HAYCOCK ENVIRONMENTAL CONSULTANTS LIMITED
Independent Hydrologist and Waterscape Consultants

**P25/V1646/FUL**

# Review of "Flood Risk Assessment and Drainage Strategy Old Hayes Solar, Coleshill: Lucion Contract Reference: 88693.547362

**Client**

K Hearn (Parish Council Focus Group)

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# Table of Contents

## Introduction

The following review has been commissions by Coleshill Parish Council at the request of Katherine Hearn (Parish Council Focus Group member). The comments below have been generated by Dr N E Haycock, an independent hydrologist with some 33 years experience with flood management and floodplain habitat management. Notable projects include supporting the National Trust with the restoration of Boscastle after the extreme floods that impacted this community in 2004, to supporting the Environment Agency with the multi-million pound re-naturalisation of the River Otter and its estuary near Budleigh Salterton, Devon. Dr NE Haycock is a member of the British Hydrology Society and British Dam Society. Dr NE Haycock was a lecturer at Oxford University (Hydro-Chemistry), Cranfield University (School of Water Management) and lately visiting research fellow at Manchester University (Surface Runoff Modelling).

The comments below relate specifically to the Flood Risk Assessment and Drainage Strategy for the Old Hayes Solar Farm (post code SN6 7PS), as generated by Lucion (Contract Reference: 88693.547362). The site is immediately downstream of Coleshill Village and also downstream but adjacent to the River Cole Floodplain Restoration scheme that was funded by the EU and the Environment Agency as an exemplar river and floodplain habitat protect. Dr N Haycock was a board member of the River Cole project team and subsequent chairman of the UK River Restoration Centre. Dr N Haycock is therefore extremely familiar with the hydrology, hydraulics and land drainage of this section of the River Cole and its catchment, which has been extensively research by HR Wallingford and the Environment Agency.

## Summary

The key observations with the Hydraulic Modelling (Herrington, 17/6/2025) for the proposed PV farm are as follows. The hydraulic model is based on a series of assumptions, notably they have assumed that the topography of the right bank of the River Cole is the same as the left bank, which they could not survey. The hydraulic model is not based on any survey of the channel nor contains any channel cross section information based on actual on the ground measurements, instead they have relied on Environment Agency airborne LiDAR data and assumed that the channel will be deeper than this airborne LiDAR data. The hydraulic model does not represent the B4019 bridge. The hydraulic model does not consider the backwater impacts of the River Thames, which it should and was required to include for the River Cole Restoration Scheme, which is upstream of the proposed PV farm. The hydraulic model does not simulate the current flood dynamics of the site and compare it to the proposed PV land use of the site and its floodplain. The hydraulic model does not simulate the impact of flood debris, notably wood debris, and its potential interaction with the PV panel support structure but assumes that the floodwater is clear water. The Hydraulic Modelling (Herrington, 17/6/2025) therefore does not represent the current geometry and hydraulics of the channel and floodplain to an acceptable standard and has not, nor cannot, be used as a tool to determine the impact of the PV panel on the flood risks to the wider area.

In relation to the main flood risk assessment, which draws on the Hydraulic Modelling by Herrington, no weight can be given to any of the conclusions because of the defects in the Hydraulic Modelling. In the main flood risk

assessment, no assessment has been made of the impact of flood debris interacting with the PV panel support structure so that estimated flood water levels must be considered underestimates. The main flood risk assessment does not contain any determination of the site soil properties, saturation status or infiltration rates and as such the surface water runoff risk from the site remains speculation with resultant recommendations based on US literature that has no proven relevance to the River Cole and its floodplain. If the floodplain soils are dominated by Lias and Marl clays, as site investigations associated with the UK River Restoration Scheme upstream of the site show, then there is a serious concern that runoff from the site will be enhanced with implications for the flood risk of land, infrastructure and properties both upstream and downstream.

The defects in the Hydraulic Modelling and Surface Water Runoff Modelling for the proposed PV farm need to be addressed since the current reports have structural weaknesses which will most likely under report the flood risk to the proposed development site as well as risks to adjoining land and property.

## Flood Risk Assessment - Notes

1. Section 1.4, Sources of Information, make no reference to the extensive body of research on the hydrology and floodplain ecology of this section of the River Cole undertaken by the Environment Agency, HR Wallingford and Cambridge University as well as the UK River Restoration Centre.

2. Section 1.4.1 cites a report "Cook, L., & McCuen, R. H. Hydrologic Response of Solar Farms (Cook and McCuen 2013) but the full citation is not listed so we cannot determine if this is a peer review article. L Cook appears to be from the Swiss Federal Institute of Aquatic Science and Technology, Dübendorf, Switzerland so the relevance of research to the hydrology of this particular landscape may not be applicable.

3. Section 2 and reference to geology claims "There are no BGS borehole records at the Site or within the Site's near vicinity". Extensive records exist with the Environment Agency and HR Wallingford for the floodplain upstream of the site and all these records are held by the Environment Agency, UK River Restoration Centre and BGS.

4. Section 2, Hydrogeology, suggests that the applicant has not undertaken any soil or shallow geology samples for the site and is wholly reliant on online information for the soil and geology of the site.

5. Section 2, Proposed site conditions states that the PV panels will be raised but there is no associated drawing of the supporting frames and elevation of the PV panels above the ground, especially for the PV panels to be located within the floodplain.

6. Section 3.6.2 states that there is a "the lack of detailed modelling available for this location" yet this section of the River Cole was subject to the most detailed hydraulic modelling for the River Cole River Restoration Scheme and has been subject to long term reviews by the UK River Restoration Centre as and when new modifications to the floodplain habitat are implemented.

7. Section 4.2.4 states "The EA 'Historical Flood Map' (Appendix E) indicates that the Site has historically flooded in March 1947". The River Cole flooded in 1947 as a result of the major flood along the River Thames and this section of land essentially held water that could not freely drain because of this backwater effect. But this section of the River Cole **frequently floods** and its floodplain routinely floods as a result

of the approved modifications to the River Cole channel and bank morphology undertaken by the Environment Agency and the UK River Restoration Centre.

8. Section 4.2.5 states the river geomorphology has "the natural riverbank" but historic records for the River Cole show this section of the river was extensively modified in the 1950-1960s as part of an extensive land drainage scheme and therefore the channel was over deepened and the rising from the dredge extensively worked into the floodplain.

9. Section 4.2.8 relates to the parameters used to set up the hydraulic model for the site and states "To overcome Site access limitations, survey data for the right bank has been applied to the left bank by agreement with the Environment Agency". Given the sensitivity of the top of bank information to a hydraulic model, the land level of the left bank would be essential to validate the overall model. The report does not state if the superimposed left bank model data was cross checked with the Environment Agency LiDAR data. But superimposed right bank data for left bank data when the Environment Agency flood map shows the significance of restrictive flow to the left banks is a critical flaw in the hydraulic model.

10. Section 4.2.11, 1 in 30 year flood event, reports extensive flooding of the floodplain and to depth of 0.25-0.75m There is no mention of the impact of flood debris being snagged on the site's infrastructure and the changing hydraulics of the flood when this debris blocks and impounds flood water (section 4.2.12). The depth of flood water is more than deep enough to transport woody debris and the current channel has had lots of evidence of wood debris dams being formed. This risk has not been evaluated to the potential damage to the PV panels from wood debris crashing through the PV panels on the designated floodplain.

11. Section 4.2.13, 1 in 100 year flood event, reports extensive flooding of the floodplain and to depth of 0.5-1.00m. There is no mention of the impact of flood debris being snagged on the site's infrastructure and the changing hydraulics of the flood when this debris blocks and impounds flood water.

12. Section 4.2.15, 1 in 1000 year flood event, reports extensive flooding of the floodplain and to depth of 0.5-1.00m. There is no mention of the impact of flood debris being snagged on the site's infrastructure and the changing hydraulics of the flood when this debris blocks and impounds flood water.

13. Section 4.2.17, 1 in 100 year flood event +26% increase in peak flow for climatic change, reports extensive flooding of the floodplain and to depth of 0.5-1.00m. There is no mention of the impact of flood debris being snagged on the site's infrastructure and the changing hydraulics of the flood when this debris blocks and impounds flood water.

14. Section 4.2.18 states that the flood depths will not impact the PV panels since they will be mounted >1.0m above the natural ground level. No drawings of the layout of the PV farm support this claim. Further, this assumes that the floodwater is clean, debris free water. The impact of woody debris on the PV support structure has not been reviewed. If the snagging of debris on the support structure results in deformation of the panels then the panels, which appear to be facing upstream, which quickly deform under water pressure result in the panels being ripped from their mounts and further snagging in the PV support structure.

15. Section 4.2.19 recommends an acceptable freeboard being included in the specifications of the PV panels, but as stated above the impact of the PV panel support structure on floods, and the snagging of debris by this forest of steel support legs has not been addressed.

16. Section 4.2.24 states that the layout and design of the PV panels "allows floodwater to pass freely beneath the panels". As stated above this has not been assessed or evaluated and assumes that the floodwater will be clean water and debris free, not a realistic assumption.

17. Section 4.2.26 states that the proposed PV farm "will not increase flood risk either on-Site, on the western side of the River Cole, or in any upstream or downstream locations". This statement cannot be justified since the hydraulic model makes major assumptions, namely that the left and right bank land levels are identical and that there is no flood debris associated with the model floods. The modeling does not assess the current hydraulic roughness of the floodplain against the proposed development with it forest of steel legs to support the PV panels. Given these weaknesses the impact of the PV panels on the River Cole floodplain has not been demonstrated.

18. Section 4.3 Surface Water Flood Risk states that the surface water flood risk is low with water depths <0.2m although rising to 0.6m depth under some scenarios, but the area impacted is extensive and larger than the fluvial flood area (Figures 3 and 4). As stated for the fluvial floods, the proposal is that the solar panels are >1.0 above the natural ground level, but no supporting drawings show this layout. If fluvial and colluvial debris collects on the PV panel support structures then floodwater levels will be higher due to snagging and flood depths and flood extents will be greater. This risk has not been assessed.

19. Section 4.3.11 states "There is no indication within relevant third party reports to suggest that the Site has historically experienced surface water flooding" yet the report states that the site flooded extensively in 1947. Equally, flood records associated with the River Cole River Restoration Scheme have not been reviewed nor has the National Trust Buscot and Coleshill archive, and extensive flooding has occurred, especially in 2007.

20. Section 4.4 Groundwater Flood Risk appears to assume that the alluvial deposits on the floodplain are sand and gravels but have no records or site evidence to suggest this is the case. The floodplain immediately upstream of PV farm (right bank) consists of clay-silt floodplain soils with evidence of clay marl. This is based on my personal experience of surveying these field prior to the River Cole River Restoration Scheme. Groundwater will not be extensive but the geomorphology of the sand and gravel lenses and seams through the floodplain have a bearing on the health of seepage flow into the main river and warrant more serious consideration.

21. Section 4.6 Summary of Flood Risk and Mitigation. This section does not reflect an adequate summary of the risks to the site, with the ingress of flood debris onto the floodplain and snagging on the PV panel support structure completely missing. The impact on flood debris on the PV panels will most likely result in damage to the panels and impede the flood water flow, resulting in higher flood water levels and an impact on the flood hydrology of the River Cole upstream. If the PV panel were dislodged and were to be washed downstream then this debris could cause further flood risk and or blockage of key bridges etc.

22. Section 5.0 Soil Management, appears to cite Cook and McCuen (2013) but the applicability of this research to the River Cole is unknown. Full citation of the article is required. The proposed application does not appear to have any specific site soil information and / or soil infiltration rates. There is no hydrological model of how the site soils will cope with concentrated runoff from the PV roof-like panel. The PV panel roof has no guttering and the rainwater is therefore concentrated along a defined drip line. Can the soil along this drip line cope with the volume of concentrated runoff, will overland flow occur? If the saturated soils along the drip line are connected to existing soil land drains, will runoff be faster as the land drains will be surcharged quicker? In section 5.1.9 the proposal is that land drainage will be repaired, but the implications on the runoff from the site have not been determined. This section is therefore vague and offers no evaluation of the risk based on site data.

23. Section 6.1.1 states : The Site currently comprises undeveloped, agricultural land with no formal, positive drainage network". How does the applicant know there is no land drainage? All the floodplains upstream of this section have land drainage and the whole river was dredged to facilitate land drainage, so unless proof can be offered that land drainage is not present then this statement is not credible.

24. Section 6.2.2 states the site is "undeveloped agricultural land and largely permeable .." but the land has been extensively and intensively farmed and there is no information presented on the permeability of the site's soils to determine if the site's soils are indeed permeable and capable of infiltrating runoff from the PV panels along the drip line. Section 6.2.2 to 6.3.13 makes multiple assumptions and recommendations on how the site will behave to runoff but none of the multiple assumptions and recommendations are based on site data on the saturation status of the soil, the infiltration rates of the soil and the resulting runoff risk. Planting wild grass mixes does not change the runoff regime of clay soils in my experience. Also to note that none of this section refers to a specific design storm or rainfall event, as the fluvial flood risk model has done, so the performance of the soil has not been assessed.

25. Section 7.0 BESS Compound. No comments made on this section since the flood and runoff risks to the main PV farm have not been addressed comprehensively so the risk to the BESS site cannot be determined.

26. Section "Limitations" does not clearly state that the report authors have visited the site or secured site specific soil, geology or hydraulic information on the current status of the River Cole.

27. Appendix B - Topographic Information. - No evidence of channel cross section surveys completed for the hydraulic models. No left bank or left floodplain survey information present.

28. Appendix D - Hydraulic Modelling (Herrington, 17/6/2025).

    1. Section 1.3 No left bank land levels in the hydraulic model. Further, model does not include channel cross section data and information has been manually adjusted in the office. This is a serious omission.

    2. Section 2.5.1 The hydraulic model does not include channel cross section data and information has been manually adjusted in the office, with base of channel levels being lowered by 1m relative to the LiDAR data. No onsite surface information was secured. Channel geometry is therefore poorly represented and may be over deep. No debris dam features mapped. This is a serious omission.

3. Section 2.5.2 notes that the B4019 bridge is omitted from the model. The model cannot therefore determine the flood risk to the bridge, the highway nor the village.

4. Section 2.6 notes that the hydraulic model is limited to a section of channel 1.3km downstream. It is known that the River Cole is impacted by backwater effects from the River Thames, this is therefore omitted from this model. This is a serious simplification and omission.

5. Section 2.8 suggests there has not been a flood model of the current and proposed land use and in Table 1 there is no manning's n value for the solar farm support structures. This is a serious omission.