

James Burt  
Innova Solar Ltd  
3 The Old Dairy  
Yanworth  
Cheltenham  
Gloucestershire  
GL54 3LQ

5th June 2019

Ref: K0871/pw

Dear James,

**WILLIAMS FARM: WREXHAM INDUSTRIAL ESTATE:  
REVIEW OF DRAINAGE MEASURES**

**1 Terms of Reference**

This is a Report on the existing solar park at William's Farm near Wrexham (LL13 0UT). Specifically, it describes the drainage measures that have been installed and on their suitability for compliance with accepted drainage design measures.

The work has been undertaken in accordance with our fee proposal to you (QT11176) dated 7<sup>th</sup> February 2019. This was informed by a Site Visit undertaken by me on 9<sup>th</sup> May 2018 as part of an earlier instruction. It has been supplemented by additional observations and measurements made on my behalf in April 2019.

The structure of this Report is as follows:

- Section 1 (this Section) gives the Terms of Reference;
- Section 2 gives some background to the Site and the sources of information;
- Section 3 describes the physical context of the Site;
- Section 4 gives a summary of the observations during the Site visits in relation to drainage;
- Section 5 describes the SuDS measures; and
- Section 6 gives a Summary of the main findings.

**2 Background and Sources of Information**

The William's Farm PV installation was Granted Planning Permission (SES P/2012/0463) on the 17.12.2015 by Wrexham County Borough Council for a 5MW array. The proposed drainage arrangement is described in the Surface Water Management Plan (SWMP) by the Magnificent Science Company dated 2016. It is illustrated in a letter to the LPA (Wrexham County Borough Council) dated 14<sup>th</sup> April 2016 and appended to that Report. It has been reproduced as Figure 2 of this Report.

The drawing shows a series of swales along part of the Site boundary. Their combined length is given as 600 m in the report with nominal dimensions shown on the inset to Figure 2 and comprising bottom width of 300 mm, top width of 1300 mm and depth of 300 mm.

The basis for the sizing of swales is not clear from the Report. The swales provide 144 m<sup>3</sup> of storage which is greater than a calculated volumetric requirement of around 130 m<sup>3</sup>.

Notwithstanding this, the current instruction has provided an opportunity to inspect the site and its drainage and to assess the performance of such measures that have been installed

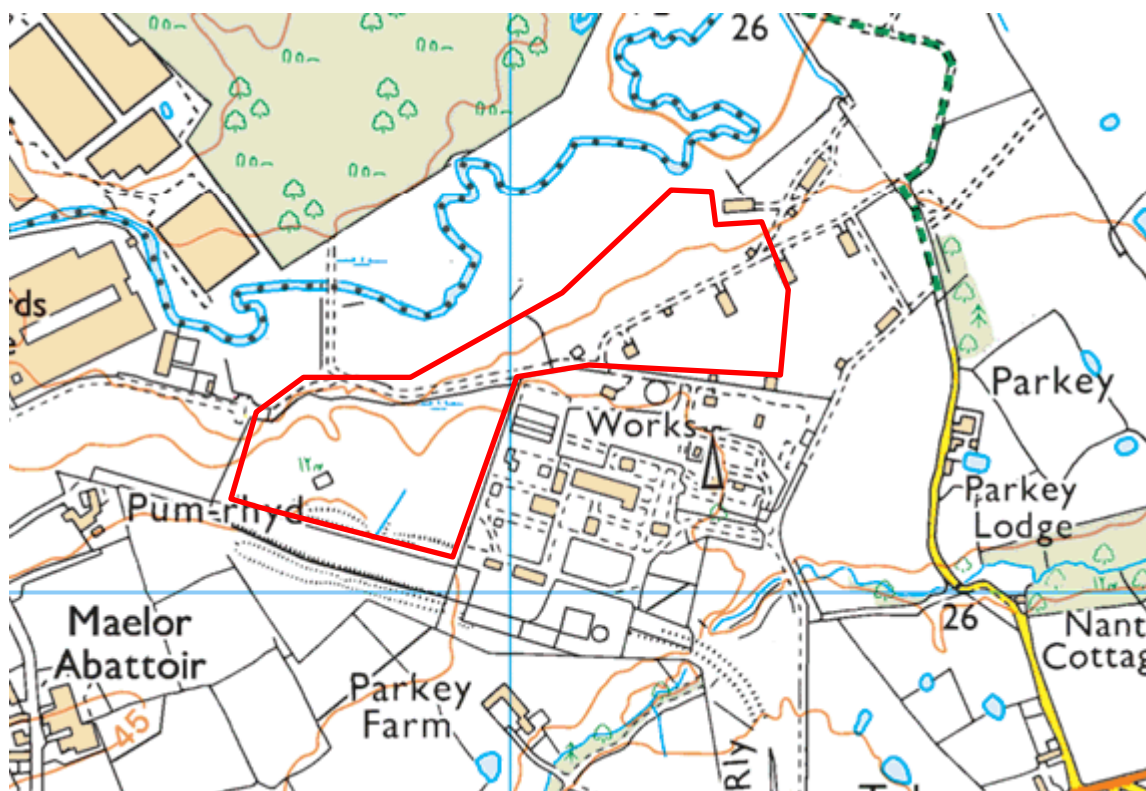
The investigation has been informed by:

- FRA and SWMP by the Magnificent Science Company (“Proposed Solar Park, William’s Farm, Wrexham” for Solar Ventures Ltd);
- Site visit by myself on 9<sup>th</sup> May 2018;
- Supplementary measurements and observations undertaken by staff from Innova and Ethical Power with guidance from myself in April 2019; and
- Access to maps and other relevant information on publicly available internet sites.

### 3 Site Context

The topography of the Site is shown in Figure 1; this shows that the solar farm is located on northerly facing slopes that drain towards the River Clywedog. The contours show that the highest point on the southern boundary is at around 40 mAOD, whilst the lowest point on the north western boundary is between 20 and 25 mAOD.

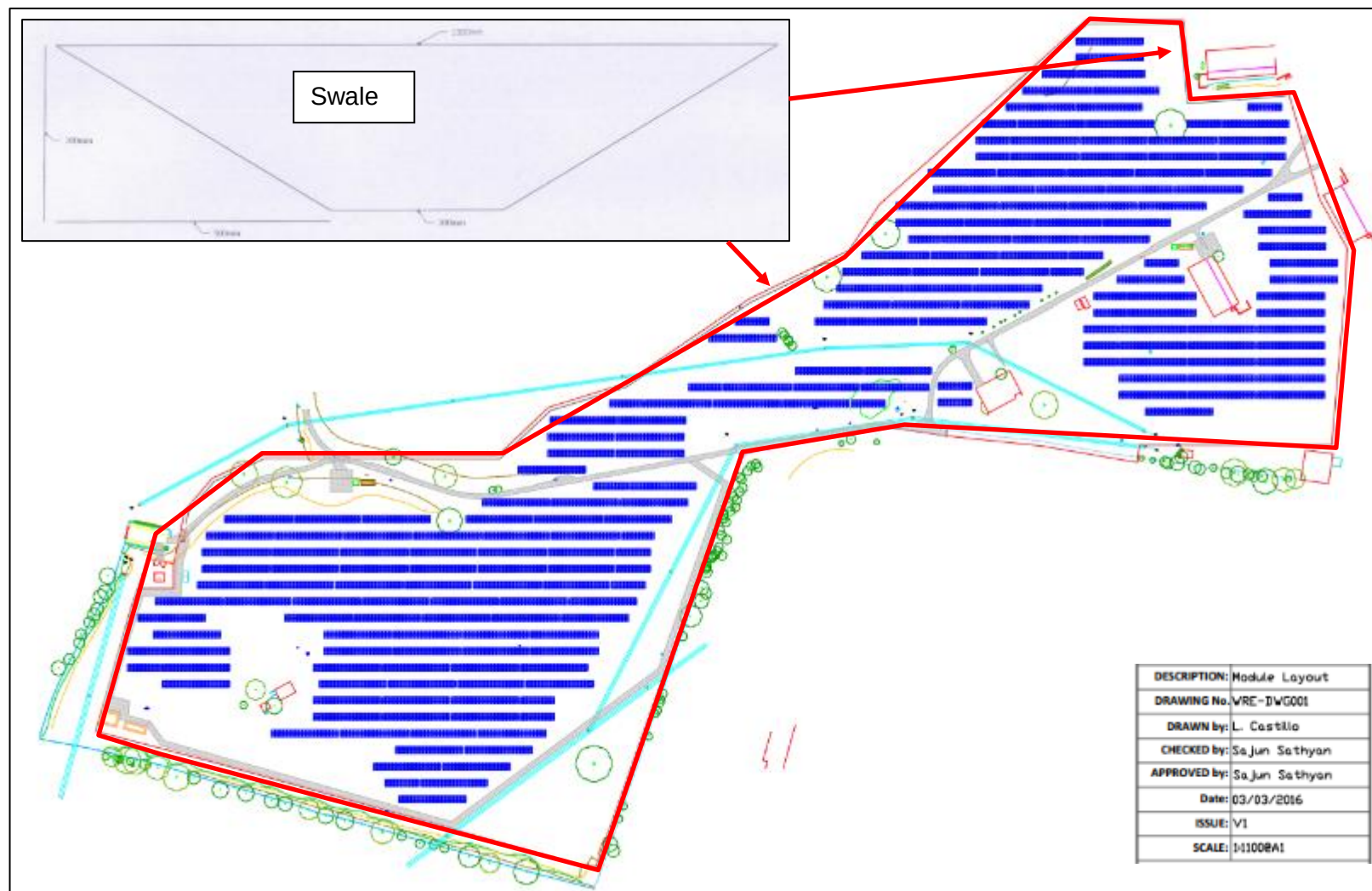
**Figure 1: Topography of Site**



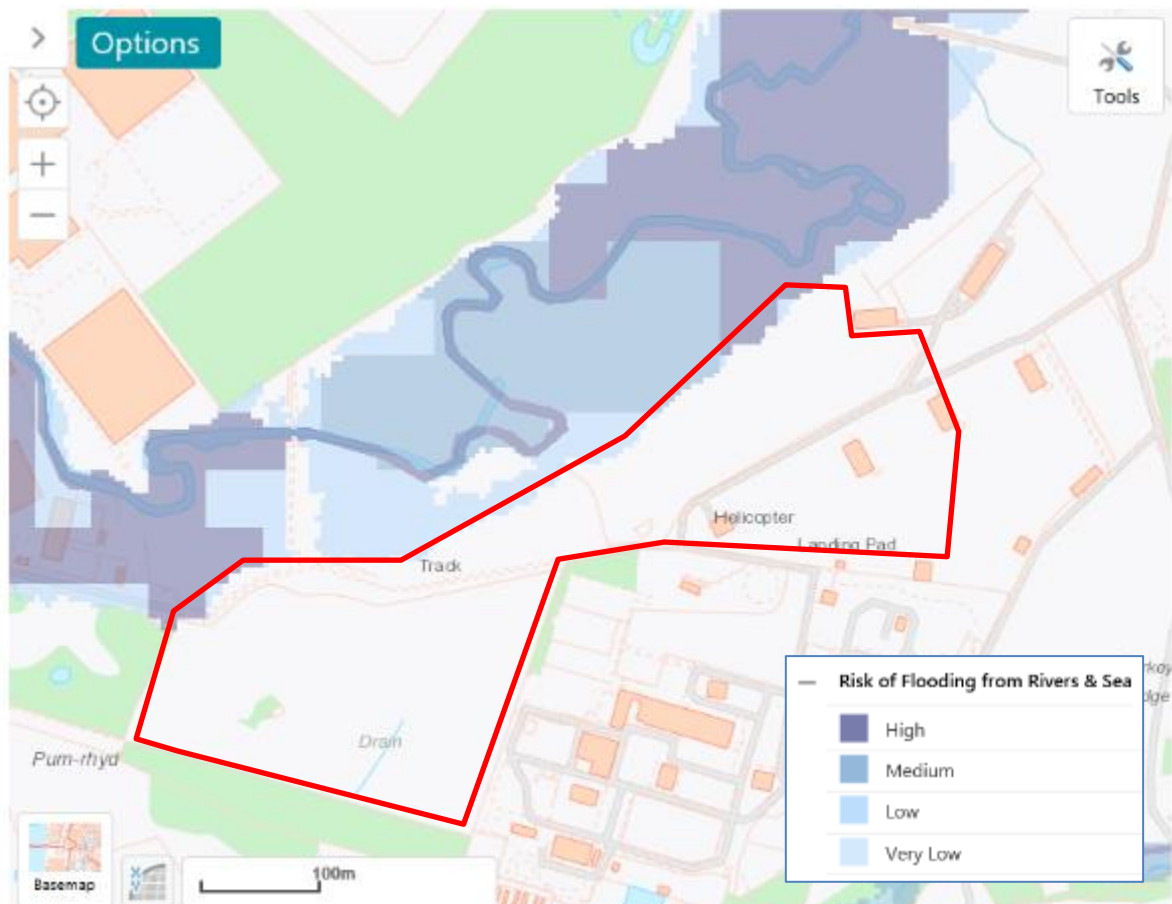
*Reproduced under Licence 100041271*

Extracts from the NRW (Natural Resources Wales) Web Site are given in Figure 3 for Fluvial Flood Risk and Figure 4 for Surface Water Flood Risk. This shows that the Site lies almost entirely within Fluvial Flood Zone 1, with an annual exceedance probability (AEP) of flooding of lower than 0.1% (very low category). There is minor encroachment into flood zones along the north western boundary, but this is of no practical consequence. The majority of the Site is at very low risk of surface water flooding being unshaded in Figure 4. The exception is a small area on the north western margin where there is a high risk.

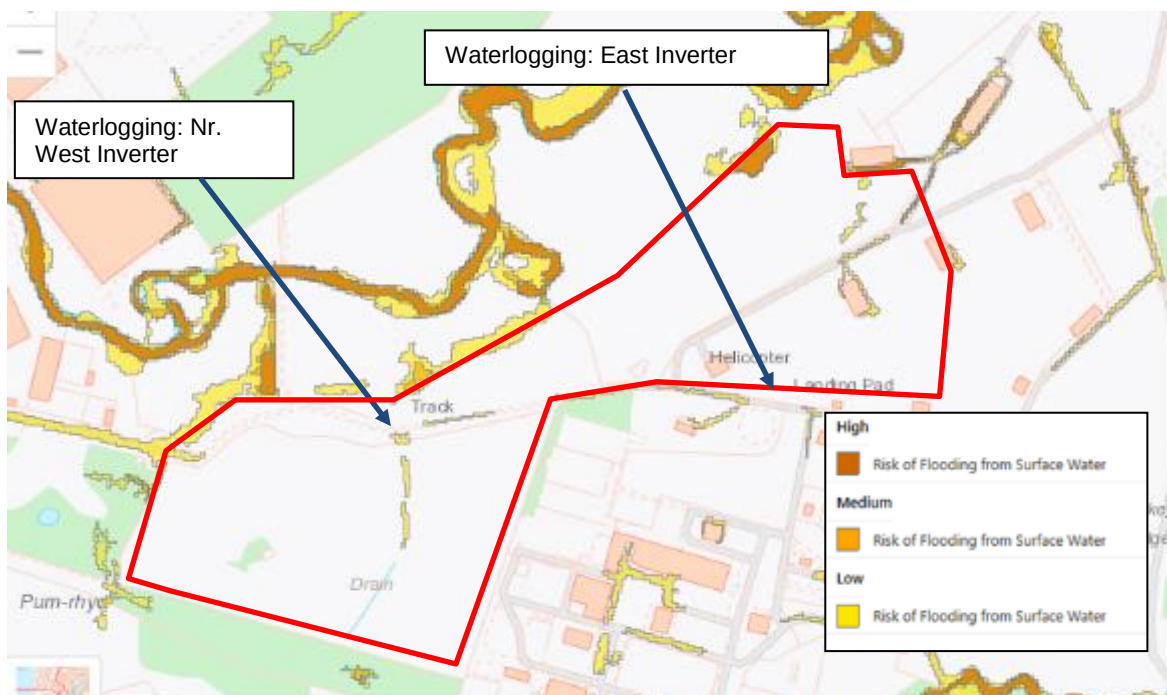
Figure 2: Proposed drainage measures as per the SWMP



**Figure 3: Fluvial Flood Risk (NRW Web Site )**

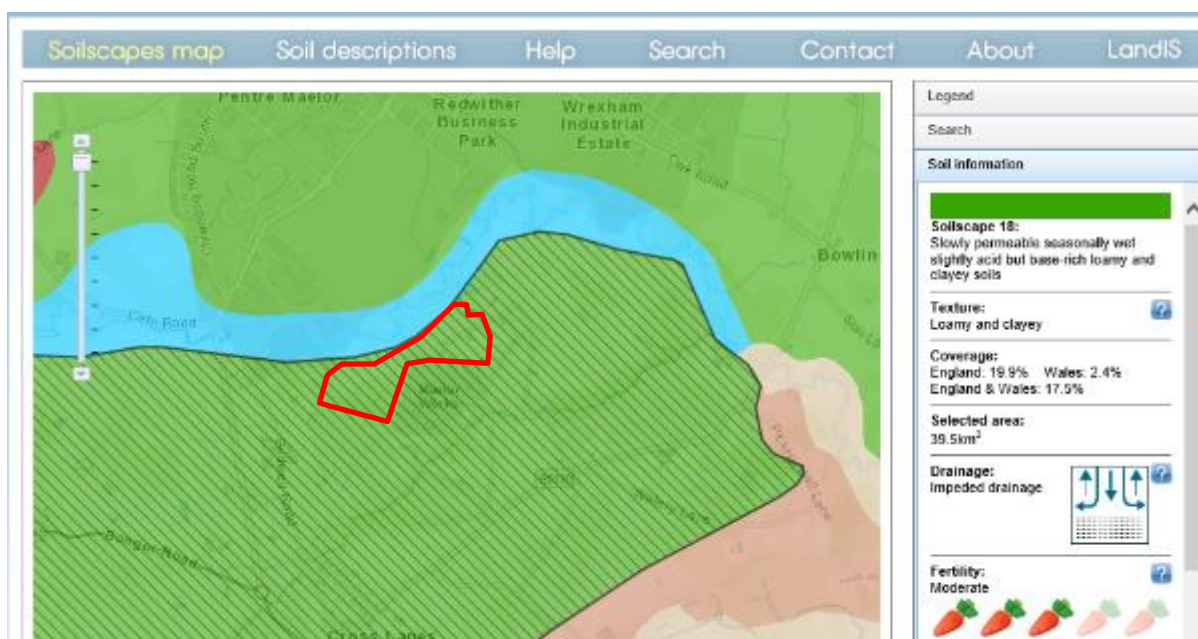


**Figure 4: Surface Water Flood Risk (NRW Web Site) with locations of waterlogging**



The soil properties for the Site are illustrated in Figure 5 from the NSRI Soilscape web site. This shows that the soils are “slowly permeable and seasonally wet”. This is relevant to the viability of swales since it gives a strong indication that infiltration swales would be unlikely to be an effective drainage measure. This consistent with infiltration testing that was reported in the SWMP.

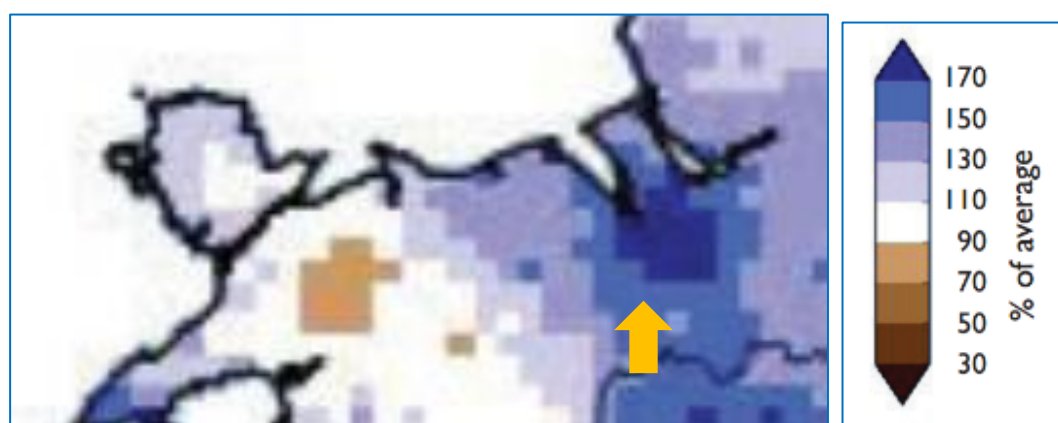
**Figure 5: Soil Properties (NSRI Soilscape Website) - approximate boundary shown in red**



#### 4 The Site Visit and Observations Relating to Drainage

The Site Visit took place on 9<sup>th</sup> May 2018. The visit took place during dry conditions, but it was noted that the previous months had been wet, the CEH Monthly Bulletin showed that March and April had received between 150 and 170% of the long term average for that period (Figure 6). The site visit was thus taking place at a particularly useful time for observing any drainage problems.

**Figure 6: Rainfall for March & April 2018**



[http://nora.nerc.ac.uk/id/eprint/520084/1/HS\\_201804.pdf](http://nora.nerc.ac.uk/id/eprint/520084/1/HS_201804.pdf)

The Site visit followed an anti-clockwise route around the perimeter of the Site. Particular note was taken of the potential problems caused by runoff from the arrays.

Within the Site, there was evidence of waterlogging at two principal locations:

- Adjacent to the west inverter set (#1); and
- Adjacent to the east inverter set (#2).

The first of these is shown in Figure 7 where the topography converges on a shallow depression, just south of the access road that was wet at the time of the visit. The dry sediment on the road surface showed that at times, this area did spill to the north, but it was not doing so at the time of the visit. The land that feeds to this wet area was investigated and is shown in Figure 8. It also seems to suffer from intermittent waterlogging, likely due to soil texture and the shallow slope and the presence of a blue-line (marked as a drain) on Figure 4.

**Figure 7: Area of waterlogging near the west Inverter set (#1)**



*Inset shows water at surface*

The second area of pronounced waterlogging was also on the southern boundary and south of the East inverter set. This is shown in Figure 9 and results from water entering the Site from the south. It appeared as if road surfaces were draining informally onto the William's Farm site. This is therefore an "inherited" drainage problem for which there seems little that can be done currently to avert it. It is posing no practical problems for the operation of the Site.

**Figure 8: Area of waterlogging in west field near southern boundary**

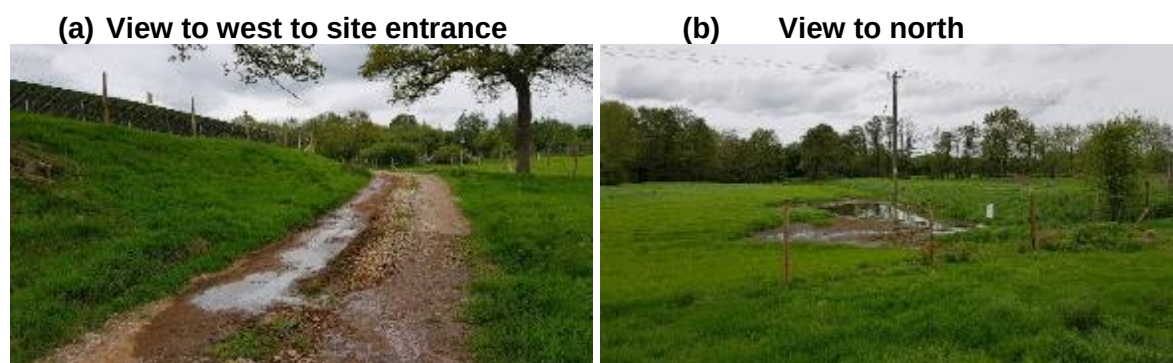


**Figure 9: Area of waterlogging resulting from runoff onto the Site – south of Inverter set #2**

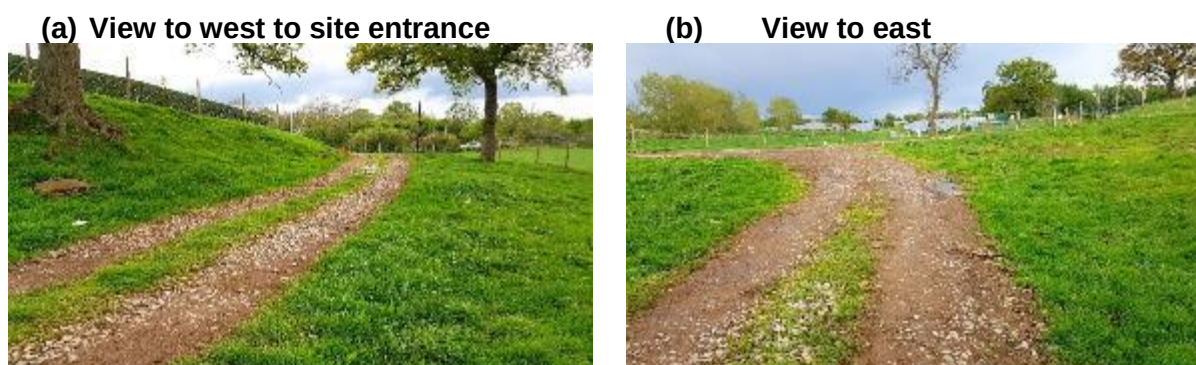


An ephemeral spring was also noted during the May 2018 visit. It is understood that this is dry for much of the year, but that its recent activity owed much to the above average rainfall leading up to the visit (Figure 10). It is an historic feature and its activity is not related to the solar farm. The spring was not active during the April 2019 visit (Figure 11).

**Figure 10: Ephemeral Spring (May 2018)**



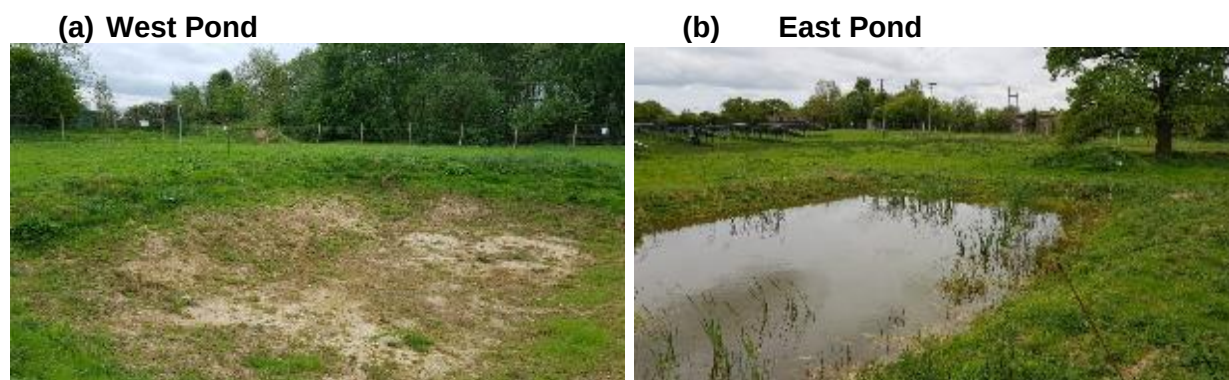
**Figure 11: Ephemeral Spring (April 2019)**



Note that the water that is visible in Figure 10b is outside the red line boundary. This accumulation can be seen on the NRW Surface Water Flood Map (Figure 4) where there is a “high” risk.

Two newt ponds had been constructed – one in each of the principal fields. The photos in Figure 12 show how the west pond was dry; this was hardly surprising given that there was no catchment draining to it and the texture of the bed was found to be silty/sandy and unlikely to hold water. The east pond was holding water, reflecting both a reasonable inflow and an ability to hold water.

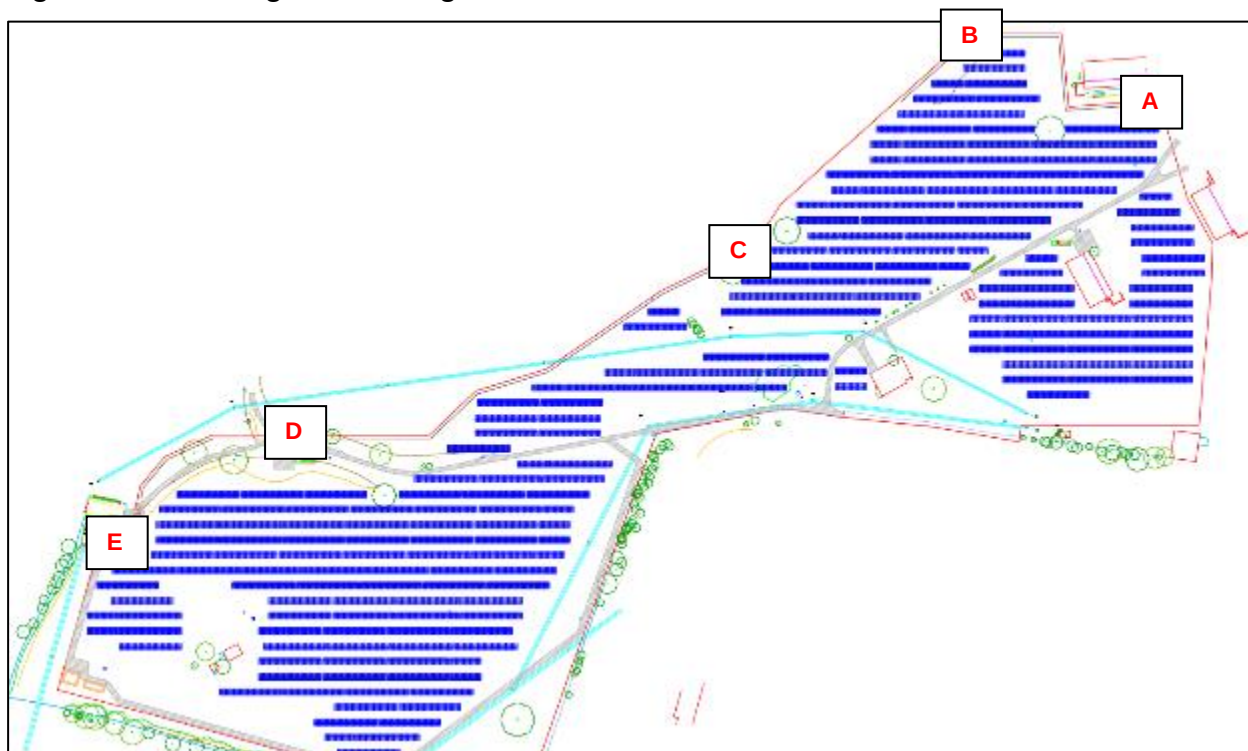
**Figure 12: Newt ponds**



## 5 Inspection of SuDS measures on downslope Site margins

The referencing of the Site margins is shown in Figure 13.

**Figure 13: Labelling of site margins**



### 5.1 Section AB – no swale

Section AB is on the northern margin of the Site. The SWMP had proposed a swale in this Section. However, the photos in Figure 14 show that there would be virtually no runoff over the Site boundary due to the topography. **No swale is thus warranted in this Section.**

**Figure 14: Part of Section AB**



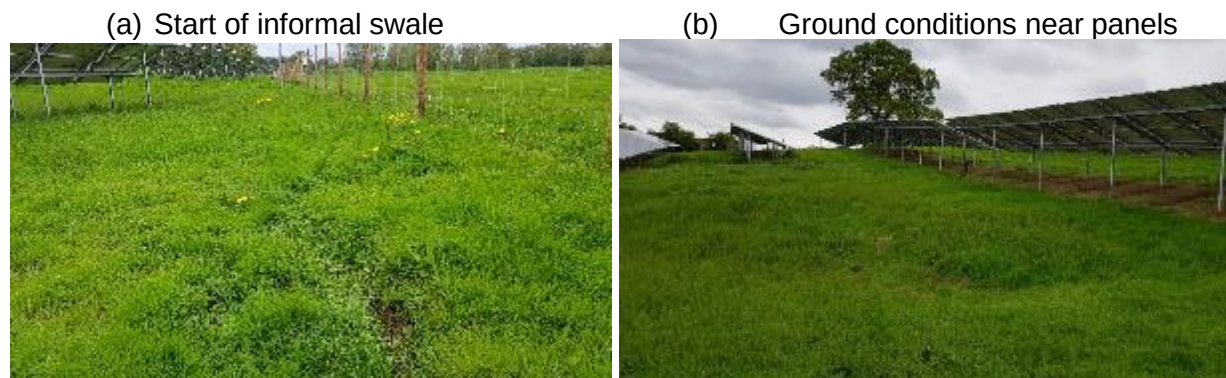
### 5.2 Section BC – informal swale

The SWMP proposed a swale for a short part of the Section BC. In practice, an informal swale exists along the entire length of BC (Figure 15a). It has a width of around 1 m and depth of up to

0.25 m. There was no indication of any waterlogging along its length. Similarly, there was no indication of excess runoff from the panels, even on the relatively steep slopes as shown in Figure 15b.

It was concluded that the informal swale, as constructed, provided a suitable buffer for any runoff that may drain from this part of the Site during an extreme storm. **No additional measures are required for this Section.**

**Figure 15: Part of Section BC**



### 5.3 Section CD – gravel trench

A swale was proposed in Section CD in the SWMP. Whilst a formal swale has not been constructed, there exists a gravel-filled cable trench (Figure 16). The width of the gravel varies from about 0.5 to 0.8 m, as measured in April 2019. Excavation of the gravel showed that it was to a depth of around 0.4 m (Figure 17). Since the gravel is coarse and angular, it provides a suitable medium that would provide both storage and some opportunity for infiltration, albeit at a slow rate.

It was concluded that the existing measures in the Section CD are adequate and would provide a suitable buffer for any excess runoff from this part of the Site. **No additional measures are required for this Section.**

**Figure 16: Part of Section CD**



**Figure 17: Gravel trench – Section CD**



### **5.3 Section DE**

The SWMP proposed a standard swale in this Section. However, none has been constructed. In practice, the need for a swale is difficult to justify, given the fact that the road (Figure 10) would intercept any excess flow prior to discharge to an informal pond that exists on the western side of a track that leads north, across the flood plain (Figure 18). The pond was dry in April 2019 which is most unusual for the time of year.

**It is concluded that no drainage measures are required in Section DE.**

**Figure 18: Informal pond (May 2018)**



## **6 Summary**

- i. This Report presents the findings of an investigation into the surface water drainage for the existing Solar Park at William's Farm near Wrexham. The investigation comprised a site visit in May 2018 during which all boundaries and drainage features were inspected. Further measurements and observations were made in April 2019.
- ii. Drainage measures were proposed as part of the scheme submitted and approved for Planning Permission. These measures included 600 m of swales which were to provide around 144 m<sup>3</sup> of storage.
- iii. There was no evidence of swales within the Site having been constructed in accordance with the approved scheme.
- iv. A detailed inspection of the ground beneath the panels, especially those on the relatively steep slopes, showed no evidence of any water logging, erosion or drainage problems in general.
- v. Although no swale had been constructed as per the approved scheme, there were boundary treatments, notably an informal swale and gravel-filled trench. These were contiguous along the north-western boundary as far as the access track over the River Clywedog flood plain. They provided a reasonable and sufficient buffer for the effects of any excess runoff during an extreme storm.
- vi. The Inverters provide additional impermeable areas within the Site. However, there was no evidence of waterlogging around any of the Inverters. .
- vii. In summary, there is no requirement for further drainage measures to be provided at the Site. It is recommended that the boundaries are inspected on an annual basis, ideally following a wet period, in order that the performance of the SuDS can be assessed and any remedial action taken.

I trust that this Report provides the information that you require. Please do not hesitate to contact me if you should require further explanation.

Yours sincerely,

*Paul Webster*

**Dr Paul Webster BSc, MSc, PhD, DIC, C.WEM, FCIWEM**  
Principal Consultant – Hydro-Logic Services (International) Ltd

### **Limitation of liability and use**

The work described in this report was undertaken for the party or parties stated; for the purpose or purposes stated; to the time and budget constraints stated. No liability is accepted for use by other parties or for other purposes, or unreasonably beyond the terms and parameters of its commission and its delivery to normal professional standards.



*Offices at*

**Bromyard**

**Clevedon**

**Exeter**

**Reading**

**Sheffield**

**Stirling**

**Warrington**

*Registered office*

**Hydro-Logic Services (International) Ltd  
Shearwater House,  
Clevedon Hall Estate,  
Victoria Road,  
Clevedon,  
BS21 7RD**

**Registered in England 03036787**