshire, c.15km south of the county administrative centre at Oxford; it occupies the site of a former MoD Central Ordnance Depot. A CCGT plant, Didcot 'B' was opened in July 1997. Didcot 'A' ceased generation in March 2013, under the terms of LCPD, and is currently undergoing demolition (process interrupted following fatal collapse of part of boiler house in February 2016).*

- Site not included on Oxfordshire County Historic Environment Record (HER).
- Assessed by Historic England in April 2013 (Case ID No. **1414666**) as not meeting criteria for statutory listing.
- Certificate of Immunity from Listing issued (ref. **1454387**).

Operational History:

CEGB (1968-1990); National Power (1990-2000); Innogy (2000-2002); RWE npower (2002-2013)

Details:

- 2,000MW capacity comprising x4 500MW turbo-generator sets, transverse alignment.
- Pannier condensers.
- Single stack (650ft.)
- x 6 CTs split into 2 fields of 3 (triangular arrangement).
- Single, common CW pump house with annular moat / tangential return channels.
- Open 400kV switch yard (axial)
- Gas Turbine House with x4 turbines powered by Bristol-Siddeley (later Rolls Royce) 'Olympus' engines.

Major modifications

No FGD added.

- **Historic Building Record Report**: n/k

4. EGGBOROUGH, NORTH YORKSHIRE

NGR: centred on SE 57939 24215

Construction dates: 1962-67
Commissioned: 1967
Status: closed September 2018

CEGB: Northern Project Group
Architects: Sir Percy Thomas and Son (George Hooper)
Engineers: Rendell, Palmer & Tritton
Principal Contractor:
Landscape Architects: Brenda Colvin
Cost:

Eggborough Power Station *is located between the towns of Knottingley and Snaith on the banks of the River Aire in North Yorkshire, 28km south of the historical county town of York; it is sited just 10km east of Ferrybridge Power Station. Built between 1962 and 1967, the plant was first commissioned in 1967, though was not officially opened until 1970. It represented the 'parent' station to Ironbridge 'B' in Shropshire, with which it shared both project architects and consultant engineers, and shares many common characteristics with the latter station. The plant ceased generation in March 2018, with plans in place for a CCGT plant at the site.* NB: shares design characteristics with Ironbridge

- Site not included on North Yorkshire County Historic Environment Record (HER).
- Assessed by Historic England in January 2017 (Case ID No. **1444011**) as not meeting criteria for statutory listing.
- Certificate of Immunity from Listing issued (ref. **1454426**).

Operational History:
CEGB (1968-1990); National Power (1990-2000); British Energy (2000-2010); Eggborough Power Ltd. (2010-present)

Details:
- 2,000MW capacity comprising x4 500MW sets, transverse alignment.
- Single stack (650ft.).
- x8 CTs in single field (2 parallel rows of 4).
- Enclosed 400kV switch house (axial).
- Gas Turbine house with turbines powered by Bristol-Siddeley (later Rolls Royce) 'Olympus' engines

Awards:
Awarded the 'Hinton Cup', the CEGB's 'good housekeeping award', in 1980/81

Major modifications

FGD added to 2 units.

- **Historic Building Record Report**: Tyler R (2020)

5. FERRYBRIDGE 'C', WEST YORKSHIRE

NGR: centred on SE 48179 24817

Construction dates: 1961-7
Commissioned: 1966
Status: closed March 2016

CEGB: Northern Project Group
Architects: Building Design Partnership (BDP)
Engineers: CS Allott and Son.
Principal Contractor:
Landscape Architects:
Cost:

(**NB**. north to right of image)

Ferrybridge 'C' Power Station *is located on the south bank of the River Aire in West Yorkshire, set between the towns of Knottingley and Castleford, 30km south-west of the historical county town of York; it is sited just 10km west of Eggborough Power Station. Two previous plants, Ferrybridge 'A' and 'B' were commissioned in 1927 and 1957 respectively; though superceded and largely demolished, the A station boiler room/turbine hall has been retained as offices. Ferrybridge 'C' was constructed between 1961-7, with commissioning in stages beginning in 1966. The station was the site of a notable cooling tower collapse on 1st November 1965, prompting a nationwide review of CT construction by the CEGB.*

- Site not included on West Yorkshire Archaeology Advisory Service (WYAAS) Historic Environment Record (HER).
- Assessed by Historic England in October 2015 (Case ID No. **1430640**) as not meeting criteria for statutory listing.
- Certificate of Immunity from Listing issued (ref. **1448208**).

Operational History:

CEGB (1968-1990); Powergen (1990-1999); Eddison Mission Energy (1999-2001); AEP Energy Services (2001-2004); SSE Plc (2004-2016)

Details:

- 2,000MW capacity, comprising x 4 500MW sets (CA Parsons), transverse alignment.
- Split-span crane over turbine hall.
- Babcock vertical-spindle PF mills (8 per unit).
- Double stacks (650ft.).
- x8 CTs (cone-torroid profile) in single field (2 rows of 4, offset).
- Single, common CW pump house with annular moat / tangential return channels.
- Enclosed 400kV switch house (axial).
- Gas Turbine house with x 2 (of original 4) 17.5MW turbines powered by Bristol-Siddeley (later Rolls Royce) 'Olympus' engines

Major modifications:

FGD added to 2 units, 2009

- **Historic Building Record Report**: Scott (2019): AECOM

6. FIDDLER'S FERRY, CHESHIRE

NGR: centred on SJ 54393 86354

Construction dates: 1967-71
Commissioned: 1971
Status: closed March 2020

CEGB: Northern Project Group
Architects: Gordon Graham; Architect's Design Group (ADG)
Engineers:
Principal Contractors: Cleveland Bridge Company
Landscape Architects: in-house
Cost:

Fiddler's Ferry Power Station *is located on the north bank of the River Mersey between Widnes and Warrington in Cheshire, close to the point where the Mersey estuary narrows at the 'Runcorn Gap'. Constructed over a four year period from 1967, the station was officially opened in 1971. In an attempt to combine efforts at design and construction phases, boiler and turbo-generator arrangements were replicated as per West Burton, Nottinghamshire, with which the station thus shares a number of characteristics (eg. split CT fields, longitudinal turbo-generator alignment).*

- Site included on Cheshire County Historic Environment Record (HER), ref. **14304**.

Operational History:

CEGB (1968-1990); Powergen (1990-1999); Edison Mission Energy (1999-2001); AEP Energy Services (2001-2004); SSE (2004-present)

NB: Shares many design characteristics with West Burton, Nottinghamshire

Details:

- 2,000MW capacity, comprising x 4 500MW turbo-generator sets, longitudinal alignment.
- Single, four-flue stack.
- x 8 CTs split into 2 fields of 4 (lozenge formation), each with independent CW pump house.

Major modifications

FGD fitted 2006-8.

- **Historic Building Record Report**: Evans D (2021)

7. IRONBRIDGE 'B', SHROPSHIRE

NGR: centred on SJ 65307 04004
Construction dates: 1963-68
Commissioned: 1969
Status: closed 2015
CEGB: Midlands Project Group
Architects: Sir Percy Thomas and Son (Alan Clark)
Engineers: Rendell, Palmer & Tritton
Principal Contractors: McAlpine / John Laing
Landscape Architects: Kenneth Booth
Cost:

Ironbridge 'B' Power Station *is located on the south bank of the River Severn as it enters the Ironbridge Gorge near Coalbrookdale in central, eastern Shropshire, 18km south-east of the county town of Shrewsbury. It operated for a short time in combination with Ironbridge 'A', dating from the late 1920s, the CW pump house of which was retained for the later station. The remainder of the 'A' station buildings were demolished in the early 1980s. Comprising only two turbo-generators with a combined output of 1,000MW, Ironbridge 'B' was one of the smaller stations of the 500MW programme. It occupies a restricted, linear site, the form of which necessitated a 'responsive' approach in terms of station design. Ironbridge 'B' shares a number of design characteristics with its 'parent' station at Eggborough, North Yorkshire, with which it shared both project architects and consultant engineers. The plant ceased generation in November 2015 and has been fully decommissioned; the site was sold in June 2018 for mixed-use redevelopment.*

- Site included on Shropshire County Historic Environment Record (HER), refs. **06710** (A Station); **32590** (B Station).
- Assessed by Historic England in June 2014 (Case ID No. **1420722**) as not meeting criteria for statutory listing.

Operational History:

CEGB (1968-1990); Powergen (1990-2001); E.On / Uniper Energy (2001-2018)

Details:

- 1,000MW capacity, comprising x2 500MW turbo-generator sets (AEI Ltd.), transverse alignment.
- Boilers (face-fired) by Foster Wheeler-John Brown Land Boilers Consortium.
- Axial, slung condensers (AEI Ltd.).
- Foster Wheeler, horizontal-spindle PF ball mills.
- Single, double-flue stack.
- x 4 CTs by FCT in single field (linear, curving), innovative use of colour.
- Enclosed 400kV switch house (lateral).
- Gas Turbine house with x 2 17.5MW turbines, powered by Bristol-Siddeley 'Olympus' engines
- No rail loop.

Major modifications: Oil Overburn added mid-1970s; Biomass conversion to 1 unit; No FGD fitted.

- **Historic Building Record Report**: Tyler R (2017)

8. RATCLIFFE ON SOAR, NOTTINGHAMSHIRE

NGR: centred on SK 50319 30075
Construction dates: 1963-67
Commissioned: 1968
Status: still operational, currently operated by Uniper
CEGB: East Midlands Division, Midlands Project Group
Architects: Godfrey Rossant and JW Gebarowicz, Building Design Partnership (BDP)
Engineers: CS Allott and Son
Principal Contractor:
Landscape Architects: in-house
Cost: *c.*£80 million

Ratcliffe on Soar Power Station *is located on the south bank of the River Trent in south-western Nottinghamshire, hard on the borders of both Leicestershire and Derbyshire, between Derby and Nottingham 16km north-west and 12.5km north-east respectively. Constructed between 1963 and 1967, it was commissioned in 1968. Together with Cottam and West Burton 'A', 58 and 63km north-east respectively, Ratcliffe is one of three broadly contemporary, still operational coal-fired 'super stations' based around the 500MW turbo-generator unit located in the Lower Trent Valley.*

- Site not included on Nottinghamshire County Historic Environment Record (HER).
- Assessed by Historic England in January 2017 (Case ID No. **1444012**) as not meeting criteria for statutory listing.

Operational History:

CEGB (1968-1990); Powergen (1990-2002); E.ON UK (2002-2015); Uniper (2015-present)

Details:

- 2,000MW capacity, comprising x4 500 MW sets (CA Parsons), transverse alignment.
- Split-span crane to turbine hall.
- Boilers by Babcock and Wilcox.
- Single, four-flue stack.
- x 8 CTs (single field; 2 rows of 4, offset).
- Common CW pump house with annular moat / tangential return channels.
- Enclosed 400kV switch house (axial).
- Gas Turbine House, turbines powered by Bristol-Siddeley (later Rolls Royce) 'Olympus' engines.

Awards:

Awarded the 'Hinton Cup', the CEGB's 'good housekeeping award', on two occasions, in 1975/6 and 1986/7

Major modifications: Flue Gas Desulphurisation (FGD) – first units fitted in 1993/4 with commissioning in 1995/6. Ratcliffe was the first power station in the UK to be fitted with Selective Catalytic Reduction (SCR) technology, reducing emissions of nitrogen oxides through the injection of ammonia directly into the flue gas and passing it over a catalyst.

- **Historic Building Record Report**: pending

9. RUGELEY 'B', STAFFORDSHIRE

NGR: centred on SK 05773 17581
Construction dates: 1964-70
Commissioned: 1972
Status: closed 2016
CEGB: Midlands Project Group
Architects: LK Watson and HJ Coates
Engineers: Mott, Hay and Anderson
Principal Contractor:
Landscape Architects: Colvin and Moggridge
Cost:

Rugeley 'B' Power Station *is located on the south bank of the River Trent in central Staffordshire, on the eastern outskirts of the town of Rugeley and 14km south-east of the county town of Stafford. An earlier station on the site, Rugeley 'A' of 600MW capacity, was built from 1956 and opened in 1961, with the 'B' station constructed between 1964-70. Comprising only two turbo-generators with a combined output of 1,000MW, Rugeley 'B' was one of the smaller stations of the 500MW programme. The stations operated in tandem for a number of years, though Rugeley 'A' was decommissioned in stages in 1994/5 and subsequently demolished. Rugeley 'B' itself ceased operation in June 2016 with decommissioning following soon after; at present, demolition is ongoing.*

- Site included on Staffordshire County Historic Environment Record (HER), refs. **MST22564** ('A' Station) and **MST22563** ('B' Station).
- Assessed by Historic England in January 2017 (Case ID No. **1444013**) as not meeting criteria for statutory listing.
- Certificate of Immunity from Listing issued (ref. **1450162**).

Operational History:

CEGB (1968-1990); National Power (1990-1996); Eastern Generation/TXU Europe (1996-2001); International Power (2001-2016); ENGIE (2016-present)

Details:

- 1,000MW capacity, comprising x 2 500MW turbo-generator sets (CA Parsons), designated 6/7; transverse alignment.
- Single stack (replaced, offset; original, axial).
- x 4 CTs in single field (lozenge).
- Common CW pump house.
- Open 400kV switch yard (axial).
- Gas Turbine House with x 2 English Electric turbines powered by Rolls Royce 'Olympus' engines.

Awards:

Awarded the 'Hinton Cup', the CEGB's 'good housekeeping award', in 1987/8

Major modifications: FGD added 2007-9.

- **Historic Building Record Report**: Tyler R (2019)

10. WEST BURTON 'A', NOTTINGHAMSHIRE

NGR: centred on SK 79235 85580
Construction dates: 1961-7
Commissioned: 1967-8
Status: still operational, currently operated by EDF Energy
CEGB: East Midlands Division, Northern Project Group
Architects: Rex Savidge / John Gelsthorpe of Architects Design Group (ADG)
Engineers: Merz and MacLellan
Principal Contractor: Alfred McAlpine
Landscape Architects: Derek Lovejoy Associates
Cost: *c.*£80m

***West Burton 'A' Power Station** is located on the west bank of the River Trent in north-east Nottinghamshire, hard on the border with Lincolnshire (the river here forming the county boundary), c.10km north-east of Retford and 50km NNE of the county town of Nottingham. Built between 1961-7, the station was commissioned in stages between 1967-8 and officially opened in April 1969. In an attempt to combine efforts at design and construction phases, boiler and turbo-generator arrangements were replicated as per Fiddlers Ferry in Cheshire, with which the station thus shares a number of characteristics (eg. split CT fields, longitudinal turbo-generator alignment). Together with Cottam and Ratcliffe on Soar, 7km south-east and 63km south-west respectively, West Burton is one of three broadly contemporary, still operational coal-fired 'super stations' based around the 500MW turbo-generator unit located in the Lower Trent Valley.*

- Site included on Nottinghamshire County Historic Environment Record (HER), ref. **M17772**
- Assessed by Historic England in May 2017 (Case ID No. **1445808**) as not meeting criteria for statutory listing.
- Certificate of Immunity from Listing issued (ref. **1448823**).

Operational History:

CEGB (1968-1990); National Power (1990-1996); Eastern Group (1996-8); TXU Energy (1998-2001); London Power Company/EDF Energy (2001-present)

<u>**NB**: Shares many design characteristics with Fiddler's Ferry, Cheshire</u>

Details:

- 2,000MW capacity, comprising x 4 500MW turbo-generator sets (English Electric), longitudinal alignment.
- 'Bridge' condensers.
- Boilers (tangentially-fired) by International Combustion Ltd. (ICL).
- ICL 'Lopulco' feeders and vertical-spindle PF mills (6 per unit), arranged within transverse 'mill bays'.
- ESPs (with initial grit arrestors).
- Double-stacks (600ft.); originals (by Tileman and Co.) replaced, 2004 (contemp. FGD).
- x 8 hyperbolic CTs by Davenport Engineering, split into two fields (lozenge and linear arrangement), each with independent CW pump house. Innovative use of colour.
- Enclosed 400kV switch house (axial).
- Gas Turbine House with x4 English Electric (EE) turbines powered by Rolls-Royce 'Avon' engines (2 decommissioned).

Awards:

Granted Civic Trust award in 1968 for 'outstanding contribution to surrounding scene'

Awarded the 'Hinton Cup', the CEGB's 'good housekeeping award', on two occasions, in 1968/9 and 1988/9

Major modifications

Oil Overburn added mid 1970s.

Biomass co-firing, early 2000s.

FGD added 2000-04 (chimneys rebuilt to north of originals).

- **Historic Building Record Report**: Tyler R (2018b)