# Proposed National Nature Reserve between Gravesend and the Medway

# Heritage Strategy Report Theme 6 : INDUSTRY



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#### **Cover illustrations**

Extracts from 1960 and 2024 aerial photographs, and 1936-37 25in Ordnance Survey showing surviving remains of the quarry morphology created by hand digging of chalk for cement manufacture at Hilton or Manor Works, Halling, in Bottom Pit, Upper Halling.

### 1.0 Introduction

- 1.1 The proposed National Nature Reserve (pNNR) boundary has of course been drawn for the purposes of that designation and on its own is insufficient for examining other factors. The industrial background of the area is explained only partly by the nature of the land within the pNNR boundaries and at least as much by external influences.
- 1.2 The existing published record of those industries external or peripheral to the pNNR is patchy. A selective bibliography is given in Appendix 2. In summary on the eastern, River Medway, side of the pNNR the prime source is Preston's *Industrial Medway*, a comprehensive account of the full range of industries that once existed here (and, when written in 1977, many still did exist), certainly including the lime, cement and brick activities that were once so prominent, but also the other varied service industries so essential to and thriving beside those primary activities. Preston's account has more recently (2009) been supplemented by Andrew Hann *The Medway Valley a Kent landscape transformed.*
- 1.3 To the north of the pNNR, Thames-side, there is no such comprehensive source. The cement industry, and its chalk and clay pits, is fairly well-recorded and written up for most of the individual cement works which have existed between Dartford and Gravesend but the record of many other industries notably power generation and paper is patchy and a synoptic account has yet to be produced. Nor, with a few welcome exceptions, do many local, parish or topic-based histories exist.
- 1.4 To the south and west, the pNNR boundaries and study area relate to no significant industrial features or historic activity.
- 1.5 This section is therefore not a condensation of existing wisdom, although it certainly draws upon what does exist. It is also an attempt to create an overview where none currently exists.
- 1.6 Predominantly, the pNNR contains at surface two main broad geological strata, chalk<sup>1</sup> and Thanet Sand with clays, plus two main vegetation types: woodland and chalk grassland, of various detailed compositions. Agricultural use is extensive. The topography is generally elevated chalk downland, except towards the northwest and hence relatively lacking in surface water. Thus, the industrial opportunities are also circumscribed: no watermills and few other water-based industries, for example, but certainly the potential for quarries for various minerals; also industry serving the needs of agriculture, silviculture and the local communities dependent on such activities.
- 1.7 Geography has also exerted a strong influence. Although not remote from the River Medway (indeed the study area just overlaps the Medway, albeit only casually), neither that nor the slightly more distant River Thames exerted any great direct influence upon the pNNR area until well into the twentieth century

although, as will be discussed, there is evidence of indirect influence potentially of some significance<sup>2</sup>.



# Kent Historic Environment Record

Figure 1 : Solid geology in the study area (pink) around the pNNR (blue); yellow lines are Parish boundaries. At this scale it is not easy to read the detail but, put simply, to the north and west the solid strata are Thanet Sand (blue) and London Clay (brown); in the remainder of the pNNR, shades of green and orange, are chalk. Light blue to the extreme southeast is Gault Clay. (BGS data)



# Kent Historic Environment Record - Industrial

Figure 2 : The study area in relation to HER 'Industrial' records

1.8 This review is presented in two main eras: pre- and post-1800. That is not synonymous with the HER definition of "Modern" nor the industrial revolution, a term which can be contentious but is typically taken to have begun around about 1700. The HER nominal epoch/date ranges go from Post Medieval (1500s – 1900) to Modern (post-1900) but that breadth is unhelpful in this instance, given the precision with which the start of the cement industry in north Kent can be dated. The 1800 date is used here as shorthand for the date at which the cement industry was introduced into north Kent, an event which quickly created a sharp division between earlier centuries of little industrial impact within the pNNR, and two centuries of increasing impact, some direct and perhaps more indirect. Accordingly, for the 'Cement Industry' section only, 'Modern' is replaced by 'post-1800', not 1900, purely to facilitate review and discussion.

BGS Mineral Resources (Kent) map description	Traditional geological map description	BGS 1 : 10,000 scale geological map description and map abbreviation	Chalk quarries in each stratum (approx.)	
	UPPER CHALK	Seaford Chalk (SCk) White with flints, bands	CROWN & QUARRY (and all Frindsbury group works plus Strood Dock and Upnor) MARTIN EARLE'S	
High Purity Chalk 93—97% CaCO₃		Lewes Chalk (LeCk) White with flints and nodular chalk		
	MIDDLE CHALK	New Pit Chalk (NPCk) White/grey ,softish, mas- sive with scattered flints	LEES TRECHMANN RUGBY (from 1990)	
Low Purity Chalk <93% CaCO <sub>3</sub>		Holywell Chalk (HCk) White, hard and nodular with thin marls	HOLBOROUGH	
	LOWER CHALK	Undivided, grey/creamy white, many thin marls etc	HILTON MANOR RUGBY	
Gault Clay	GAULT	Mudstone, grey	11 1	

Figure 3 : Local chalk geology and the cement industry's general quarry distribution within it.

#### 2.0 The HER 'Industry' entries

2.1 It is not possible to derive meaningful statistics from the HER because, although there are 56 separate records under the 'Industry' heading for the pNNR study area, the quality of each record is variable, in both description and dating. After setting aside three that are too indeterminate to be helpful, Table 1 summarises broadly what is currently recorded in the HER. It should be considered as more qualitative, than quantitative.

Industry	Pre-1800	Post- 1800
Mineral exploitation -		
chalk	2	7
clay	3	5
other (marl, lignite etc)	8	1
flint	3	0
Pottery	1	0
Saw pit	2	0
Tannery	2	0
Water-related features	8	1
Windmills	3	0
Oast houses	5	2
Sub-total	37	16
Total	53	

Table 1 : Summary of HER records showing number of records in each category

- 2.2 It is striking that pre-1800 (the "rural" or "cottage" industry era) most of the industries that would be expected are referenced but a notable absence is any mention of iron (black) smithing, despite older editions of Ordnance Survey maps disclosing buildings labelled 'smithy' in various local settlements. Post-1800, chalk and clay for use in the lime-, cement- and brick-related industries predominate<sup>3</sup>. However, too much should not be made of this, for the reasons set out in Appendix 3.
- 2.3 It is noted that several of the categories in Table 1 lie in a grey area between "end of agriculture" and "beginning of industry". For examples, are windmills a penultimate stage in agriculture, or an early stage of industry? For the present purpose, there is no need to be diverted by semantics; the industrial impacts upon the pNNR derived largely from mineral exploitation serving the brick, lime and cement industries.
- 2.4 However, to say 'largely' itself risks confusion. In terms of direct physical effect upon the pNNR, mineral working and cement factories have had but trivial effects occupying but a few hectares among thousands, other than at Shorne Wood (and even there no more than about 40ha). In the wider study area, direct impacts are still statistically tiny, albeit concentrated along the eastern pNNR boundary. Indirect effects may be a different issue and this report also explores that aspect.

#### 3.0 The pre-1800 industrial background in and around the pNNR

3.1 The particular range of soils, geology and biodiversity in the pNNR resulted in a similarly (limited) range and scale of early industrial activities. These can be

summarised as follows, together with the sort of industrial features which sometimes do, and might still, exist although not necessarily in easily recognisable or even discoverable form:

- Quarrying for clays, to make bricks, tiles, pottery, etc, plus perhaps occasional needs such as sealing farm ponds etc – possible remains include traces of shallow excavations, brick clamps and tileries, pottery sites, etc.
  Preston sets out that Medway industries prospering and expanding before 1850 included brick-making (pre-1664), with Frindsbury and Aylesford – both fairly proximate if not within the pNNR – being particularly important.
- Quarrying for flints, stones and sands, often probably for road-making and similar – possible remains likely to be limited to traces of very shallow excavations. Those products could also be the incidental result of digging for chalk, if they formed the callow (overburden) overlying chalk.
- Quarrying for chalk, for use as a manure on agricultural land in the north of the pNNR where the soils do not derive from the underlying chalk – possible remains likely to be limited to traces of shallow excavations unless deneholes (small underground chalk mines) can be identified.
- Artificial water sources given the absence of natural surface water over the areas with chalk surface geology, traces of wells and/or means of intercepting and collecting flash rainfall might exist.
- Facilities needed to manufacture and repair agricultural equipment, such as plough shares, saws, axe heads etc – records of buildings such as "Smithy", "Old Smithy" etc do exist
- Similar records of facilities for carpentry on large or small scale (saw pits or woodworking, for example)
- Sites for processing of agricultural produce, for example, windmills (grain) oast houses (hops), tanneries (skins) and so forth.
- 3.2 In the wider area beyond the pNNR, however, chalk quarrying for manuring agricultural land, ballasting empty shipping and for lime burning had been established on a large scale for centuries in the Northfleet Gravesend area north of the pNNR; slightly less so, apparently, on the Medway. Nonetheless,

Preston sets out examples along the Medway of chalk digging for ballast and lime before 1623, with Upnor and Frindsbury important in later centuries. Daniel Defoe's Tour of 1724-27<sup>4</sup> described the Thames-side situation thus:

"....the whole shore being low, and spread with marshes and unhealthy grounds, except with small intervals, where the land bends inward as at Erith, Greenwich and North-fleet etc in which places the chalk hills come close to the river, and from thence the city of London, the adjacent countries, and even Holland and Flanders, are supply'd with lime, for their building, or chalk to make lime, and for other uses.

"From these chalky cliffs on the river side, the rubbish of the chalk, which crumbles away when they dig the larger chalk for lime, or (as we might call it) the chips of the chalk, and which they must be at the charge of removing to be out of their way, is bought and fetch'd away by lighters and hoys, and carry'd to all the ports and creeks in the opposite county of Essex, and even to Suffolk and Norfolk, and sold there to the country farmers to lay upon their land, and that in prodigious quantities; and so is it valued by the farmers of those countries, that they not only give from two shillings and six pence, to four shillings a load for it, according to the distance the place is from the said chalkcliff, but they fetch it by land-carriage ten miles, nay fifteen miles, up into the country."

Location	Start date
Chatham dockyard	1623
West Court, Rochester	1669
Whorn(e)s Place, Cuxton	1799
Borstal	by 1820s
Snodland	by 1831
Halling	by 1831
Wouldham	by 1831
Manor Farm, Frindsbury	by 1837
Cuxton	by 1844

Table 2 : Early lime- and chalk-works in the general pNNR area,	in approximate
order of establishment	

3.3 At no time did those similar excavations on the Medway, ill-known though they mostly are, significantly extend south- or west-wards into the study area or its immediate surroundings, but further study could well modify that impression. Certainly there were several early lime- and chalk-works which could have generated quarries extensive enough to reach near or into the pNNR, at least eventually. The known examples are listed in Table 2.

### 4.0 The cement industry background post-1800 in and around the pNNR

- 4.1 The development of modern cement – indeed, the definition of it – need not detain us. The date at which Joseph Aspdin patented what he called Portland Cement, 1824, matters less that the fact that neither he nor his son William understood exactly what they had patented, nor knew exactly how to make it on a commercial scale. It was another two decades before William Aspdin (1844) and Isaac Charles Johnson (1845), experimenting separately, managed to create industrially workable processes; up to those dates precursors of Portland cement (principally those known as Roman and British cements) continued in use. The important point is that the first known cement manufactory in Kent was established by James Parker at Northfleet in 1798 (to make the cement he had patented in 1796) and that was followed by cement works at Sheerness (c1810), Faversham (1813), and by the 1830s factories at Sittingbourne, Dartford, Upnor and Halling, probably plus others, had been added to the list. The Portland cement industry seems first to have reached the Medway on any scale in 1847 at Frindsbury, closely followed by Isaac Johnson's Crown Portland Cement factory in 1851. However, it is worth noting that the Royal Engineer's Major General Sir Charles Pasley (as he became) who was based at Chatham, had been researching and experimenting with cement manufacture locally since at least 1830<sup>5</sup>.
- 4.2 Once the secrets of manufacturing a reliable Portland variety (the exact blend of chalk and clay and how to achieve it, optimum kiln temperatures, correct grinding of the kiln product [clinker] and so on) had become better understood, the attractions of north Kent, both Thames, Medway and Swale, for cement manufacture became obvious, not least because of the extensive chalk quarries and shipping facilities already available, but also because of the wide availability and proximity of the other main raw material, clay, and the pre-existing record of manufacturing precursors to Portland cement.
- 4.3 Logistics also played an extremely important role. Roughly, to make 1 tonne of cement required 1.5 tonnes of chalk and 0.35 tonnes of clay, each measured as dry raw materials, or in total a little over 2 tonnes at typical as-dug moisture contents (10-20%). Also, around 0.2 tonnes of coal or coke fuel were needed for the kilns, all of which needed to be imported from the North East by river. Therefore, in an ideal world, a cement works would be located immediately beside chalk, clay and water, but, as the majority tonnage of raw material, proximity to chalk was key.
- 4.4 Timing also had an indirect but significant effect. The manufacture and use of town gas in London, from coal, began with experimental installations in the 1790s and the coal required came from the North East by coastal shipping. One residue of the gasification process was coke, a high-carbon high-calorie material ideally suited to firing cement kilns. Also, once the colliers had discharged their coal, they needed ballasting for the return journey. Thus came the growth of symbiotic trades: coal from the North East to London, coke from London to the Thames and Medway cement industries, chalk for ballasting vessels back to the North East and finally another spin-off establishment of

a small cement industry in the North East using as raw material the discarded chalk ballast.

4.5 Ideal circumstances rarely exist but most cement works, on both banks of the Medway, display most of these locational criteria. We can see, also, that once practical means of manufacturing Portland cement became widely known, the rapidly growing construction market prompted the establishment of new factories, whether expanding on sites already with chalk and/or lime production, or green-field. Table 3 gives an idea of how this process unfolded at those sites most relevant to the pNNR.

			A success late of
Cement works	HER ref (within study area only)	Approx. dates of founding and period of operation	Approx. date of chalk quarry entering today's pNNR area
Crown, Frindsbury	-	1851 – by c1907 (but see Crown & Quarry)	Never; distant
Whorn(e)'s Place/Trechmann's, Cuxton	TQ76 NW 296	1850s – 1921	1850s (or 1799?)
Lee's, Halling	TQ66 SE 157 TQ66 SE 165	1854 (cement) – 1925 1830s (lime) – 1939	1890s (South Hill quarry only)
Formby's/Batchelor's/Rochester, Halling	TQ66 NE 226, TQ66 SE 146, TQ76 NW 757	1855 (lime) – 1920s 1860s (cement) – 2000	c.1900? (lime)
Upnor	-	1859 – c1902	Never; distant
Whitewall, Frindsbury	-	1862 - 1909	Never; distant
Phoenix, Frindsbury	-	1863? or 1875? – by 1907	Never; distant
Strood Dock	-	c1866 – c1887	Never; distant
Globe, Frindsbury	-	c1880 – by 1907	Never; distant
Bridge, Frindsbury	-	1885 – by 1907	Never; distant
Quarry, Frindsbury	-	1889 – by 1907 (but see Crown & Quarry)	Never; distant
Beehive, Frindsbury	-	c1890 – by 1907	Never; distant
Beaver, Frindsbury	-	c1890 – by 1907	Never; distant
Crown & Quarry, Frindsbury	-	Formed from the above seven Frindsbury factories, 1907 – 1963	Never; distant
Martin Earle's, Wickham	-	1881 – 1967 – (1981 for lime)	Never; nearby
Hilton or Manor, Halling	-	1878 – 1928	Never; adjoining
Medway	TQ76 NW 424	1885 – 1901	Never; adjoining
Holborough	-	1924 (cement) – 1984 1939 (lime) – 1950s	Never; adjoining
Medway (II)	-	Permitted 2001 at Holborough but never built	Never; the quarry would have adjoined

Table 3: Cement works on the west bank of the Medway and approximate dates of establishment and operation, in rough chronological order of establishment<sup>6</sup>.

- 4.6 Minerals are non-renewable resources so that to continue consuming them requires that more resources are identified and exploited; put simply, existing quarries must be extended and/or new ones opened. The rate at which that occurred depended of course upon rates of mineral consumption and exhaustion, but against a complex background of other factors. That was heavily influenced not merely by the installed cement-making capacity at each factory but also the potential for modernisation to enhance capacity and reduce costs.
- 4.7 Of the factories of main concern here, all except Holborough began using brickbuilt intermittent-process kilns, bottle or chamber types, looking (and in some ways operating) much like their predecessor lime kilns. The application of the continuous-process rotary kiln technology, from 1900, marked a step-change in production. The decision to be made then was whether any particular factory warranted the considerable capital investment required for conversion to a rotary plant, which required a great increase in production to recoup the cost. Many sites could not justify that, either because of shortage of raw materials or site limitations and, at any scale, on the west bank only Frindsbury (Crown & Quarry), Martin Earle's and Batchelor's justified conversion to rotary kilns. Sites not converted might continue making cement for a few years until they became uneconomic and were closed, while others (Lee's and especially Martin Earle's) continued for some years also making relatively small-volume lime and other chalk-based products (such as whiting), or acting as reserve capacity to modernised factories. Holborough, opened 1923-24, was a rotary kiln plant from the first.
- 4.8 The final example of this westwards expansion of quarrying towards and into the pNNR area came quite recently, after 1989 when the Rugby Portland Cement Company's Rochester works secured planning permission to open a chalk quarry in the Dean Valley, west of the Medway chalk scarp and adjacent if not slightly within the proposed pNNR boundary. An entirely new quarry, not an extension of a pre-existing one, it would be connected to the cement works via a tunnel and conveyor belt through the scarp, to minimise visual impact. Unlike the planning permission granted for Holborough chalk quarry in 1950, in an era when few effective planning conditions were imposed, Dean Valley was more tightly controlled. When the factory and quarry closed, in 2000, thorough restoration of the quarry was undertaken.

#### 5.0 The clay, brick and tile industries in and around the pNNR at all eras

5.1 Unlike cement manufacture, where the dating is quite secure, exploitation of clay for brick and tile manufacture is much vaguer. Exploitation of clay for cement is, of course, as well-dated as for chalk. Table 4 sets out the HER information (using the HER epochs).

HER reference	Description	Date range
TQ67 SE 248	Claypit	1540 – 1900
TQ67 SE 252	Pond, former claypit?	Pre-1540?
TQ67 SE 253	Claypit	1540 – 1900
TQ67 SE 268	Extensive claypit	Modern
TQ67 NE 76	Claypit	1540 – 1900
TQ67 SE 275	Clay extraction	Modern
TQ66 NE 89	Quarry, Brewer's Wood	Claypit?
TQ67 SE 276	Quarry, Shorne Wood	1540 – 1900 (claypit?)
TQ76 NW 423	Cuxton brickfield	<1800 – 1880
TQ67 SE 326	Well or claypit?	Bronze Age
TQ67 SE 330	Brick-built kiln,	1750 – 1875
	brickworks	
TQ67 SE 1260	Site of old brickworks	1800 – 1925

Table 4 : HER references to pricks and claypit	Table 4 : HER	references to	bricks and	claypits
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#### Brick and tile making

5.2 As late as the early 1900s, small-scale brick- and tile-making could depend largely on availability of clay and little else. It was possible, with little skill or equipment, to make

bricks on a small scale in a field at the site of a proposed development simply by digging the local clay, building a "clamp" and lighting fires within it. This had the additional advantage that the bricks thus made were more-or-less on site and did not need laborious transport. However, at any scale, such methods were wholly inadequate so that industrial machinery was essential and, as with cement, the investment required for mechanisation brought with it the need to locate more extensive clay deposits capable of supporting higher production.

- 5.3 There were links, occasionally direct and certainly indirect, between cement and brick entrepreneurs. To a cement manufacturer, clay (or indeed anything else) overlying the chalk was a nuisance, requiring expensive excavation to remove it. However, if these overlying strata ("callow" in the trade) had some commercial value then, with some forward planning, the chalk could be uncallowed in advance of chalk quarrying at little or no cost, perhaps even some profit.
- 5.4 Here we meet an important difference between Medway and Thames-side. Except at its northwestern end, the pNNR area is predominantly chalk which lacks significant callow and no cement works on the Medway was greatly troubled by any significant thickness of it. Only around Shorne Wood does clay callow exist on any scale, namely London Clay and Thanet Sand lying over the chalk. There was however no demand for the chalk beneath it – the area was too remote from river transport. Clay exploitation other than in the north must have depended upon small scattered and isolated deposits, maybe too small to be mapped and, as far as the HER goes, nothing of that sort seems known. Indeed, only Cuxton brickfield (HER TQ76 NW 423) appears to conform even vaguely to the Thames-side situation and that needs further study. Typically, many areas of chalk on Thames-side required the excavation of more callow than chalk, culminating after 1970 with the Northfleet quarries that at full

Kent Historic Environment Record ighar Cuxton (Rugby (Rugby) Halling Wouldham Halling addlesw orth Legend worth Non-cement/lime-related Parish Snodla chalk or gravel pit Study Area ement/lime-related chalk Proposed NNR Boundary Birling S 1,100 550 1,100 Meters Produced by Kent County Council N (C) Crown Copyright. All rights reserved 100019238, 2013

production would have to dig nearly twice as much callow as chalk. That never applied on the Medway.

Figure 4 : This map locates the main mineral working sites discussed in the text, and some others. The red triangular symbols are old chalk or other pits at sites shown on older editions of the Ordnance Survey; the locations are approximate. It is likely that Tithe Maps could offer additional information. The remainder are the larger post-1800 quarries associated with cement, lime and brick industries. The factories themselves are omitted for clarity.

- 5.5 However, a very important point is that early cement works' structures indeed up to the 1920s – were typically built of brick, and were brick-intensive at that. It is no more than a very rough estimate (by the present author) that a single brick-built chamber kiln might require as many bricks to build it as would about two workers' houses; even the earlier conical "bottle" designs of kiln might require as many bricks as would a single house. Factories with dozens of kilns could require bricks enough to build a small village. From where were those obtained?
- 5.6 Further study might suggest that some, at least, came by coastal vessel from the great brickfields around Sittingbourne and Faversham, but many almost certainly came from Burham, on the east bank of the Medway, where the cement works had enormous brickfields from its establishment in 1852-53; cement manufacture was added in 1854 and lime a few years later. These were not however based upon callow, London Clay, but on the Gault Clay underlying the chalk. They continued at work until about 1905.



Figure 5 : Burham brick, lime and cement works, in 1859, looking west/northwest. Although on the east bank of the Medway it was probably a major source of building materials on the west bank also. Left of centre is the four-storey pottery building and, to its right, the brick 'hacks' (drying grounds). Although the view is romanticised, the detail fits well with map evidence (below).



Figure 6 : Extract from the 25-inch OS sheet Kent XXXI.5 revised 1895 and published 1897 showing the extensive brickworks area. (National Library of Scotland)

### Clay for cement

- 5.7 As referred to above, making cement requires about 0.35 tonnes of clay (dry basis) per tonne of cement. In and around the pNNR area, this was obtained in three main ways:
  - An early source was digging the Medway river and Swale marshes, estuarine and marine salt marsh mudbanks. The procedure was to sail a barge to the required spot and, as the tide dropped and the barge grounded, dig clay as quickly as possible before the flood tide refloated the barge; the men engaged on such work became known, understandably, as the "muddies". These sources grew increasing scarce and expensive, as well as impacting adversely upon navigation and coastal erosion.
  - They were mostly replaced by the 1920s with digging clay from the Gault Clay beds, primarily in dedicated quarries at Paddlesworth, which served Holborough up to its closure in 1984 (and to a small extent Lee's and Rugby at Halling).

- The Rugby Portland Cement works at Halling for many years dug both chalk and clay in the same quarry, dug below ground water level using a bucket chain excavator, until that quarry was exhausted and replaced by two separate quarries: Dean Valley (chalk) and Park Farm, Wrotham (clay).
- 5.8 The other industrial involvement with clay in the pNNR, and arguably that with the largest impact, came in 1936-37 with the new Shorne Wood or Cobham claypit (now Shorne Wood Country Park). The Thames-side cement industry had undergone the same early evolutions in its clay resources as did the Medway industry but as those became exhausted (excepting those at Cliffe Marshes, exploited up to 1970) there was no accessible Gault Clay to fall back on. Therefore, attention concentrated on the few London Clay deposits and Shorne Wood was one of those. Producing clay which was slurried on site and piped (mostly alongside the A2) to Bevan's Works at Northfleet, the pit worked until about 1964. After lying derelict for some years, it reverted to the landowner and the Country Park project was initiated.

### 6.0 Some other industry examples in and around the pNNR, post-1800

#### Service corridors

- 6.1 The pNNR is traversed by at least two industrial service corridors.
- 6.2 The modern Shorne Wood claypit exported its clay to Bevan's cement works, Northfleet, in a pipeline as a slurry. For reasons not fully understood, there was inadequate natural water available in the locality to prepare the slurry and the necessary water was therefore pumped from Martin Earle's cement works at Wickham, Rochester, to Shorne Wood. The pipeline presumably still exists although its complete route has not been traced.
- 6.3 Four overhead wire electricity pylon lines traverse the pNNR, one of which during construction encountered the human remains referred to in Appendix 3.

#### Cobham lignite mine

- 6.4 Sometimes mis-described as a coal mine, lignite was discovered during civil engineering work to upgrade the A2 Watling Street (1922-24) (HER TQ66 NE113), near today's 'Inn on the Lake' hotel. It comprised a very thin deposit, just 6in near surface and thickening to 2ft 6in at shallow depth. At first it may have been dug from surface on a small scale for local use on the Cobham Estates of the Earls of Darnley, the landowners, but no substantial development occurred until after 1947 when underground mining began to be considered. Development began in 1948 by a private company, despite the newly-formed National Coal Board considering the claims for the deposit extremely optimistic.
- 6.5 Although with increasing depth the thickness of lignite also increased (to as much as 6ft) the quality was poor and effectively the material proved unsaleable, while underground working conditions became ever more difficult.

Working ceased in 1953 and subsequent further road widenings appear to have destroyed the majority of the surface features.

6.6 It is likely that one cause for the initial optimism was the adjoining cement industry, a large coal consumer in which coal's physical quality was less important than in domestic and other industrial uses. On Kent Thames-side, the industry at that period produced around 2.7 million tons of cement annually and required about 550,000 tons of coal; the Kent Coalfield inland from Dover supplied less than half that, despite its favourable geographical proximity and Cobham would probably have found itself in a similar position. The cement industry, equipped to receive coal by water, might have found adapting to more rail- or road-borne supplies problematic.

### 7.0 HER and non-HER assets: 'group value'

- 7.1 In assigning value to heritage assets in general it is natural to value more highly those carrying statutory or non-statutory local designations, than those not so designated. That is an understandable approach, but although it is clearly necessary to wish to preserve the distinctive high values of statutory designations a side effect might be to, perhaps unfairly, diminish the importance of undesignated items which might not be listed even in an HER or similar inventory.
- 7.2 This is not the document in which to assign relative values to HER or unlisted assets, which can only be done within a particular set of circumstances. However, a related issue is one of principle, that of group value; whether a group of assets might, collectively, be valued as higher than the sum of their parts.
- 7.3 In the study area, for example, what appear to be a few modest portions of the old Hilton (Manor) cement works buildings have survived and been exposed and conserved in Halling village, in the Bishop's Palace area; the remains of the Palace are a Scheduled Ancient Monument. The conjunction of these remains, from very different eras, are interesting in themselves, not least for the questions they raise about the history of the economic and social origins and growth of the village, quite apart from the narrower interpretation of them as relics of the lime and cement industries. Also, it was the development of the cement works that destroyed large parts of the Palace.
- 7.4 Hilton's chalk quarry also survives, in large part not seriously disturbed since closure, and almost adjoining the pNNR. It also possesses several industrial archaeology features and relics.
- 7.5 Lee's Works too has intrinsic interest, not least because portions of its quarry are designated as Houlder & Monarch Hill Pits Site of Special Scientific Interest (on geological grounds; it is a Geological Conservation Review location) but also because it too possesses several industrial archaeology features and relics.

- 7.6 These assets have their particular values, whether undesignated, listed in the HER or established via statute. There is no need to quantify those values (however that might be done) to suggest that, if considered, interpreted, accessed and historically linked together, their group value might be higher than the sum of their parts.
- 7.7 There is one particular aspect of industrial history which is demonstrated in the study area, but which is now rare, namely the transition from manual to machine excavation of chalk guarries. This trend began in the USA, prompted by labour shortages. In the UK, it was prompted by civil engineering contactors who needed to speed up construction projects and, in quarries, by the modernisation of cement making processes particularly the rotary kiln from 1900, which required greater chalk production than manual labour alone was able to supply. Mechanical excavators (steam navvies and similar) first made their large-scale appearance in the UK on the Manchester Ship Canal construction (1887 - 1894) and then on building the Great Central Railway London Extension (1894 - 1899) and, from around 1900 made their first appearances in cement industry guarries. On the Thames, the first was probably about 1903 at Swanscombe; on the Medway, by 1906 at Burham. Of the two guarries most relevant here, Lee's had some mechanical excavation certainly before 1918 and Hilton or Manor probably before 1919 - both probably well before.
- 7.8 The change in quarrying technique caused considerable changes in quarry face morphology. Hand digging by men often supported by ropes or chains on faces 50-100ft high employed gravity to load chalk into railway wagons for haulage to the washmills . Each man dug what was in effect a steep chalk "funnel" or narrow valley ending in a chute or similar so that the dug chalk fell by gravity into the wagon. Each man had his separate working place so a fan of railway tracks and chutes developed, multiplying and extending as the quarry grew. This very characteristic pattern can be seen on many maps.
- 7.9 By contrast, mechanical excavation created a single, almost vertical and regular face which, because early machines could only "reach" a limited height, had to be repeated for faces higher than about 20ft initially. Thus appeared the step or bench face morphology which was almost universal by the 1930s. For the survival of hand-dug morphology, one requires a quarry (or a part of one) that was not worked after around World War 1, has not been landfilled and has not given rise to instability or been redeveloped such as to necessitate stabilising the faces by regrading them. The only surviving examples in the area may well be Hilton Quarry and probably Lee's Houlder quarry; just possibly also White Pit or the older portions of Burham on the east bank.

### 8.0 Discussion and conclusions

8.1 From the above review, the overall conclusions to be drawn seem to be as follows:

- Direct industrial activity within the pNNR from pre-history to 1800 was slight and limited to those small-scale activities associated largely with (and necessitated by) agriculture and housing the workforce. Such activities were primarily small-scale mineral working – chalk, clay and occasionally stone for flints or road-making – meeting primarily local needs
- After 1800, but not on any scale prior to the 1850s, the eastern periphery of the pNNR began to be impacted by larger-scale quarrying of chalk for the cement industry although, up to the cessation of that local industry in 2000, of the very extensive chalk area within the pNNR only a tiny percentage was ever dug. Clay dug on a large scale for cement manufacture (as opposed to on a small scale for bricks and tiles) affected only one area, at Shorne Wood and only for about three decades 1930s – 1960s.
- From any period, the potential for some industrial archaeological remains exists, but most are likely to be associated with the post-1850s cement-mineral quarries. The HER data are certainly incomplete as regards such features and not always well-correlated.
- Research into old OS, Tithe, and similar maps is likely to increase the number of small-scale records in the pNNR although it may not be necessary, or possible, physically to investigate those sites except in rare cases when opportunity arises.
- Various indirect effects of industry upon the pNNR can be canvassed, but one in particular the potential impact of depositing high-alkali cement kiln dust upon local ecology may have considerable potential for study.
- 8.2 Taken overall, the pNNR lends itself to several different industry-related research and field projects, of various degrees of sophistication and accessibility by and with landowners, lay and professional people alike. Some suggestions are given in Appendix 4.

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### A CASE STUDY : RUGBY ROCHESTER WORKS, HALLING

Formby's, later Batchelor's works (and later still Rugby Portland Cement's Rochester Works) offers a good demonstration of these locational principles. Opened as a limeworks in 1855 at what became known as White Pit, where kilns still survive (HER ref: TQ66 SE 146), this site was linked to the River Medway via a lengthy (1km) narrow gauge railway incline and the reason for this, no doubt costly, separation was the need for relatively pure, low flint, white chalk for lime burning, which here was found towards the upper scarp.

Before long, perhaps about 1880, a second chalk pit was opened, known as 'Grey Pit' to both distinguish and describe it, following the recognition that slightly lower qualities of chalk could also be used to make saleable lime and that pit was located half way down the scarp. A new set of limekilns was built, down at the Medway

wharf, for this grey lime but it appears that the white lime kilns continued in operation.

When cement manufacture was initiated about 1913 that factory (HER ref: TQ78 NW 757) was located beside the river wharf, where both less pure chalk, and clay, were accessible. Dug in the Lower Chalk and later, in places, into the underlying Gault Clay, it yielded raw materials approximating chemically to the c3 : 1 ratio of chalk : clay required<sup>7</sup>. Overall cement manufacture needs raw materials comprising 76-78% CaCO<sub>3</sub> and most natural chalk beds are too pure or too impure, hence the need for blending.

When rotary kilns were being considered in 1913 the reserves of Lower Chalk were considered to be substantial and that continued to be the conclusion as more rotary kilns were added (in 1938, 1950, 1955 and 1980). By 1938, a brand new cement works had been built to the west of the main line railway and the A228, the riverside site being far too restricted and it was adapted for cement storage and distribution, with the addition of a rail siding.

However, the future of the site became increasing problematic as chalk reserves diminished and closure was a serious possibility. In June 1989, planning permission was obtained for a new chalk quarry in Dean Valley, behind the chalk scarp, which contained 17 million tonnes of reserves in the Upper Chalk. This was too pure to be used alone and the Grey Pit was almost exhausted, so clay was obtained from a separate quarry in the Gault Clay near Wrotham, from where it was sent to Halling by lorry for blending with Dean Valley chalk. This blending, routine at many cement works, had seldom been employed at Rochester on any scale. A feature of the new quarry was that it was accessed via a conveyor belt in a tunnel through the scarp, for landscape reasons.

None of this kept the factory at work for very long and it closed for cement manufacture in 2000, the quarry being restored and the factory demolished and redeveloped for housing.





The overall development of the site can be followed in the following OS maps, the dates given being those of survey/re-survey and not publication.

In the 1860s a single quarry, bank of lime kilns and tramway sufficed, with a primitive river wharf. Thirty years later, the second (Grey) quarry had opened, with a branch tramway, and now known as Clinkham Lime Works. A row of houses, Formby Terrace, had been built for the workforce.





By the turn of the century, Grey Pit has expanded considerably (though White Pit was almost unchanged, but not obviously closed). The 1932 OS lacks a matching westwards sheet but clearly by that date the new cement works had not yet been started.



By the late1930s the new cement works has appeared west of the A228 and what had previously been labelled Clinkham Lime Works is now also described as a cement works. Not until the 1960s was White Pit described as disused, although it had apparently not expanded for six decades beforehand.

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# Appendices

## **APPENDIX 1 : PHOTOGRAPHS**



Photo 1 : Rugby Portland Cement, Halling Works looking west towards the NNR on the horizon, probably about 1950. (Bob Darvill/Chris Down collection)



Photo 2 : Rugby Portland Cement, Halling Works in (probably) the Pring's area of the Grey Chalk pit adjoining Pilgrim's Way and the NNR, showing the narrow gauge quarry railway which was in use until about December 1952 when replaced by conveyor belts. (Bob Darvill/Chris Down collection)



*Photo.3 : Remains of the 4ft 3in gauge quarry tramway at Lee's Works, still in situ on 23 March 2000 near the former A228 level crossing. (Chris Down photograph)* 



Photo 4 : Lee's Works, Halling, quarry looking east, on 1 June 1922. Although captioned as "Holder" quarry by BGS the viewpoint appears to be from the Pilgrim's Way/NNR boundary in which case Houlder quarry in the strict sense is behind the photographer. This area would be known as Monarch Hill Pit, the (geological) SSSI covering parts of this area and Houlder being named as Houlder & Monarch Hill SSSI. (British Geological Survey image ref: P202127)



Photo 5 :One of the Aveling & Porter-built traction engine locomotives in Houlder quarry. The incline behind took the quarry railway up to South Hill pit. Remains of some of these wagons still exist here. Date would be Winter 1929/Spring 1930 (Charles F. Klapper photograph, John Hutchings collection)



Photo 6 : Part of Houlder pit, photographed on 2 June 2010. Although not very clearly visible, the longitudinal timber baulks supporting the quarry railway incline up to South Hill pit can still be seen, c80 years after abandonment. These, and other railway relics, are thought still to survive here. (Chris Down photograph)



Photo 7 : Extracts from the 25-inch OS sheets Kent XVIII.6 and XXX.4 revised 1936-37 and published 1938, locating the railway incline (circled) from Houlder up to South Hill pit. It is an excellent match to the photographs above and below.



Photos 8 above and 9 below : Views from South Hill pit looking east down into Houlder quarry (n.d.), showing the railway line leading to the tunnel under Pilgrim's Way and thence to the cement works. (John Oxford/Chris Down collection)





Photo 10 : This is the quarry serving Hilton Manor Works, Halling, apparently looking west from the NNR boundary, towards the village and, on the horizon, the east bank of the Medway. (Medway Archives/Halling Primary School)



Photos 11 and 12 : derelict chalk wagon recovered from Hilton Manor quarries, Halling, in April 2008 (left) and after restoration in May 2009 displayed at The Cedars, Holborough. Similar as well as very different wagons still exist in those quarries. (Chris Down photographs)



Photo 13 : Bore's Hole quarry, Trechmann's Works, Cuxton, looking south from near the A228 southwest. This lies within the pNNR. The traditional (and perilous) working of quarries as a single, often very high, face is clearly demonstrated. (Medway Archives/Halling Primary School?)



Photo 14 : Demolition at Shorne Wood claypit, 1960s. Footings of many demolished buildings remain. (Gravesend Historical Society collection ref: BC 1332)



Photo 15 : An early stage in natural regeneration at the closed Shorne Wood claypit. In the photograph are four concrete pyramids, apparently foundations for a wartime pylon, while remains of the conveyor belt can be seen running across the upper part of the view. (Gravesend Historical Society collection, ref: BC 1323A 80)



Photo 16 : Remains of small-scale brick kiln for local production at Wakeley Bros, Upchurch, nr Gillingham, 6 January 1965. It is possible that similar, albeit reduced, structures exist in/near the NNR. (Chris Down photograph)



Photo 17 : The A2 Watling Street during improvement works, showing the exposure of lignite, on 1 September 1922. (British Geological Survey image ref: P202337)



Photos 18 and 19 : Although these views are in Essex they are (or were once) typical of Kent and the industry in general. Above (Lion Works, Wouldham) is the ultimate in manual chalk quarrying, with the chalk cut into a funnel shape and feeding by gravity to a chute and platform from which the railway wagons are loaded. The quarrymen can be seen at the top, in their quarried niches. Below (in Grays quarries) the layout is much simpler and less precise but the principle is the same; this is more like what is still visible in Hilton quarry, Halling. (Thurrock Museum, Library & Archives)





Photo 20 : Again a view from Essex (Lion Works, Wouldham), this is typical of the regular "bench" quarry profile resulting from mechanical excavators. (Thurrock Museum, Library & Archives)

### **APPENDIX 2 : Main published sources**

### Web site

https://www.cementkilns.co.uk/index.html

### **Books and papers**

Ashbee, Andrew, *A little History of Snodland*, published by the Author (1994), 150pp. Down, Chris, *Swanscombe Cement Works and it Railways*, Industrial Locomotive Society (2022), 424pp.

Dunster, Sandra, *The Medway Towns: River, Docks and Urban Life*, Philimore (2013), 176pp.

Francis, A.J, *The Cement Industry* 1796-1914: a history, David & Charles (1977), 319pp.

Gowers, Edward and Church, Derek, *Across the Low Meadow – a history of Halling in Kent*, Christine Swift (1979), pp137.

Hann, Andrew, *The Medway Valley – a landscape transformed*, Philimore (2009), 182pp.

Preston, J.M, *Industrial Medway, an historical survey*, published by the author (1977), 218pp.

Wilmott, F.G, *Cement, Mud and 'Muddies', a history of the APCM barges*, Meresborough (1977), 141pp.

Stoyel B.D and Kidner, R.W, *The Cement Railways of Kent*, Oakwood Press (Second edition, 1990), 128pp.

Valley of Visions Landscape Partnership, *The Medway Gap, Kent's forgotten landscape*, (n.d.), 36pp.

Winn, Capt. George, *Sailing Barge Master,* the story of a Victorian bargeman, Chaffcutter (2009), pp166

<u>Relevant individual cement works and allied histories</u> (marked \* by John Fletcher and Chris Down, thereafter Chris Down only)

- 1967 *Frindsbury Cement Works*, Industrial Railway Record Vol.2, No.16, pp.132-43 and no.18 pp.233-34.
- 2016\* The Ball family, The Industrial Locomotive No.158 (Vol.15 No.9), pp.227-243.
- 2016\* *Burham Cement Works*, The Industrial Locomotive No.159 (Vol.15 No.10), pp.258-284.
- 2016\* *Dartford Cement Works*, The Industrial Locomotive No.160 (Vol.16 No.1), pp.1-9.
- 2017 An introduction to the Northfleet Gravesend area, The Industrial Locomotive No.161 (Vol.16 No.2), pp.46-55.
- 2017 *Robins' Works, Northfleet, Kent*, The Industrial Locomotive No.162 (Vol.16 No.3), pp.72-85.
- 2017 *London Works, Northfleet, Kent*, The Industrial Locomotive No.163 (Vol.16 No.4), pp.97-116.
- 2017 Crown Works, Northfleet, Kent with notes on Horlock's Engine Works and Northfleet Engineering Works, The Industrial Locomotive No.164 (Vol.16 No.5), pp.129-140.
- 2017 Bevan's Works, Northfleet foundation and narrow-gauge era, The Industrial Locomotive No.165 (Vol.16 No.6), pp.161-186.
- 2018 Bevan's Works, Northfleet the Neath Abbey Ironworks locomotives, The Industrial Locomotive No.166 (Vol.16 No.7), pp 193-202.
- 2018 Bevan's Works, Northfleet reconstruction and the standard gauge era, The Industrial Locomotive No.167 (Vol.16 No.8), pp.225-240.
- 2018 *Peters' Works, Wouldham Hall, Kent*, The Industrial Locomotive No.168 (Vol.16 No.9), pp.257-279.
- 2018 *Introduction to the Dartford Swanscombe area*, The Industrial Locomotive No.169 (Vol.16 No.10), pp.297-318.
- 2019 *The Ingress Park quarries and railway*, The Industrial Locomotive No.170 (Vol.17 No.1), pp.1-9.
- 2019 Johnson's Works, Greenhithe founding and the narrow gauge era Part I, The Industrial Locomotive No.171 (Vol.17 No.2), pp.33-48.
- 2019 Johnson's Works, Greenhithe founding and the narrow gauge era Part II, The Industrial Locomotive 172 (Vol.17 No.3), pp.69-80.
- 2019 *Johnson's Works, Greenhithe the standard gauge era Part I,* The Industrial Locomotive No.173 (Vol.17 No.4), pp.97-113.
- 2020 *Johnson's Works, Greenhithe the standard gauge era Part II*, The Industrial Locomotive No.174 (Vol.17 No.5), pp.130-142.
- 2020 *Globe Whiting Works, Greenhithe Part I*, The Industrial Locomotive 175 (Vol.17, No.7), pp.163-177.

- 2020 Globe Whiting Works, Greenhithe Part II, the West Works project and its *Pecketts*, The Industrial Locomotive No.176 (Vol.17, No.7), pp.193-208.
- 2020 *The Stone Court companies, Part I*, The Industrial Locomotive No.177 (Vol.17, No.8), pp.234-256.
- 2021 *The Stone Court companies, Part II*, The Industrial Locomotive No.178 (Vol.17, No.9), pp.272-288.
- 2021 Kent Works Part I The Industrial Locomotive No.179 (Vol.17, No.10), pp.289-306.
- 2021 *Kent Works Part II* The Industrial Locomotive No.180 (Vol.18, No.1), pp.1-12.
- 2021 *Kent Works Part III* The Industrial Locomotive No.181 (Vol.18 No.2), pp.33-48.
- 2022 *The North Kent claypit railways, Part I: introduction and Alkerden claypit* The Industrial Locomotive No.182 (Vol.18 No.3), pp.65-88.
- 2022 The North Kent claypit railways, Part II: Bean claypit The Industrial Locomotive No.183 (Vol.18 No.4), pp.97-107.
- 2022 The North Kent claypit railways, Part III: Cobham (Shorne Wood) claypit The Industrial Locomotive No.184 (Vol.18 No.5), pp.129-147.
- 2022 West Kent, Millbay or Margetts Works, Burham and Aylesford The Industrial Locomotive No.185 (Vol.18 No.6), pp.164-184.

# **APPENDIX 3 : Comment on the HER Industry entries**

The HER entries have certain limitations, including the following:

- 1) they depend upon the availability, manner and format in which evidence was created for incorporation.
- 2) their dating is sometimes so broad, and/or vague, as to be unhelpful or obscure.
- 3) the number of records depends partly upon the extent to which entries are 'lumped' or 'split'. For example, a single functional industrial entity such as the clay pit at Shorne has several entries (HER refs: TQ67 SE 275 [extensive modern clay pit], TQ66 NE 82 [reservoir] and TQ66 NE 84 [tramway sleepers]) whereas the chalk quarry at Lee's Works has just two entries (TQ66 SE 157 [pumphouse and well] and TQ66 SE 165 [tunnel]) although several more features could have been distinguished.
- 4) other sites are known also to contain a significant body of industrial archaeology remains, which have not been reported via the HER, in an accessible format or at all. Lee's, for example, has numerous remains of the former quarry railway system, traces of its rolling stock, and an aerial ropeway, but also World War 2 remains. Hilton Works has several items of rolling stock, one of which was salvaged, rebuilt and preserved at "The Cedars", Snodland. Two others salvaged remain derelict there.
- 5) it is immediately obvious from a glance at the map of HER Industrial site entries that they are nearly all concentrated around the north and east peripheries of the NNR. In the north, geologically one would expect industrial associations relating

to clay; in the east, to chalk. But, these are also the localities where development likely to disclose archaeological remains has occurred and are likely, therefore, to be over-represented; the rural hinterland of the NNR has by contrast has experienced little development and hence fewer opportunities for chance discoveries to be made<sup>8</sup>.

### **APPENDIX 4 : Possible research topics**

 Cobham lignite mine – referred to above, to elucidate its history would be a modest research exercise, which might usefully be "compared and contrasted" with (a) other lignite occurrences in the UK, such as Bovey Tracey in Devon, and (b) the discovery and development of true coal in the Dover hinterland after 1890. There is (given the small size of the business) a surprisingly large body of information about it, albeit much is anecdotal. That needs collating into a unified story. What would also be valuable is to discover more documented evidence of its activities (for example, Cobham Estate records, Abandoned Mine Plan, Company Records, newspaper reports, etc) to obtain more secure dating; then, to assess and record what surface remains still survive successive road widenings and natural decay.

Note that the mine site is the Lower Thames Crossing, Highways England Heritage Asset Number 2512 and that if the LTC project were to go-ahead the site of the mine would be impacted and would need to be subject to detailed archaeological excavation. A good historic account of the mine would be helpful in that regard.

- 2) Shorne Wood claypit/Shorne Wood Country Park<sup>9</sup> It is noted that in addition to the main HER reference to this site, there are several HER references to other clay workings locally. It would be potentially valuable to correlate all such HER and other clay references in this locality and gain a better understanding of the pre- and post-cement usages and opportunities of the clay deposit(s) locally.
- 3) Place and other names often a topic in which lay persons excel, the HER Industrial map makes clear that 80% of the study area contains no reference to HER locations. Yet, a superficial glance at OS maps shows that some industrial sites were recorded in that 80% area back in the 1860s and subsequently (references to clay pit, old clay pit, brick kiln, clay mill etc are common). Tithe maps would be another source of relevant information, as would a source such as the Electoral Roll (looking for 'Old Smithy' 'Old Forge' "Old Brewery" etc as house names). This could link to the next possible topic....
- 4) Linking industry to geology clearly evident from old OS and Tithe information ('Clay Pit, "Old Chalk Pit" etc) there would be an opportunity to increase the knowledge of the links between understanding of local geology and mineral working. This is also true of the major mineral working sites where more detailed understanding of geology and industry could refine and expand knowledge. For example, making 'Lime' requires 'Chalk', 'Cement' requires 'Chalk' and 'Clay' but what grades of each? Where do Upper, Middle and Lower

chalk, or London Clay, or Brick Earth, or Silica Sand occur, given that some are particularly valuable for different industries? Is our understanding of those numerous industries, especially the more rural, entirely consistent with the geology as presently known?

5) Air pollution impacts on the NNR – The cement industry was always known/notorious for its output of dust (technically known as Cement Kiln Dust, CKD). Although not known as a health hazard (unlike, say, dust from slate working) – indeed, rightly or wrongly, the cement industry often prided itself on the longevity of its workforce – dust deposition was certainly a nuisance. As testified by many photographs and anecdotes it built up progressively on roofs and other surfaces. Such impacts were probably mainly local up to around 1900 but there are a few earlier reports of legal action (particularly *Umfreville* and *Frederick Murray* v *Johnson*, 1875) to try and compel the industry to abate dust nuisance. A result was that Johnson constructed the first tall chimney, 300ft, at his new Greenhithe factory. Umfreville was less successful with a similar action against Swanscombe cement works, in 1874<sup>10</sup>.

From 1900 the introduction of the rotary kiln brought greatly increased cement production and similarly increased amounts of CKD emitted. The industry responded to that by increasing the height of the chimneys via which dust was discharged, from a nineteenth century height of little more than ground level, to 200ft or greater (the tallest chimneys, at Northfleet Works from 1970, were 600ft); this approach was known as "dilute and disperse" and was general at those cement works surviving by the 1920s along both the Thames and Medway. The dust itself had high levels of alkalis – calcium and potassium in particular – to the point that it could be beneficial as an agricultural fertiliser and it was sometimes sold as such.

In about 1978 the present writer (while an academic in Imperial College of Science & Technology and a consultant to the Blue Circle Cement Group) commissioned a study of the effects of cement kiln dust (highly alkaline) upon soils and plants in Darenth Wood SSSI, north Kent, by Paul Burnham, of Wye College, Ashford. The dust originated from cement works nearby (but outside) the NNR study area, perhaps 20-30 works in all, since the 1830s-40s but more especially from the 1920s when "dilute and disperse" via tall chimneys became more general. It was found that in situations where the natural soils should have been acidic - over Thanet Sand geology, for example - the surface few centimetres were alkaline and that this appeared to influence the flora. CKD was a potential explanation for the odd associations of alkaline ground flora with acid woodland. The research was never published but surviving notes have been relocated, and can be summarised and developed as a guide to further work. Those effects were found at least as far southeast as Canterbury (Blean Woods SSSI). If the NNR contains suitable soils the effect should also have been seen in the study area and would bear investigation. It would probably need to be a college-based study, with an appropriate soil analysis facility although, nowadays, simple soil test-kits (garden centre type!) might also be employable?

6) **Recovery of bio-diverse chalk grassland** – The pNNR area contains both agricultural activity and woodland. Given the way national agricultural policy

seems to be moving, studies aimed at accelerating the process of reverting agricultural land to species-rich grassland, as compared to the rates achieved by natural recolonisation in local chalk quarries, could prove valuable. In 1995, Blue Circle Cement funded a desk study of how species-poor agricultural land might best be reverted to chalk grassland, undertaken by Bioscan and with the co-operation of English Nature (as was)<sup>11</sup>. Albeit with different starting points, these three circumstances are directed towards the same ends.

### References

- <sup>1</sup> Traditionally, chalk was sub-divided into Upper, Middle and Lower Chalk for geological classification; that has subsequently been modified and partly renamed, but the old terminology remains intuitively helpful for some purposes, including this report.
- <sup>2</sup> Although the cement-related industrialisation along the Kent bank of the Thames and the Medway was similar in causation and principles, the Medway was always the junior partner. In the 1940s the eight cement works along the Thames (Metropolitan, Tunnel, Wouldham (Grays), Kent, Johnson's, Swanscombe, Bevan's and Thames/Cliffe) had an installed manufacturing capacity of just over 4 million tons (average per factory (0.5 million tons). Along the banks of the Medway the five surviving factories (Burham [just], Crown & Quarry, Martin Earle's, Rugby and Holborough) totalled but 0.9 million tons (average 0.190 million tons). Geologically, the two areas were similar (in fact Medway was in some ways slightly superior), but the smaller, shallower river and especially the lack of headroom under Rochester bridge severely inhibited growth, especially upstream, of an industry then so reliant upon river transport.
- <sup>3</sup> Brick making goes back to at least 7000BCE, and apart from a temporary introduction into Britain by the Romans, came back into use by the 13<sup>th</sup> century CE. Lime burning, too, is a very old industry worldwide, from 6000 BCE, becoming increasingly widespread in Britain from the 13<sup>th</sup> century CE; excavating deneholes goes back to the 1<sup>st</sup> century CE to obtain chalk for use as manure. Cements, based originally on lime, are also recorded some thousands of years ago.
- <sup>4</sup> Daniel Defoe, "A Tour thro' the whole island of Great Britain, divided into circuits or *journeys*", Letter II Part I, Containing a description of the sea-coasts of Kent, Sussex, Hampshire, and of part of Surrey (1724-27).
- <sup>5</sup> Colonel (later Major-General Sir) Charles William Pasley of the Royal Engineers was heavily involved in investigations into the manufacture and use of cements for military construction. His first book was published in 1838 ("Observations on Limes, Calcareous Cements, Mortars, Stuccos and Concrete, and on Puzzolanas, Natural and Artificial") but, as he noted in its preface, the "first sheets of the present work" had been sent to the press in May 1836.
- <sup>6</sup> Cement works and quarries on the East Bank are largely ignored for the present purpose; except very indirectly they could have little effect on the pNNR. However, for completeness they were (north to south and with approximate operational dates) Borstal Court/Booth's (1852-1921), Borstal Manor (1893-1922), Tingey's quarry (c1890-c1910), Wouldham (1856-c1900), Peter's/Wouldham Hall (1869c1927), West Kent/Margett's (c1873-1926), Burham (1854-c1941) and West Kent/Aylesford (1860s?-c1907?).

- <sup>7</sup> The same principle was adopted by Blue Circle Industries for their proposed new Medway Cement Works, permitted in 2001 but never built. As with the Rugby Portland Cement example, the end result of quarrying would have been a substantial deep lake.
- <sup>8</sup> There are occasional exceptions. One such is the chance discovery [TQ 67046515] of human remains in A.D.1930-31 by workmen digging the foundations for electricity pylons. Such occurrences would today be more likely to result from archaeological investigations submitted in response to pre-application requirements or pre-commencement planning conditions.
- <sup>9</sup> A history and industrial archaeology appraisal of Shorne Wood claypit, Chris Down, BSc PhD. Paper prepared for use by the Country Park, 12 August 2020 and derived, with additional material and illustrations, from what was subsequently published as: "The North Kent claypit railways, Part III: Cobham (Shorne Wood) claypit", The Industrial Locomotive, No.184 (Vol.18 No.5) (2022), pp.129-147.
- <sup>10</sup> Samuel Charles Umfreville JP (1820 94) of Ingress Abbey and his Fight with the Cement Makers. (<u>https://www.nwkfhs.org.uk/images/online\_articles/umfreville.pdf</u>), North West Kent Family History Society.
- <sup>11</sup> Gibson, C.W.D, *Creating Chalk Grasslands on Former Arable Land: a Review*, Bioscan Report E0491R2 (1995), 39pp.