From:	[redacted]
To:	One Earth Solar
Subject:	Hydrological Audit
Date:	27 December 2025 11:48:34

To: The Examining Authority

From: Stephen Fox, Interested Party (Ref: [redacted])

Date: 27 December 2025

Deadline 8 Submission

Project Reference: EN010159 – One Earth Solar Farm

Dear Sirs

Please accept this deadline 8 submission.

Hydrological Audit

Subject: Cumulative Hydraulic Impact & Peak Flood Exacerbation

Reservation of Rights (Litigant in Person)

This submission is made under **explicit protest** and strictly **without prejudice** to the Interested Party's right to challenge the lawfulness and procedural integrity of the Examination.

The Interested Party's continued participation is legally **compelled** by the statutory process (Planning Act 2008) to maintain standing, but this action does **not** constitute a waiver, acceptance, or validation of any alleged procedural impropriety, ExA bias, unlawful censorship, or fundamental flaws in the Administrative Record.

All rights to seek Statutory Appeal and Judicial Review against the final Development Consent Order decision are fully reserved.

1. Summary

1.1. This submission constitutes a formal objection to the hydrological methodology employed in **Environmental Statement Chapter 7** 1 and **Appendix 7.2 (Flood Risk Assessment)** 2.
1.2. A forensic review of the Application alongside independent data reveals that the assessment is critically flawed. It evaluates the One Earth Solar Farm (OESF) in isolation, failing to account for the systemic transformation of the Trent Valley floodplain. When viewed cumulatively with the four other Nationally Significant Infrastructure Projects (NSIPs) in the immediate vicinity, the proposal contributes to a combined development area of approximately **5,953 hectares** 3.
1.3. Furthermore, the assessment of surface water runoff relies on the "Greenfield Runoff" assumption. This ignores the **"Glass Panel Effect"**, where the kinetic

energy of water shedding from solar arrays causes soil scour and channelization. Recent peer-reviewed research confirms this mechanism can increase peak discharge rates by over **11 times** compared to natural ground 4, threatening to overwhelm Internal Drainage Board (IDB) assets.

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2. The "Glass Panel Effect": Exacerbating Peak Flooding

2.1 The Physics of "Greenfield" vs. "Glass"

2.1.1. The Applicant's Drainage Strategy calculates runoff rates using standard "Greenfield" coefficients (ICP SuDS/FEH methods), treating the solar arrays effectively as permeable grass fields 5.

2.1.2. **Scientific Rebuttal:** This methodology ignores the physical reality of **Kinetic Energy Amplification**, as documented in *Baiamonte et al. (2023)* 4.

- **Concentration:** Solar panels are impermeable glass surfaces that intercept 100% of rainfall and channel it to the lower drip-line.
- **Amplification:** Water falling from the panel edge (height ~3m) strikes the ground with up to **11.7 times** the kinetic energy of natural rainfall 6.
- **Scour & Channelization:** On the site's **Foggathorpe 2** soils (slowly permeable, seasonally waterlogged clays) 7, this concentrated energy causes surface sealing and the formation of scour channels (rills).

2.2 Mechanism of Peak Flow Exacerbation

2.2.1. The formation of scour channels fundamentally alters the flow regime. Water flows significantly faster through smooth clay rills than it does as sheet flow over rough grass.

2.2.2. **Impact on Peak Timing:** Increased velocity reduces the **Time of Concentration (Tc)**. Since Peak Discharge (Q) = Area (A) x Rainfall Intensity (i), and intensity is higher over shorter durations, a shorter Tc results in a significantly higher **Peak Discharge**.

2.2.3. **The Peak Flood Spike:** By using "Greenfield" assumptions, the Applicant has modelled a slow, broad hydrograph. The reality—driven by the "Glass Panel Effect"—will likely be a sharp, high-amplitude flood spike.

2.3 Threat to IDB Assets

2.3.1. The Trent Valley Internal Drainage Board (TVIDB) has specifically warned that any increase in flow or volume requires consent 8. The TVIDB ditch network is a pumped system with finite capacity.

2.3.2. **Conclusion:** If the "Glass Panel Effect" generates peak flows exceeding the "Greenfield" rates assumed in the model, the IDB ditches will be overwhelmed, leading to localized backing-up of floodwaters and increased risk to third-party assets in North and South Clifton.

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3. Cumulative Effects: The "Trent Solar Cluster"

3.1 The Scale of the Intervention

3.1.1. The Applicant's Cumulative Effects Assessment fails to acknowledge the

aggregate hydrological footprint of the "Trent Solar Cluster." This is a landscape-scale transformation of the Trent floodplain involving five contiguous or proximate NSIPs.

Table 1: Cumulative Development Area of the Trent Solar Cluster

Project Name	Status	Approx. Order Limits (Hectares)	Source
One Earth Solar Farm	Examination	**1,409 ha**	9
Cottam Solar Project	Consented	**1,270 ha**	10
West Burton Solar Project	Consented	**1,050 ha**	11
Tillbridge Solar Project	Consented	**1,400 ha**	12
Gate Burton Energy Park	Consented	**824 ha**	13
TOTAL		**5,953 ha**	

3.1.2. **Defect:** Converting nearly **6,000 hectares** (approx. 15,000 acres) of floodplain and agricultural land into industrial solar generation represents a systemic change to the catchment's hydrological function. The Applicant's "salami-slicing" approach masks this true scale of risk.

3.2 Cumulative Hydraulic Synchronization

3.2.1. The "Joint Report on Interrelationships" provided by the applicants of these schemes fails to model **Hydraulic Synchronization** 14.
3.2.2. **The Risk:** If the "Glass Panel Effect" accelerates runoff across all 5,953 hectares simultaneously during a storm event, the cumulative volume of water entering the River Trent catchment will peak sooner and higher than historical baselines.
3.2.3. **Superposition of Flood Waves:** The danger is not just volume, but **timing**. If the accelerated "solar runoff peak" from these five sites coincides with the main fluvial flood peak travelling down the River Trent, the superposition of these waves could breach flood defences at critical pinch points like Dunham-on-Trent. The current modelling, which treats the floodplain as "Distinct Cells" 15, is blind to this dynamic catchment-wide risk.

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4. Critique of Hydraulic Modelling (Appendix 7.2)

4.1 The "5mm Loophole" and Conservation of Mass

4.1.1. The Applicant dismisses flood depth increases of <5mm as "negligible" and within model tolerance 16.

4.1.2. **Cumulative Displacement:** As calculated in the *Fox Stitched* forensic audit, a 4-5mm rise across the impacted extent represents a displacement of approximately **39,900 m³** of floodwater 17.
4.1.3. **Policy Violation:** This violates **NPS EN-1**, which requires "no net loss" of floodplain storage 18. The cumulative displacement from the Cluster effectively transfers a massive storage debt to the river channel.

4.2 Climate Change Standards

4.2.1. The FRA applies a +39% climate change allowance (Higher Central) for the "Design Flood Event" 19. However, for Essential Infrastructure with a lifespan reaching the 2080s, the **Upper End (+62%)** allowance is the appropriate safety standard for the Lower Trent & Erewash catchment 20. By designing to +39%, the project accepts a residual risk of overtopping.

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5. Water Framework Directive (WFD) Implications

5.1 Sediment Mobilization & Chemical Status

5.1.1. The River Trent currently **fails** Chemical Status due to Priority Hazardous Substances, specifically **PFOS** and **Mercury** 21. These are legacy pollutants bound to sediment.
5.1.2. **Mechanism:** The increased velocity and scour identified in Section 2.1 will mobilize significant quantities of silt. The Applicant's "No Deterioration" claim relies on the assumption of greenfield runoff rates 1. In reality, "Glass Panel" runoff will transport this sediment into the Trent, re-suspending toxic contaminants and potentially causing a breach of **WFD Regulation 17**.

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6. Recommendations for the Examining Authority

The Examining Authority is requested to compel the Applicant to:

1. **Model the "Glass Panel" Scenario:** Re-calculate runoff rates using a "contributing area factor" greater than 1.0 (to account for kinetic energy amplification) rather than standard grass coefficients.
2. **Run a Cumulative Joint Model:** Commission a single hydraulic model that includes the discharge from **all 5,953 hectares** of the Trent Solar Cluster to test for peak flow synchronization.
3. **Abandon the "5mm Loophole":** Acknowledge the physical volume of displaced water (39,900 m³) and provide Level-for-Level Floodplain Compensation for this volume.
4. **Secure TVIDB Consent:** Demonstrate technical approval from the Trent Valley Internal Drainage Board for the *actual* peak discharge rates, not just the theoretical greenfield rates.

References & Footnotes

1. One Earth Solar Farm Ltd (2025). Environmental Statement Chapter 7: Hydrology and Hydrogeology.
2. One Earth Solar Farm Ltd (2025). Appendix 7.2: Flood Risk Assessment and Outline Drainage Strategy.
3. Aggregated data from DCO Applications for One Earth, Cottam, West

Burton, Tillbridge, and Gate Burton. See Table 1 for breakdown.

4. Baiamonte, G. et al. (2023). "Impact of solar panels on runoff generation process." *Hydrological Processes*, 37:e15053.
5. Appendix 7.2, Section 4 "Surface Water Drainage Strategy", para 7.14 (Calculated greenfield runoff rate of 4.9 l/s).
6. Baiamonte et al. (2023) findings: "Results showed that solar panels increase the peak discharge by about 11 times".
7. Soilscapes / Cranfield University Data: "Foggathorpe 2 - Slowly permeable seasonally waterlogged stoneless clayey soils".
8. Trent Valley Internal Drainage Board Representation. "The Board's consent is required for any works that increase the flow or volume of water".
9. One Earth Solar Farm Ltd, Design Approach Document. "The Order Limits extend across 1,409 hectares".
10. Planning Inspectorate, Cottam Solar Project Decision. "The development will cover... 1,270 hectares."
11. West Burton Solar Project Website. "Our proposals... involve around 2,550 acres (1,050 hectares)".
12. West Lindsey District Council. "Tillbridge Solar Project... approximately 1,400ha".
13. Gate Burton Energy Park, Statement of Reasons. "The Order limits comprises a total area of 824 hectares".
14. Fox Stitched (2025): "The document failing to assess cumulative hydraulic synchronization."
15. Stephen Fox (2025). Technical Critique of Environmental Statement Appendix 7.2, "Critique of the 'Distinct Cell' Hypothesis".
16. Environmental Statement Chapter 7, para 7.6.41. "Changes in flood depth... between 0mm and 5mm, which is... considered to have a negligible impact".
17. Fox Stitched (2025): "The 5mm Loophole... masks the displacement of over 39,900 cubic meters of flood water".
18. National Policy Statement EN-1, para 5.7.9. "No Net Loss of floodplain storage".

Yours faithfully

Stephen Fox.