Flood Risk Assessment

Reach Community Solar Farm

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Introduction

1.1 Reach is a village of approximately 100 households on the edge of the Fens. We intend to construct a small solar farm that should generate sufficient electricity each year to match the consumption in the village. The solar farm will be owned and operated by a non-for-profit co-operative.

1.2 We have identified a site on the outskirts of the village that is suitable for our purposes, and have a provisional agreement with the owner to lease the land. An 11kV line crosses the land, and UK Power Networks have confirmed that it will be possible to connect into this line.

1.3 The site is approximately 1 hectare. Around 1/3 of area will be covered with solar panels mounted on steel frames. The remainder will be kept as grassland, and we intend to mount the panels sufficiently high off the ground that grazing of sheep can continue on the site.

1.3 The land is very gently undulating. Some of the land lies within flood zone 1, but towards the eastern side of the site it falls away slightly, and falls within flood zones 2 and 3.

1.4 The site benefits from flood defences built along the banks of the River Cam, Reach Lode and Swaffham Bulbeck Lode.

1.5 We consider here the risk of increased run-off from the solar panels. We also consider whether the site might be at risk if the flood defences along the Cam or Lodes were to be breached.

Figure 1: Proposed site for community-owned solar farm. Picture taken from the junction of Little Fen Drove with Blackberry Droveway, looking North.

2 Site Description

2.1 The site lies at the edge of the fens. To the south-east the land rises gently towards the villages of Reach and Swaffham Prior. To the north, the land gradually falls to below Ordnance Datum. A network of drains managed by Swaffham Internal Drainage Board divert water within this area to the pumping station at Upware, which pumps it into the River Cam.

2.2 The lowest point in the site is approximately 2m above the water level in the drain which runs along the north-western and north-eastern borders of the field.

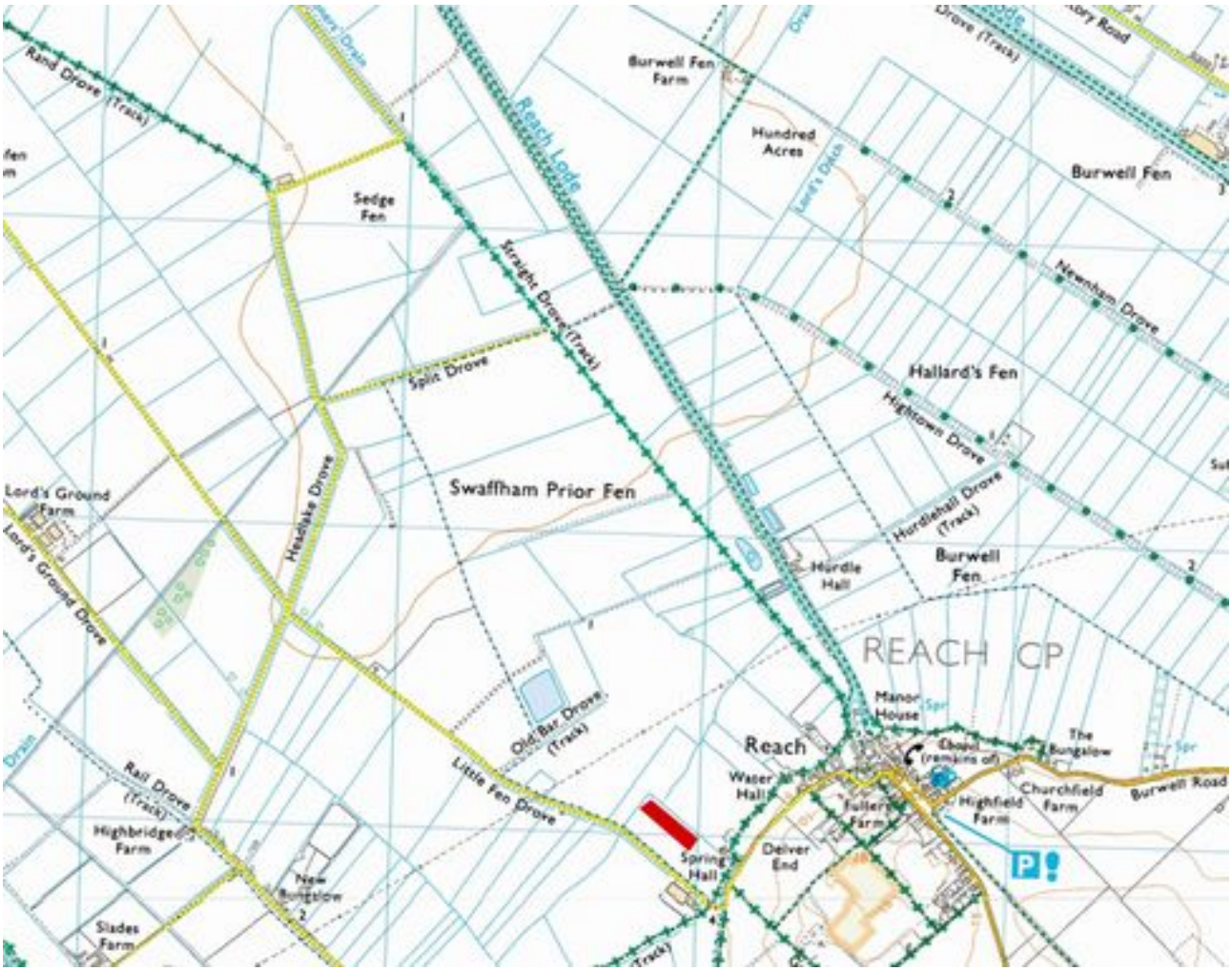

Figure 2: Location plan. The site (marked in red) lies just below the 5m contour and is drained by ditches maintained by Swaffham Internal Drainage Board on the north-eastern and north-western boundaries. To the north the land drops to below sea level.

Figure 3: Site plan with flood map overlay. The boundary of the region covered by solar panels is shown in red. Light blue is flood zone two, dark blue is flood zone three. The hatching indicates that the area is protected by flood defences.

3 Risk of inundation and over-topping of flood defences

3.1 Although the site lies partially within zones with a theoretical risk of flooding, in practice the flood defences along the Cam and along Swaffham Bulbeck Lode and Reach Lode, along with the extensive network of maintained drainage ditches and the pumping station at Upware, maintain safe levels within the area managed by the Swaffham Internal Drainage Board. As long as the flood defences remain intact and operational practices stay in place to maintain the levels there is a very low likelihood of flooding at the site.

3.2 It is difficult to assess the risk of over-topping or failure of the flood defences. At present the defences are well maintained, and it is considered extremely unlikely that a major failure will occur. In the event that a failure did take place however, levels could in theory eventually rise to an extent that flooding could occur over parts of the solar farm site.

3.3 It should be noted that there is considerably lower land to the north of the site; much of Adventurer's Fen and Swaffham Prior Fen lie below Ordnance Datum. In the event of a failure, an area of many square miles of this lower-lying land would have to flood to a depth of several meters before the solar farm was threatened. The risk of this happening is extremely low.

3.4 Panels will in any case be mounted such that junction boxes and isolators are at least 1m above ground level. Armoured cable, which can withstand flooding, is the only electrical component that will be used below this level. Even in the very unlikely event of breach of the river defences severe enough to cause flooding at the site, water levels are not likely to reach the height of any electrical component that would be affected by the flood waters.

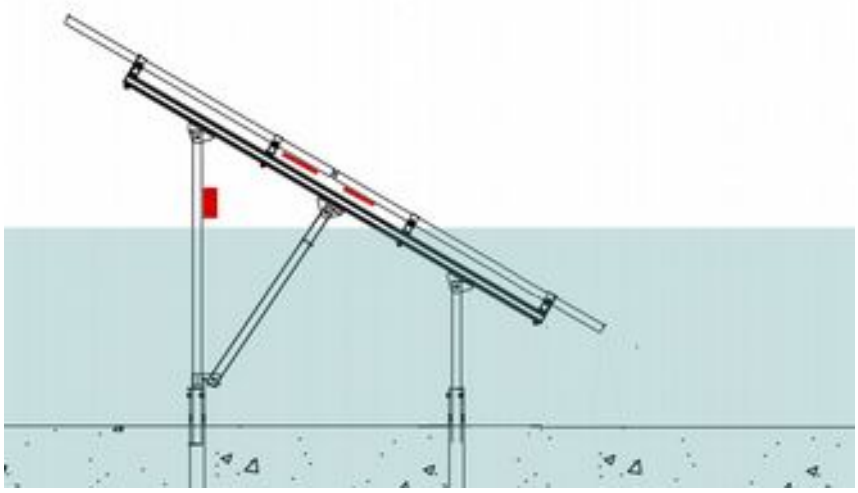

Figure 4: Mounting frames. The only components sensitive to water ingress are the junction boxes and isolators – shown in red. Water levels would have to reach at least 1m before these were affected by flood waters.

4 Run off

4.1 As solar panels are impermeable, they will shed water to the lower (southern) edge of each row of panels. There will therefore be a small strip beneath the lower edge of each row of panels that will receive a slightly higher amount of rainfall, while the strip of earth directly below each row of panels will be drier. If the ground under the front of each row of panels is not able to absorb the water, run-off could occur.

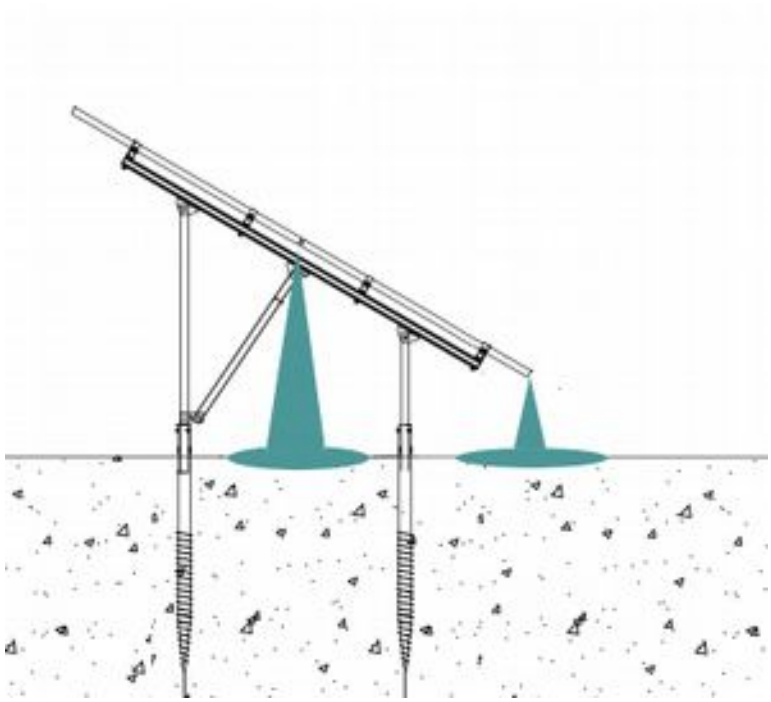

Figure 5: Run-off due to concentration of rainfall to the front edge of each row of panels.

4.2 We understand that there has been at least one case where solar panels, installed on a steep slope on compacted clay, have caused increased run-off owing to the infiltration rate of the land not being sufficient to absorb the increased water falling upon it.

4.3 The principal factors affecting infiltration rate are soil characteristics, vegetation cover, and slope angle.

4.4 Grass cover helps reduce runoff and erosion by slowing movement of water in the affected areas.

4.5 Clay soils are less permeable and at more risk of flooding than sandy or peaty soils, and permeability can be further reduced by compaction of soils – for example by vehicle movements during development.

4.6 Slope angle is a very important factor in determining the behaviour of water reaching the ground. Water will run very rapidly from a steep slope, but will pool on flatter areas, allowing it to permeate into neighbouring drier areas.

4.7 At the proposed site for the community-owned solar farm at Reach, the following factors will reduce the likelihood of increased run-off:

- We intend to retain vegetation beneath and around the solar panels.

- The ground is fairly level, so even if the infiltration rate of the soil is exceeded the velocity of any standing water that does begin to form will be slow, giving a greater likelihood that it will be absorbed by the drier land under the panels.

- The ground at Reach is well drained. Recent archaeology studies showed between 300 and 500mm of free-draining soil above the clay subsoil throughout the site. As the site is small total vehicle movements over the ground during the build will be limited, so the ground will not be compacted to the extent that it would be in larger developments.

Figure 6: Soil characteristics. The clay subsoil is covered with well-drained topsoil throughout the site.

4.8 Owing to the low ground slope, retention of vegetation, and well drained soils we do not expect measurably increased run-off as a result of the installation of the panels.

4.9 Swaffham Internal Drainage Board had no objections to the proposal when contacted in our initial Screening Opinion request to the Council. They will however be consulted again when the planning application is lodged.

5 Drainage Checks

5.1 As solar farms are relatively new and the effect of increased run-off is uncertain, the Environment Agency have recommended for similar sites that monitoring be undertaken at six monthly intervals for increased flooding or erosion[1]. If problems are encountered at the site, remedial action can then be taken.

5.2 We propose the following simple monitoring scheme for problems due to increased run-off. The checks will be undertaken by staff visiting the site for maintenance visits at 6 monthly intervals, and the results of the checks recorded.

Check	**Action required**
Check for the presence of standing water at the site	If standing water is present on the land a drainage engineer should be consulted.
Check for presence of water channels forming, or soil erosion	If water channels are developing or there is any evidence of soil erosion a drainage engineer should be consulted.
Check that ditches bounding the site are not blocked or overgrown	Ditches should be cleared if necessary. The local Drainage Board should be informed if there are any blockages in the drains that they maintain.

5.3 If the regular monitoring demonstrates that erosion or flooding is occurring, professional advice will be sought on a course of action to improve the drainage.

[1] http://docs.huntsdc.gov.uk/AnitePublicDocs/00332751.pdf

6 Summary

6.1 Parts of the site lie within flood zones 2 and 3, and if undefended would be at high risk of flooding during a 100-year flood event.

6.2 There are however extensive flood defences along the River Cam and the Lodes, together with a network of drainage ditches to drain the area to the pumping station at Upware. The flood defences and drainage system should prevent flooding in normal circumstances.

6.3 There remains a small possibility of breaching of flood defences or over-topping. However, as the site is several meters higher than the land to the north, a very considerable volume of water would have to flow into the area before the site itself was threatened by floodwater.

6.4 Solar panels are impermeable, and will shed water to the lower (southern) side of each row. There will therefore be a slight increase in water reaching the ground at these points. However, the ground at the site is well-drained, and vegetation will be retained at ground level. As the ground is flat water that falls from the panels is likely to permeate into the drier ground behind rather than run off as surface water.

6.5 A perimeter track allows access to nearby drains for maintenance. This is carried out regularly by the local Drainage Board.

6.6 Checks will be undertaken at six-monthly intervals for the presence of increased standing water or erosion at the site. If problems are encountered, professional advice will be sought and action taken to improve the drainage.

6.7 There are precedents for planning permission being granted in similar locations. For example, the nearby solar farm at Chittering is largely in flood zone three, but is also protected by the flood defences of the River Cam catchment. The Chittering development is more than an order of magnitude larger than the scheme that we propose, and is at a lower elevation.