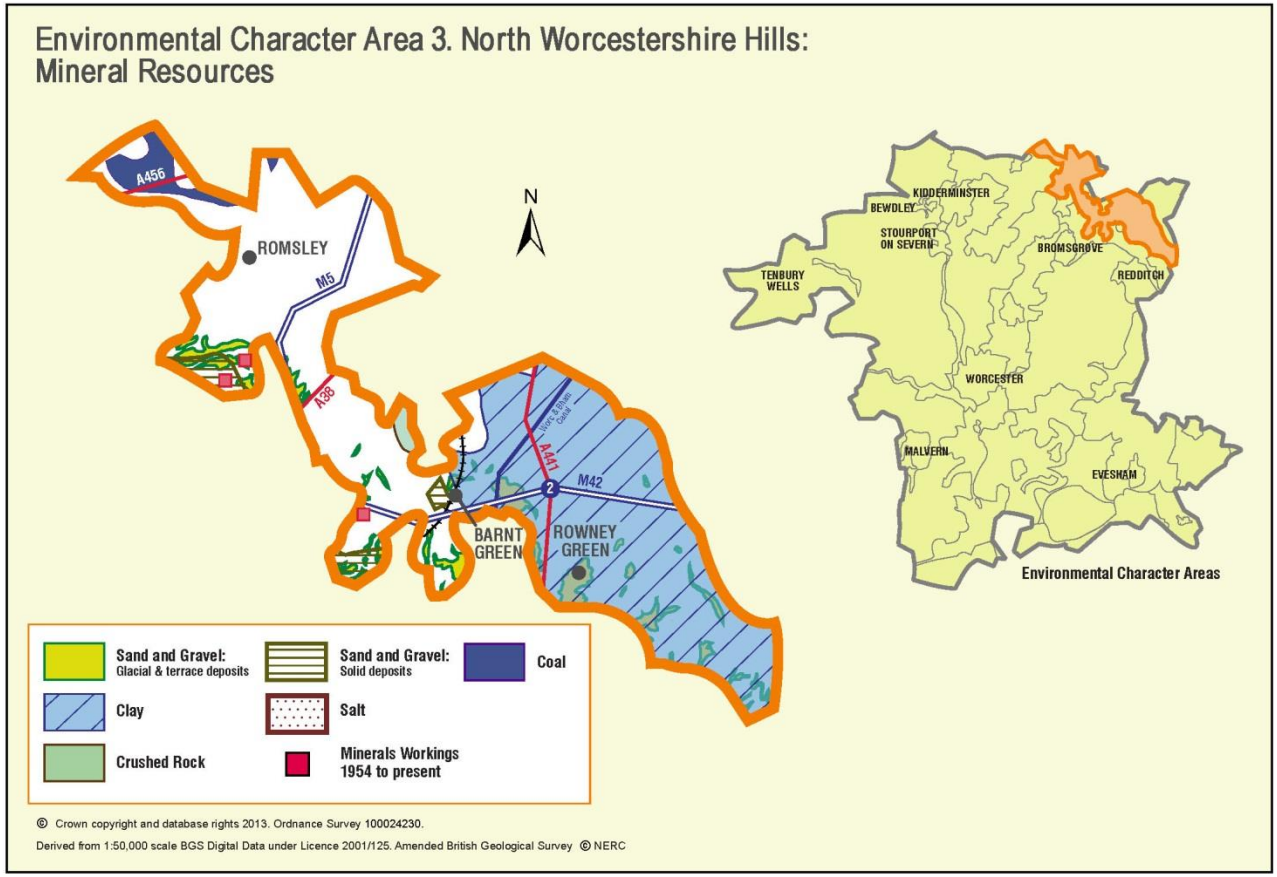
Appendix 3: Analysis of aggregate resources in ECA 3: North Worcestershire Hills



ECA Summary for the Fourth Stage consultation on MLP (Winter 2018):

<u>Sand and gravel</u>
There are 17 resource areas identified for sand and gravel in North Worcestershire Hills ECA:

- Key: 4
- Not significant: 4
- Compromised: 9

<u>Crushed rock</u>
There is one resource area identified for crushed rock in North Worcestershire Hills ECA:

- Significant: 1

<u>Non-aggregates</u>
BGS data indicates that there are deposits of clay and coal in this ECA.

Overview of resource assessment for ECA 3

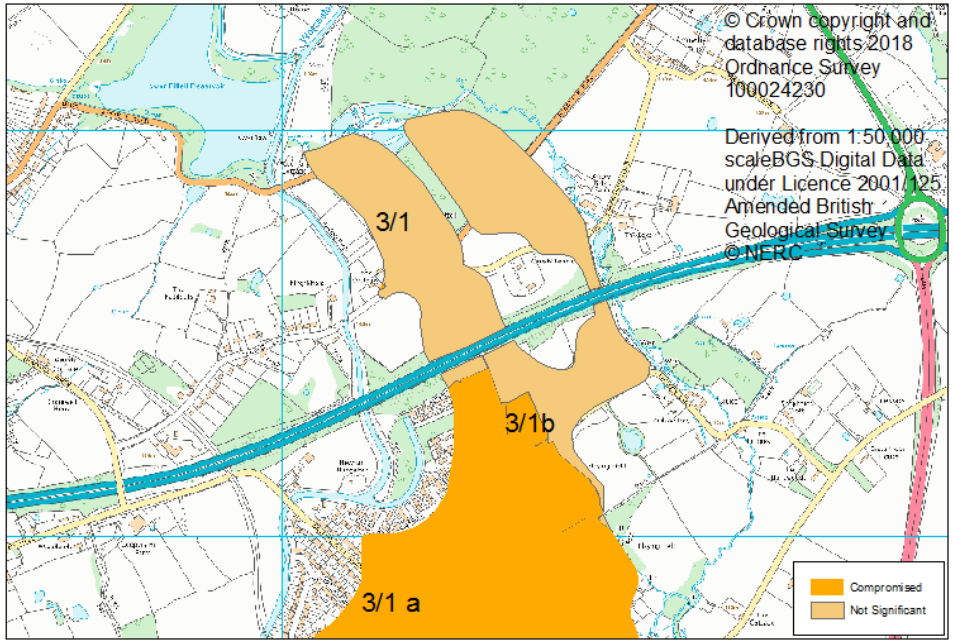
Sand and gravel resource areas:

Resource number*	Second Stage Consultation		Third Stage Consultation		Fourth Stage Consultation		
	Original estimated resource tonnage (2 tonnes/m³)	Significance	Revised estimate of resource tonnage (1.65 tonnes/m³)	Significance	New resource number (where resource has been split)	Revised estimate of resource tonnage (1.65 tonnes/m³)	Result
3/1	Depth not known	Not significant	Depth not known	Not significant	Not reassessed		
3/1 a	Depth not known	Compromised	Depth not known	Compromised			
3/2	Depth not known	Not significant	Depth not known	Not significant			
3/3	3,268,000	Key	2,696,100	Key	3/3	2,696,100	Key
					3/3b		Compromised
3/4	7,750,000	Key	6,393,750	Key	3/4	6,393,750	Key
					3/4b		Compromised
3/4 a	2,375,000	Compromised	1,959,375	Compromised	Not reassessed		
3/5	Depth not known	Not significant	Depth not known	Not significant			
3/6	240,000	Not significant	198,000	Not significant			
3/7	671,044,000	Key	553,611,300	Key	3/7	531,167,800	Key
					3/7b		Compromised
3/8	750,162,000	Key	618,883,650	Key	3/8	422,848,800	Key
					3/8b		Compromised
3/8a	48,928,000	Compromised	40,365,600	Compromised	Not reassessed		
3/9	205,200,000	Compromised	169,290,000	Compromised			
3/10	240,172,000	Compromised	198,141,900	Compromised			

Crushed rock resource areas:

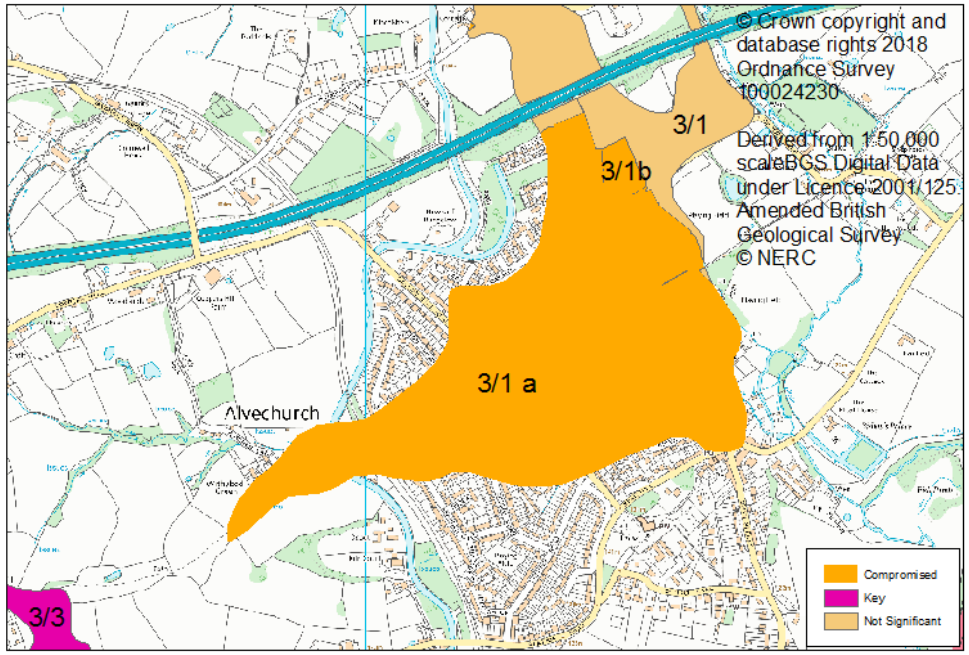
Resource number*	Second Stage Consultation		Third Stage Consultation		Fourth Stage Consultation		
	Original estimated resource tonnage	Significance	Revised estimate of resource tonnage (2.45 tonnes/m³)	Significance	New resource number (where resource has been split)	Revised estimate of resource tonnage (1.65 tonnes/m³)	Result
3/11	Depth not known	Significant	Depth not known	Significant		Depth not known	Significant

Overview	
Resource number:	3/1
Resource name:	North of Alvechurch
Resource area:	29ha
Resource depth:	Not known
Location	
OS sheet reference:	SP 07 SW
National grid ref:	402502, 273645



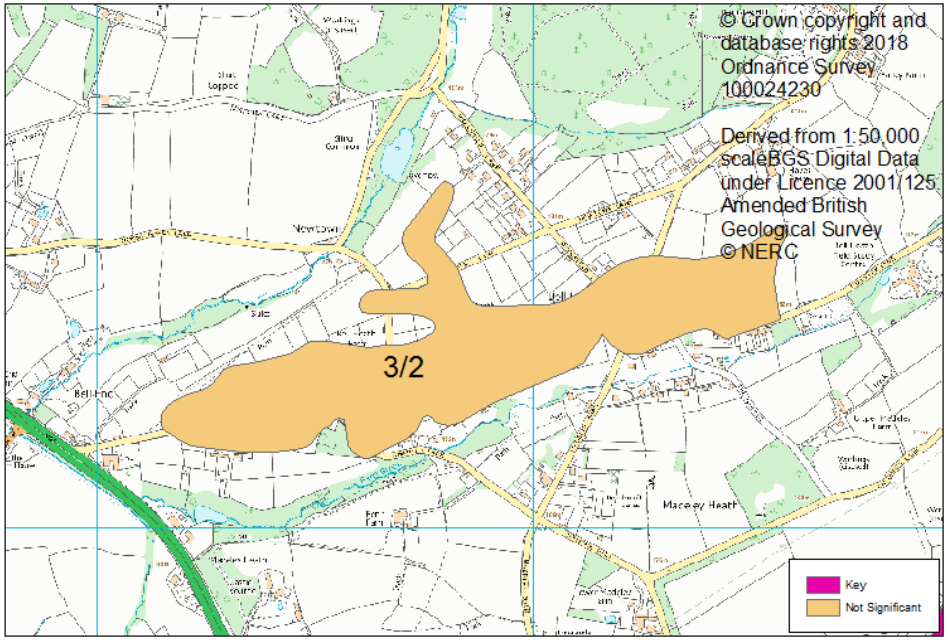
Resource description:	
Resource description:	Largely alluvial fan sand and gravel with some 3rd terrace (New Inn) and some 2nd terrace (Wasperton) sand and gravel. No information on thicknesses available in BGS memoirs.
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area intersected by roads, with dispersed built development. The deposit extends under the M42 motorway this is not included as part of the resource area. The deposit also extends under the settlement of Alvechurch, this section is considered as resource area 3/1a
Crude estimate of resource:	Depth not known
Conclusion:	Not significant: Small deposit with no information to estimate the resource in this area. Not for consideration in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	No change to the assessment.
Conclusion:	Not significant.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/1a
Resource name:	Alvechurch a)
Resource area:	45ha
Resource depth:	Not known
Location	
OS sheet reference:	SP 07 SW
National grid ref:	402426, 272832



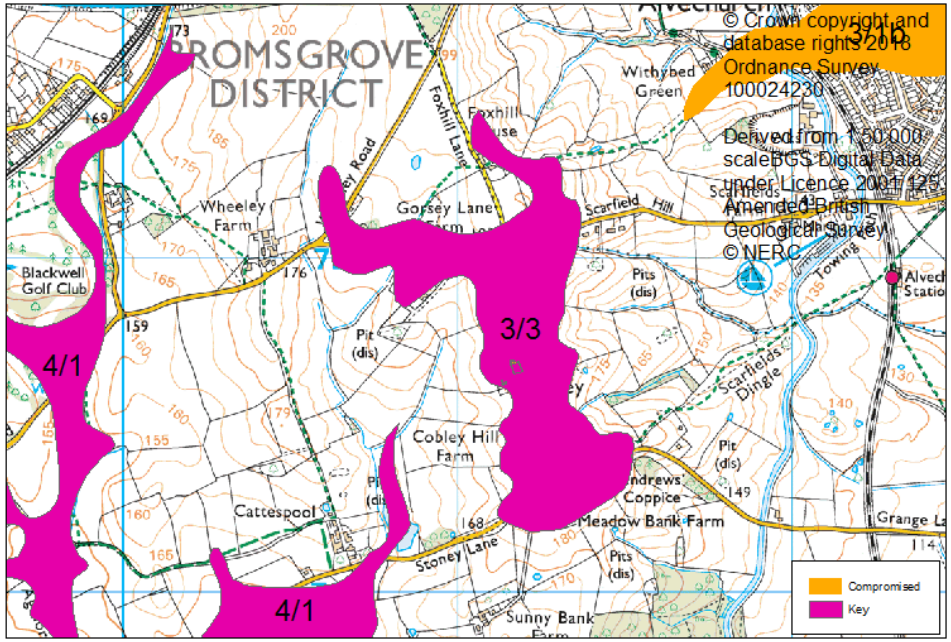
Resource description:	
Resource description:	Largely alluvial fan sand and gravel with some 3rd terrace (New Inn) and some 2nd terrace (Wasperton) sand and gravel. No information on thicknesses available in BGS memoirs.
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area compromised by the settlement of Alvechurch. The deposit extends to the north of Alvechurch, this section is considered as resource area 3/1.
Crude estimate of resource:	Depth not known
Conclusion:	Compromised by development with less than 10ha of the deposit remaining.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	No change to the assessment.
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/2
Resource name:	Heath End Road
Resource area:	31ha
Resource depth:	Not known
Location	
OS sheet reference:	SO 97 NW
National grid ref:	394852, 277418



Resource description:	
Resource description:	Resource area 3/2 is 4th terrace (Kidderminster Station) sand and gravel. No information on thicknesses available in BGS memoirs. This resource area is underlain by solid sand deposits (assessed as resource area 3/7).
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small deposit intersected by roads with some built development across the area.
Crude estimate of resource:	Depth not known
Conclusion:	Not significant: Small deposit with no information to estimate the resource in this area. Not for consideration in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	No change to the assessment.
Conclusion:	Not significant.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

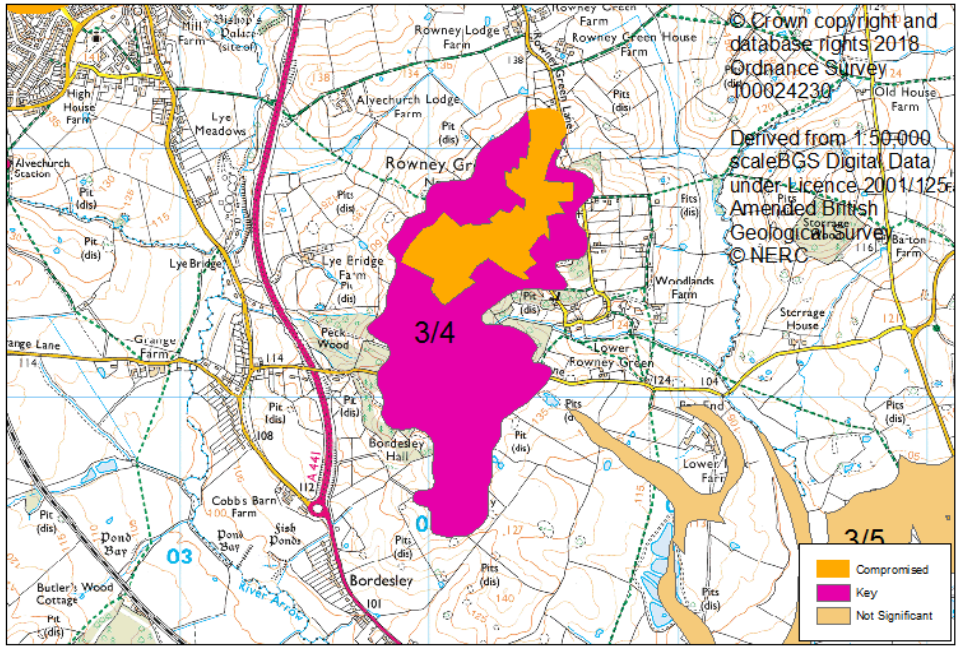
Overview	
Resource number:	3/3
Resource name:	Cobley Hill
Resource area:	38ha
Resource depth:	Estimated 8.6m
Location	
OS sheet reference:	SO 07 SW
National grid ref:	401147, 271785



Resource description:	
Resource description:	Glaciofluvial sand and gravel. Glacial sand and gravel and boulder clay cap the plateau of Cobley Hill, Fox Hill and Cockscroft with sand and gravel lying above and below the boulder clay. At Cobley Hill sand and gravel are present at the surface and a borehole at The Nook (in this resource area) recorded 12.2m of sand and gravel and silt on marl, but the BGS memoirs state that the average depth of the deposit is probably more in the region of 5m. (Estimated resource depth based on mean average of a) borehole at The Nook: 12.2m and b) average in BGS memoirs: 5m = 8.6m
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A medium resource area intersected by roads with some ribbon development.
Crude estimate of resource:	Area: 38 ha x average depth: 8.6 m ÷ 2 Estimated resource volume: 1,634,000,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 3,268,000 tonnes**
Conclusion:	Significant – key resource. Use to define areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 38 ha x average depth: 8.6 m ÷ 2 Estimated resource volume: 1,634,000,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 2,696,100 tonnes**
Conclusion:	Significant – key resource.

Assessment of resource for the Fourth Stage consultation on MLP (August 2018)			
This resource area has been split into areas 3/3 and 3/3b.			
Resource area 3/3		**Resource area 3/3b**	
Resource area:	**38ha**	**Commentary:**	Screened out due to the following appendix A criterion: - Listed Building
Resource depth:	**8.6m**		
Revised estimate of resource:	Area: 38ha x average depth: 8.6m ÷ 2 Estimated resource volume: 1,634,000,000m^3 **Estimated resource tonnage (at 1.65 t/m³): 2,696,100 tonnes**		
Conclusion:	Significant resource.	**Conclusion:**	Compromised

Overview	
Resource number:	3/4
Resource name:	Rowney Green
Resource area:	62ha
Resource depth:	Estimated 12.5m
Location	
OS sheet reference:	SO 07 SW
National grid ref:	404160, 271261

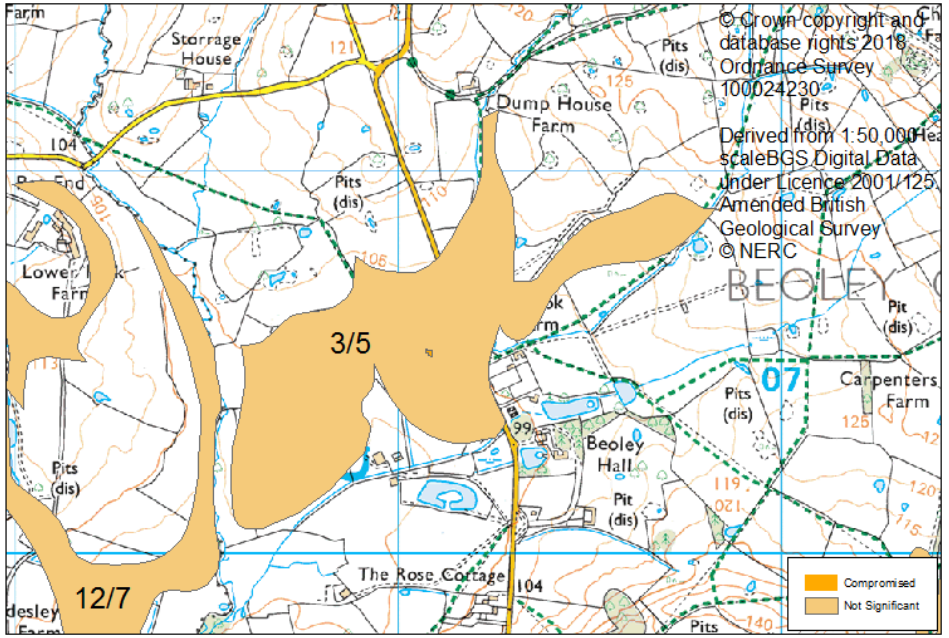


Resource description:	
Resource description:	Glaciofluvial sand and gravel. A pit south of Gravel Pit Lane formerly exposed 12m of fine grained, well bedded gravel. Galliford's application to extract sand and gravel from the area proposed working to a maximum depth of 13m. (Estimated resource depth based on mean average of a) former pit south of Gravel Lane: 12m and b) Galliford's application: 13m = 12.5m).
Assessment of resource for the second consultation on MLP (Autumn 2013)	

Commentary:	A medium resource area with some built development. The deposit extends to the north under the village of Rowney Green. This is assessed as resource area 3/4a.
Crude estimate of resource:	Area: 62 ha x average depth: 12.5 m ÷ 2 Estimated resource volume: 3,875,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 7,750,000 tonnes**
Conclusion:	Significant – key resource. Use to define areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 62 ha x average depth: 12.5 m ÷ 2 Estimated resource volume: 3,875,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 6,393,750 tonnes**
Conclusion:	Significant – key resource.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
This resource area has been split into areas 3/4 and 3/4b.	

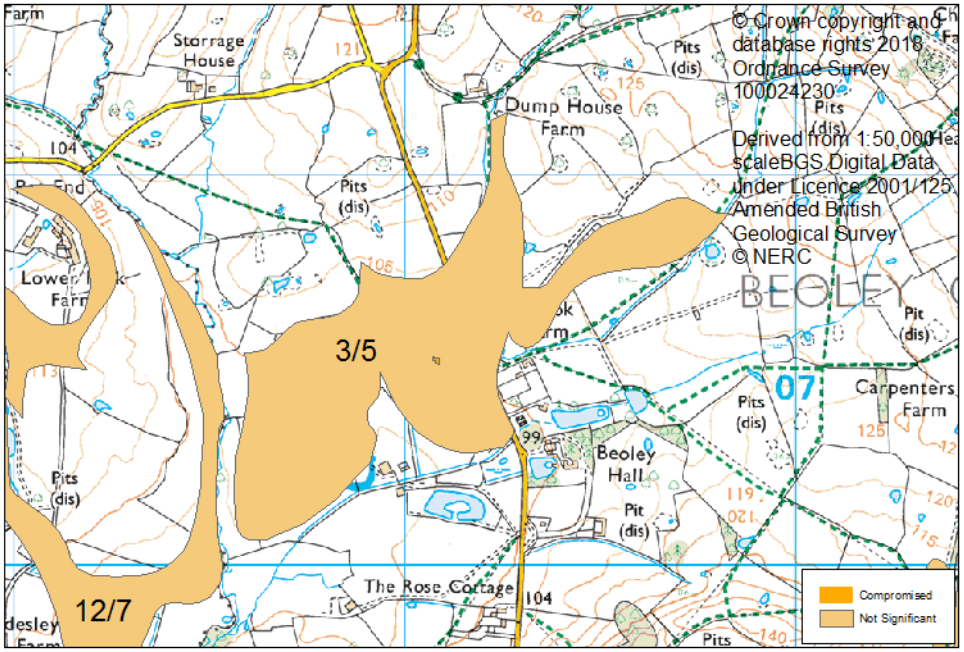
Resource area 3/4		**Resource area 3/4b**	
Resource area:	**62ha**	**Commentary:**	Screened out due to the following appendix A criterion: - Settlement Boundary
Resource depth:	**12.5m**		
Revised estimate of resource:	Area: 62ha x average depth: 12.5m ÷ 2 Estimated resource volume: 3,875,000m^3 **Estimated resource tonnage (at 1.65 t/m^3): 6,393,750 tonnes**		
Conclusion:	Key resource.	**Conclusion:**	Compromised

Overview	
Resource number:	3/4 a
Resource name:	Rowney Green a)
Resource area:	19ha
Resource depth:	Estimated 12.5m
Location	
OS sheet reference:	SO 07 SW
National grid ref:	404160, 271261



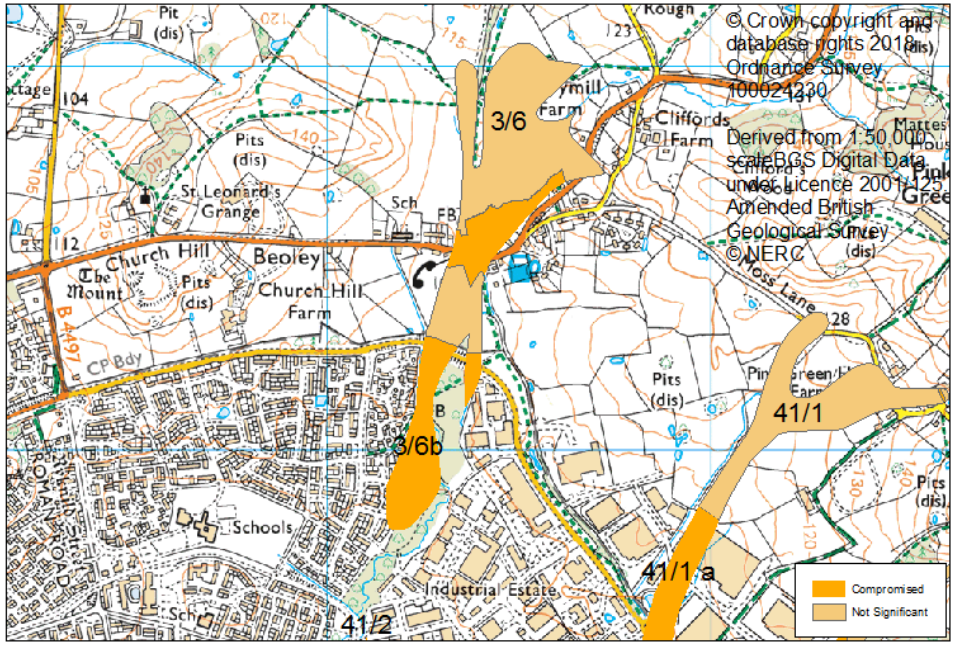
Resource description:	
Resource description:	Glaciofluvial sand and gravel. A pit south of Gravel Pit Lane formerly exposed 12m of fine grained, well bedded gravel. Galliford's application to extract sand and gravel from the area proposed working to a maximum depth of 13m. (Estimated resource depth based on mean average of a) former pit south of Gravel Lane: 12m and b) Galliford's application: 13m = 12.5m).
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area compromised by the village of Rowney Green. The deposit extends north of the village, this section is considered as resource area 3/4.
Crude estimate of resource:	Area: 19 ha x average depth: 12.5 m ÷ 2 Estimated resource volume: 1,187,500 m^3 **Estimated resource tonnage (at 2 t/m^3): 2,375,000 tonnes**
Conclusion:	Compromised by development.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 19 ha x average depth: 12.5 m ÷ 2 Estimated resource volume: 1,187,500 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 1,959,375 tonnes**
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/5
Resource name:	North of Beoley
Resource area:	41ha
Resource depth:	Not known
Location	
OS sheet reference:	SO 07 SE
National grid ref:	406041, 270546



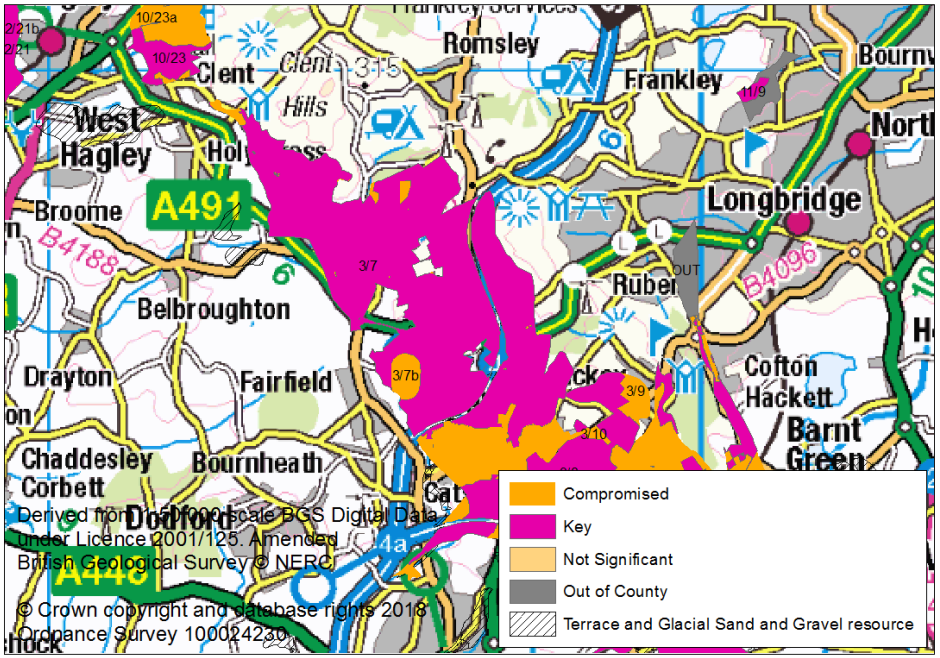
Resource description:	
Resource description:	Alluvial fan sand and gravel. No information on thicknesses available in BGS memoirs.
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area intersected by a road with some ribbon development.
Crude estimate of resource:	Depth not known
Conclusion:	Not significant: Small deposit with no information to estimate the resource in this area. Not for consideration in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	No change to the assessment.
Conclusion:	Not significant.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/6
Resource name:	Holt End
Resource area:	20 ha
Resource depth:	Estimated 1.2m
Location	
OS sheet reference:	SO 06 NE, SO 07 SE
National grid ref:	407427, 269609



Resource description:	
Resource description:	Alluvial fan sand and gravel. Exposures within the deposit show gravel 1m and 1.3m deep. Adjoining deposits show terrace-like gravel spread less than 1m thick. Old gravel diggings are shown as 1m deep on the hilltop in Clifford's Wood. (Estimated resource depth base on mid-point of exposures within the deposit (1m to 1.3m) = 1.15m rounded to 1.2m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area with dispersed development.
Crude estimate of resource:	Area: 20 ha x average depth: 1.2 m ÷ 2 Estimated resource volume: 120,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 240,000 tonnes**
Conclusion:	Not significant: Small deposit with less than 300,000m^3. Not for consideration in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 20 ha x average depth: 1.2 m ÷ 2 Estimated resource volume: 120,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 198,000 tonnes**
Conclusion:	Not significant.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/7
Resource name:	Clent to Lydiate Ash
Resource area:	1111ha
Resource depth:	Estimated 60.4m
Location	
OS sheet reference:	SO 97 NW, SO 97 NE, SO 97 SE
National grid ref:	395685, 276697



Resource description:

Resource description: Resource area 3/7 is Wildmoor Sandstone Formation and Kidderminster Formation solid sand.

In this part of the county there are large areas of Wildmoor sandstone formation and Kidderminster formation solid sand of considerable geological complexity. The Kidderminster and Wildmoor sandstones are partially but extensively overlain by terrace and glacial sand and gravel deposits which are recorded as separate resource areas (in this area assessed as resource areas 3/2, 10/21, 12/1, 12/2 and 12/3).

Wildmoor Formation

The western half of this resource area is predominantly Wildmoor Formation. The Wildmoor Formation is generally described as red-brown and orange, fine to medium grained, feldspathic sandstone with sparse, thin mudstone beds. Generally the formation is characterised by a remarkably uniform, very weakly cemented, fine grained, silty, micaceous sandstone and an absence of pebbles, in contrast to the Kidderminster Formation, although sparse pebbly stringers are recorded. The fine grain-size and soft, poorly cemented, nature of the sandstone in some areas made it ideal for exploitation as moulding sand for use in the foundry industry.

West of the Blackwell Fault the base rock is Wildmoor Formation. The Wildmoor formation ranges in thickness, a borehole near Hagley proved 175m of red hard and soft sandstone some of this could be attributed to the underlying Kidderminster Formation since the lower boundary is indistinct. The memoir for Droitwich Abberley and Kidderminster recorded that the greatest depth of this formation was proved in a

borehole at Wildmoor, east of Fairfield, where 398' (121.3m) were passed through without the bottom being touched. East of the main outcrop the formation is cut out rapidly by the overstepping Bromsgrove Sandstone.

Sand pits within the Wildmoor Sandstone deposit have been granted planning permission at:

- Chadwich Lane (currently operational, extended in 2012),
- immediately north of Sandy lane, still operational as Veolia tip (formerly Stanley N Evans)
- south of the lane, Cinetic sand (formerly John Williams Cinetic Sand, currently operated by the Salop sand and gravel company) and
- immediately west of the motorway junction currently operated by MV Kelly (formerly "Pinches").

The memoir records all of these as Foundry sand (silica sand) pits.

There is some information about exposures for some sections of the deposit in this area:

- A borehole adjacent to the M5 South East of Chadwich Lane/Money Lane junction proves sand and gravel on sandstone overlain by boulder clay.
- Material supporting the 1979 application to deepen Chadwich Lane pit reported that the silica sand deposit "varies with the height of the land" and depth is "unknown". Supporting material for the 1998 application to extend the Chadwich Lane Pit indicated a depth of 80' (24.4m), based on the depths of material in and adjoining the existing pit.
- South of Chadwich Lane, material supporting the 1971 application for the pit to the south of Chadwich Lane, formerly known as John Williams Cinetic Sand and currently operated by the Salop Sand and Gravel Company, reported a depth of 80' (24.4m).
- At the site currently operated by MV Kelley (formerly "Pinches"), immediately west of Junction 4 of the M5, the 1990 application proposed to work the site to a depth of 42m.

Kidderminster Formation

The northern and eastern half of this resource area is Kidderminster Formation. The Kidderminster Formation is generally described as well-rounded pebble to cobble size conglomerate and red-brown, medium to coarse sandstone. The lower part of the formation predominantly consists of clast-supported conglomerate composed largely of pebbles and cobbles of red, red brown and grey fine-grained quartzite together with red sandstone, milky quartz and rare porphyritic igneous rocks and re-worked conglomerate. The formation rests uncomformably on Bridgnorth Sandstone. The maximum thickness of the conglomerate dominated facies is probably about 20m but this is gradational into the overlying sandstone dominated facies, which also contains beds and lenses of pebble conglomerate. The thickness of the formation in this district varies although the upper boundary is difficult to recognise because of the lithological similarity of the Kidderminster sandstone to the predominantly non-pebbly Wildmoor Sandstone. The memoir for Redditch records its greatest depth is 155m at Wildmoor (in this resource area) and it thins to 133m at Burcot (resource area 3/8) and 127-129m at Brockhill (resource area 12/8).

There is some information about exposures for some sections of the deposit in this area:

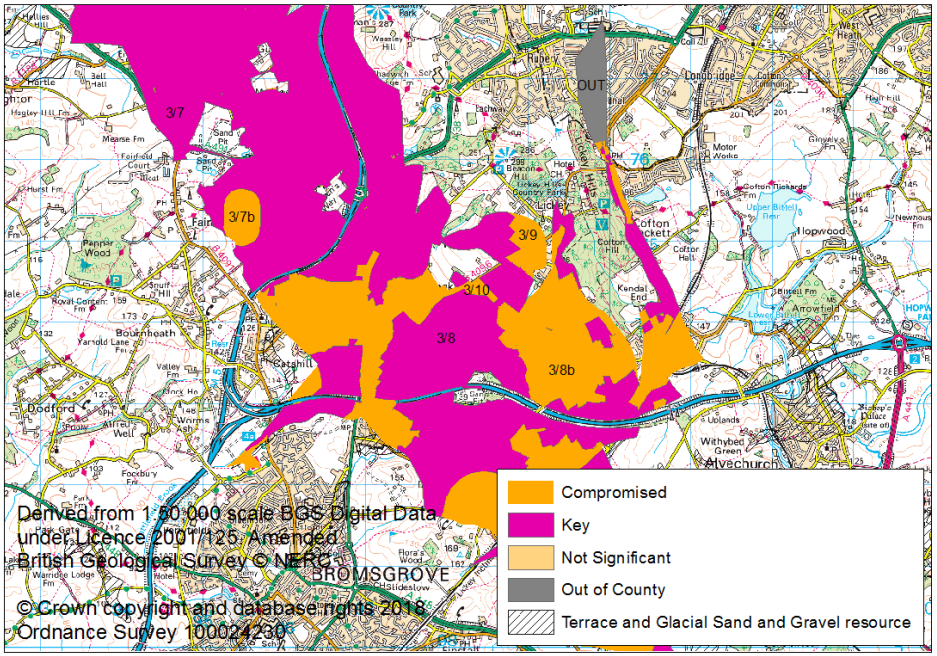
- Walton Pool, Calcot Hill and Sling Common: An outcrop of Kidderminster Formation is exposed on the south western flanks of the Clent Hills. The formation beds directly upon the Clent Breccia and is thought to consist of beds of shingle with lenses of red/brown sand. The only exposure in this area is at Sling Common where pebbly red sandstones were formerly worked. It is possible that the Kidderminster formation outcrops on the high ground, e.g. at Calcot Hill, with the higher beds in the Kidderminster formation exposed on the south western flanks of the outcrop.
- Great Farley Wood, Romsley Hill and Bell Heath: This area is Kidderminster Formation basal conglomerate bounded to the north and south by faults and overlain by boulder clay at Romsley Hill and by 2nd river terrace deposits at Bell Heath. There are no boreholes but details of a well North of Romsley Hill Hospital at Winwood Heath shows the Kidderminster formation to 39.5m, and the memoir (Old 1983) records the Kidderminster Formation in this area as red and brown, pebbly, coarse sandstone up to 160m thick. Madley Ridge is capped by boulder clay, which in turn overlies fluvio glacial sand and gravel which is exposed on the flanks of the boulder clay. The deposit has been worked at the former Madley pit (former County Council tip).
- Boreholes at Money Lane in this area prove up to 60.5m of sandstone dominated part of the Kidderminster Formation with a few mudstone beds and one of conglomerate up to 1m thick. The lack of conglomerates at this working and that at Shepley suggest that the quarried strata are high in the formation.
- Chapman's Hill and Quantry Lane: The outcrop of the Kidderminster formation is overlain by boulder clay adjacent to the M5. Details of the exposure south of Quantry Lane record 2.3m of the Kidderminster formation overlain by 0.1 metres of sandy gravel, but up to 6m of conglomerate has been exposed with the base not seen.
- Lydiate Ash: The Kidderminster formation in this area is primarily a source of building sand but the deposit becomes coarser down the system with quartz and quartzite pebbles increasing. It overlies basal conglomerate. Two boreholes East of Lydiate Ash M5 interchange immediately West of the Chadwich fault recorded:
    - 13.5m of Kidderminster formation and 9.3m of basal conglomerate (total 22.8m) overlying 0.8m of Clent brecchias; and
    - 30.5m of Kidderminster formation overlying 0.5m of Clent breccias with the basal conglomerate faulted out.
- Alvechuch Highway: A borehole north of the Alvechurch Highway, east of the Hollywell fault on the edge of the outcrop, recorded 2.3m of boulder clay on 2.2m of conglomerate with Clent breccias to 17.2m.
- Marlbrook: An outcrop of Kidderminster Formation bounded to the west by the Blackwell fault and to the south by the Burcot fault, extensively covered by superficial deposits. The deposit has been worked at Marlbrook. There are no boreholes recorded in the memoir but the exposure at the eastern end of the Marlbrook site showed 9m of Kidderminster Formation and the statement and supporting plans accompanying the RMC application indicated that within that site the deposit reaches a thickness of over 14m in the south thinning to less than 6m in the north (midpoint = 10m).

	Estimated depth Estimated resource depth based on a mean average of: a) borehole at Wildmoor (Wildmoor Formation): 121.3m, b) Chadwich Lane Pit 1998 application: 24.4m, c) Salop Sand and Gravel pit 1971 application: 24.4m, d) MV Kelley site 1990 application: 42m, e) memoir record for the Kidderminster formation at Wildmoor: 155m, f) memoir record for the Kidderminster formation at Burcot: 133m, g) memoir record for the Kidderminster formation at Brockhill (midpoint of 127m to 129m): 128m, h) well north of Romsley Hill Hospital: 39.5m, i) Old 1983 record: 160m, j) boreholes at Money Lane: 60.5m, k) exposures south of Quantry Lane (midpoint of 2.3m to 6m): 4.15m, l) borehole 1 east of Lydiate Ash M5 interchange: 22.8m, m) borehole 2 east of Lydiate Ash M5 interchange: 30.5m, n) borehole north of Alvechurch highway: 2.2m, o) exposure at Marlbrook: 9m, p) RMC application at Marlbrook (midpoint of 6m to 14m): 10m = 60.4m
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A large resource area with dispersed development across the area and some clusters of development in small settlements. The deposit extends under the motorway, this section is not included as part of the resource area. The deposit has been worked in a number of places, these workings are not included as part of the resource area. The deposit continues to the south east, where it is considered as resource areas 3/8, 3/8a, 3/9, 3/10 and 12/8.
Crude estimate of resource:	Area: 1111 ha x average depth: 60.4 m ÷ 2 Estimated resource volume: 335,522,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 671,044,000 tonnes**
Conclusion:	Significant – key resource. Use to define areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Additional information	2 sites (one 10ha site and one 4ha) covering part of this resource area were submitted in response to the Second Stage Consultation. No detailed geological information was provided with the site submissions. They also cover part of resource area 10/21.
Revised estimate of resource:	Area: 1111 ha x average depth: 60.4 m ÷ 2 Estimated resource volume: 335,522,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 553,611,300 tonnes**
Conclusion:	Significant – key resource.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
This resource area has been split into areas 3/7 and 3/7b.	

Resource area 3/7		**Resource area 3/7b**	
Resource area:	**1066ha**	**Commentary:**	Screened out due to the following appendix A criterion: - Allocations in adopted plans - Ancient Semi-Natural Woodland - Conservation Area - Listed Buildings - Site of Special Scientific Interest
Resource depth:	**60.4m**		
Revised estimate of resource:	Area: 31ha x average depth: 60.4m ÷ 2 Estimated resource volume: 321,932,000m^3 **Estimated resource tonnage (at**		

	1.65 t/m³): 531,187,800 tonnes		- Source Protection Zone
Conclusion:	Key resource.	**Conclusion:**	Compromised

Overview	
Resource number:	3/8
Resource name:	Catshill, Blackwell and Cofton
Resource area:	742ha
Resource depth (2nd Stage Consultation):	Estimated 101.1m
Revised resource depth (3rd Stage Consultation)	Estimated 91.2m
Location	
OS sheet reference:	SO 97 SE, SO 97 NE, SP 07 SW, SP 07 NW
National grid ref:	398565, 273316



Resource description:

Resource description: Resource area 3/8 is Wildmoor Sandstone Formation and Kidderminster Formation solid sand.

In this part of the county there are large areas of Wildmoor sandstone formation and Kidderminster formation solid sand of considerable geological complexity. The Kidderminster and Wildmoor sandstones are partially but extensively overlain by terrace and glacial sand and gravel deposits which are recorded as separate resource areas (in this area assessed as resource areas 12/5, 12/6 and 13/10).

Wildmoor Formation

The western half of this resource area is predominantly Wildmoor Formation. The Wildmoor Formation is generally described as red-brown and orange, fine to medium grained, feldspathic sandstone with sparse, thin mudstone beds. Generally the formation is characterised by a remarkably uniform, very weakly cemented, fine grained, silty, micaceous sandstone and an absence of pebbles, in contrast to the Kidderminster Formation, although sparse pebbly stringers are recorded. The fine grain-size and soft, poorly cemented, nature of the sandstone in some areas made it ideal for exploitation as moulding sand for use in the foundry industry.

The Wildmoor Sandstone formation ranges in thickness, a borehole near Hagley proved 175m of red hard and soft sandstone some of this could be attributed to the underlying Kidderminster Formation since the lower boundary is indistinct. The memoir for Droitwich Abberley and Kidderminster recorded that the greatest depth of this formation was proved in a borehole at Wildmoor, east of Fairfield, where 398' (121.3m) were passed through without the bottom being touched. East of the main outcrop the formation is cut out rapidly by the overstepping Bromsgrove Sandstone.

There is no information about exposures within this resource area, but to the north of this resource area (in resource area 3/7), there have been a number of mineral workings in the Wildmoor area: Chadwich Lane (currently operational, extended in 2012), immediately north of Sandy lane, currently still operational as Veolia tip (formerly Stanley N Evans) and south of the lane, Cinetic sand (formerly John Williams Cinetic Sand, currently operated by the Salop sand and gravel company) and immediately west of the motorway junction currently operated by MV Kelly (formerly "Pinches"). The memoir records all of these as Foundry sand (silica sand) pits.

- A borehole adjacent to the M5 South East of Chadwich Lane/Money Lane junction proves sand and gravel on sandstone overlain by boulder clay.
- Material supporting the 1979 application to deepen Chadwich Lane pit reported that the silica sand deposit "varies with the height of the land" and depth is "unknown". Supporting material for the 1998 application to extend the Chadwich Lane Pit indicated a depth of 80' (24.4m), based on the depths of material in and adjoining the existing pit.
- South of Chadwich Lane, material supporting the 1971 application for the pit to the south of Chadwich Lane, formerly known as John Williams Cinetic Sand and currently operated by the Salop Sand and Gravel Company, reported a depth of 80' (24.4m).
- At the site currently operated by MV Kelley (formerly "Pinches", immediately west of the motorway junction, the 1990 application proposed to work the site to a depth of 42m.

(Mean average from the Wildmoor area workings, 30.3m)

Kidderminster Formation

The eastern half of this resource area is Kidderminster Formation. The Kidderminster Formation is generally described as well-rounded pebble to cobble size conglomerate and red-brown, medium to coarse sandstone. The lower part of the formation predominantly consists of clast-supported conglomerate composed largely of pebbles and cobbles of red, red brown and grey fine-grained quartzite together with red sandstone, milky quartz and rare porphyritic igneous rocks and re-worked conglomerate. The formation rests uncomformably on Bridgenorth Sandstone. The maximum thickness of the conglomerate dominated facies is probably about 20m but this is gradational into the overlying sandstone dominated facies, which also contains beds and lenses of pebble conglomerate. The thickness of the formation in this district varies although the upper boundary is difficult to recognise because of the lithological similarity of the Kidderminster sandstone to the predominantly non-pebbly Wildmoor Sandstone. The memoir for Redditch records its greatest depth is 155m at Wildmoor (in resource area 3/7) and it thins to 133m at Burcot (in this resource area) and 127-129m at

	Brockhill (resource area 12/8). There is some further information recorded for this resource area: • Gorse Hill: On the eastern flank of the Blackwell fault is an outcrop of Kidderminster Formation, overlain in the north by a small glacial deposit. Adjacent to Brookhouse road the Kidderminster Formation is overlain by alluvium. • Apesdale, Linthurst: In this area, the Kidderminster Formation is overlain by boulder clay and glacial sand and gravel. At the Shepley pit 25m of Kidderminster Formation is exposed on the eastern edge. The quarry at Shepley is in the upper part of the formation where conglomorates are largely absent. At least 41m of cross-bedded, medium to coarse sandstone have been proved by borehole at this site. **Estimated depth** Estimated resource depth based on mean average of: a) borehole near Hagley: 175m, b) borehole at Wildmoor: 121.3m, c) average depth for Wildmoor area workings: 30.3m, d) memoir record for the Kidderminster formation at Wildmoor: 155m, e) memoir record for the Kidderminster formation at Burcot: 133m, f) memoir record for the Kidderminster formation at Brockhill (midpoint of 127m to 129m): 128m, g) Shepley pit: 25m, h) borehole at Shepley pit: 41m = 101.1m
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A large resource area with some dispersed built development. The deposit extends under a motorway, this section is not included as part of the resource area. The deposit has been worked at Shepley Pit, these workings are not included as part of the resource area. The deposit continues to the north west (assessed as resource areas 3/7 and 3/10), to the south east (assessed as resource areas 3/8a, and 12/8), to the east (assessed as resource area 3/9) and beyond the county boundary under the settlement of Rednal, this is not included as part of the resource area and is marked as OUT on the figure.
Crude estimate of resource:	Area: 742 ha x average depth: 101.1 m ÷ 2 Estimated resource volume: 375,081,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 750,162,000 tonnes**
Conclusion:	Significant – key resource. Use to define areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Additional resource information	A planning application from 1983 for Yew Tree Farm (application reference P/407057, refused at appeal) near Gorse Hill in the Kidderminster Formation showed an average thickness of between 7.5 and 16.5m. **The estimated depth has therefore been revised:** Estimated resource depth based on mean average of: a) borehole near Hagley: 175m, b) borehole at Wildmoor: 121.3m, c) average depth for Wildmoor area workings: 30.3m, d) memoir record for the Kidderminster formation at Wildmoor: 155m, e) memoir record for the Kidderminster formation at Burcot: 133m, f) memoir record for the Kidderminster formation at Brockhill (midpoint of 127m to 129m): 128m, g) Shepley pit: 25m, h) borehole at Shepley pit: 41m, i) average depth at Yew Tree Farm (midpoint of 7.5-16.5m):

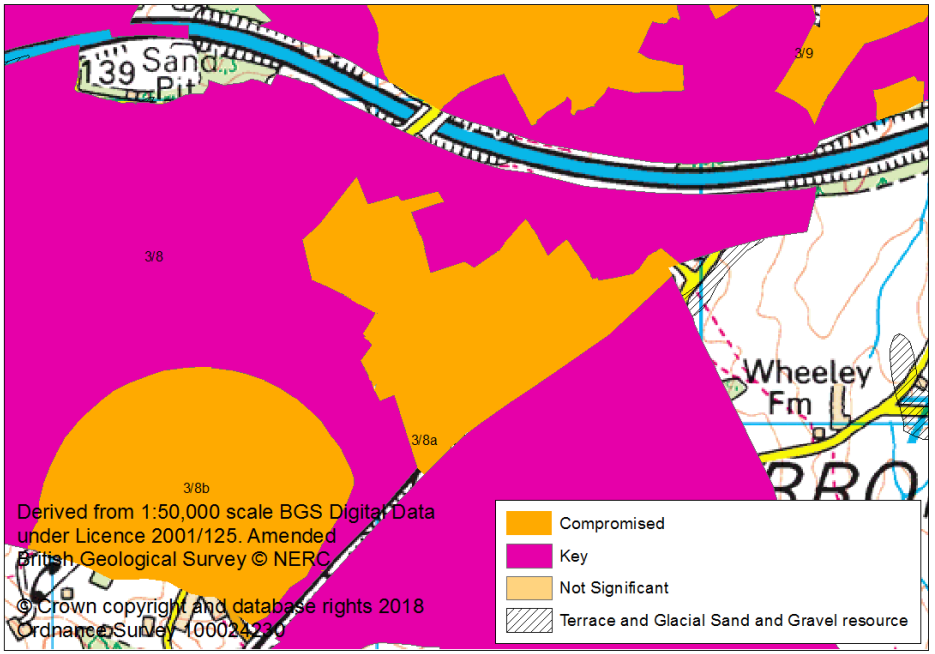
	12m = 91.2m
Revised estimate of resource:	Area: 742 ha x average depth: 91.2m ÷ 2 Estimated resource volume: 338,352,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 558,280,800 tonnes**
Conclusion:	Significant – key resource.

Assessment of resource for the Fourth Stage consultation on MLP (August 2018)

This resource area has been split into areas 3/8 and 3/8b.

Resource area 3/8		**Resource area 3/8b**	
Resource area:	**562ha**	**Commentary:**	Screened out due to the following appendix A criterion: - Allocation in adopted local plan - Conservation Area - Settlement Boundary - Source Protection Zone
Resource depth:	**91.2m**		
Revised estimate of resource:	Area: 562ha x average depth: 91.2m ÷ 2 Estimated resource volume: 256,272,000m^3 **Estimated resource tonnage (at 1.65 t/m^3): 422,848,800 tonnes**		
Conclusion:	Key resource.	**Conclusion:**	Compromised

Overview	
Resource number:	3/8 a
Resource name:	Blackwell
Resource area:	44ha
Resource depth:	Estimated 111.2m
Location	
OS sheet reference:	SO 97 SE, SO 97 NE, SP 07 SW, SP 07 NW
National grid ref:	398565, 273316



Resource description:

Resource description: Resource area 3/8a is Wildmoor Sandstone Formation and Kidderminster Formation solid sand.

In this part of the county there are large areas of Wildmoor sandstone formation and Kidderminster formation solid sand of considerable geological complexity. The Kidderminster and Wildmoor sandstones are partially but extensively overlain by terrace and glacial sand and gravel deposits which are recorded as separate resource areas (in this area assessed as resource areas 12/5, 12/6 and 13/10).

Wildmoor Formation

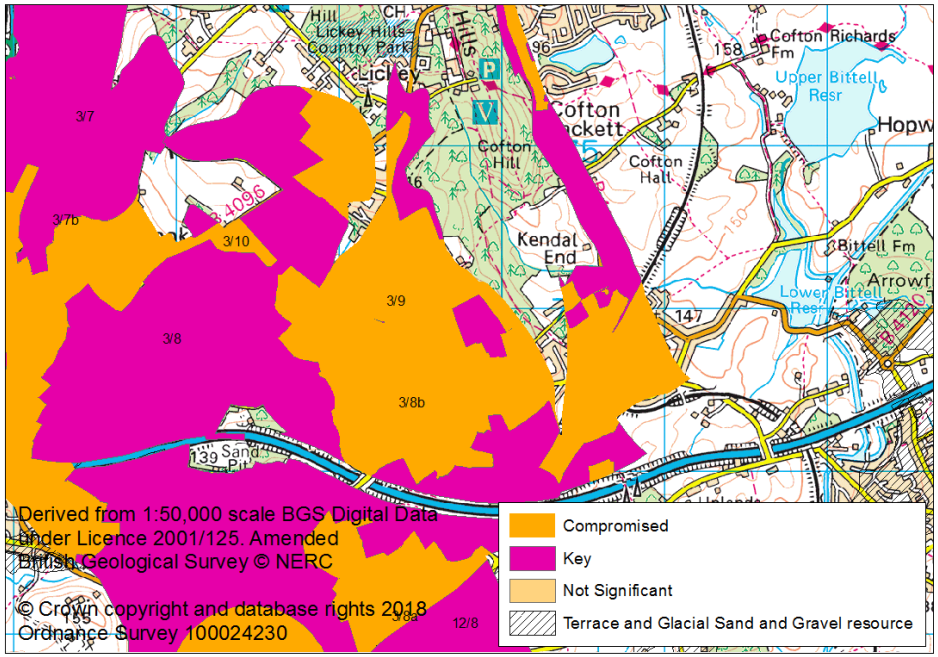
The Wildmoor Formation is generally described as red-brown and orange, fine to medium grained, feldspathic sandstone with sparse, thin mudstone beds. Generally the formation is characterised by a remarkably uniform, very weakly cemented, fine grained, silty, micaceous sandstone and an absence of pebbles, in contrast to the Kidderminster Formation, although sparse pebbly stringers are recorded. The fine grain-size and soft, poorly cemented, nature of the sandstone in some areas made it ideal for exploitation as moulding sand for use in the foundry industry.

The Wildmoor Sandstone formation ranges in thickness, a borehole near Hagley proved 175m of red hard and soft sandstone some of this could be attributed to the underlying Kidderminster Formation since the lower boundary is indistinct. The memoir for Droitwich Abberley and Kidderminster recorded that the greatest depth of this formation was proved in a borehole at Wildmoor, east of Fairfield, where 398' (121.3m) were passed

	through without the bottom being touched. East of the main outcrop the formation is cut out rapidly by the overstepping Bromsgrove Sandstone. There is no more detailed information for the Wildmoor Formation in this area. **Kidderminster Formation** The Kidderminster Formation is generally described as well-rounded pebble to cobble size conglomerate and red-brown, medium to coarse sandstone. The lower part of the formation predominantly consists of clast-supported conglomerate composed largely of pebbles and cobbles of red, red brown and grey fine-grained quartzite together with red sandstone, milky quartz and rare porphyritic igneous rocks and re-worked conglomerate. The formation rests uncomformably on Bridgenorth Sandstone. The maximum thickness of the conglomerate dominated facies is probably about 20m but this is gradational into the overlying sandstone dominated facies, which also contains beds and lenses of pebble conglomerate. The thickness of the formation in this district varies although the upper boundary is difficult to recognise because of the lithological similarity of the Kidderminster sandstone to the predominantly non-pebbly Wildmoor Sandstone. The memoir for Redditch records its greatest depth is 155m at Wildmoor (in resource area 3/7) and it thins to 133m at Burcot (in resource area 3/8) and 127-129m at Brockhill (resource area 12/8). There is some further information recorded for the deposit in this area: • Apesdale, Linthurst: In this area, the Kidderminster Formation is overlain by boulder clay and glacial sand and gravel. At the Shepley pit 25m of Kidderminster Formation is exposed on the eastern edge. The quarry at Shepley is in the upper part of the formation where conglomorates are largely absent. At least 41m of cross-bedded, medium to coarse sandstone have been proved by borehole at this site. Estimated resource depth based on mean average of: a) borehole near Hagley: 175m, b) memoir record for the Wildmoor Formation at Wildmoor: 121.3m, c) memoir record for the Kidderminster Formation at Wildmoor: 155m, d) memoir record for the Kidderminster formation at Burcot: 133m, e) memoir record for the Kidderminster Formation at Brockhill (midpoint of 127-129m): 128m, f) Shepley pit: 25m, g) borehole at Shepley pit: 41m = 111.2m
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area compromised by the settlement of Blackwell. The deposit continues to the north west (assessed as resource areas 3/7, 3/8 and 3/10), to the south east (assessed as resource area 12/8), to the east (assessed as resource area 3/9) and beyond the county boundary under the settlement of Rednal, this is not included as part of the resource area and is marked as OUT on the figure.
Crude estimate of resource:	Area: 44 ha x average depth: 111.2 m ÷ 2 Estimated resource volume: 24,464,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 48,928,000 tonnes**
Conclusion:	Compromised by development.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	

Revised estimate of resource:	Area: 44 ha x average depth: 111.2 m ÷ 2 Estimated resource volume: 24,464,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 40,365,600 tonnes**
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/9
Resource name:	Barnt Green
Resource area:	144 ha
Resource depth:	Estimated 142.5m
Location	
OS sheet reference:	SP 07 SW, SO 97 NE, SO 97 SE
National grid ref:	3999979, 273871



Resource description:

Resource description: Resource area 3/9 is Wildmoor Sandstone Formation and Kidderminster Formation solid sand.

In this part of the county there are large areas of Wildmoor sandstone formation and Kidderminster formation solid sand of considerable geological complexity. The Kidderminster and Wildmoor sandstones are partially but extensively overlain by terrace and glacial sand and gravel deposits which are recorded as separate resource areas, however there are no terrace and glacial resource areas overlying this resource area.

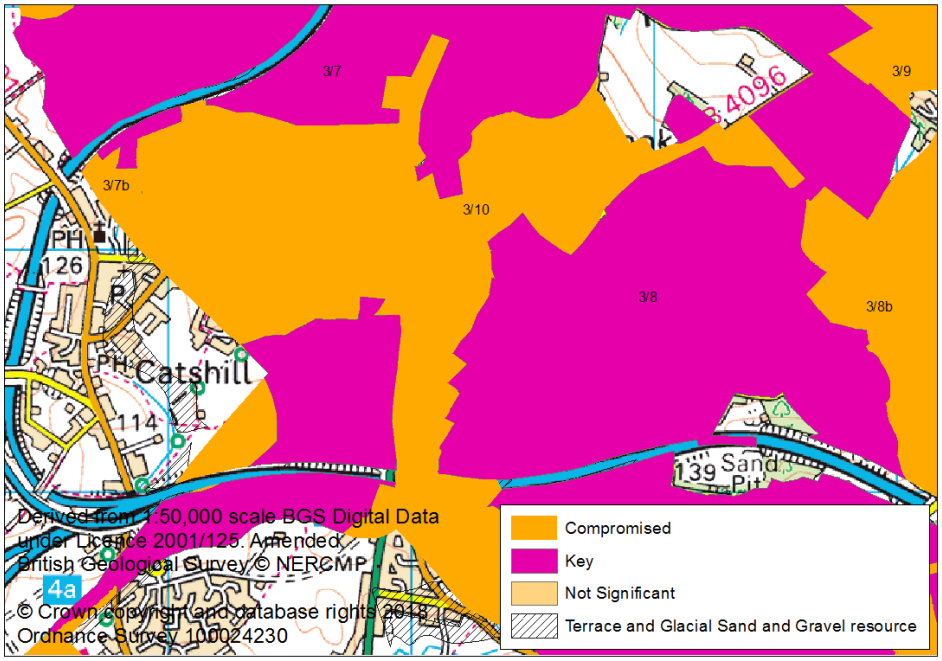
Wildmoor Formation

The Wildmoor Formation is generally described as red-brown and orange, fine to medium grained, feldspathic sandstone with sparse, thin mudstone beds. Generally the formation is characterised by a remarkably uniform, very weakly cemented, fine grained, silty, micaceous sandstone and an absence of pebbles, in contrast to the Kidderminster Formation, although sparse pebbly stringers are recorded. The fine grain-size and soft, poorly cemented, nature of the sandstone in some areas made it ideal for exploitation as moulding sand for use in the foundry industry.

The Wildmoor Sandstone formation ranges in thickness, a borehole near Hagley proved 175m of red hard and soft sandstone some of this could be attributed to the underlying Kidderminster Formation since the lower boundary is indistinct. The memoir for Droitwich Abberley and Kidderminster recorded that the greatest depth of this formation was proved in a borehole at Wildmoor, east of Fairfield, where 398' (121.3m) were passed

	through without the bottom being touched. East of the main outcrop the formation is cut out rapidly by the overstepping Bromsgrove Sandstone. There is no further information recorded for the deposit in this resource area. **Kidderminster Formation** The Kidderminster Formation is generally described as well-rounded pebble to cobble size conglomerate and red-brown, medium to coarse sandstone. The lower part of the formation predominantly consists of clast-supported conglomerate composed largely of pebbles and cobbles of red, red brown and grey fine-grained quartzite together with red sandstone, milky quartz and rare porphyritic igneous rocks and re-worked conglomerate. The formation rests uncomformably on Bridgnorth Sandstone. The maximum thickness of the conglomerate dominated facies is probably about 20m but this is gradational into the overlying sandstone dominated facies, which also contains beds and lenses of pebble conglomerate. The thickness of the formation in this district varies although the upper boundary is difficult to recognise because of the lithological similarity of the Kidderminster sandstone to the predominantly non-pebbly Wildmoor Sandstone. The memoir for Redditch records its greatest depth is 155m at Wildmoor (in resource area 3/7) and it thins to 133m at Burcot (in resource area 3/8) and 127-129m at Brockhill (resource area 12/8). There is no further information recorded for the deposit in this resource area. Estimated resource depth based on mean average of: a) borehole near Hagley: 175m, b) borehole at Wildmoor: 121.3m, c) Redditch memoir record for Wildmoor: 155m, d) Redditch memoir record for Burcott: 133m, e) Redditch memoir record for Brockhill: (midpoint of 127m to 129m): 128m = 142.5m
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A medium resource area compromised by the settlement of Barnt Green. The deposit continues beyond Barnt Green and is assessed as resource areas 3/7, 3/8, 3/10 and 12/8. It also extends beyond the county boundary under the settlement of Rednal.
Crude estimate of resource:	Area: 144 ha x average depth: 142.5 m ÷ 2 Estimated resource volume: 102,600,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 205,200,000 tonnes**
Conclusion:	Compromised by development with less than 10ha remaining.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 144 ha x average depth: 142.5 m ÷ 2 Estimated resource volume: 102,600,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 169,290,000 tonnes**
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/10
Resource name:	Marlbrook
Resource area:	194 ha
Resource depth:	Not known
Location	
OS sheet reference:	SO 97 SE
National grid ref:	396938, 273918



Resource description:

Resource description: Resource area 3/10 is primarily Wildmoor Sandstone Formation with some Kidderminster Formation solid sand.

In this part of the county there are large areas of Wildmoor sandstone formation and Kidderminster formation solid sand of considerable geological complexity. The Kidderminster and Wildmoor sandstones are partially but extensively overlain by terrace and glacial sand and gravel deposits which are recorded as separate resource areas (in this area assessed as resource areas 12/1, 10/21a, 12/2, 12/3, 12/4, 12/5a, 12/6a).

Wildmoor Formation

The Wildmoor Formation is generally described as red-brown and orange, fine to medium grained, feldspathic sandstone with sparse, thin mudstone beds. Generally the formation is characterised by a remarkably uniform, very weakly cemented, fine grained, silty, micaceous sandstone and an absence of pebbles, in contrast to the Kidderminster Formation, although sparse pebbly stringers are recorded. The fine grain-size and soft, poorly cemented, nature of the sandstone in some areas made it ideal for exploitation as moulding sand for use in the foundry industry.

The Wildmoor Sandstone formation ranges in thickness, a borehole near Hagley proved 175m of red hard and soft sandstone some of this could be attributed to the underlying Kidderminster Formation since the lower boundary is indistinct. The memoir for Droitwich Abberley and Kidderminster recorded that the greatest depth

of this formation was proved in a borehole at Wildmoor, east of Fairfield, where 398' (121.3m) were passed through without the bottom being touched. East of the main outcrop the formation is cut out rapidly by the overstepping Bromsgrove Sandstone.

To the north of this resource area (in resource area 3/7), there have been a number of mineral workings in the Wildmoor area: Chadwich Lane (currently operational, extended in 2012), immediately north of Sandy lane, currently still operational as Veolia tip (formerly Stanley N Evans) and south of the lane, Cinetic sand (formerly John Williams Cinetic Sand, currently operated by the Salop sand and gravel company) and immediately west of the motorway junction currently operated by MV Kelly (formerly "Pinches"). The memoir records all of these as Foundry sand (silica sand) pits.

- A borehole adjacent to the M5 South East of Chadwich Lane/Money Lane junction proves sand and gravel on sandstone overlain by boulder clay.
- Material supporting the 1979 application to deepen Chadwich Lane pit reported that the silica sand deposit "varies with the height of the land" and depth is "unknown". Supporting material for the 1998 application to extend the Chadwich Lane Pit indicated a depth of 80' (24.4m), based on the depths of material in and adjoining the existing pit.
- South of Chadwich Lane, material supporting the 1971 application for the pit to the south of Chadwich Lane, formerly known as John Williams Cinetic Sand and currently operated by the Salop Sand and Gravel Company, reported a depth of 80' (24.4m).
- At the site currently operated by MV Kelley (formerly "Pinches", immediately west of the motorway junction, the 1990 application proposed to work the site to a depth of 42m.

(Mean average from the Wildmoor area workings, 30.3m)

Kidderminster Formation

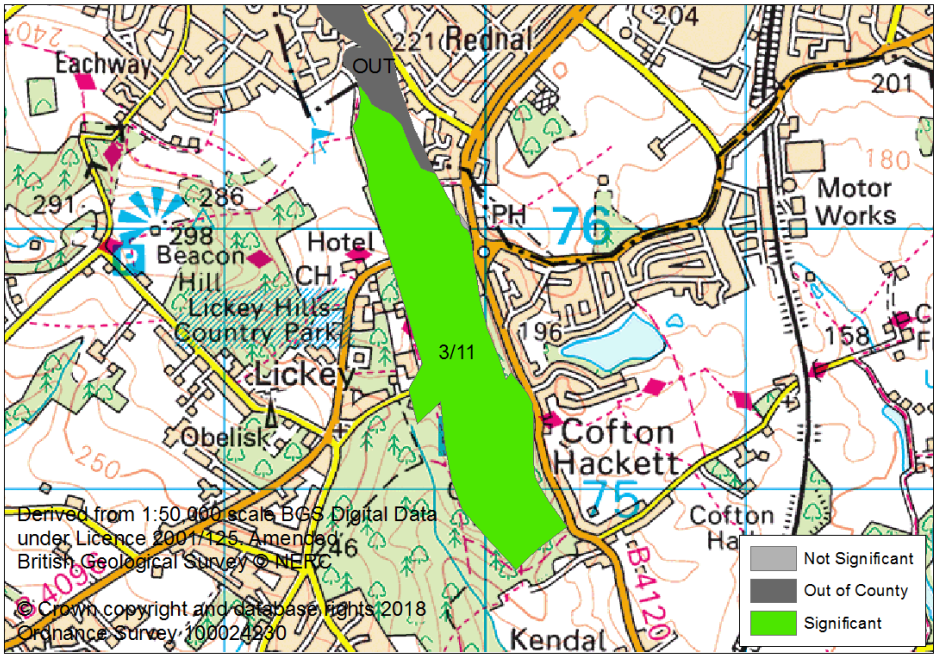
The Kidderminster Formation is generally described as well-rounded pebble to cobble size conglomerate and red-brown, medium to coarse sandstone. The lower part of the formation predominantly consists of clast-supported conglomerate composed largely of pebbles and cobbles of red, red brown and grey fine-grained quartzite together with red sandstone, milky quartz and rare porphyritic igneous rocks and re-worked conglomerate. The formation rests uncomformably on Bridgenorth Sandstone. The maximum thickness of the conglomerate dominated facies is probably about 20m but this is gradational into the overlying sandstone dominated facies, which also contains beds and lenses of pebble conglomerate. The thickness of the formation in this district varies although the upper boundary is difficult to recognise because of the lithological similarity of the Kidderminster sandstone to the predominantly non-pebbly Wildmoor Sandstone. The memoir for Redditch records its greatest depth is 155m at Wildmoor (in resource area 3/7) and it thins to 133m at Burcot (in resource area 3/8) and 127-129m at Brockhill (resource area 12/8).

There is some further information recorded for the deposit in this area:

- Gorse Hill: On the eastern flank of the Blackwell fault is an outcrop of Kidderminster Formation, overlain in the north by a small glacial deposit. Adjacent to Brookhouse road the Kidderminster

	Formation is overlain by alluvium. Estimated resource depth based on mean average of: a) borehole near Hagley: 175m, b) borehole at Wildmoor: 121.3m, c) average for Wildmoor Workings: 30.3m, d) Redditch memoir record for Wildmoor: 155m, e) Redditch memoir record for Burcott: 133m, f) Redditch memoir record for Brockhill: (median average of 127m to 129m): 128m = 123.8m
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A medium resource area compromised by the settlement of Catshill. The deposit continues beyond Catshill and is assessed as resource areas 3/7, 3/8, 3/9 and 12/8. It also extends beyond the county boundary under the settlement of Rednal.
Crude estimate of resource:	Area: 194 ha x average depth: 123.8 m ÷ 2 Estimated resource volume: 120,086,000 m^3 **Estimated resource tonnage (at 2 t/m^3): 240,172,000 tonnes**
Conclusion:	Compromised by development.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 194 ha x average depth: 123.8 m ÷ 2 Estimated resource volume: 120,086,000 m^3 **Estimated resource tonnage (at 1.65 t/m^3): 198,141,900 tonnes**
Conclusion:	Compromised by development.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Not reassessed due to resource not being classified as Key or Significant in the Third Stage Consultation.	

Overview	
Resource number:	3/11
Resource name:	Cofton Hackett
Resource area:	53 ha
Resource depth:	Not known
Location	
OS sheet reference:	SO 97 NE, SO 97 SE, SP 07 NW, SP 07 SW
National grid ref:	399886, 275552



Resource description:	
Resource description:	Lickey quartzite (crushed rock). This deposit is described as "hard, of unknown thickness, steeply dipping, tightly folded and highly fractured" outcrops in a North-North-Westerly trending fault-bounded discontinuous inlier between Rubery and Cofton Hill. The deposit forms Rednal, Bilberry and Cofton Hills. The memoir and geologic maps show that there have been numerous historic quarries but no details are given. The Quartzite is of unknown thickness. The strata have been worked for roadstone in the past.
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A medium-sized resource area with little built development. The deposit extends beyond the county boundary under the settlement of Rednal, this is not included as part of the resource area and is marked as OUT on the figure.
Crude estimate of resource:	Depth not known
Conclusion:	Significant. Consider in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	No change to the assessment.
Conclusion:	Significant.
Assessment of resource for the Fourth Stage consultation on MLP (August 2018)	
Resource area:	53ha
Resource depth:	Depth not known

Revised estimate of resource:	Depth not known. Resource area is greater than 50ha
Conclusion:	Significant resource.