The University Of Sheffield.

Archaeological Process Recoding

Stocksbridge Steel Works, Sheffield, South Yorkshire

Archaeological Process Recording at the Scrap Yard and the Electric Arc Furnace

ARCUS report 837c.1(1)

March 2009

Client: RSK ENSR Environment Ltd

ARCUS

Stocksbridge Steelworks, Sheffield

Grid Reference: SK 2580 9910 (centred)

Archaeological Process Recording

Assessment Report No. 837c.1(1)

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Checked by:	Passed for submission to client:
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OASIS SUMMARY FORM

PROJECT DETAILS		
OASIS identifier	arcus2-55724	
Project title	Stockbridge Steelworks, Sheffield	
Short description of the project	In July 2005, ARCUS were commissioned by RSK ENSR, on behalf of Corus, to undertake process recording on the operation of the scrapyard and on the penultimate steel melt of the electric arc furnace at Stocksbridge Steelworks, South Yorkshire (SK 2580 9910). Recording included black and white and colour photography, as well as video of the melt. The work was undertaken prior to the closing of the melting shop and scrapyard, with the aim of preserving a record of the processes and technology used at the Stocksbridge Works at the end of its 143-year history of steel production. The management of materials throughout the site was structured to directly reflect the site process flow. Materials were sorted and arranged to facilitate quick selection for melting in the furnace. The processes and equipment used in the melt shop were typical of the operation, and differed little from other works running similar operations. However significance was earned in Stocksbridge Steelworks to what had been the final evolution in production methods onsite that had began with crucible steel manufacturing.	
Project dates	11th July 2005 – 25th August 2005	
Previous/future work	Desk-based assessment and historic buildings appraisal / watching brief	
Monument type and period	Steelworks – Post mediaeval	
Significant finds (artefact type and period)	none	
PROJECT LOCATION		
County/Parish	South Yorkshire,	
Site address	Stocksbridge	
Site co-ordinates	SK 2580 9910	
Site area	18.5 ha	
Height OD	180-220m AOD	
PROJECT CREATORS		
Organisation	ARCUS	
Project brief originator	SYAS	
Project design originator	ARCUS	
Project supervisor	Oliver Jessop	
Project manager	Oliver Jessop	
Sponsor or funding body	RSK ENSR Environment Ltd	
PROJECT ARCHIVES		
Archive Type	**Location/Accession no.**	**Content (e.g. pottery, metalwork, etc)**
Physical	n.a.	n.a.
Paper	Sheffield City Archives	Report, photographic archive, fieldwork notes
Digital	SMR	pdf copy of report
BIBLIOGRAPHY		
Title	Archaeological process recording at Stocksbridge Steelworks, Sheffield	
Report no	837c.1(1)	
Author	James Thomson and Mark Douglas	
Date	March 2009	

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63 On cooling, an overhead crane is used to move the moulds and the stainless steel ingots are removed

64 The finished ingots are loaded on to flat bogies for transfer from the melting shop

NON-TECHNICAL SUMMARY

In July 2005, ARCUS were commissioned by RSK ENSR, on behalf of Corus, to undertake process recording on the operation of the scrap-yard and on the penultimate steel melt of the electric arc furnace at Stocksbridge Steelworks, South Yorkshire (SK 2580 9910). Recording included black and white and colour photography, as well as a digital video record of the melt. The work was undertaken prior to the closing of the melting shop and scrap-yard, with the aim of preserving a record of the processes and technology used at the Stocksbridge Works at the end of its 143-year history of steel production.

The scrap-yard was located to the west of the site, mainly consisting of a large open space divided into silos for the storage of materials, and infrastructure for its movement. The management of materials throughout the site was structured to directly reflect the site process flow with incoming and outgoing goods stored towards the site entrance and materials sorted and arranged to facilitate quick selection within named areas.

The melting shop was located to the east of the scap-yard contained an electric arc furnace, and dated to c.1950. The processes and equipment used in the melting shop were typical of the operation, and differed little from other works running similar operations. The electric arc furnace in Stocksbridge Steelworks represented the end of a long history of steelmaking that had begun with crucible steel manufacturing in the mid-19th century.

The process recording of the scrap-yard and melting shop established technical knowledge of the processes at work with the oral testimonies given by the workers and revealed preserved extraneous practices that represented the remnants of previous processes. This included the preservation of a demolished slag mill through the continued practice of storing slag in the area where it had been situated.

1 INTRODUCTION

This report presents the results of archaeological process recording of the scrapyard and electric arc furnace at Stocksbridge Steelworks. The scheme of recording included a site visits and was prepared in accordance with Institute of Field Archaeologists guidelines (IfA 2008). ARCUS were commissioned by RSK ENSR Environment Ltd to undertake process recording.

1.1 Site Location

The site (centred on SK 270 987) is located to the north of Stocksbridge, at the bottom of the steep valley of the River Porter or Little Don (**Illustration 1**). It is bounded on the south by Manchester Road, and to the north by Hunshelf Road. The site is currently occupied by extensive steelworks buildings which are arranged in a linear fashion along the bottom of the valley (**Illustration 2**). The processes recorded as part of this investigation were undertaken in the western end of the site, and related to the operation of a scrap heap (SK 2588 9911) and electric arc furnace (SK 2632 9892).

2 AIMS AND METHODOLOGY

2.1 Aims

The general aim of this investigation was to interpret the function of structures and yards on site at the time of the survey, and to form a process flow detailing their relationships. This is achieved by interpreting information gathered on the site during the desk-based assessment and buildings appraisal (May & Jessop 2005) and enhancing it with additional photography, video, and written observations.

The specific aims are:

- to assess the function of standing buildings and yards on the site; and
- to identify the flow of processes between them.

2.2 Methodology

The recording methodology adopted during this survey has been undertaken in accordance with guidelines described in Understanding Historic Buildings: A Guide to Good Recording Practice (English Heritage 2006).

Site fieldwork was undertaken on 11/07/2005 and 28/08/2005, and comprised photography, digital video recording, written notes and sketch plans. The photographic record comprised a series of general and detailed shots taken with 35mm and medium format camera. Where possible, photographs were taken of the exterior and interior of each building. Additional digital recording of the operation of the electric arc furnace included colour digital photography, and digital video recording over two mini-DV tapes. A selection of images taken during fieldwork are included as plates (**Plates 1-64**), and their locations recorded on a plan of the site (**Illustration 4**). The drawn record consists of plans showing features of significance to site processes. Standard RCHME drawing conventions were followed were necessary.

3 SITE PROCESSES

The site processes covered in this investigation were located in the northwest end of Stockbridge Steelworks, and constituted the preparation and melting of scrap into high quality steel for use in specialised industries (**Illustration 3**).

3.1 Scrap-yard

The yard was a strip of land measuring 588 x 195m to the northwest of the site (**Plates 1-2**) although the recycling activity was concentrated in a broad strip along the northern half of this area. The area contained few structures consisting mainly of open air silos for the sorting and storage of materials. A site railway system linked the scrap-yard to the rest of the steelworks, with numerous sidings, and access to maintenance buildings (A6-A7). In addition there was a disused railway cutting across the north of the scrap-yard that predated the scrap-yard and had until the early 20th-century been the Sheffield Corporation Railway.

3.1.1 Scrap sorting

The main structures involved in this process were two buildings, A1 and A3, at either end of the area, which were separated by structure A2: consisting of silos and massive overhead gantries (**Plates 3-5**). Originally there had been three parallel gantries supporting two large overhead cranes, although the southernmost gantry had been mostly dismantled and the remaining crane was redundant. Instead the movement of material was entirely facilitated by vehicles.

Vehicles used in the manipulation and transport of material included Kress slag pot carriers (**Plate 6**) that were also fitted to carry scrap skips, wheel loaders with tyre protection chains (**Plate 7**), track 360 hydraulic arm with electromagnet (**Plate 8**), railway crane (**Plate 9**), and flatbed railway wagons (**Plate 10**).

Received scrap was broken up and cut down around building A3, using a combination of thermal lances (**Plate 11**) and machines including a wheeled 360 degree long reach machine with orange peel grapple that was used to drop a wrecking ball to smash large pieces of scrap (**Plates 12-13**). The scrap was then sorted, some of it in building A3, a steel framed shed with corrugated sheet cladding (**Plates 14-17**), where its movement was facilitated by a travelling crane with electromagnet attachment. Scrap material was sorted into two main categories (**Plate 18-20**):

- Basic: steel produced from iron with low sulphur impurity; and
- Acid: steel produced from iron with low phosphorus impurity

The differences in the compositions of the metals are a significant factor in the production of specialised steels from scrap, and care would be taken to use the appropriate material for a particular product. In addition there was a third material category consisting of iron. Imported onto the site, this iron had very few impurities and consequently could be used in conjunction with low quality scrap in order to enrich it during re-melting.

Within the main categories, the scrap would be sorted into two broad grades:

- Shred: consisting of light-gauge steel; and
- Heavy melt: consisting of heavier beams and slabs

The grades became important when preparing the scrap for charging, during which the scrap was sandwiched with heavy melt between a thin layer of shred on the

bottom, and a thicker layer of shred on top. This was to ensure good furnace operation, and to present a looser material for the electrodes to bore through during meltdown.

Building A1 was a large rectangular steel frame building with red brick lower storey and semi clad first storey with corrugated sheeting (**Plates 21-22**). The remaining disused travelling crane (**Plates 23-26**) entered into the top storey of the building, presumably for access and maintenance, with room to the south of it for the removed crane. The ground floor of the building functioned as a store for the alloys used in melting (**Plate 27**). In addition building A1 contained an electrical cabinet with a mercury arc rectifier for transforming incoming electricity from AC to DC (**Plate 28**).

In addition to the preparation of material for the furnaces, a plot to the west of the area dealt with uprisings and stockpiled waste products of the furnace process (**Plate 29**). The slag mill, recorded in the area from *c*1930 to *c*1981, had been located to the west of building A3 and would have facilitated the reclamation of usable material from slag. Its demolition indicates a change in policy towards waste material, and the probable outsourcing of its processing. Part of this area was referred to as the *slag lagoon* (**Plate 30**): a term commonly used to describe ponds that resulted from the excavation of limestone for use as a flux in furnaces. Although there were no such ponds, two pits in the area could be the remnant of mineral extractions.

3.1.2 Other processes

Several buildings within the survey area did not form a direct link in the site's process flow but rather facilitated general operations. These included site infrastructures such as access roads and rail network (**Plates 9 & 31**); buildings for the maintenance and storage of vehicles such as buildings A5 (**Plate 32**), A6 (**Plates 33-34**) and A7 (**Plate 35**); and buildings A4 that supervised the site entrance (**Plate 36**).

3.2 Melting Shop

The melting shop dated to the 1950s and was a rectangular steel framed structure with corrugated sheet cladding (**Plates 37-38**), aligned northwest-southeast, and located to the east of the scrap-yard. Access between the two was via an access road to the north of the melting shop, and railway to the north and south. In addition to the steel melting and casting equipment within the building was an area for the preparation of scrap for charging to the north of the structure, and storage areas to the south.

The production of high quality steel by the 'Electric Arc Furnace' method can be divided into nine basic operations:

- Charging: the introduction into the furnace of the major constituent material necessary;
- Melting: the efficient melting, primarily by electric means, of the charged material;
- Refining: the charging of lime to the furnace to accelerate the formation of slag;
- Alloying: the charging of secondary minor constituent material;
- Oxidising: the removal of unwanted chemical components such as phosphorus, manganese, sulphur and aluminium from the melted steel;

- De-slagging: the removal of molten slag from the surface of the melt;
- Tapping: pouring the molten steel into a ladle for transfer to the next process;
- Vacuum de-gassing: the removal of dissolved gasses from the refined steel; and
- Teeming: the casting of the molten steel into solid ingots.

The 'Electric Arc Furnace' is an efficient method of bulk steel production. As the name of the process suggests the heat needed to produce molten steel is generated with the aid of graphite electrodes. The furnace is of a direct arc type where the heat is generated by the arc transferred from the electrodes and the metal charge. The energy for the electrodes is supplied, via water cooled high current cables, from the furnace transformer. The transformer converts a direct supply in the form of high-voltage electricity to low voltage electricity, with a high current.

The use of the electric arc process allows high temperatures to be achieved rapidly, therefore accelerating the rate of melting; producing a typical melt of around 150 tonnes. In addition a close control of the temperature and the physical and chemical properties within the furnace is achievable, allowing for the utilisation of low-grade scrap in the production of high quality steels.

The furnace can be divided into two sections. The bottom section, which includes the furnace shell and its associated mechanical components, and the top section which comprises the roof supporting and swinging structure, the electrode holders and lifting mechanism as well as the electrodes themselves. The roof is also capable of being swung to one side (the tapping side) to allow for charging to take place.

The furnace shell consists of a dished bottom and cylindrical wall lined with refractory material and water-cooled panels. The base of the furnace rests on rockers allowing for the tilting of the complete furnace, up to 15° from horizontal, either towards the slagging hole or the tapping side that are located on opposite sides of the shell. A working platform circumvents the furnace shell in line with the slagging door, allowing for ease of testing and alloying.

3.2.1 Charging the furnace

To charge the furnace the roof was swung to one side and the initial charge of scrap metal contained within a charging basket was manoeuvred into a position directly above the furnace shell (**Plate 39**). The base of the basket, which comprised clamshell doors, was opened and the scrap was dropped into the furnace (**Plates 40-41**). The roof was then swung back into place (**Plates 42**) and the electrodes lowered into position and the melt began (**Plate 43**).

As the electrodes bore into the scrap the arc was erratic and produced heavy and unsteady fluctuations within the furnace, which resulted in violent vibrations and movement of the high voltage cables. As the scrap charge began to melt, forming a molten pool in the base of the furnace, the furnace operation stabilized and the voltage increased (**Plate 44**). The charging of scrap was repeated until the required amount of virgin metal was achieved (**Plates 45-50**). Once all of the scrap had been reduced to molten state and a flat bath conditions had been achieved the temperature of the melt was measured and a sample of the metal was taken for analysis.

Sampling was carried out by passing a sample probe through the slagging door. The

sample probe consisted of a hollow sample mould, the interior of which is held under sealed vacuum. As the probe was passed into the molten metal the seal was broken thereby drawing a small amount of uncontaminated metal into the mould. The analysis of the resulting sample determined the next stage in the steel production process, the alloying and refining.

3.2.2 Alloying

To produce high quality steel of a certain grade the properties of the finished material is carefully controlled. In the case of stainless steel chromium was added to the basic virgin steel to produce the essential properties required. The chromium was charged into the furnace via the slagging door by a small truck with a bucket on the end of a long rod allowing the alloys to be charged into the centre of the furnace (**Plate 57**).

3.2.3 Refining

Refining operations involved the removal from the melt of unwanted chemical components, and occurred simultaneously with the melting operation. Chemical impurities within the steel include sulphur, phosphorous, manganese, aluminium and silicon, which all react readily with the oxygen supplied to the furnace, separating from the iron and rising to the surface of the bath. Crushed limestone (calcium

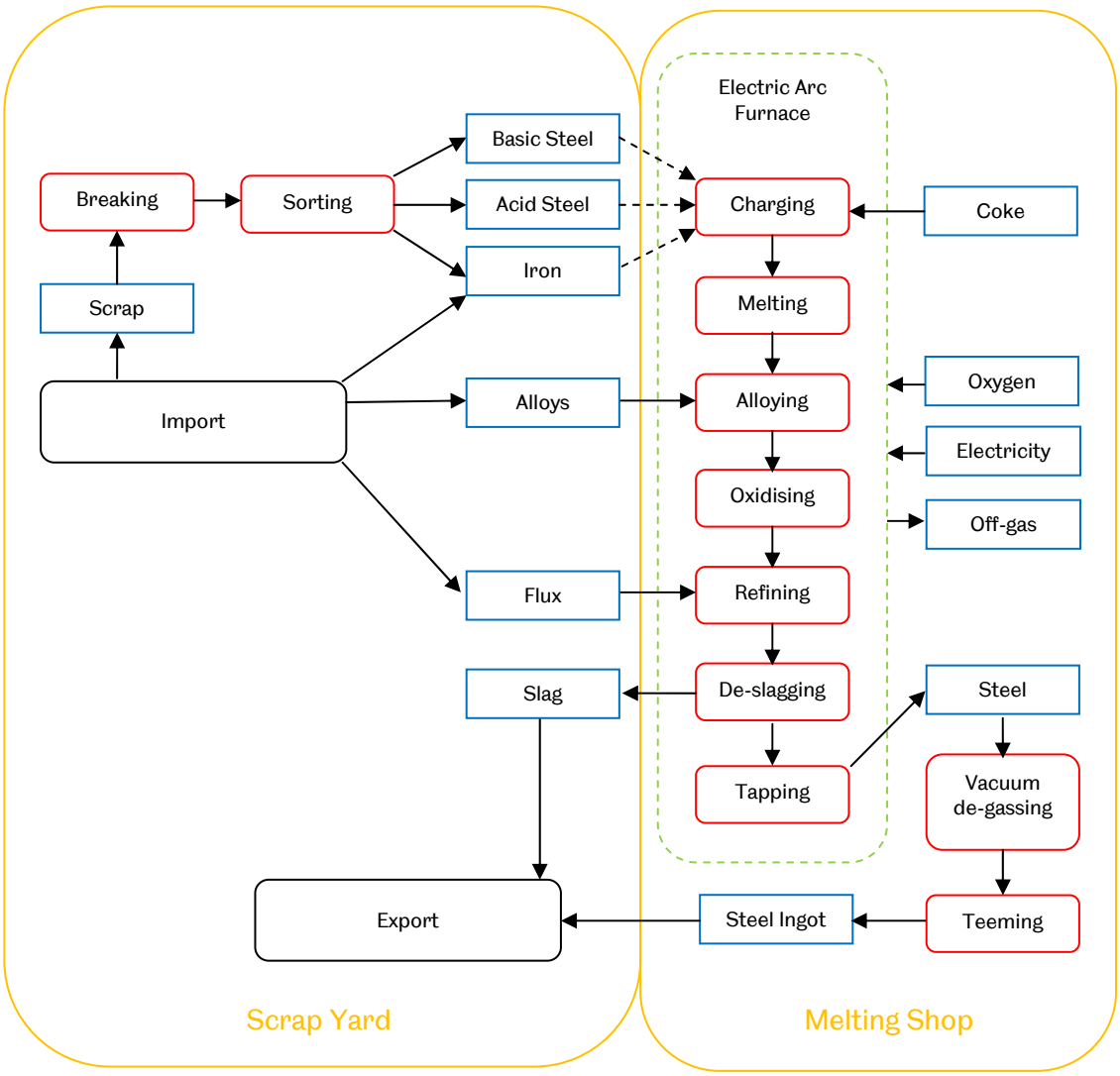

Figure 1: Process flow chart for Stocksbridge Steelworks

oxide) charged into the furnace acted as a slagging agent, consolidating the contaminates and protecting the refractory lining of the furnace (**Plates 51-53**). When heated the limestone releases carbon dioxide which combines with the phosphorus and creates turbulence within the molten metal assisting the process. Where there was sulphur in the melt from acid steel, magnesite (magnesium carbonate) could be added to neutralise it. The oxygen also combined with the carbon in the iron forming carbon monoxide gas that rose to the surface and was extracted.

The oxidized contaminants, being less dense than the molten metal, floated to the surface to collect as molten slag. The slag was poured off into a ladle by tilting the furnace in the direction of the slagging door. A portion of the working platform had to be moved aside during de-slagging in order to manoeuvre a ladle into position beneath the opening (**Plates 54-56**). Further monitoring and removal of contaminates was undertaken in vacuum de-gassing between tapping and teeming. During this process the ladle carrying the molten metal was placed within a chamber that was then evacuated. Automated stirring and monitoring of temperature ensured quality of the product while elements such as hydrogen and sulphur were removed.

3.2.4 Tapping and teeming

Once the slag had been removed, the furnace would be tilted the opposite way and the molten steel tapped into a ladle (**Plates 58-60**). This ladle was then manipulated by travelling crane through the vacuum de-gassing system, and then tipped to pour the still molten metal into ingot moulds (**Plates 61-62**). Once set a crane fitted with a grapple pulled the still red-hot ingots from their moulds and laid them on to flat bed bogie wagons for transfer to storage (**Plates 63-64**).

3.2.5 Other processes

The discussion of the melting shop process has been deliberately focused on the melting process. Although control systems, waste gas processing, and electricity generation were significant element of the furnace operation, they either did not form a significant part of the surveyed area or in the case of control systems, were simply involved in facilitating the main processes.

4 DISCUSSION

The management of materials throughout the site was structured to directly reflect the site process flow (**Figure 1**). Received scrap and outgoing waste was stored to the western end of the site in proximity to the site entrance, with prepared scrap and alloys closer to the furnaces to the east. In addition the scrap was arranged into areas with *basic side* to the north, *acid side* in the centre, and *ironland* to the south facilitating quick selection for melting. The relative size of the sorting areas also illustrated the comparative rarity of acid steel to basic steel, the later having been largely favoured for mass production.

The processes and equipment used in the melt shop were typical of the operation, and differed little from other works running similar operations. The melting process can be seen as the product of the progressive evolution of knowledge and techniques developed in steel making from the early 18th century. The electric arc furnace itself was developed in the mid-late 19th century, with the furnace in Stocksbridge of a design common to many integrated steelworks across the world. However the significance of the electric arc furnace in Stocksbridge Steelworks is amplified when

viewed in terms of the site's history, where steel making on site began with the crucible process, evolving though Bessemer converters and Siemens furnaces before taking up electric furnaces.

The process recording of the scrap-yard and melting shop combined established technical knowledge of the processes at work with the oral testimonies given by the workers, both of which were an integral part of the site, and crucial to understanding its wider significance (after Badcock and Malaws 2004). Despite the area's development as connected units in the process of converting scrap to high quality steel, the area preserved redundant or extraneous practices that represented the remnants of previous processes. This is illustrated in the continued storage of uprisings from the furnace process in proximity to where from *c*1930-1981 a slag mill had been situated; and the use of 'slag lagoon' in the description of an area where a slag lagoon was no longer evident. This preservation of memory through practice contrasts with the preservation of practice through physical remnants, seen in the disused gantries and travelling cranes of the scrap-yard that were abandoned in favour of vehicles for the manipulation of scrap. These examples demonstrate how processes are shaped by both functional considerations and retained associations, which often only manifest in the actual physical arrangement of processes and the associated labels preserved by those who worked them.

5 ARCHIVE

The project archive will be deposited with Sheffield City Archives. The archive will be prepared by ARCUS staff in accordance with the requirements specified in Management of Research Projects in the Historic Environment (English Heritage 2006b) and with UKIC guidelines (1990). In addition, copies of this report will be circulated to the client, and retained in the offices of ARCUS. It is intended that an edited copy of the digital video footage will be submitted to the Yorkshire Film Archive; acceptance has not yet been confirmed.

6 ACKNOWLEDGEMENTS

The authors would like to thank the following for their assistance and cooperation: CORUS for arranging access to the site, RSK for their aid and cooperation, and Trevor Lodge for providing information on the history and processes of Stocksbridge Steelworks.

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8 APPENDIX 1: PHOTOGRAPHIC REGISTERS

Film 10

Format	B&W	**Type**	Medium format	**Photographer**	S. Jessop

Film & frame	**View point**	**Report plate**	**Description**	**Direction**	**Date**
10.1	1		East elevation of A1	NW	25/8/05
10.2	2	2	General view of scrapyard	W	25/8/05
10.3	2	1	General view of A7	SW	25/8/05
10.4	2	4	Detail of scrap baskets	W	25/8/05
10.5	2		Detail of gantries in A2	NW	25/8/05
10.6	2		Detail of scrap pile	NW	25/8/05
10.7	2		General view of scrap yard	W	25/8/05
10.8	2	23	Interior of top floor, A1 (overhead crane)	N	25/8/05
10.9	2		Interior of top floor, A1 (control cabin)	S	25/8/05
10.10	2		Detail of top section of A1	NW	25/8/05

Film 11

Format	B&W	**Type**	Medium format	**Photographer**	S. Jessop

Film & frame	**View point**	**Report plate**	**Description**	**Direction**	**Date**
11.1	2		General view of melting shop	SE	25/8/05
11.2	2		General view of billet pivoting shop	SE	25/8/05
11.3	3		General view of A2 and scrap	NW	25/8/05
11.4	3	25	Detail of cab on overhead crane	N	25/8/05
11.5	3	26	Detail of interior of cab	N/A	25/8/05
11.6	3		View along top of A2 walkway	NW	25/8/05
11.7	3		View along top of A2 walkway	NW	25/8/05
11.8	3	24	View along driveshaft of overhead crane	N	25/8/05
11.9	-	28	Detail of Meray Arc rectifier in A1	S	25/8/05
11.1	2		General view of melting shop	SE	25/8/05

Film 12

Format	B&W	Type	Medium format	Photographer	S. Jessop

Film & frame	View point	Report plate	Description (room/ NMR number)	Direction	Date
12.1	4		Northern passage through A1	SW	25/8/05
12.2	4	21	Detail of attached block, east side of A1	SW	25/8/05
12.3	5	22	General view of west elevation of A1	SE	25/8/05
12.4	5		Detail of crane stanchion, A2	NW	25/8/05
12.5	6	5	General view of Top Tip (scrapyard)	SW	25/8/05
12.6	6		General view of Top Tip (scrapyard)	SE	25/8/05
12.7	7	7	Detail of bucket loader (dump truck)	W	25/8/05
12.8	7		Detail of Kress carrier	W	25/8/05
12.9	7	6	Detail of Kress carrier	W	25/8/05
12.10	7	3	Detail of Kress carrier	W	25/8/05

Film 13

Format	B&W	Type	Medium format	Photographer	D. Tucker

Film & frame	View point	Report plate	Description	Direction	Date
13.1	8	8	Details of electromagnetic loading of scrap	NE	25/8/05
13.2	8	18	General view of scrap piles	W	25/8/05
13.3	8	14	Exterior of A3	NW	25/8/05
13.4	9	29	Scrap waste from melting	SW	25/8/05
13.5	9	19	Detail of baled scrap (wire bails)	SE	25/8/05
13.6	9	20	Detail of baled scrap (wire bails)	SW	25/8/05
13.7	10	10	Detail of railway wagons and scrap	NW	25/8/05
13.8	11	15	General view of SE end of A3 (overhead crane)	NW	25/8/05
13.9	12		Details of cut up steel for pressing	SW	25/8/05
13.10	12	11	Cutting scrap with thermal lance	SW	25/8/05

Film 14

Format	B&W	Type	Medium format	Photographer	S. Jessop

Film & frame	View point	Report plate	Description	Direction	Date
14.1	12	16	Cutting scrap with thermal lance	SW	25/8/05
14.2	13		Interior of A3	SW	25/8/05
14.3	13	17	Interior of A3, showing loading of scrap	NW	25/8/05
14.4	14		General view along scrapyard	E	25/8/05
14.5	14	13	General view of W end of scrapyard	S	25/8/05
14.6	15		General view of slag lagoon	SW	25/8/05
14.7	15	30	General view of slag lagoon	NE	25/8/05
14.8	16		Detail of weighbridge	NW	25/8/05
14.9	16	36	Detail of weighbridge	NE	25/8/05

Film 15

Format	B&W	Type	Medium format	Photographer	S. Jessop

Film & frame	View point	Report plate	Description (room/ NMR number)	Direction	Date
15.1	17	12	Long arm 360 degree clam shell grab	SE	25/8/05
15.2	18	32	Kress maintenance building	W	25/8/05
15.3	18		General view of scrapyard	SE	25/8/05
15.4	19	9	General view of railway sidings and crane	SE	25/8/05
15.5	19		General view of crane with magnet	W	25/8/05
15.6	20	35	General view of A6	SW	25/8/05
15.7	21	34	General view of interior of A6	E	25/8/05
15.8	22		General view of exterior of A6	S	25/8/05
15.9	23	33	General view of front of A6	SW	25/8/05
15.10	23	31	General view E of A1	NE	25/8/05

Film 16			Project 837, Stocksbridge Steel Works		
Format	B&W	**Type**	35mm	**Photographer**	M. Douglas

Film & frame	View point	Report plate	Description	Direction	Date	Colour Slide
16.1	-		Close-up of furnace	-	11/7/05	
16.2	-		Hoppers	-	11/7/05	
16.3	-		General shot of production area	-	11/7/05	
16.4	-		Teeming steel into moulds	-	11/7/05	
16.5	-		Teeming steel into moulds	-	11/7/05	
16.6	-		Teeming steel into moulds	-	11/7/05	
16.7	-		General shot of teeming area	-	11/7/05	
16.8	-		Charging baskets	-	11/7/05	
16.9	-		Teeming steel into moulds	-	11/7/05	
16.10	-		Teeming steel into moulds	-	11/7/05	
16.11	-		Void	-	-	
16.12	-		Void	-	-	
16.13	-		Void	-	-	
16.14	-		Void	-	-	
16.15	-		Void	-	-	
16.16	-		Void	-	-	
16.17	-		Void	-	-	
16.18	-		Void	-	-	
16.19	-		Void	-	-	
16.20	-		Void	-	-	
16.21	-		Void	-	-	
16.22	-		Void	-	-	
16.23	-		Void	-	-	
16.24	-		Void	-	-	
16.25	-		Void	-	-	
16.26	-		Void	-	-	
16.27	-		Void	-	-	
16.28	-		Void	-	-	
16.29	-		Void	-	-	
16.30	-		Void	-	-	
16.31	-		Void	-	-	
16.32	-		Void	-	-	
16.33	-		Void	-	-	
16.34	-		Void	-	-	
16.35	-		Void	-	-	
16.36	-		Void	-	-	

Film 17			Project 837, Stocksbridge Steel Works		
Format	B&W	**Type**	35mm	**Photographer**	M. Douglas

Film & frame	View point	Report plate	Description	Direction	Date	Colour Slide
17.1	-		Teeming area	-	11/7/05	
17.2	-		Teeming area	-	11/7/05	
17.3	-		Moulds for steel ingots	-	11/7/05	
17.4	-		Teeming area	-	11/7/05	
17.5	-		Crane moving moulds containing ingots	-	11/7/05	
17.6	-		Crane moving moulds containing ingots	-	11/7/05	
17.7	-		Teeming area	-	11/7/05	
17.8	-		Moulds for steel ingots	-	11/7/05	
17.9	-		Crane moving moulds containing ingots	-	11/7/05	
17.10	-		Ladle in position, awaiting tapping of steel	-	11/7/05	
17.11	-		Ladle in position, awaiting tapping of steel	-	11/7/05	
17.12	-		Ladle in position, awaiting tapping of steel	-	11/7/05	
17.13	-		Tapping of molten steel into ladle	-	11/7/05	
17.14	-		Tapping of molten steel into ladle	-	11/7/05	
17.15	-		Tapping of molten steel into ladle	-	11/7/05	
17.16	-		Overhead hoist	-	11/7/05	
17.17	-		Tapping of molten steel into ladle	-	11/7/05	
17.18	-		Tapping of molten steel into ladle	-	11/7/05	
17.19	-		Transfer of ladle	-	11/7/05	
17.20	-		Transfer of ladle	-	11/7/05	
17.21	-		Transfer of ladle	-	11/7/05	
17.22	-		Addition of materials to molten steel	-	11/7/05	
17.23	-		Addition of materials to molten steel	-	11/7/05	
17.24	-		Addition of materials to molten steel	-	11/7/05	
17.25	-		Addition of materials to molten steel	-	11/7/05	
17.26	-		Addition of materials to molten steel	-	11/7/05	
17.27	-		Addition of materials to molten steel	-	11/7/05	
17.28	-		Ladle	-	11/7/05	
17.29	-		Teeming area	-	11/7/05	
17.30	-		Removal of cooled ingots from moulds	-	11/7/05	
17.31	-		Addition of materials to molten steel	-	11/7/05	
17.32	-		Addition of materials to molten steel	-	11/7/05	
17.33	-		Addition of materials to molten steel	-	11/7/05	
17.34	-		Addition of materials to molten steel	-	11/7/05	
17.35	-		Void	-	-	
17.36	-		Sign in cuneiform, reading 'Steelworks' (made by employee)	-	11/7/05	

Film 18			Project 837, Stocksbridge Steel Works		
Format	B&W	**Type**	35mm	**Photographer**	M. Douglas

Film & frame	View point	Report plate	Description	Direction	Date	Colour Slide
18.1	-		Tapping of slag	-	11/7/05	
18.2	-		Tapping of slag	-	11/7/05	
18.3	-		Tapping of slag	-	11/7/05	
18.4	-		Tapping of slag	-	11/7/05	
18.5	-		Tapping of slag	-	11/7/05	
18.6	-		Tapping of slag	-	11/7/05	
18.7	-		Addition of chromium to melt	-	11/7/05	
18.8	-		Addition of chromium to melt	-	11/7/05	
18.9	-		Addition of chromium to melt	-	11/7/05	
18.10	-		Addition of chromium to melt	-	11/7/05	
18.11	-		Addition of chromium to melt	-	11/7/05	
18.12	-		Addition of chromium to melt	-	11/7/05	
18.13	-		Addition of chromium to melt	-	11/7/05	
18.14	-		Loading of cooled ingots onto bogey for transferral to stockyard	-	11/7/05	
18.15	-		Electrodes and furnace	-	11/7/05	
18.16	-		Addition of limestone to melt	-	11/7/05	
18.17	-		Addition of limestone to melt	-	11/7/05	
18.18	-		Addition of limestone to melt	-	11/7/05	
18.19	-		Furnace, lid open	-	11/7/05	
18.20	-		Furnace, lid open	-	11/7/05	
18.21	-		Furnace, lid open	-	11/7/05	
18.22	-		Furnace, lid open	-	11/7/05	
18.23	-		Furnace and basket of limestone	-	11/7/05	
18.24	-		Furnace	-	11/7/05	
18.25	-		Furnace	-	11/7/05	
18.26	-		Furnace	-	11/7/05	
18.27	-		Scrap storage area adjacent to furnace	-	11/7/05	
18.28	-		Scrap storage area adjacent to furnace	-	11/7/05	
18.29	-		Teeming area	-	11/7/05	
18.30	-		Teeming area	-	11/7/05	
18.31	-		Teeming area	-	11/7/05	
18.32	-		Teeming area, showing flow of molten steel to moulds	-	11/7/05	
18.33	-		Detail of ladle in teeming area	-	11/7/05	
18.34	-		Detail of ladle in teeming area	-	11/7/05	
18.35	-		Detail of ladle in teeming area	-	11/7/05	
18.36	-		Detail of ladle in teeming area	-	11/7/05	

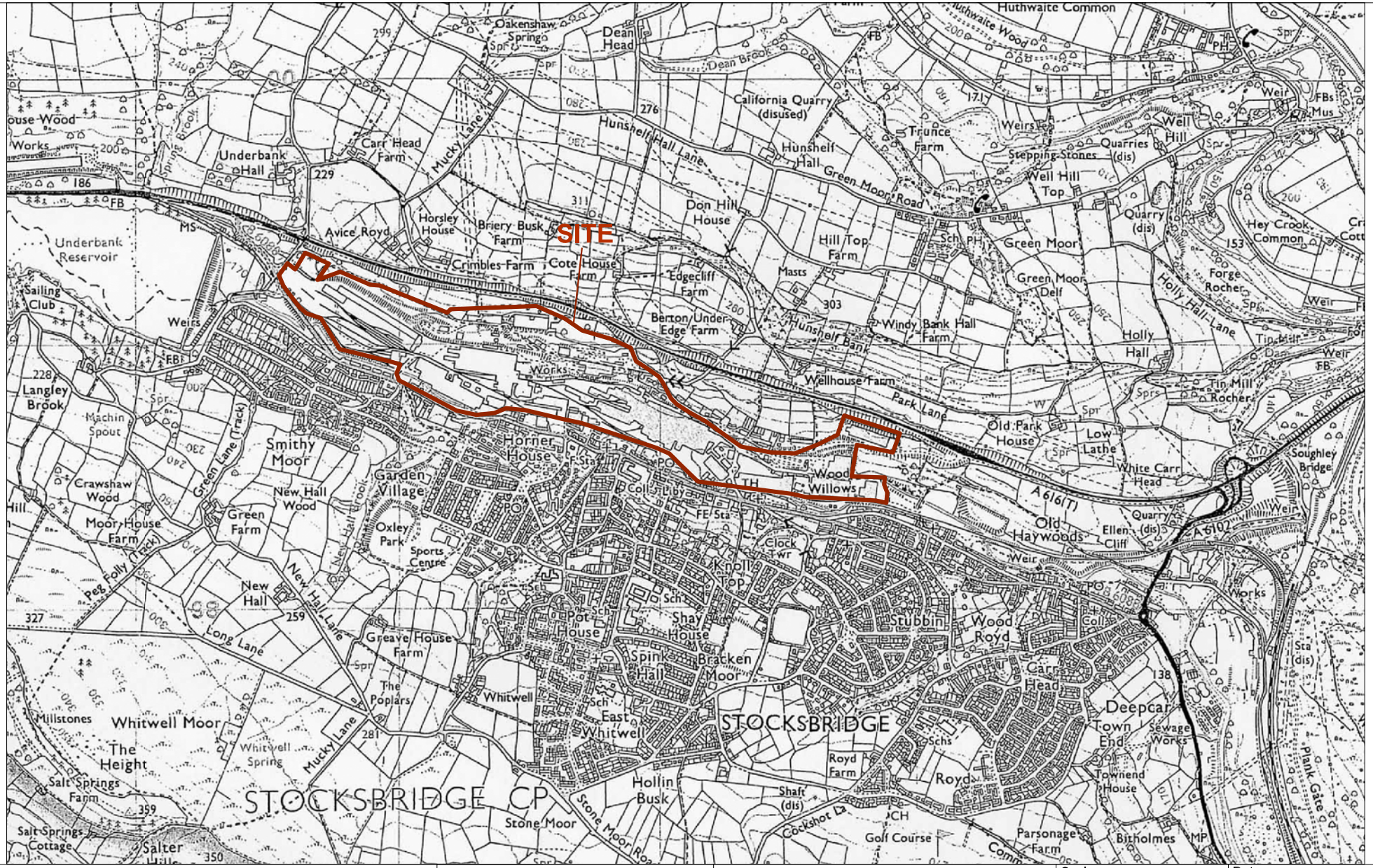
Film 19			Project 837, Stocksbridge Steel Works		
Format	B&W	**Type**	35mm	**Photographer**	M. Douglas

Film & frame	View point	Report plate	Description	Direction	Date	Colour Slide
19.1	-		Furnace	-	11/7/05	
19.2	-		Charging basket	-	11/7/05	
19.3	-		Charging basket	-	11/7/05	
19.4	-		Furnace	-	11/7/05	
19.5	-		Furnace	-	11/7/05	
19.6	-		Furnace	-	11/7/05	
19.7	-		Electrodes melting scrap in furnace	-	11/7/05	
19.8	-		Electrodes melting scrap in furnace	-	11/7/05	
19.9	-		Electrodes melting scrap in furnace	-	11/7/05	
19.10	-		Electrodes melting scrap in furnace	-	11/7/05	
19.11	-		Scrap steel glowing in furnace	-	11/7/05	
19.12	-		Scrap steel glowing in furnace	-	11/7/05	
19.13	-		Scrap steel glowing in furnace	-	11/7/05	
19.14	-		Electrodes melting scrap in furnace	-	11/7/05	
19.15	-		Ladle hoist	-	11/7/05	
19.16	-		Scrap storage area adjacent to furnace	-	11/7/05	
19.17	-		Scrap storage area adjacent to furnace	-	11/7/05	
19.18	-		Furnace	-	11/7/05	
19.19	-		Furnace	-	11/7/05	
19.20	-		Videoing furnace	-	11/7/05	
19.21	-		Tapping slag	-	11/7/05	
19.22	-		Tapping slag	-	11/7/05	
19.23	-		Tapping slag	-	11/7/05	
19.24	-		Tapping slag	-	11/7/05	
19.25	-		Tapping slag	-	11/7/05	
19.26	-		Tapping slag	-	11/7/05	
19.27	-		Tapping slag	-	11/7/05	
19.28	-		Tapping slag	-	11/7/05	
19.29	-		Tapping slag	-	11/7/05	
19.30	-		Tapping slag	-	11/7/05	
19.31	-		Tapping slag	-	11/7/05	
19.32	-		Tapping slag	-	11/7/05	
19.33	-		Tapping slag	-	11/7/05	
19.34	-		Tapping slag	-	11/7/05	
19.35	-		Tapping slag	-	11/7/05	
19.36	-		Tapping slag	-	11/7/05	

Film 20			Project 837, Stocksbridge Steel Works		
Format	B&W	**Type**	35mm	**Photographer**	M. Douglas

Film & frame	View point	Report plate	Description	Direction	Date	Colour Slide
20.1	-		Opening furnace lid	-	11/7/05	
20.2	-		Ladle full of slag	-	11/7/05	
20.3	-		Furnace, lid shut	-	11/7/05	
20.4	-		Furnace, lid shut	-	11/7/05	
20.5	-		Ventilation duct	-	11/7/05	
20.6	-		Ventilation duct	-	11/7/05	
20.7	-		Furnace	-	11/7/05	
20.8	-		Furnace	-	11/7/05	
20.9	-		Slag ladle moving into position	-	11/7/05	
20.10	-		Cover for slag ladle pit moving into position	-	11/7/05	
20.11	-		Electrodes for furnace	-	11/7/05	
20.12	-		Electrodes for furnace	-	11/7/05	
20.13	-		Electrodes for furnace	-	11/7/05	
20.14	-		Tapping slag	-	11/7/05	
20.15	-		Tapping slag	-	11/7/05	
20.16	-		Tapping slag	-	11/7/05	
20.17	-		Tapping slag	-	11/7/05	
20.18	-		Tapping slag	-	11/7/05	
20.19	-		Using magnet to pick up scrap for melting	-	11/7/05	
20.20	-		Furnace, charging basket moving into position	-	11/7/05	
20.21	-		Furnace, charging basket moving into position	-	11/7/05	
20.22	-		Furnace, charging basket moving into position	-	11/7/05	
20.23	-		Furnace, charging basket moving into position	-	11/7/05	
20.24	-		Furnace, charging basket moving into position	-	11/7/05	
20.25	-		Furnace, charging basket moving into position	-	11/7/05	
20.26	-		Furnace, charging basket moving into position	-	11/7/05	
20.27	-		Furnace, charging basket moving into position	-	11/7/05	
20.28	-		Furnace, charging basket moving into position	-	11/7/05	
20.29	-		Furnace, charging basket moving into position	-	11/7/05	
20.30	-		Furnace, charging basket moving into position	-	11/7/05	
20.31	-		Furnace, charging basket moving into position	-	11/7/05	
20.32	-		Charging basket releasing scrap into furnace	-	11/7/05	
20.33	-		Charging basket releasing scrap into furnace	-	11/7/05	
20.34	-		Charging basket releasing scrap into furnace	-	11/7/05	
20.35	-		Charging basket releasing scrap into furnace	-	11/7/05	
20.36	-		Charging basket releasing scrap into furnace	-	11/7/05	
20.37	-		Furnace closing	-	11/7/05	

9 ILLUSTRATIONS



N

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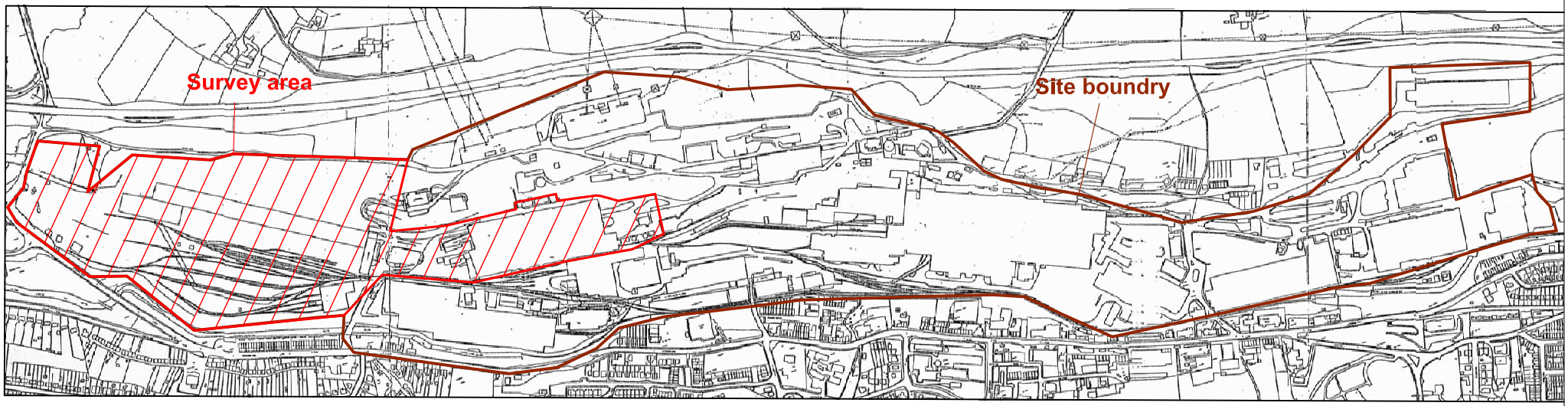
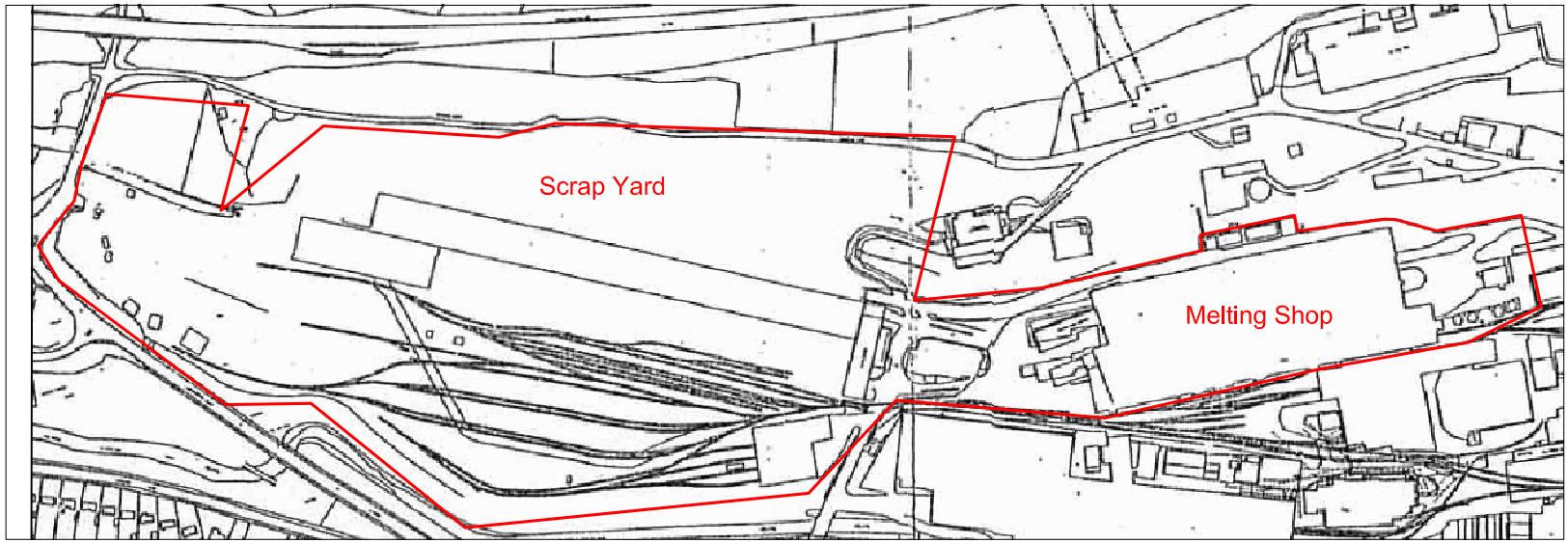
Project:
Stockbridge Steelworks, South Yorkshire

Title
Site location map

Scale	Date
1:20000	February 2009
NGR	Drawn
SK 2580 9910	J Debska
Project No.	Illustration No.
837c	**1**



Stockbridge Steelworks



Survey area

N

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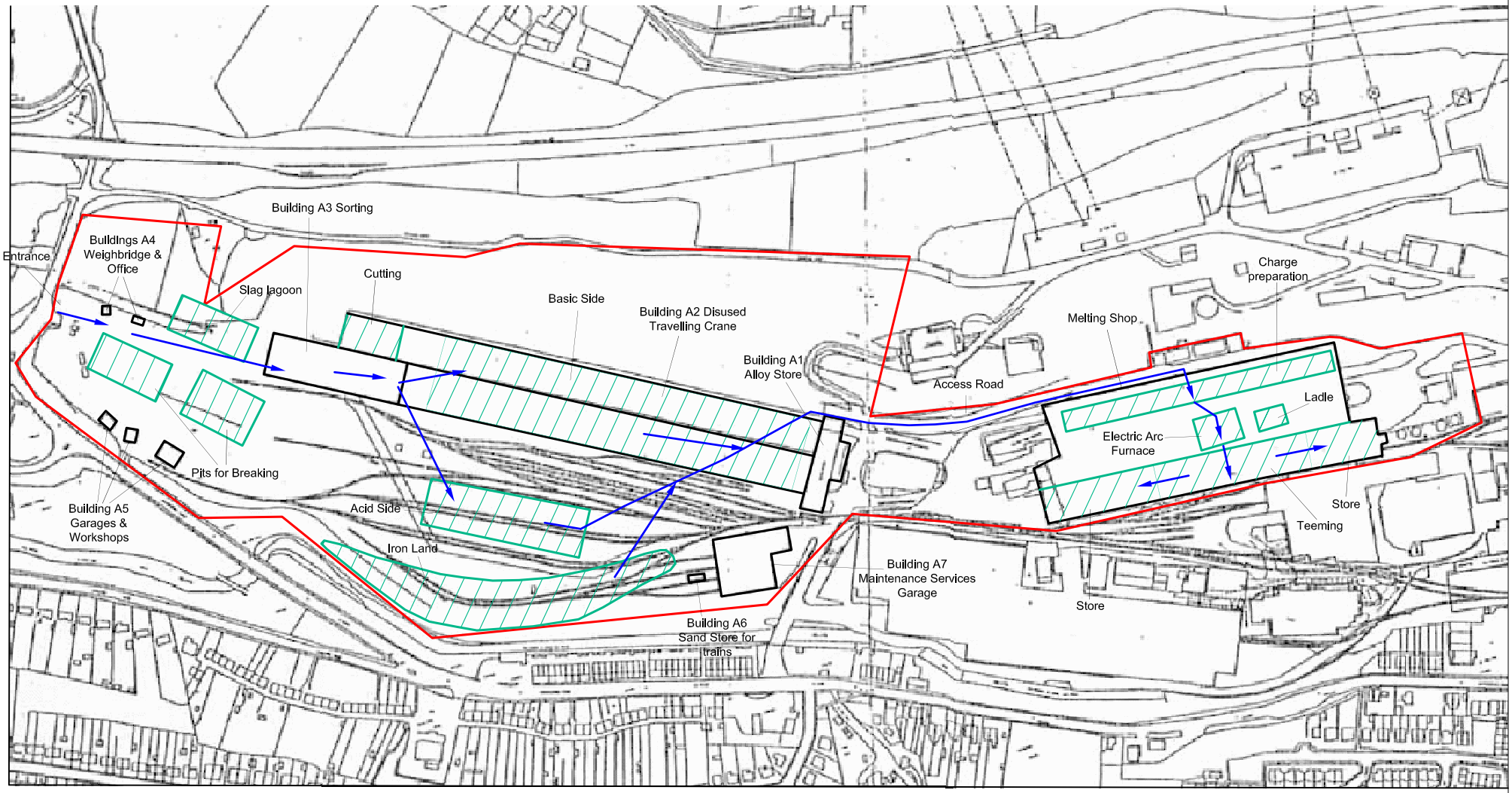
Project: **Stockbridge Steelworks, South Yorkshire**	Scale: -	Date: February 2009	
	NGR: SK 2580 9910	Drawn: J Debska	
Title: **Site plan**	Project No.: **837c**	Illustration No.: **2**	



Key

- Process Operation
- Process Flow
- Survey Area

N

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Project:
Stockbridge Steelworks, South Yorkshire

Title
Sketch layout of site

Scale	Date
-	February 2009
NGR	Drawn
SK 2580 9910	J Debska
Project No.	Illustration No.
837c	**3**

Key

Plate location

Survey Area

N

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Project:
Stockbridge Steelworks, South Yorkshire

Title
Location of photographic plates

Scale	Date
-	February 2009
NGR	Drawn
SK 2580 9910	J Debska
Project No.	Illustration No.
837c	**4**

10 PLATES

Consultancy
Planning Advice
Field Services
Historic Buildings Analysis
Parks & Gardens
Cultural Resource Management
Material Culture
Brownfield & Industrial Archaeology
Palaeoenvironments
Osteology
Historic Landscapes
Archaeometallurgy
Visualistion & Reconstruction
Outreach and Community Projects

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