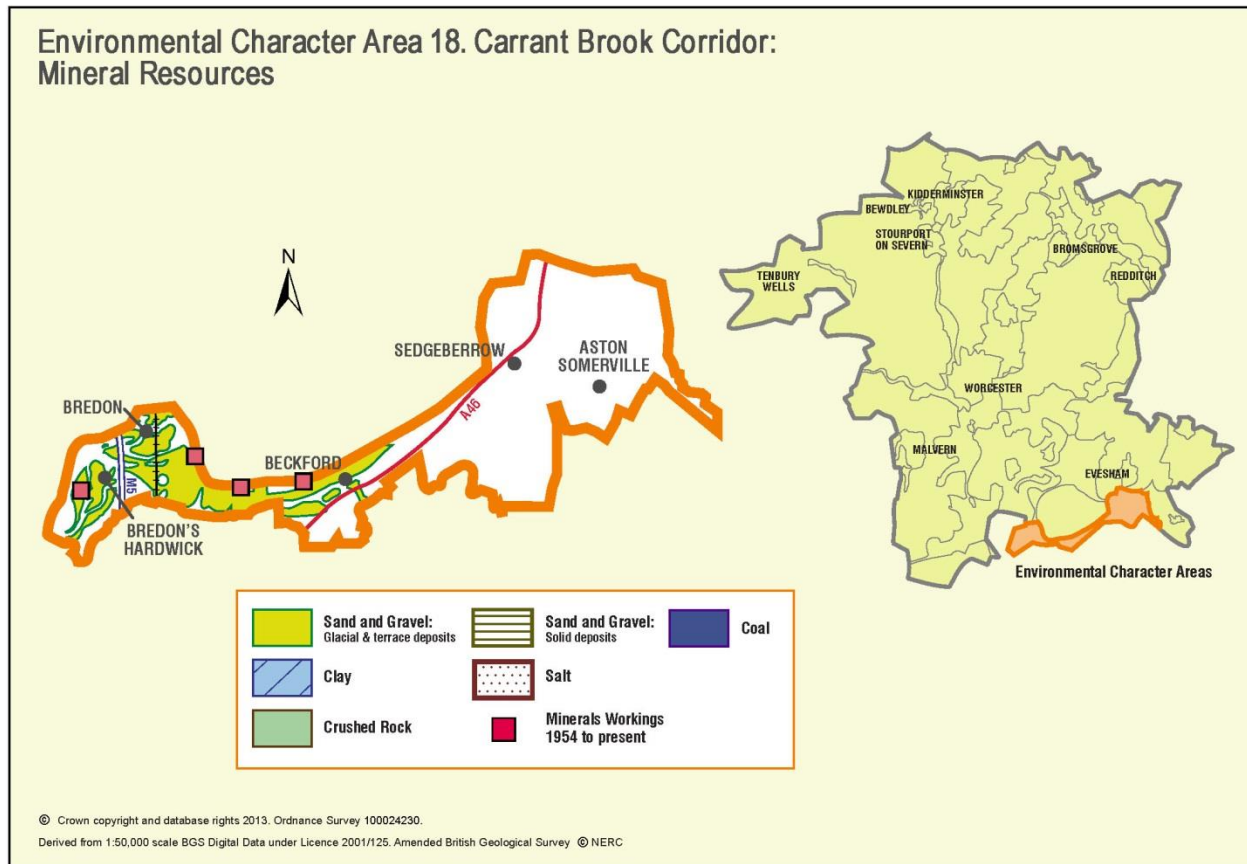


Appendix 18: Analysis of aggregate resources in ECA 18: Carrant Brook Corridor



ECA Summary for the Third Stage consultation on MLP (Spring 2015):

Sand and gravel

There are 12 resource areas identified for sand and gravel in Carrant Brook Corridor ECA:

- Key: 1
- Significant: 7
- Not significant: 1
- Compromised: 3

Crushed rock

There are no resource areas identified in Carrant Brook Corridor ECA for crushed rock.

Non-aggregates

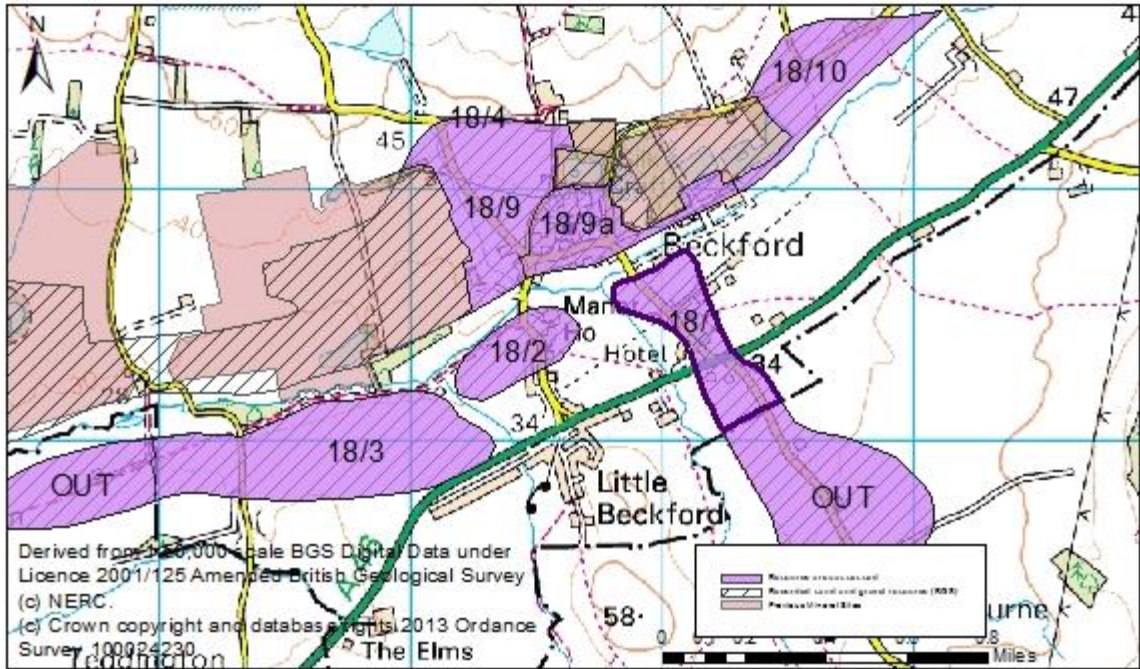
BGS data indicates that there are no non-aggregate mineral deposits in Carrant Brook Corridor ECA.

Overview of resource assessment for ECA 18

Sand and gravel resource areas:

Resource number*	Second Stage Consultation		Third Stage Consultation	
	Original estimated resource tonnage (2 tonnes/m ³)	Significance	Revised estimate of resource tonnage (1.65 tonnes/m ³)	Significance
18/1	960,000	Significant	792,000	Significant
18/2	Depth unknown	Not significant	Depth unknown	Not significant
18/3	1,596,000	Significant	1,316,700	Significant
18/4	7,232,000	Key	5,966,400	Key
18/5	1,300,000	Significant	1,072,500	Significant
18/5a	1,400,000	Compromised	1,155,000	Compromised
18/6	300,000	Compromised	247,500	Compromised
18/7	1,265,000	Significant	1,043,625	Significant
18/8	1,575,000	Significant	1,299,375	Significant
18/9	1,350,000	Significant	1,113,750	Significant
18/9a	700,000	Compromised	577,500	Compromised
18/10	1,140,000	Significant	940,500	Significant

Overview	
Resource number:	18/1
Resource name:	South of Beckford
Resource area:	16 ha
Resource depth:	Estimated 6m
Location	
OS sheet reference:	SO 93 NE
National grid ref:	398139, 235414



Resource description:

Resource description: This resource area is comprised of a small area of 1st river terrace sand and gravel alongside a larger area of 2nd terrace Wasperton sand and gravel.

The 2nd terrace deposit was derived by solifluction from the inferior oolite of Bredon Hill, re-sorted at this lower level by fluvial action. The mapped boundary between the 2nd terrace (Wasperton) and the fan gravel to the north (not included as a resource area) is somewhat arbitrary. The deposit generally consists of Jurassic limestone fragments with some rounded ironstone fragments and occasional bunter quartzite and flint pebbles in a matrix of medium-grained well-rounded sand. BGS memoirs record that the 2nd terrace differs in character depending on whether they occur in the valleys of the Avon, the Carrant Brook or the Washbourne Brook.

The 2nd terrace in the deposits to the north has previously been worked at a number of sites. The planning application for Carrant Brook Pit (to the north west of this resource area) stated that the site would be worked to 6m depth. The 2nd terrace has also been worked to the north of this area, on a site which is now a Silk Mill. No information on depth is available for the Silk Mill area.

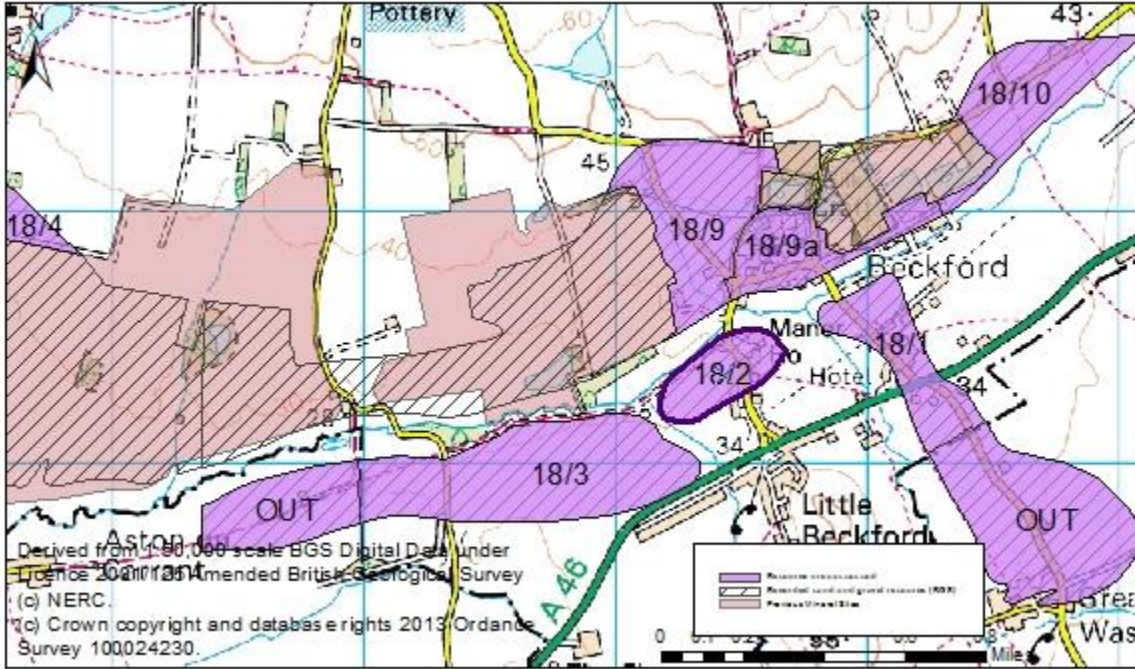
(Estimated resource depth based on Carrant Brook Pit: 6m)

Assessment of resource for the second consultation on MLP (Autumn 2013)

Commentary: Small resource area intersected by roads with small-scale ribbon development. This deposit extends into Gloucestershire (labelled OUT on the figure), this is not considered as a resource area in Worcestershire.

Crude estimate of Area: 16ha x average depth: 6 m / 2

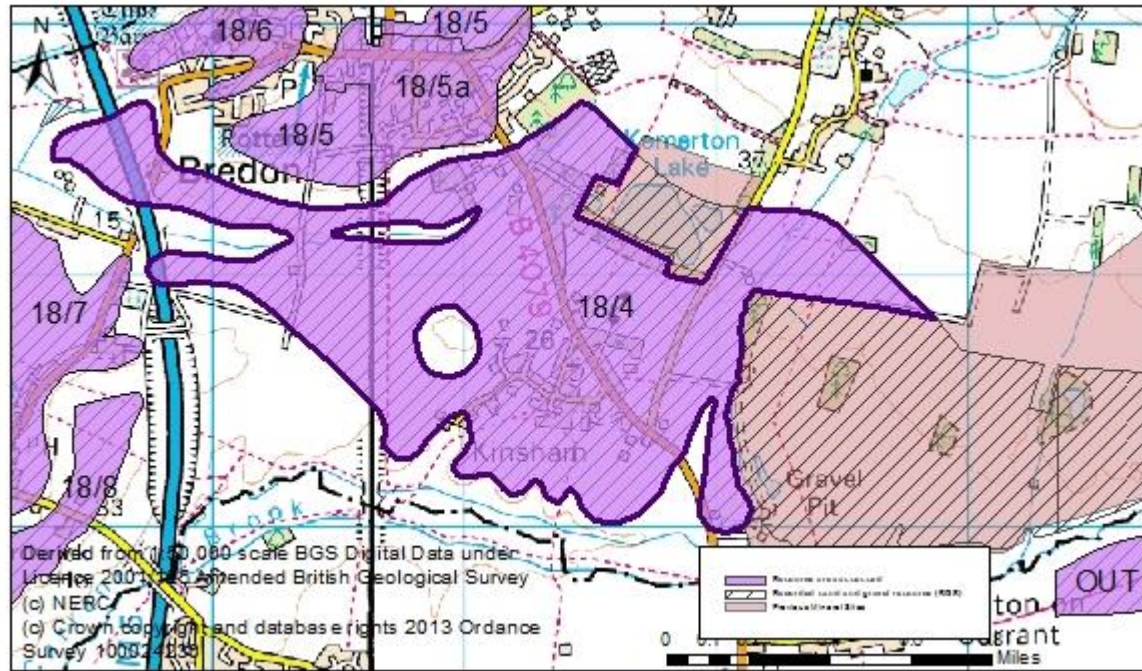
resource:	Estimated resource volume:.480,000 m ³ Estimated resource tonnage (at 2 t/m³): 960,000
Conclusion:	Significant. Consider in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 16ha x average depth: 6 m / 2 Estimated resource volume:.480,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 792,000 tonnes
Conclusion:	Significant.

Overview		
Resource number:	18/2	
Resource name:	North of Little Beckford	
Resource area:	10 ha	
Resource depth:	Not known	
Location		
OS sheet reference:	SO 93 NE	
National grid ref:	397415, 235353	
Resource description:		
Resource description:	1 st river terrace sand and gravel. No exposures. None of the workings in this area have worked the 1 st river terrace deposits.	
Assessment of resource for the second consultation on MLP (Autumn 2013)		
Commentary:	Small deposit intersected by a road and small-scale development in the east of the resource 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.	

Overview	
Resource number:	18/3
Resource name:	South of the Carrant Brook
Resource area:	42 ha
Resource depth:	Estimated 3.8m
Location	
OS sheet reference:	SO 93 SE
National grid ref:	396671, 234953
Resource description:	
Resource description:	2 nd terrace (Wasperton) sand and gravel.
	<p>The 2nd terrace deposit was derived by solifluction from the inferior oolite of Bredon Hill, re-sorted at this lower level by fluvial action. The mapped boundary between the 2nd terrace (Wasperton) and the fan gravel to the north (not included as a resource area) is somewhat arbitrary. The deposit generally consists of Jurassic limestone fragments with some rounded ironstone fragments and occasional bunter quartzite and flint pebbles in a matrix of medium-grained well-rounded sand. BGS memoirs record that the 2nd terrace differs in character depending on whether they occur in the valleys of the Avon, the Carrant Brook or the Washbourne Brook.</p> <p>The 2nd terrace in the deposits to the north has previously been worked at a number of sites. The planning application for Carrant Brook Pit (to the north of this resource area) stated that the site would be worked to 6m depth. The 2nd terrace has also been worked to the north west of this area, at Aston Mill, where thickness averaged around 1.5m.</p> <p>(Estimated resource depth based on Carrant Brook Pit: 6m + Aston Mill: 1.5m / 2 = 3.8m)</p>
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	Small resource area with a road but no built development in the resource area. This deposit extends into Gloucestershire (labelled OUT on the figure), this is not considered as a resource area in Worcestershire.
Crude estimate of resource:	Area: 42 ha x average depth: 3.8 m / 2 Estimated resource volume: 798,000 m ³

	Estimated resource tonnage (at 2 t/m³):1,596,000
Conclusion:	Significant. Consider in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 42 ha x average depth: 3.8 m / 2 Estimated resource volume: 798,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 1,316,700 tonnes
Conclusion:	Significant.

Overview	
Resource number:	18/4
Resource name:	Bredon to Beckford
Resource area:	226 ha
Resource depth:	Estimated 3.2m
Location	
OS sheet reference:	SO 93 NW, SO 93 NE
National grid ref:	394048, 235907



Resource description:	
Resource description:	<p>2nd terrace (Wasperton) sand and gravel.</p> <p>The 2nd terrace deposit was derived by solifluction from the inferior oolite of Bredon Hill, re-sorted at this lower level by fluvial action. The mapped boundary between the 2nd terrace (Wasperton) and the fan gravel to the north (not included as a resource area) is somewhat arbitrary. The deposit generally consists of Jurassic limestone fragments with some rounded ironstone fragments and occasional bunter quartzite and flint pebbles in a matrix of medium-grained well-rounded sand. BGS memoirs record that the 2nd terrace differs in character depending on whether they occur in the valleys of the Avon, the Carrant Brook or the Washbourne Brook. On the north side of the Carrant Brook valley, sandy gravels predominantly of limestone pebbles, "merit further investigation as to their thickness and quality".</p> <p>The 2nd terrace deposit has previously been worked at a number of sites:</p> <ul style="list-style-type: none"> • Working took place in the Aston Mill pit (to the east of this resource area). Thickness averaged around 1.5m but this thickness is not maintained further west towards Kinsham with increasing distance from the gravel source. • A planning application for Carrant Brook Pit (beyond Aston Mill to the east of this resource area) stated that the site would be worked to 6m depth. • The 2nd terrace has also been worked to further east of this area, on a site which is now a Silk Mill. No information on depth is available for the Silk Mill area. • Working at Kemerton Pit (to the north west of the resource area) showed 4.5m of sand and gravel

overlain by 0.5m of sandy loam.

- An old gravel pit immediately to the north showed 2.1m of sand and gravel overlain by 0.9m of loam.

In the western end of this resource area, immediately south west of Bredon, the memoir records that the thickness probably does not exceed 2m.

(Estimated resource depth based on mean average of: a) Aston Mill Pit: 1.5m b) Carrant Brook Pit: 6m c) Kemerton Pit 4.5m d) pit to the north: 2.1m e) memoir: 2m = 3.2m)

Assessment of resource for the second consultation on MLP (Autumn 2013)

Commentary: A large resource area intersected by roads with some ribbon development. The deposit has been extensively worked and these areas are not included as part of the resource area. The deposit continues to the east beyond the former Aston Mill pit, and this is considered as separate resource areas (18/10, 18/11 and 18/12) as the areas are separated by over 500m.

Crude estimate of resource: Area: 226ha x average depth: 3.2 m / 2
Estimated resource: 3,616,000 m³.
Estimated resource tonnage (at 2 t/m³): 7,232,000 tonnes

Conclusion: Significant – key resource.
Use to define areas of search.

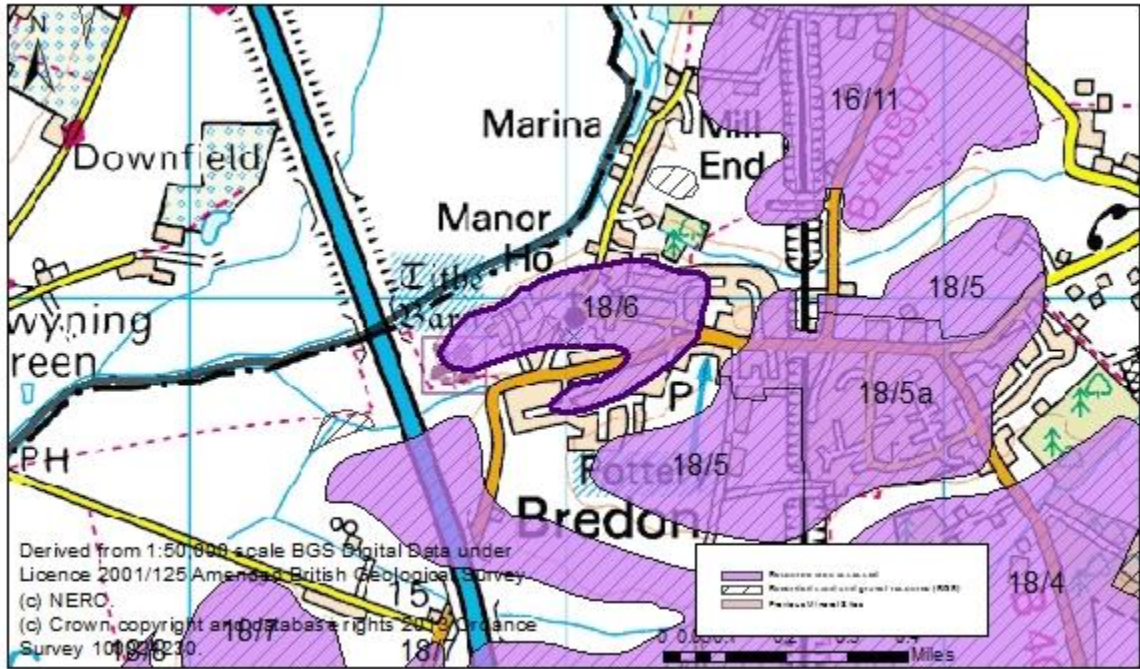
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)

Revised estimate of resource: Area: 226ha x average depth: 3.2 m / 2
Estimated resource: 3,616,000 m³.
Estimated resource tonnage (at 1.65 t/m³): 5,966,400 tonnes

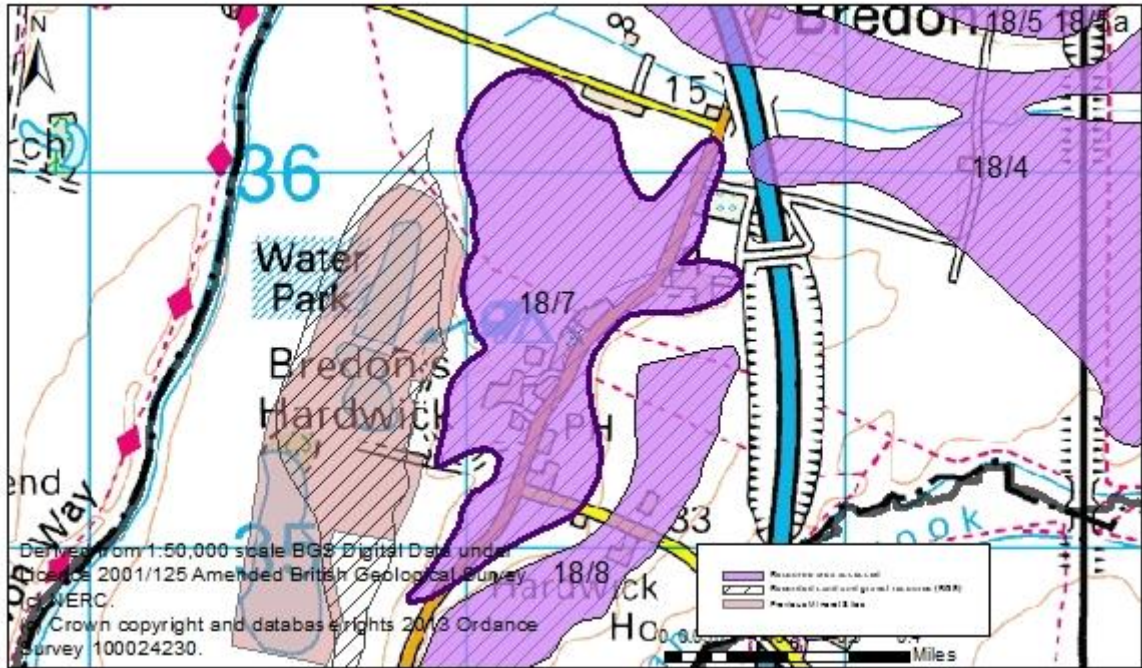
Conclusion: Significant – key resource.

Overview	
Resource number:	18/5
Resource name:	Bredon east
Resource area:	26 ha
Resource depth:	Estimated 5m
Location	
OS sheet reference:	SO 93 NW
National grid ref:	392634, 236735
Resource description:	
Resource description:	4 th terrace (Crophorne) sand and gravel. BGS memoirs state that gravel is estimated to be 4-5m thick, possibly up to 6m to the north. An exposure at Bredon showed course-grained pebbly sand and pebbly gravel. (Estimated resource depth based on median average of 4m to 6m range = 5m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small resource area with small-scale development on the periphery of the area. The deposit extends under the village of Bredon and the railway line, this section is assessed as a separate resource area (18/5a).
Crude estimate of resource:	Area: 26ha x average depth: 5m / 2 Estimated resource volume: 650,000m ³ Estimated resource tonnage (at 2 t/m³): 1,300,000 tonnes
Conclusion:	Significant. Consider in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 26ha x average depth: 5m / 2 Estimated resource volume: 650,000m ³ Estimated resource tonnage (at 1.65 t/m³): 1,072,500 tonnes
Conclusion:	Significant.

Overview	
Resource number:	18/5a
Resource name:	Bredon east a)
Resource area:	28 ha
Resource depth:	Estimated 5m
Location	
OS sheet reference:	SO 93 NW
National grid ref:	3997753, 235859
Resource description:	
Resource description:	4 th terrace (Crothorne) sand and gravel. BGS memoirs state that gravel is estimated to be 4-5m thick, possibly up to 6m to the north. An exposure at Bredon showed course-grained pebbly sand and pebbly gravel. (Estimated resource depth based on median average of 4m to 6m range = 5m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	This resource area is compromised by the village of Bredon and the railway line. The deposit extends beyond the village, this section is assessed as a separate resource area (18/5).
Crude estimate of resource:	Area: 28ha x average depth: 5m / 2 Estimated resource volume: 700,000m ³ Estimated resource tonnage (at 2 t/m³): 1,400,000 tonnes
Conclusion:	Compromised by development.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 28ha x average depth: 5m / 2 Estimated resource volume: 700,000m ³ Estimated resource tonnage (at 1.65 t/m³): 1,155,000 tonnes
Conclusion:	Compromised by development.

Overview	
Resource number:	18/6
Resource name:	Bredon Church Street
Resource area:	15 ha
Resource depth:	Estimated 2m
Location	
OS sheet reference:	SO 93 NW
National grid ref:	392061, 236930
	
Resource description:	
Resource description:	2 nd terrace (Wasperton) and 3 rd terrace (New Inn) sand and gravel. The BGS memoirs record no clear data regarding thickness of the 2 nd terrace in this location. The memoirs state that 3 rd terrace thickness is not likely to be more than 2m. (Estimated resource depth based depth on 2m)
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small deposit, over half of which is compromised by the village of Bredon, less than 10ha remains uncompromised.
Crude estimate of resource:	Area: 15 ha x average depth: 2m x 0.5 Estimated resource volume: 150,000m ³ Estimated resource tonnage (at 2 t/m³): 300,000 tonnes.
Conclusion:	Compromised by development. 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: 15 ha x average depth: 2m x 0.5 Estimated resource volume: 150,000m ³ Estimated resource tonnage (at 1.65 t/m³): 247,500 tonnes
Conclusion:	Compromised by development.

Overview	
Resource number:	18/7
Resource name:	Bredon's Hardwick North
Resource area:	55 ha
Resource depth:	Estimated 2.3m
Location	
OS sheet reference:	SO 93 NW
National grid ref:	391231, 235656



Resource description:

Resource description: 2nd terrace (Wasperton) and 3rd terrace (New Inn) sand and gravel.

BGS memoirs record that the 2nd terrace differs in character depending on whether they occur in the valleys of the Avon, the Carrant Brook or the Washbourne Brook. On the north side of the Carrant Brook valley, sandy gravels predominantly of limestone pebbles, "merit further investigation as to their thickness and quality". The memoir reports that working has taken place south of Twyning Green but considerable areas likely to be over 2m in thickness remain. Between Bredon and Bredon's Hardwick the memoir records that soils suggest that sand is the dominant component. Bunter pebbles comprise most of the gravel portion but flints and a significant percentage (perhaps 10%) of Jurassic limestone pebbles are also present. The gravelly sands at and to the north of Bredon's Hardwick are estimated to be 2-3m thick on average, possibly reaching a maximum of 4m locally.

For the 3rd terrace, approximately 2m depth is exposed in a road cutting at Bredon's Hardwick.

The nearby working at Bredon's Hardwick worked the Avon 1st terrace.

(Estimated resource depth based on: a) south of Twyning Green: 2m, b) Bredon's Hardwick median average of 2m, 3m and 4m = 3m, c) road cutting at Bredon's Hardwick: 2m = 2.3m)

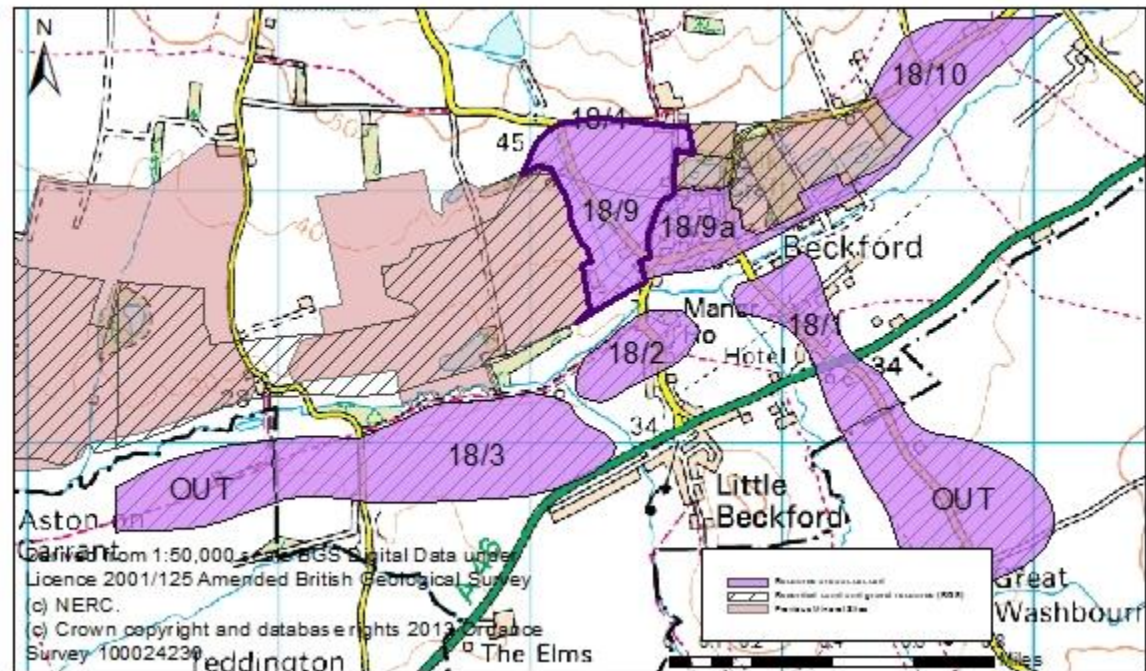
Assessment of resource for the second consultation on MLP (Autumn 2013)

Commentary: A medium-sized deposit intersected by a road with scattered development.

Crude estimate of resource:	Area: 55 ha x average depth: 2.3m x 0.5 Estimated resource volume: 632,500 m ³ Estimated resource tonnage (at 2 t/m³): 1,265,000 tonnes.
Conclusion:	Significant. Consider in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 55 ha x average depth: 2.3m x 0.5 Estimated resource volume: 632,500 m ³ Estimated resource tonnage (at 1.65 t/m³): 1,043,625 tonnes
Conclusion:	Significant.

Overview		
Resource number:	18/8	
Resource name:	Hardwick House	
Resource area:	35 ha	
Resource depth:	Estimated 4.5m	
Location		
OS sheet reference:	SO 93 NW	
National grid ref:	391095, 234771	
Resource description:		
Resource description:	<p>4th terrace (Crophorne) sand and gravel. Ferruginous coarse-grained pebbly sand and pebbly gravel containing abundant bunter pebbles and subordinate flint and Jurassic limestone pebbles. The BGS memoirs indicate that deposits are 4-5m deep.</p> <p>The nearby working at Bredon's Hardwick worked the Avon 1st terrace.</p> <p>(Estimated resource depth based on median depth of 4.5m)</p>	
Assessment of resource for the second consultation on MLP (Autumn 2013)		
Commentary:	A small deposit with small-scale dispersed development across the resource area.	
Crude estimate of resource:	Area: 35 ha x average depth: 4.5m / 2 Estimated resource volume: 787,500m ³ Estimated resource tonnage (at 2 t/m³): 1,575,000 tonnes	
Conclusion:	Significant. Consider in defining areas of search.	
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)		
Revised estimate of resource:	Area: 35 ha x average depth: 4.5m / 2 Estimated resource volume: 787,500m ³ Estimated resource tonnage (at 1.65 t/m³): 1,299,375 tonnes	
Conclusion:	Significant.	

Overview	
Resource number:	18/9
Resource name:	West of Beckford
Resource area:	27ha
Resource depth:	Estimated 5m
Location	
OS sheet reference:	SO 93 NE
National grid ref:	397322, 235993



Resource description:

Resource description: 2nd terrace (Wasperton) and 4th terrace sand and gravel.

The 2nd terrace deposit was derived by solifluction from the inferior oolite of Bredon Hill, re-sorted at this lower level by fluvial action. The mapped boundary between the 2nd terrace (Wasperton) and the fan gravel to the north (not included as a resource area) is somewhat arbitrary. The deposit generally consists of Jurassic limestone fragments with some rounded ironstone fragments and occasional bunter quartzite and flint pebbles in a matrix of medium-grained well-rounded sand.

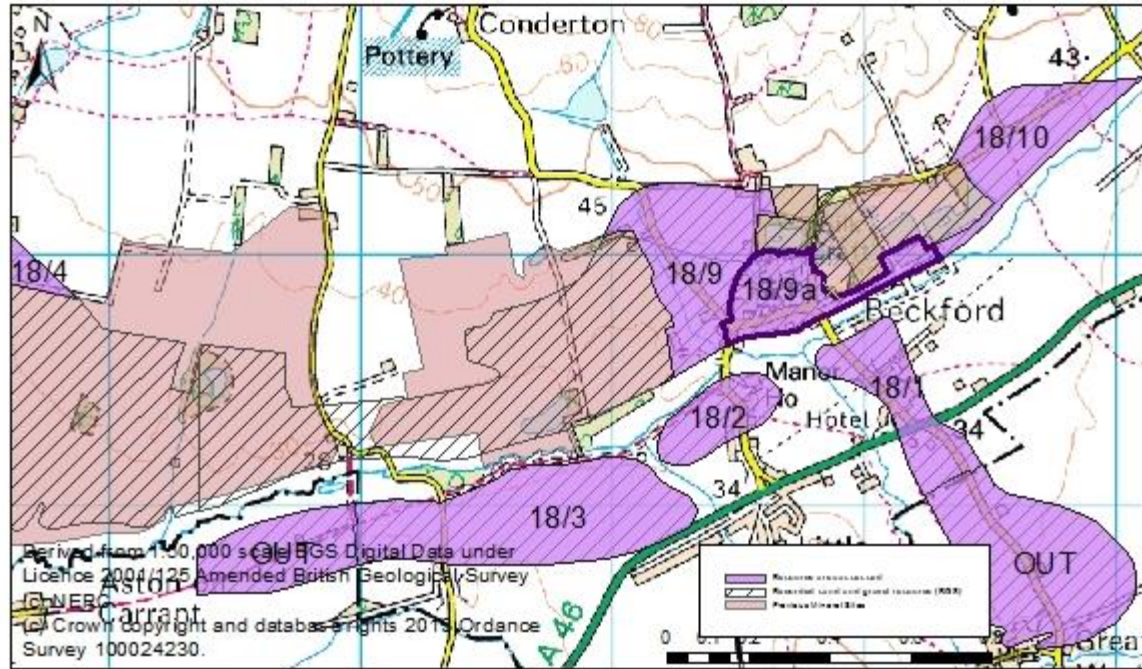
The 2nd terrace deposit has previously been worked at a number of sites. The planning application for Carrant Brook Pit (to the west of this resource area) stated that the site would be worked to 6m depth. The 2nd terrace has also been worked in an area to the east of Beckford which is now a Silk Mill. No information on depth is available for the Silk Mill area.

The 4th terrace deposit has been worked at Beckford Quarry and at an older site north of Beckford Quarry at Court Farm. The planning application for Beckford Quarry stated that the maximum depth of the resource was 4m, and 8 boreholes showed the depth of sand and gravel to range between 12' and 14' (3.66m-4.27m, median average = 3.97m).

(Estimated resource depth based on mean average of a) 2nd terrace deposits at Carrant Brook Pit: 6m and b) Beckford Quarry: 3.97m = 5.0m)

Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small deposit intersected by a road. The deposit has been extensively worked and these areas are not included as part of the resource area. The 2 nd terrace deposit continues to the west beyond the former Carrant Brook pit, and this is not considered as a resource area as there is less than 10ha remaining. The 2 nd terrace deposit also extends to the east, under the village of Beckford (18/9a) and beyond the previous workings (18/10).
Crude estimate of resource:	Area: 27 ha x average depth: 5 m ÷ 2 Estimated resource volume: 675,000 m ³ Estimated resource tonnage (at 2 t/m³): 1,350,000 tonnes
Conclusion:	Significant. Consider in defining areas of search.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 27 ha x average depth: 5 m ÷ 2 Estimated resource volume: 675,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 1,113,750 tonnes
Conclusion:	Significant.

Overview	
Resource number:	18/9a
Resource name:	Beckford a)
Resource area:	14 ha
Resource depth:	Estimated 5m
Location	
OS sheet reference:	SO 93 NE
National grid ref:	397322, 235993



Resource description:

Resource description: 2nd terrace (Wasperton) and 4th terrace sand and gravel.

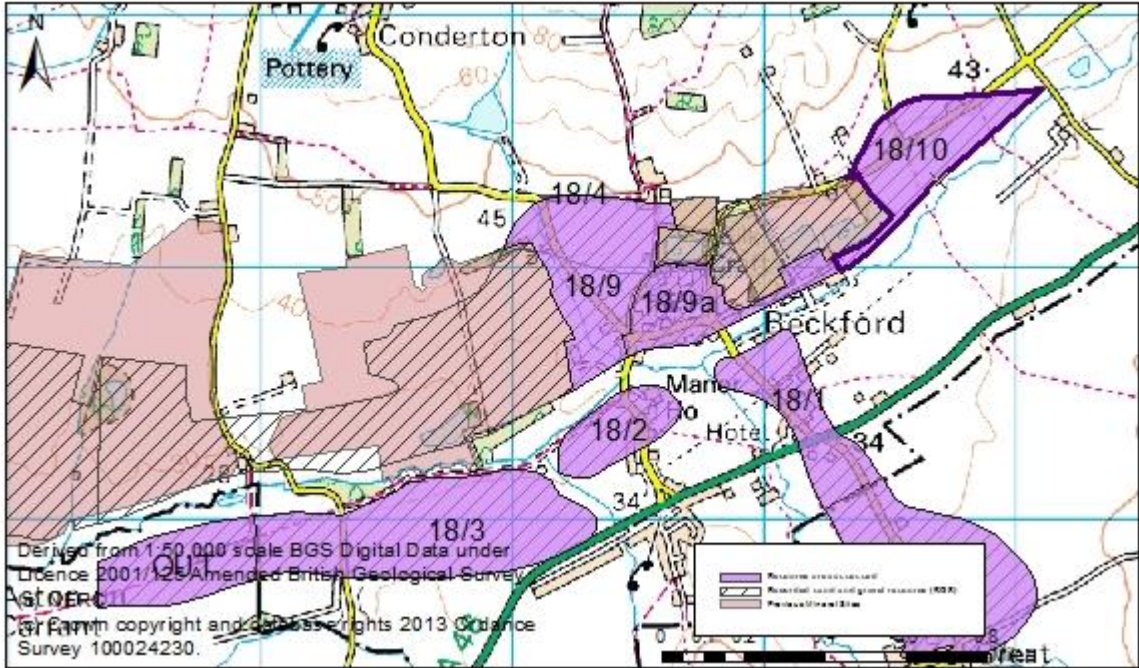
The 2nd terrace deposit was derived by solifluction from the inferior oolite of Bredon Hill, re-sorted at this lower level by fluvial action. The mapped boundary between the 2nd terrace (Wasperton) and the fan gravel to the north (not included as a resource area) is somewhat arbitrary. The deposit generally consists of Jurassic limestone fragments with some rounded ironstone fragments and occasional bunter quartzite and flint pebbles in a matrix of medium-grained well-rounded sand.

The 2nd terrace deposit has previously been worked at a number of sites. The planning application for Carrant Brook Pit (to the west of this resource area) stated that the site would be worked to 6m depth. The 2nd terrace has also been worked in an area to the east of Beckford which is now a Silk Mill. No information on depth is available for the Silk Mill area.

The 4th terrace deposit has been worked at Beckford Quarry and at an older site north of Beckford Quarry at Court Farm. The planning application for Beckford Quarry stated that the maximum depth of the resource was 4m, and 8 boreholes showed the depth of sand and gravel to range between 12' and 14' (3.66m-4.27m, median average = 3.97m).

(Estimated resource depth based on mean average of a) 2nd terrace deposits at Carrant Brook Pit: 6m and b) Beckford Quarry: (3.97m) = 5.0m)

Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small deposit which is compromised by the village of Beckford. The 2 nd terrace deposit continues to the west (18/9) and to the east beyond the previous workings (18/10).
Crude estimate of resource:	Area: 14 ha x average depth: 5 m ÷ 2 Estimated resource volume: 350,000 m ³ Estimated resource tonnage (at 2 t/m³): 700,000 tonnes
Conclusion:	Compromised by development.
Assessment of resource for the Third Stage consultation on MLP (Spring 2015)	
Revised estimate of resource:	Area: 14 ha x average depth: 5 m ÷ 2 Estimated resource volume: 350,000 m ³ Estimated resource tonnage (at 1.65 t/m³): 577,500 tonnes
Conclusion:	Compromised by development.

Overview	
Resource number:	18/10
Resource name:	East of Beckford
Resource area:	19ha
Resource depth:	Estimated 6m
Location	
OS sheet reference:	SO 93 NE
National grid ref:	398632, 236465
	
Resource description:	
Resource description:	<p>The 2nd terrace deposit was derived by solifluction from the inferior oolite of Bredon Hill, re-sorted at this lower level by fluvial action. The mapped boundary between the 2nd terrace (Wasperton) and the fan gravel to the north (not included as a resource area) is somewhat arbitrary. The deposit generally consists of Jurassic limestone fragments with some rounded ironstone fragments and occasional bunter quartzite and flint pebbles in a matrix of medium-grained well-rounded sand.</p> <p>The 2nd terrace deposit has previously been worked at a number of sites. The planning application for Carrant Brook Pit (to the north west of this resource area) stated that the site would be worked to 6m depth. The 2nd terrace has also been worked to the north of this area, on a site which is now a Silk Mill. No information on depth is available for the Silk Mill area.</p> <p>(Estimated resource depth based on Carrant Brook Pit: 6m).</p>
Assessment of resource for the second consultation on MLP (Autumn 2013)	
Commentary:	A small deposit intersected by a road. The deposit has been extensively worked and these areas are not included as part of the resource area. The deposit continues to the west under former workings and the village of Beckford (assessed as resource areas 18/9 and 18/9a).
Crude estimate of resource:	<p>Area: 19 ha x average depth: 6 m ÷ 2</p> <p>Estimated resource volume: 570,000 m³</p> <p>Estimated resource tonnage (at 2 t/m³): 1,140,000 tonnes</p>
Conclusion:	Significant.

Consider in defining areas of search.

Assessment of resource for the Third Stage consultation on MLP (Spring 2015)

Revised estimate of resource: Area: 19 ha x average depth: 6 m ÷ 2
Estimated resource volume: 570,000 m³
Estimated resource tonnage (at 1.65 t/m³): 940,500 tonnes

Conclusion: Significant.