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Our reference: 11897 L01 (01)
Date:15 November 2023

[redacted]

Response to comments made on Hydrology
Downlands Farm, Uckfield

Dear [redacted]

In response to objections raised within a document (proof of evidence) prepared by [redacted] we note comments have been received during the Appeal Inquiry (ref: WD/2022/1637).

RSK Geosciences division has a background in the fields of hydrogeology, ground investigation and environmental impact assessment. Some of the specialists involved with this response have experience working in areas local to the study site and have experience investigating and assessing the superficial and bedrock geological formations present in the locality of Downlands Farm. RSK as a company is an internationally recognised and respected multi-disciplinary environmental consultant with a long-standing history of ground investigation, site characterisation and hydrogeological assessment.

Following receipt of an email from [redacted] of Gleeson Land on 7 November 2023, we received a copy of technical responses from [redacted]. At the time of writing these responses by [redacted] are yet to formally provided, however we have reviewed extract photographs provided from a document seen by your legal counsel (provided as enclosure to this response).

With reference to these comments, we would like to take the opportunity to make the following responses.

1) Groundwater is known to be present within the geological formations below the site. These units have different hydrogeological properties and characteristics linked to their original depositional environments, grain size (and distribution), discontinuities (fractures and bedding) and post depositional events (cambering). Terminology such as aquiclude and aquitard being related back to seepage fails to quantify the rate of groundwater movement and therefore opens to ambiguity.

Groundwater movement vertically through the Grinstead Clay will be possible, but the rate at which this occurs will be very slow, indeed clay landfill lining systems are considered as very low permeability/impermeable, with permeabilities of 1x10-9 metres per second.

2) Groundwater travel distances can be very large, but are generally controlled by factors such as faulting, limits to the lateral extent of the aquifer, and topography. In this instance it is likely that the actual groundwater catchment is limited by the geological faulting to the north that forms a 'geological block'. Lateral groundwater flows outside of the 'block' may be limited by deformation of the geological formation within the fault zone, additionally there may be the potential for springlines to be present along the fault boundaries. The geological block would appear to extent some 2.50 km to the south, with the reports (including the Cuesta report) indicating that the geology dips to the northwest, with the groundwater flowing in the same direction. No consideration has been given to any recharge/discharge to the lake from groundwater flowing from the south/southeast.

3) The proportion of groundwater recharge (where occurring) versus surface water flows is not quantified within the Cuesta report. Where the Grinstead Clay is present, vertical flows will be limited, with surface water being far and away dominant. Given the groundwater flow direction to the north west, groundwater meeting the upper surface of the Grinstead Clay will then, likely, flow to the north west. There will be a potential proportion of groundwater water flow from the south into the lake.

4) The issue of hydraulic gradient is raised, this refers to the groundwater flows into the ghylls. This point is misused, hydraulic gradient is a measure of the change in groundwater elevation over a given distance, and therefore represents a ratio between the change in groundwater elevation over distance. The hydraulic head is the pressure or force caused by the change in hydraulic gradient as difference between two groundwater levels. The importance here is that the hydraulic gradient across the aquifer (Ardingly Sandstone, Lower Tunbridge Wells Sand or Upper Tunbridge Wells Sand) will vary across the length of the aquifer unit. There will be localised variabilities, again related back to the properties of the geological unit and also areas of discharge (including in the Ghylls), but these will be localised only and not dominant the wider groundwater flow.

We trust that the above comments are sufficient to address the matters raised by [redacted] and would be happy to provide further clarification or support on this matter should it be required.

Yours sincerely

For RSK Environment Limited, Geosciences

[redacted]

[redacted]

Enclosures

Copies of photographic records of response received from [redacted].

Photographic records provided by Counsel from [redacted] (pg. 1 of 2)

Having now had chance to review some of the rebuttal arguments submitted by [redacted] (CD1-56, section 6.9.5 on pages 44 to 48), I would like to take this opportunity, if I may, to briefly address those points:

- Regarding the characterisation of the Grinstead Clay as an **aquiclude** or an **aquitard**, the difference is subtle, but the point which we agree on is that the clay is '**unable to transmit water in significant amounts**'. But of course that does NOT mean that it is impermeable. Limited seepage through the clay will be possible. My Proof of evidence already expands upon this point.
- Regarding the point about **overland flow from Downlands Farm into Lake Wood**, I would concede that only a small part of the development site may contribute to this, but that is still a 'material hydrological connection' in contradiction of the Appellant's claim.
- Regarding the issue of **hydrophilic vegetation in Lake Wood**, the fact that my Proof shows only one example of this should not be taken to imply that only one example exists. Moreover, the fact that this is 70m distant from the development boundary is of no consequence whatsoever. **Groundwater is able to flow for very considerable distances and could easily reach from Downlands Farm to Lake Wood**. One example that I would offer here is the flow of groundwater from the Mendip Hills in Somerset to the Roman hot springs in Bath – a distance of around 14 miles. It is telling that, in

Photographic records provided by Counsel from [redacted] (pg. 2 of 2)

ignorance of such things [redacted] admits that they searched only within what they thought was a *'plausible zone of influence'* from Downlands – less than 70m, evidently. Not surprising that they failed to find the evidence that was there.

- A similar point arises regarding the evidence of **seepage through the Ardingly Sandstone** at the edge of Lake Wood. Mr. Forbes-Laird argues that it is more likely that this seepage is of more local origin, rather than coming from Downlands. There is perhaps a need for some technical explanation here:
  - Groundwater flow is governed by a number of things. The dip of the strata can be an important influence, as can vertical joints, fissures and wider fractures such as the open 'gulls' created by periglacial cambering processes. All of these provide potential **pathways** for the movement of water through the rock.
  - But the 'driving force' behind the direction of groundwater flow is something called the '**hydraulic gradient**'. Put simply, that is the degree and direction of slope of the water table surface, dictated by the difference in height of the water table between any two points and the distance between them.
  - Over much of the Site, that gradient is likely to be more or less parallel with the ground surface. But in the vicinity of deeply-incised Ghylls – including and most especially that of Lake Wood – **the hydraulic gradient will be towards those features and will be much steeper than the more general gradient towards the Shortbridge Stream, which is further away.**
  - **It follows that it is entirely reasonable to expect groundwater within the Downlands Farm Site to flow towards these features.**
  - Pertinent here is the fact that the Appellant agrees that **Lake Wood is a spring-fed lake**. As noted in paragraph 23 of my Proof of Evidence, this begs the question of where the spring water originates from? The only logical answer is the local groundwater system, fed by recharge on the surrounding higher ground – i.e. Downlands Farm.
- *I maintain* that the Appellant has failed to prove their assertion that there is no material hydrological or hydrogeological link between the proposed development and Lake Wood. Having made this assertion, the onus is on the Appellant to provide the evidence (e.g. by installing piezometers within boreholes and monitoring these to demonstrate hydraulic gradients and groundwater flow directions). They have chosen not to do this.