This document reproduces the latest review of the Trumpet Fields planning application (150765) by WSP/PB acting as drainage consultants on behalf of Herefordshire Council. WSP/PB responses to earlier comments on the original WMA Report (February 2015) and subsequent Addendum (June 2015), are highlighted.

Additional responses to this review, prepared by David Floyd, are appended in red text.

SITE:	Trumpet Fields adjacent A438, Trumpet, Ledbury HR8 2RA
TYPE:	Planning Permission
DESCRIPTION:	Erection of polytunnels on fields at Trumpet for covered commercial growing of soft fruit and new pond area
APPLICATION NO:	150765
GRID REFERENCE:	OS 366269, 239068
DATE OF THIS RESPONSE:	02/07/15

The original planning application for the above development was reviewed in May 2015. It was recommended that the following information is provided prior to planning permission being granted:

1. Soil infiltration test results for the site to demonstrate that infiltration techniques are not appropriate at this site;
2. Details on how the predicted increase in flow would affect the existing capacity of the watercourse and how it would impact nearby properties and areas further downstream;
3. Consideration of the potential impact that a failure (breach) of the attenuation area embankments could have downstream of the site. The application should also confirm the freeboard allowance/factor of safety incorporated within the design of the storage areas. It is recommended that the Applicant contacts the EA to confirm appropriate assessment criteria for the assessment and guidance on the minimum freeboard allowance;
4. Provide details relating to the consideration of multiple events on capacity of the proposed storages and how this would impact flood risk in the area and elsewhere;
5. Confirmation of the volume of storage proposed for Phase 2 that will be provided for surface water runoff compensation.

It was also recommended that the Applicant submits a short statement summarising flood risk to the site from all sources as required by NPPF. Should the Applicant propose to increase the runoff from the site it was recommended that the Applicant contacts the LSIDB to confirm whether they have any criteria that must be met.

This response is in regard to the following additional information submitted by the Applicant in June 2015:

Water Management Audit (WMA) - Addendum, June 2015;
Figures to Water management Audit (WMA) - Addendum;
Tables missing from the original Water Management Audit submitted in May 2015;
Baeza Pond Cross Sections;
New Pond Cross Section - sketch;
Email from Louise Clayton dated 10 June 2015.

1. Soil infiltration test results

No soil infiltration test results were submitted. The submitted WMA Addendum states that soil infiltration tests will be undertaken in accordance with BRE 365 guidance prior to construction. We agree with this approach and recommend that it is set as condition of planning.

2. Details on how the predicted increase in flow would affect the existing capacity of the watercourse and how it would impact nearby properties and areas further downstream

Prior's Court

The submitted WMA Addendum provides evidence that the following alterations to the proposed drainage system will mean that the scheme will not increase flows and even reduce the flows in comparison with the existing flows at Prior's Court for up to and including the 1 in 100 year storm event with climate change (summer and winter):

Retain existing inlet pipe diameters at 350mm (north and south inlet pipes);

Lower outlet pipe invert level to 74.4m AOD (previously 74.5m AOD). This will reduce available live storage from 15,600m^3 to 15,000m^3, whilst providing an additional 600m^3 flood storage capacity;
Reduce outlet pipe diameter from 350mm to 300mm;
Reduce spillway width from 5m to 4m.

The proposed alterations to the drainage system are found to provide satisfactory results.

Trumpet Site

The original WMA proposed that surface water runoff from the entire Trumpet site (17.3ha) drains south-eastwards, discharging to the North Branch watercourse and eventually to the Pixley Brook. The submitted WMA Addendum states that during a site visit it was identified that the very north-western part of the site drains westwards to a ditch on the northern boundary with an outfall at the Trumpet access road off the A438. A 200mm diameter pipe conveys excess runoff under the access track and discharges to an open ditch running westwards south of the A438 towards the crossroads. The pipe is located adjacent to a garage; during heavy rain, or if the pipe is partially blocked, the excess surface water runoff is retained within or around the garage site. The owner of the garage is concerned that the proposed development will exacerbate the flood risk to their property.

To mitigate the increased flood risk the Applicant has proposed that a small pool near the existing entrance will be constructed, linked to a new pipe drain passing beneath proposed polytunnels, draining eastwards to discharge into the natural depression crossing the site and sloping in south-easterly direction towards the proposed Baeza Pond. The pool will act as a collection point and will be approximately 6m x 6m with a depth of 1 m. The model was run with different pipe diameters to compare flow in excess of the pipe capacity with the present situation. For the selected 250mm diameter pipe the results show betterments for the Q_{10} summer and winter events and for the winter Q_1oo+cc event, i.e. the pipe has sufficient capacity to convey all runoff and there is no spill. For the summer Q_1oo+cc, the future volume of spill is reduced in comparison with the existing situation. However, the peak flow is increased from 33l/sec to 53 l/sec, and the hydrograph plot shows that the excess is short-live - about 30 minutes. The WMA Addendum states that given the rarity of this event and complete elimination of spill for all other scenarios, the overall impact will be beneficial.

In accordance with the current guidance, a new development should not increase a peak flow and volume of water for up to an including the 1 in 100 year event with climate change allowance. Therefore, the Applicant should provide a design that will fulfil these requirements or provide evidence that the predicted increase of a peak flow will not increase risk of flooding to any properties and people.

Further analysis has been carried out for the 1 in 100 year (no climate change allowance) event. This confirms betterment for winter Q_{100} peak and volume, and summer Q_{100} volume, and no increase in summer Q_{100} peak flow.

To summarise, once in every 100 years (including climate change allowance) there could be an increase in peak flow (but not flood volume) leaving the north-west part of the site of 20 l/sec lasting for a maximum of 30 minutes. In the other 99 years, peak flows and volumes will be reduced. The overall impact will be beneficial.

The WMA Addendum states that construction of a new pool by the site entrance will not increase the runoff to Pixley Brook since the original WMA model conservatively assumed that the entire Trumpet site drains to the North Branch watercourse. We concur with this statement.

3. *Consideration of the potential impact that a failure (breach) of the attenuation area embankments could have downstream of the site. The application should also confirm the freeboard allowance/factor of safety incorporated within the design of the storage areas. It is recommended that the Applicant contacts the EA to confirm appropriate assessment criteria for the assessment and guidance on the minimum freeboard allowance.*

The submitted WMA Addendum states that issues concerning embankment stability etc are beyond the remit of the report and should be properly addressed at the detailed design stage and therefore no further information attaining to the impact of a breach of the attenuation area has been provided. Although the likelihood of a failure occurring is associated with the design of the embankment, the potential damage that could be caused still needs to be understood in order to adequately assess the residual risks associated with the development. Further discussion of the assessment of residual risks associated with the scheme is provided below.

4. Provide details relating to the consideration of multiple events on capacity of the proposed storages and how this would impact flood risk in the area and elsewhere.

The submitted WMA Addendum states that the assumption of zero initial drawdown in the Baeza Pond calculations indirectly allows for multiple storm events. We agree with this statement in principle however without further information it is not possible to ascertain what level of residual risk remains associated with the operation of the storage area. Further discussion of the assessment of residual risks associated with the scheme is provided below.

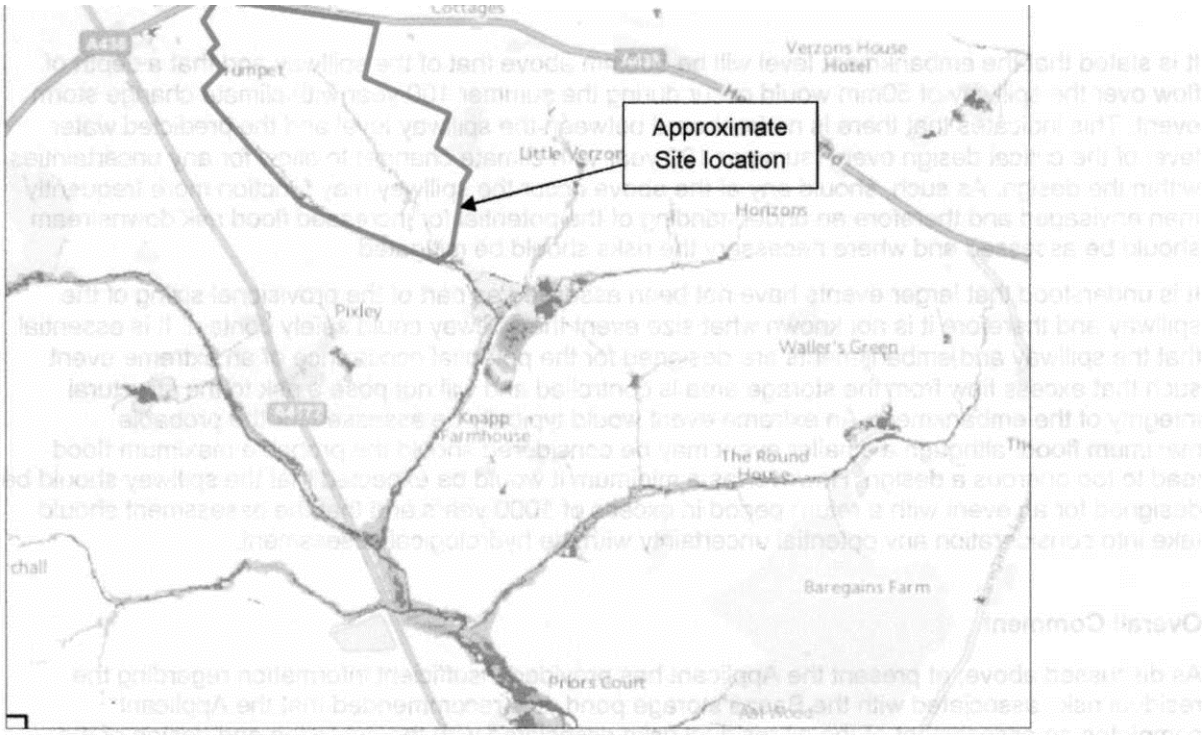
5. Confirmation of the volume of storage proposed for Phase 2 that will be provided for surface water runoff compensation.

The submitted WMA Addendum states that flood compensation storage of volume approximately 4,000m^3 will be provided in the Baeza Pond. This volume will be provided between the outlet pipe invert level of 74.4m AOD and the spillway crest level of 75m AOD. Correct.

Statement summarising flood risk

The submitted WMA Addendum includes short statement summarising flood risk assessment at the site. The provided summary statement is found to be satisfactory. It is noted that the Addendum states that Figure 5 of the document shows the EA's Risk of Flooding from Surface Water map, but it shows EA's Flood Map for Planning which indicates extent of fluvial flooding. A review of the EA's Risk of Flooding from Surface Water Map (shown below) indicates a potential low risk flow path through the site.

Figure 1: Extract from EA's Risk of Flooding from Surface Water Map



Risk of surface water (as opposed to fluvial) flooding within the site is acknowledged. However, this will be confined to the grass swale to be constructed along the natural W-E depression and will not constitute a risk to life.

Should the Applicant propose to increase the proposed runoff from the site it was recommended that the Applicant contacts the LSIDB to confirm whether thev have any criteria that must be met.

The submitted WMA Addendum provides evidence that if the proposed mitigations are implemented, there will be no increase in surface water runoff to the Pixley Brook. However, as discussed above there is a proposed increase in the peak flow from north-western section of the site, and therefore if this remains the case LSIDB should be consulted. As stated above, the increase in peak flow for the Q_{100+CC} summer event is minimal (20 lit/sec) and short-lived (30 minutes). In view of the **reduced** peak flows and volumes for all other scenarios, this is acceptable.

Assessment of Residual Risk

At present insufficient information regarding the residual risks associated with the storage pond has been provided by the Applicant.

It is acknowledged that if designed and constructed appropriately a breach in the embankment is unlikely to occur. However it is proposed that water is impounded to a height of up to approximately 4m, and therefore a sudden failure of the embankment could potentially be fatal. Therefore it is essential that prior to planning permission being granted the potential impact of a breach occurring is properly understood in order to ensure that the risks can be appropriately managed and where possible mitigated. see below.

As stated above the current assessment assumes that the calculation of storage volume is conservative, particularly when considering the summer events, as there will be additional volume _ within the storage area due to a draw down from water used for irrigation. Although this may be the case during normal operation further residual risks remain that need to be considered:

- Risk of blockage of the outfall;
- Potential underestimation of the storage volumes due to methodology;
- Loss of storage volume from sediment accumulation etc;
- Suspension in drawdown of water, including 'end of use' scenarios prior to deconstruction.

It is stated that the embankment level will be 500mm above that of the spillway and that a depth of flow over the spillway of 50mm would occur during the summer 100 year with climate change storm event. This indicates that there is no freeboard between the spillway level and the predicted water level of the critical design event (summer 100 year with climate change) to allow for any uncertainties within the design. Not so - freeboard above the spillway crest of 450 mm is available for the critical summer Q_{100+CC} event. As such, should any of the above occur the spillway may function more frequently than envisaged and therefore an understanding of the potential for increased flood risk downstream should be assessed and where necessary the risks should be mitigated.

It is understood that larger events have not been assessed as part of the provisional sizing of the spillway and therefore it is not known what size event the spillway could safely contain. It is essential that the spillway and embankments are designed for the potential occurrence of an extreme event such that excess flow from the storage area is controlled and will not pose a risk to the structural integrity of the embankment. An extreme event would typically be assessed for the probable maximum flood, although a smaller event may be considered should the probable maximum flood lead to too onerous a design. The concept of designing the spillway for a farm pond to pass the probable maximum flood does not comply with National guidelines (Institute of Civil Engineers, "*Floods and Reservoir Safety*"). Baeza Pond would be classified at worst as Category C with a recommended design inflow corresponding to the 1000-year flood. However as a minimum it would be expected that the spillway should be designed for an event with a return period in excess of 1000 years and that the assessment should take into consideration any potential uncertainty with the hydrological assessment.

The HEC-HMS model was run for the design **1000-year** storm event. The main point is that pond inflow is restricted by the capacity of inlet pipes (shown by inflows for Q_{100+CC} event in Figure 33 of Report 20114). Flow in excess of the pipe capacity spills to existing watercourses (North Branch and E Ditch) and can not enter the pond.

For the 1000-year event, peak inflow is 0.95 m^3/s (summer) and 0.81 m^3/s (winter), compared with Q_{100+CC} peaks of 0.85 m^3/s and 0.76 m^3/s respectively. The increased peak inflow for Q_{1000} is due solely to increased runoff from the residual Baeza polytunnel field area upstream of the pond.

Under 'normal' operating conditions for Q_{1000} (outlet pipe diameter 0.3 m with invert level 74.4 m, initial pond level 74.4 m), peak pond elevation is 75.15 m (summer) and 75.12 m (winter). i.e. maximum depth of flow over the spillway is 0.15 m, minimum freeboard 0.35 m.

Under extreme conditions of blocked outlet pipe, initial pond level 75.0 m (spillway crest), peak pond elevation is 75.26 m (summer) and 75.25 m (winter). i.e. maximum depth of flow over the spillway is 0.26 m, minimum freeboard 0.24 m).

This confirms that the indicative spillway dimensions as adopted, bearing in mind that this is a hydrological assessment not detailed design, are adequate to prevent overtopping of the embankment. These results were sent to WSP/PB (email, 14 July 2015) who concluded that "*design of the spillway can be dealt with as reserved matters with a thorough review completed at detailed design*".

Any potential breach analysis would therefore be confined to a piping breach (seepage through the embankment creating progressive erosion and, in the worst case, embankment failure). This is a geotechnical issue also to be properly dealt with at the detailed design stage.

WSP/PB provided a document (Environment Agency, June 2009, '*Reservoir Inundation Mapping Specification*'). The requirements set out in this document are appropriate for a major reservoir (not a farm pond that does not come within the Reservoirs Act). They are prohibitive technically, financially and in terms of time inputs required, for this planning application.

Overall Comment

As discussed above, at present the Applicant has provided insufficient information regarding the residual risks associated with the Baeza storage pond. It is recommended that the Applicant completes an assessment of the all residual risks associated with the operation and design of the storage area, as highlighted above, and where required provides mitigation.

It is also recommended that either the proposed mitigation measures for the north-western part of the site are designed to not increase the existing peak runoff rate and existing flood volume, or that the Applicant demonstrates that the predicted increase in peak flow will not increase flood risk downstream. Done.

It is recommended that the above information is submitted prior planning permission being granted.

In addition we recommend that the following conditions are applied should planning be granted:

- Provision of results from onsite soil infiltration tests, undertaken in accordance with BRE 365 guidance, prior to construction; agreed
- Detailed design to be independently reviewed by an appropriately qualified individual. agreed
- The spillway for the flood storage area should be designed to ensure that any potential excess flow from the storage area is controlled and will not pose a risk to the structural integrity of the embankment. DONE
- The poly tunnels and flood storage area should be removed from the site if irrigation ceases *[permanently]*, unless continued maintenance of the storage can be demonstrated and the volume of runoff storage can be shown to have an adequate factor of safety, without the assumed draw down provided by the use of water for irrigation. **NOT AGREED** *This is covered by the analysis for the 1000-year flood described above. With no irrigation drawdown, even under extreme conditions of blockage of the outlet pipe, the embankment is not overtopped.*

- Appropriate maintenance regime *[for Baeza Pond and appurtenant works (inlet and outlet pipes, spillway, pond embankment), and of grass swales],* is outlined and provided to the council for review. agreed.