Dr. GM Reeves

For

The Stonehenge Alliance

On

Geology, Hydrogeology, Geotechnics &

Effects of Tunnelling on Groundwater

Additional Topics: August 2019

- 1. Groundwater Issues
- 2. Presentation of Data
- 3. Unpublished Information
- 4. Consequences

1. Groundwater Issues

- Whitway/Stockbridge Rock (Barrois' Sponge Bed Horizon)
- Amesbury Abbey/Blick Mead Springs
- Borehole Log interpretations.

2. Presentation of Data

- 2-D Plan
- 2-D Sections
- Complexities: Chalk Permeability is 3-dimensional and multi-modal
- Variations in 3 Dimensions- Space + Time (4^{th} Dimension!)


Fargo
Plantation
The Cursus
Cumuli
Sewage
Works
Long
Barrow
Totterdown
Clump
Dismantled Railway
Cumulus
Old King
Barrows
Halfmoon
Clump
Cumulus
Memorial
The Avenue
The Avenue
(course of)
PC
New King
Barrows
Countess
Countess
Farm
Motel
Long
Barrow
Stonehenge
Stonehenge
Cottages
A303(T)
MS
Cumulus
Cumulus
Cumuli
Stoke Group
Normanton
Gorse
Henge
(site of)
West
Amesbury
Fort
Amesbury
Park
Amesbury
Abbey
Luxenborough
Coneybury
Hill
Cumuli
Coneybury
House
Queens
Falls
(Weir)
Bush
Barrow
Normanton Down
Cumuli
Coneybury Hill
Plantation
FB
Cemy
Recn
Gd
Moor Hatches
New Barn
Ham
Hatches
Sewage
Works
Aqueduct
Wilsford Down
Earthwork
Pit
(dis)
Southmill
Plantation
Chalk Pit
AMESBURY
Cumuli
(Lake Group)
Springbottom
Farm
Resr
Normanton Down
House
Normanton
FBs
11
12
13
14
15
WILSFORD CUM LAKE CP
RX508A
SU14SW/114
RX509
SU14SW/131
RX510A
SU14SW/132
SU14SW7
R158
R 507A
SU14SW/154
R19A
R18
R22
R135
R142
SU14SW/94
R143
PX506
P505A
P502B
R503B
PX504
R172
SU14SW/101
RX501
RX513A
SU14SW/120
SU14SE/85
SML 2000
* 1:10 000 'DESCALED'


British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL
Geology of Britain viewer
More BGS map viewers
Surface Geology
3D Models
Borehole Scans
Earthquake Timeline
Borehole Scans
Click on a borehole to view scan.
Borehole depth
0 - 10m
10 - 30m
30m+
Unknown
Confidential or Restricted
More on boreholes
Stonehenge, Wilts
Go to Location
Switch Basemap
100%
0%
Geology Transparency
Grid Ref: 409314, 142917
Visitor Centre
A360
Longbarrow Lane
Winterbourne Stoke Barrows
Byway 12
Stonehenge Landscape
Normanton Gorse
Normanton Down Barrows
SU14SW25
SU14SW61
SU14SW78
SU14SW79
SU14SW77
SU14SW63
SU14SW58
SU14SW76
SU14SW99
SU14SW97
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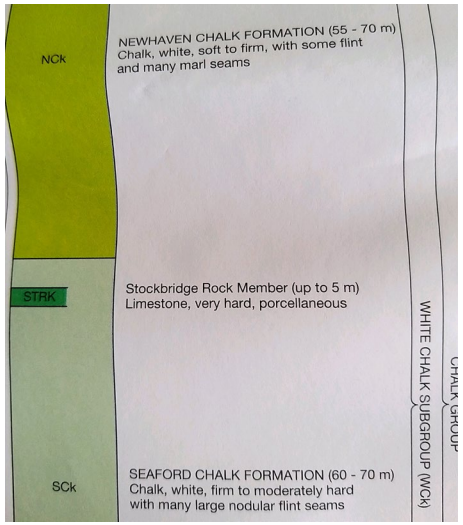
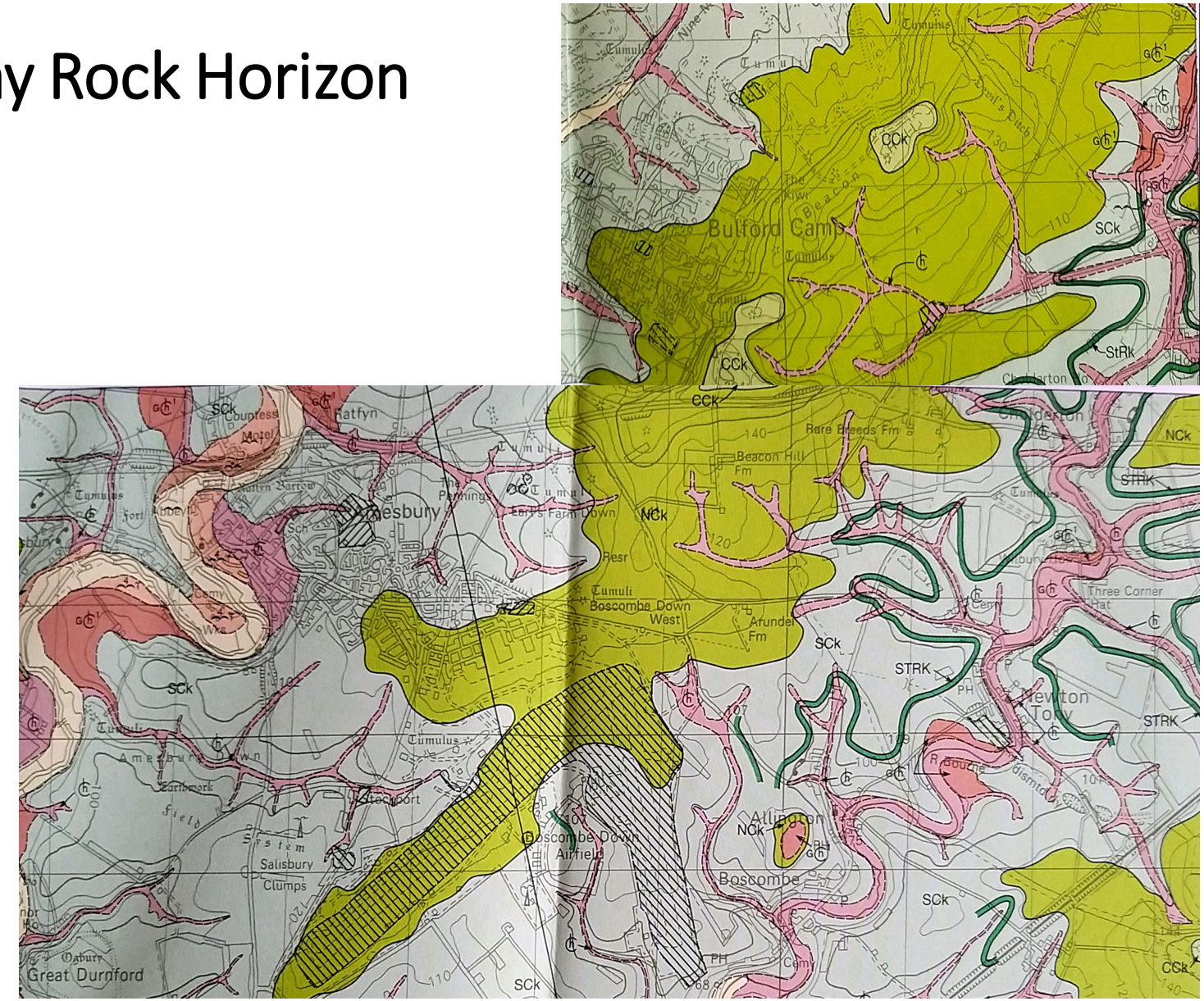
SU14SW40
SU14SW33
SU14SW32
SU14SW28
SU14SW27
SU04SE84
SU04SE85
SU04SE99
SU04SE82
SU04SE106
SU04SE33
SU04SE60
SU04SE81
SU04SE83
SU04SE117
SU14SW101
0
0.15
0.3km
POWERED BY esri

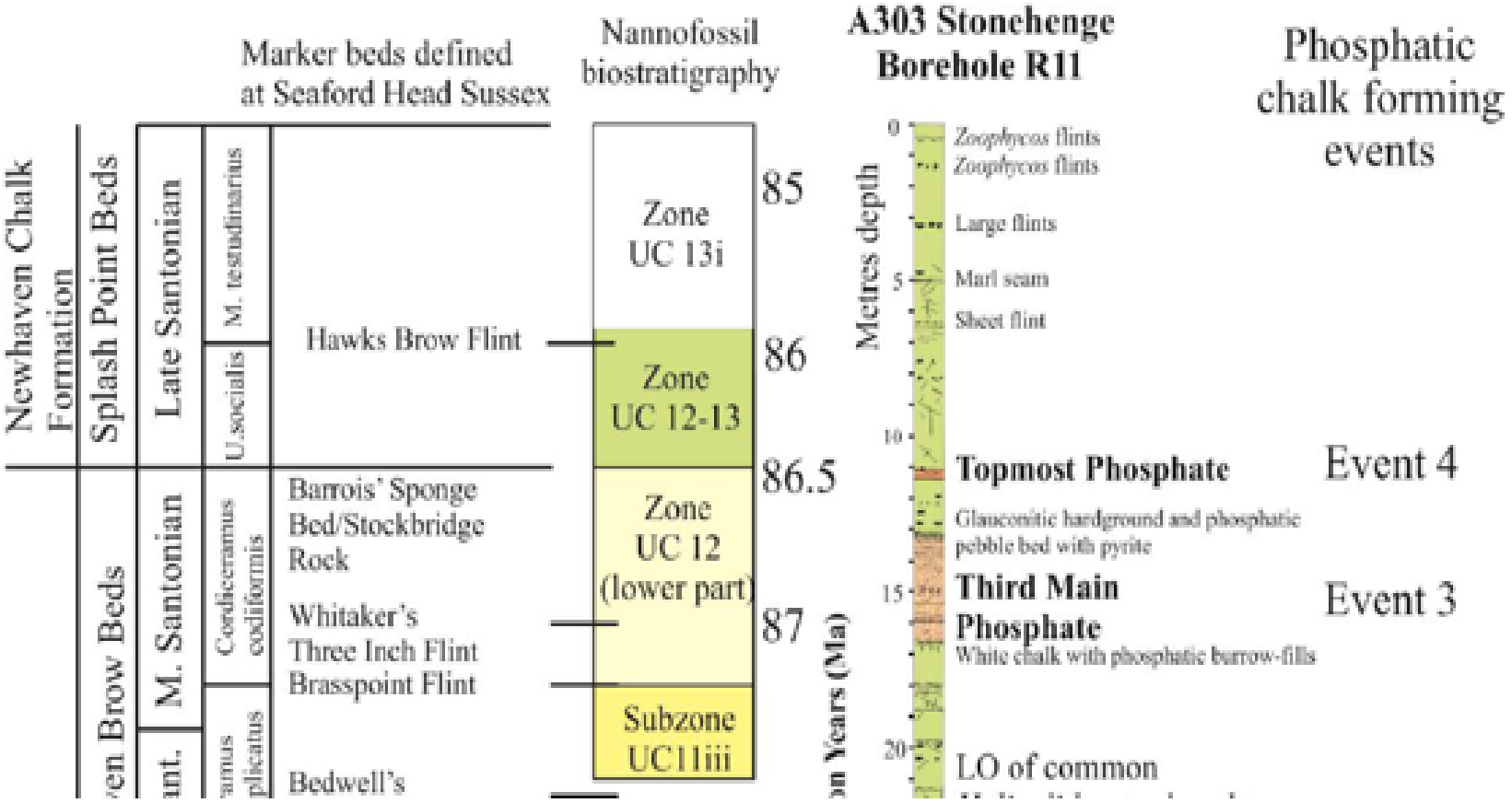
The Whitway Rock Horizon





Barrois' Sponge Bed/Whitway Rock Stratigraphic Level:

- A zone of elevated permeability (sub-horizontal fissures) controlling lateral groundwater flow- SE wards- :underlain by Seaford Chalk/"Porcellanous Limestone" of significantly lower horizontal permeability.



(From Mortimore et al, 2017, in part)

Details of Evidence for Whitway Rock Horizon

- From Blick Mead to Eastern Portal to Western Portal.
- **A zone of elevated permeability (sub-horizontal fissures) controlling lateral groundwater flow- SE wards- :underlain by Seaford Chalk/"Porcellanous Limestone" of significantly lower horizontal permeability.**
- **A dominant High Permeability sub-horizontal zone, above, with restricted flow below.**
- Varies from 60m AOD to 71.30m AOD at Blick Mead
- Sometimes as Stockbridge Rock Member…"a hard porcellanous limestone up to 5m thick, ……approx. 5m below Seaford/Newhaven Chalk Boundary".
- Equivalent stratigraphically with Barrois' Sponge Bed.
- Typified by high degree of fracturing (sub-horizontal to near vertical).
- Seen as weak zones in numerous core boxes
- Coincident often with orange staining, core loss and sponge fragments with rinded flints.
- Often shows on OPT, POR, Den
- For full list of evidence, see separate listing.

Figure 2: from AWMReport No. TR010025 Document 8.23 – Implications of 2018 Ground Investigations to the Groundwater Risk Assessment (republished with tracked changes, dated 31.05.19)- Travis et al.

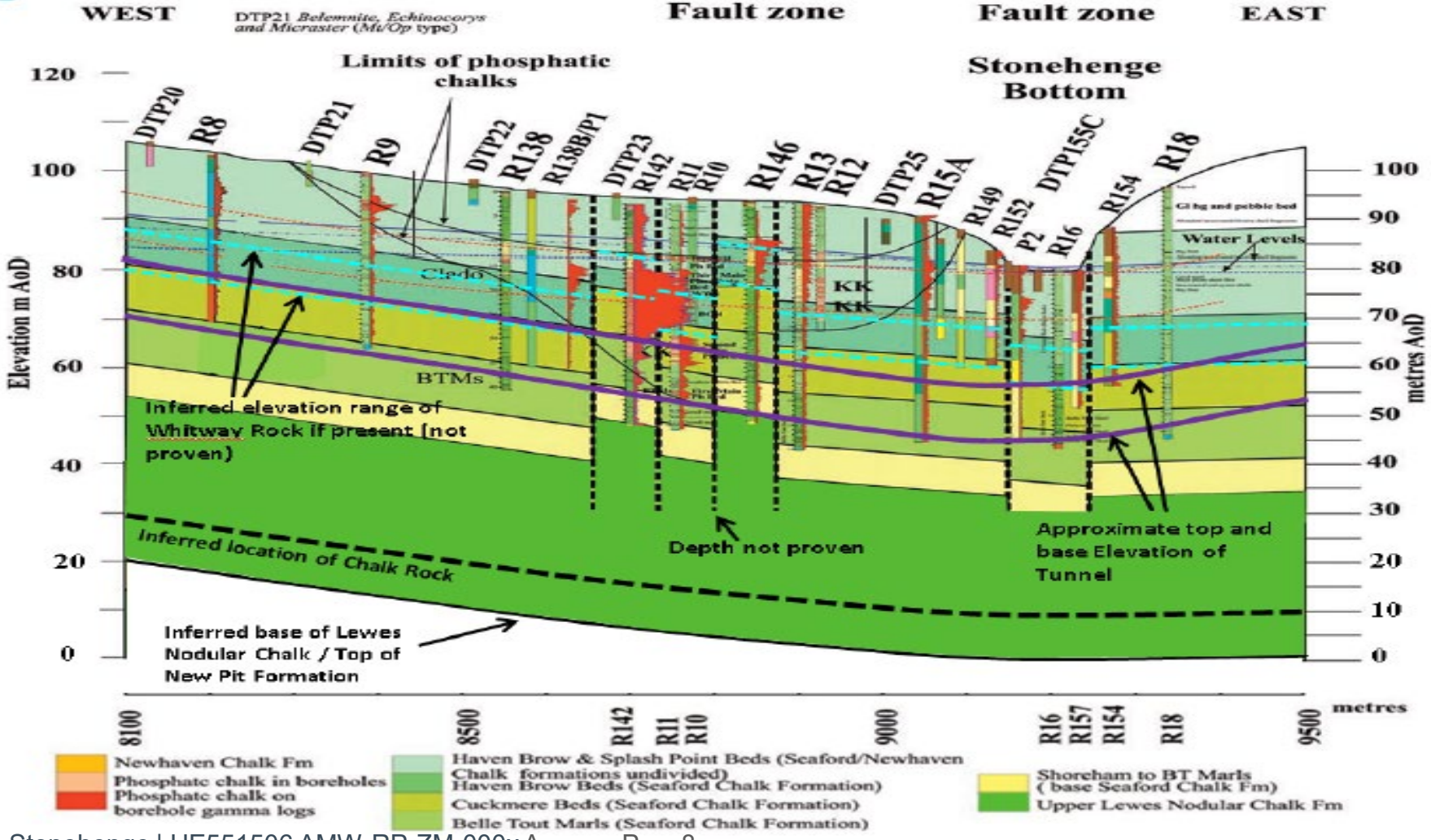
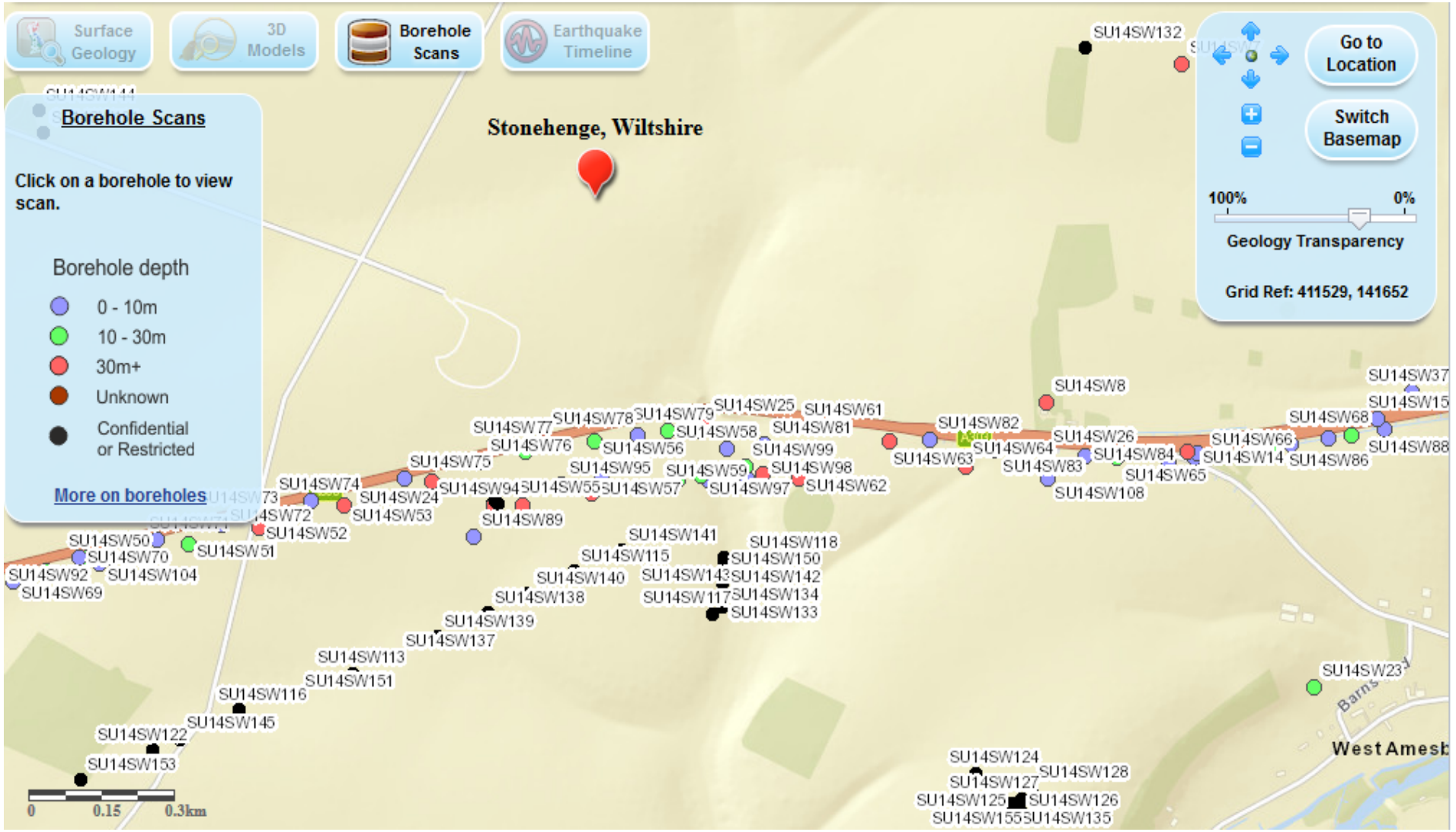


Figure 2 Chalk Stratigraphy with Tunnel and Chalk Rock Elevations (adapted from Mortimore (2012))

3. Unpublished SI Information

- **A303 Amesbury to Berwick Down:** Factual Report on Ground Investigation
  -Project No: 731823 (Last available Download from BGS- Ref: 107358)
- Amesbury Abbey/Blick Mead Springs investigation-Short Duration hydrographs.
- Supporting SI data for Groundwater modelling and Reports.
- Borehole Log interpretations.

BGS GeoIndex Database:



Whiteway Rock Horizon- Boreholes: East to West- A Zone of Elevated Permeability

Chainage	Borehole No.	GL (mAOD)	Total Depth	GWL (mAOD) (As Drilled)	Tunnel Soffit mAOD	WR Level (mAOD)	Evidence	WR Level wrt Tunnel Sc
N/A	P3	109.48	31.3	12		N/A	Not deep enough for WR	
9600	R20	103.9	35	N/A	58.38	c.74-68m...71.30m	"Possible Sponge Bed at 32.56-32.69m+CorePix-9+10	10m ABOVE
9400	R19A	106.33	45	N/A	53.42	c.80.0-73.00m	26.00-Por:33.0-FDN+CorePix	20m ABOVE
9200	R18	96.5	51	N/A	51	70-66m	CoreBoxes 6-9+POR:26m+FDN:29m	20m ABOVE
9100	R16	79.5	36	N/A	51.3	c.53mAOD	26.0m-30.50m	2m ABOVE
9050	P2	80.88	35.7	N/A	52	N/A	10-18m -core heavily orange stainned	
9050	R152	83.48	23	N/A	52	?	Zero RQD for whole hole.	
8700	R13	93.1	50	N/A	59	60.6mAOD	32.50 CoreBox 12	At Tunnel Soffit Level!!!
8700	R11	92.9	45.7	19.5	59	86.5	OPT+Core+RM	At Tunnel Soffit Level!!!
8650	R10	94.4	25.43	N/A	60	c.74.40m	20.50 DEPTH-Core Pix	15m ABOVE
8570	R142	92.94	45	19.5	63	c.80mAOD	Core Logs	23m ABOVE

The Whitway Rock Horizon- A Zone of Higher Permeability-

Underdraining the Newhaven Chalk & Upper Seaford Chalk

Borehole R20