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## Appendix 1. Principal sources of project data

## Appendix 2. Summary of archaeological mitigation works carried out at aggregates quarries in the study area

Quarry	Cty	Assessment	Geophysical Survey	Fieldwalking	Excavation
Firgreen	WY		-		
Highmoor	WY/ NY				
Swillington	WY		<ul> <li>Abramson 1990a</li> <li>Bunn and Palmer- Brown 2006</li> </ul>		York Environs     Project 1992
Moss Carr Wood	WY	<ul> <li>Keith <i>et al.</i></li> <li>2000b</li> </ul>	<ul> <li>Keith <i>et al.</i> 2000b</li> <li>Webb and Whittingham 2000</li> <li>Whittingham 2001a</li> </ul>	• Keith <i>et al.</i> 2000b	<ul> <li>Martin 2000</li> <li>McNaught 2001a</li> <li>Roberts and Richardson 2002</li> <li>Cudlip 2002</li> </ul>
Altofts/	WY		• GSB 1997		• Wild 1997
Newlands Lane					• MAP 2002
Park Balk	WY		• GSB 1996		<ul> <li>Timms 1998</li> <li>OSA 2003a</li> <li>OSA 2004a</li> </ul>
Nostell	WY	• JSAC 2001			• JSAC 2002
Brackenhill	WY	English     Heritage     MPP 1999			
Peckfield	WY				
Methley Barnsdale Bar	WY NY	<ul> <li>Yarwood and Marriott 1986</li> <li>Boucher and Webb 1996</li> <li>Keith 1999</li> <li>Keith and Roberts 2001</li> <li>Newton 2005</li> </ul>	<ul> <li>Marriott and Yarwood 1992</li> <li>Yarwood and Marriot 1989a</li> <li>Yarwood and Marriott 1988b</li> <li>Yarwood and Marriott 1989b</li> <li>Yarwood and Marriott 1990</li> <li>Boucher and Webb 1996</li> <li>Webb 2000b</li> </ul>	<ul> <li>Yarwood and Marriott 1986</li> <li>Marriott and Yarwood 1992</li> <li>Mc Cluskey and Roberts 2003</li> <li>Webb 1995b</li> </ul>	<ul> <li>Yarwood and Marriott 1988a</li> <li>Yarwood and Marriott 1990</li> <li>Burgess 1993</li> <li>Wright 1994</li> <li>MAP 1996a</li> <li>MAP 1996b</li> <li>MAP 1997b</li> <li>MAP 1999a; b</li> <li>MAP 2002a</li> <li>MAP 2002c</li> <li>MAP 2003c</li> <li>Mc Cluskey and Roberts 2003</li> <li>Abramson 1989b</li> <li>Simpson 1990</li> <li>Webb 1993b</li> <li>Brown and Morris</li> </ul>
Smaws	NY	• MAP 1996a	<ul> <li>Webb 1996b</li> <li>Cottrell 1996</li> <li>Shiel 1992</li> <li>MAP 1996a</li> </ul>		1997 Speed 1997a O'Neill 1999 ASWYAS forthcoming Shiel 1992 Finney 1992 Finney 1993 Finney 1994 MAP 1996a MAP 1997 Parry 2001b
Jackdaw Crag	NY				
Old London Road	NY				
Copley Lane	NY				
Sherburn	NY				
Betteras Hill	NY				

Foxcliffe/	NY	Atkinson 1995		• May 2003	O'Neill 1998a
Brotherton/		<ul> <li>Fletcher and</li> </ul>		<ul> <li>ASWYAS in</li> </ul>	Howell and Cudlip
Byram Park		Keith 1997 May 2003		prep. a	2001 • McNaught 2001
Darrington	NY	• NAA 2003a	<ul> <li>Boucher and Webb 1991</li> <li>Webb 1995a</li> </ul>	• NAA 2003	<ul> <li>Dean 2003</li> <li>Buckland and Dolby 1987</li> <li>O'Neill 2000</li> <li>McQueen 2002</li> <li>ASWYAS forthcoming</li> </ul>
Went Edge	NY		Hancock 2002		<ul><li>Noel 1994</li><li>Gidman and</li></ul>
Campsall	SY	• Adams <i>et al.</i> 2002	• Adams <i>et al.</i> 2002		Whittaker 2004     Morris <i>et al.</i> 2002
Suttonfield/	SY				
Sutton					
Hatfield	SY				
Cadeby	SY				
Warmsworth	SY	Latham 1994			
Wroot Road	SY	• TVAS 2003	Stratascan 2003		
Bank End	SY				
Austerfield	SY				<ul><li>SYAS 1997</li><li>NAA 2000</li></ul>
Batty Holt/	SY	Symonds	Gaffney 1994	Merrony 1994	• ARCUS 2005
Glen/Holme		1993			
Hall/Stainton					
Maltby	SY	Wardell     Armstrong     2000			
Harris	SY				
Barnsdale Bar	SY	Roberts     2003b	<ul><li>Webb 2000c</li><li>Webb 2003</li></ul>		<ul> <li>Burgess 2000</li> <li>Burgess 2001</li> <li>Gidman 2004</li> <li>Gidman &amp; Robert 2005</li> </ul>
Long Lane	SY	•	• Webb 1997b		• O'Neill 1997
Hazel Lane	SY	<ul> <li>Cumberpatch 1993</li> <li>Sidebottom 1999</li> </ul>	<ul> <li>Noel and Lambert 1994a</li> <li>Noel and Lambert 1994b</li> <li>Webb and Whittingham 2001b</li> <li>GeoQuest 2002</li> <li>Roseveare and Roseveare 2003</li> </ul>	ARCUS 2001a	<ul> <li>Hale and Noel 1994</li> <li>Brown 1997</li> <li>ARCUS 2001b</li> <li>ARCUS 2001c</li> <li>TVAS 2002a</li> <li>TVAS 2002</li> <li>Taylor 2003</li> </ul>
Skelbrooke	SY		<ul> <li>Nicholls and Webb 1996</li> </ul>		<ul><li>Speed 1996</li><li>Speed 1997b</li></ul>
Brodsworth	SY				<ul> <li>Speed 1997b</li> <li>Sydes 1993</li> </ul>
Armthorpe	SY	RMC     Aggregates     2000     ARCUS 2006			
Dunsville	SY	- 710002000	Magilton 1978	Van de Noort and Ellis 1997	Magilton 1978
Nutwell Lane	SY				
Hurst Plantation	SY	Badcock and Symonds 1994b			
Stripe Road	SY	100-10			• Sydes 1991
Hayfield Farm	SY				Atkinson 1993
Stancil	SY				

Finningley	Ν		• Webb 2000a	• MAP 2000d	Walker and
(Misson Grange)			Whittingham		Woodhouse 1994 • TPAT 1995
			2001b • Webb and		<ul> <li>TPAT 1995</li> <li>Challis 1996</li> </ul>
			Webb and     Whittingham		<ul> <li>MAP 2000a</li> </ul>
			2001a		
			<ul> <li>Webb 2001a</li> </ul>		
Nourington	N		• Webb 2001a		• MAP 2003b
Newington	IN				
Bryan's Close	Ν				
Finningley (Bawtry	Ν				
Road)					
Misson Bawtry	Ν	Collcutt and		Collcutt and	• Gidman 2002
Road (Rowley)		Griffiths 1993		Griffiths 1993	<ul> <li>ASWYAS in prep.</li> </ul>
(towicy)		<ul> <li>Keith et al.</li> </ul>			
		2000a			
Misson West	N				
Newington North	Ν		• GSB 2000		<ul> <li>NAA 2002</li> </ul>
					<ul> <li>NAA 2003b</li> </ul>
					<ul> <li>Simpson 2004</li> </ul>
Newington 2	Ν				• TPAT 1994b
Styrrup	Ν				
Serlby Sand	Ν				
Scrooby	Ν				• Stead 2000
North					
Mattersey	Ν				
Newthorpe	NY				Signorelli and
					Roberts 2006

## Appendix 3. Archaeology from the air

by A. Deegan

Aerial photographs taken in the appropriate conditions can record buried archaeological features as cropmarks or soilmarks and upstanding remains either as earthworks or structures. Aerial photographs can reveal the presence of levelled and buried archaeological remains that are undetectable from the ground, either as variations in vegetation growth or marks in bare soil.

The mechanisms of cropmark formation are simple but the variables involved are complex. Cropmarks and changes in other vegetation seen from the air are variations in leaf and stalk colour and plant height and vigour. Cropmarks may occur over buried and levelled archaeological features but also infilled natural features such as frost-cracks and palaeochannels. Superficial treatments to the topsoil and vegetation - the uneven application of fertilizers, pesticides and herbicides - or physical damage, may also produce cropmarks. It is the role of the interpreter of aerial photographs to distinguish those that have archaeological significance.

Cropmarks of archaeological features can form at any stage of plant growth, from germination to ripening, but the optimal conditions are met during periods when precipitation (e.g. rainfall) is exceeded by transpiration (water loss). This results in potential soil moisture deficit (SMD) and water-stressed plants (Jones and Evans 1975). A prolonged period of SMD will halt plant growth and then cause wilting of the plant leaves, stem and finally root, in particular it is the cumulative impact of leaf wilt in large areas of crop that is visible from the air. At times of drought, plants rooted in free-draining sub-surface deposits, such as a buried ancient road surface, may deteriorate faster than those rooted on surrounding undisturbed ground. Meanwhile, at times of SMD, plants rooted in the moisture-retentive fills of archaeological ditches and pits may thrive longer and stay greener than their neighbours. Even after ripening, differences in crop height and bulk can indicate the presence of buried features where there are no visible tonal differences. Cropmarks are often clearest in large areas of homogenous cereal cultivation but can also form in grass and some root crops. Under appropriate vegetation,

cropmarks above buried archaeological features can form readily on free-draining soils and permeable geologies, but are more reticent on impermeable clays and the finer alluvial deposits that can better retain water at times of low precipitation. Plant roots are less likely to penetrate the deposits of deeply buried archaeological features and thus be influenced by their presence: deposits of alluvium and colluvium (hill wash) often mask earlier archaeological features.

Even once all the variables required for cropmark formation are met, the appearance of these marks can change by the day and they can disappear overnight. It takes the skill of the experienced aerial photographer to produce maximum results from limited air time by exploiting their local knowledge of the developing conditions.

Parchmarks are a particular form of cropmark, usually occurring in grass at times of drought; the tonal differences between the parched plants and others are often stark and well-defined. Parchmarks may occur over buried stone structures, metalled road surfaces and the remains of rubble banks.

On bare soils archaeological features may be detected as colour and tonal variations against the background ploughsoil or subsoil. Ploughing, which can penetrate the ground to a depth of 450mm, brings to the surface previously buried material and rotates it, exposing the cut surface uppermost. Where the plough cuts sub-surface banks or infilled ditches and furrows it brings slices of these deposits to the surface; bank material will often appear lighter than the surrounding soil and ditch fill, darker. If these slices are sufficiently differentiated from the natural plough or subsoil they can be visible from the air.

The detection and recording of archaeological earthworks from the air are contingent on their condition and visibility. The condition and survival of earthworks are determined by past and present land use: natural erosion processes, deliberate destruction and ploughing can all reduce upstanding features to ground level. Furthermore, even well-preserved remains may be concealed by some types of vegetation such as gorse, heather, scrub and woodland.

Most of the earthworks recorded from aerial photographs for this project were revealed by the pattern of sunlight and shadow but upstanding features may also be highlighted by differential frost or snow cover or the distribution of standing flood water. Even heavily truncated earthworks may be detected in the appropriate conditions, particularly when their appearance is enhanced by changes in vegetation cover or soil tone. Specialist photographers can manipulate the available lighting conditions whilst in the air, circling monuments until the optimal balance of light and shadow is achieved. Both substantial and subtle variations in ground relief are further accentuated when viewed stereoscopically. Most stereo images are in the form of vertical photographs taken at regular intervals along linear flight lines but stereo overlapping can also be achieved from appropriately positioned pairs of oblique views.