Floodplain meadows Partnership response to Task 4 outlined in the document
'Oxford Flood Alleviation Scheme
SCOPE OF WORK FOR THE FLOODPLAIN MEADOWS PARTNERSHIP'
6 April 2017

Background to work
A Groundwater Report has been produced by CH2M (Appendix E). This sets out the anticipated changes in groundwater levels that will occur under various flood scenarios and under normal conditions. The Ground Investigation Report at Appendix F contains important information relating to strata.

Task 4: Use the findings of the Groundwater Report and the Ground Investigation Report to explain how the anticipated change in groundwater levels are likely to affect the MG4/MG4a floodplain meadow at Hinksey Meadow in terms of species composition, NVC classification and long-term viability. Specific questions that we have are:

- Is there likely to be a discontinuity between the groundwater levels in the gravels and the overlying alluvium that acts as a 'buffer' to changes in groundwater levels?
- Are the MG4/MG4a species at the wet end or the dry end of their tolerance range?
- Does the groundwater report provide sufficient information to allow a confident prediction of how the scheme will affect the hydrological regime of the remaining part of Hinksey Meadow in the growing season?
- Should we be putting piezometers within the MG4 on Hinksey Meadow this winter and if so, how many and where?

Response from FMP

Based on the information presented in ESI's November 2016 report "Oxford Flood Alleviation Scheme: Groundwater Flood Modelling" (referred to as the "Groundwater report,") we have considered how the anticipated changes in groundwater levels are likely to affect the MG4/MG4a floodplain meadow at Hinksey Meadow in terms of its species composition, NVC classification and long-term viability.

To help inform this deliberation, we collected six undisturbed soil cores (each 100 cm^3) from the surface horizon of the meadow to characterise how freely draining the soil is and therefore how the vegetation is likely to respond to water-table fluctuations. We analysed these cores on a sand-table and have generated a soil-moisture-release curve (Figure 1,) which demonstrates the upper soil layer to be very porous, free draining and well structured. We have not investigated the full profile in this way (as that would have involved digging pits in a sensitive area,) but the implication is that the root zone of the meadow is likely to be connected to and responsive to the water regime of the underlying gravel aquifer, especially as the alluvial thickness in some parts of the meadow is expected to be approximately 0.5 m (Richard Winstanley *pers. comm*., 24/03/17).

The Groundwater report suggests (Figure 3.53) that the water table beneath the meadow will be 12 cm (well OS1) and 14 cm (well OS 5) lower with the scheme than without the scheme and that this difference will be constant throughout the year. We have not been able to find an absolute ground-level elevation at these points to calculate absolute water-table depths, which we would need to do a full analysis of the water regime and to determine likely vegetation response. In the absence of absolute values, we can interpret the relative values shown in Fig 3.53 to show the change in the Sum Exceedence Value for soil drying (Silvertown et al, 1999; Gowing et al, 20002) would be an increase of approximately 4 metre.weeks over an annual cycle. This increase represents a very substantial change and would almost certainly lead to a shift in plant-community type. The expected changes would be that drying tolerant species such as cocksfoot (*Dactylis glomerata*) would increase in abundance at the expense of species such as great burnet (*Sanguisorba officinalis*) and the community as a whole in NVC terms would be likely to transition from MG4a to MG5.

In response to the specific question posed by the EA:

1. *Is there likely to be a discontinuity between the groundwater levels in the gravels and the overlying alluvium that acts as a 'buffer' to changes in groundwater levels?*

   There is unlikely to be a discontinuity because the alluvium is relatively shallow (<1 m deep) at the site and its soil-moisture release curve shows it to be very well structured. It is therefore likely that the root zone will be directly affected by any change to the piezometric head in the gravel aquifer.

2. *Are the MG4/MG4a species at the wet end or the dry end of their tolerance range?*

   From the 2016 NVC map supplied by Dr. T. King, the vegetation has been classed as subcommunity type a, which is the driest variant of the MG4 community, suggesting the current soil moisture conditions are at the dry end of the water-regime range typified by that community. If ground-surface elevation data for the modelled positions (OS1 and OS5) are available, we could calculate absolute measures of the water regime at those locations based on the model output and make a more definitive statement about where the site falls within the tolerance range.

3. *Does the groundwater report provide sufficient information to allow a confident prediction of how the scheme will affect the hydrological regime of the remaining part of Hinksey Meadow in the growing season?*

   As suggested above, the Groundwater report contains relevant data to address the question, but the level of interpretation is limited by the lack of ground-surface elevation data for the relevant wells. The report sets out its assumptions and model structure clearly and all these seem to be sensible, but we would query why the dry-year model did not use actual river-level data from 2011 so as to allow the outputs to be validated against observation. The use of "synthetic" data precludes validation, so we are unable to ascribe a level of confidence for the outputs. The flood model was validated against observation and showed the residual errors to be in the order of 20 cm. If the dry-year model run generated comparable residual errors, then little confidence could be placed in the detail of the output.

4. *Should we be putting piezometers within the MG4 on Hinksey Meadow this winter and if so, how many and where?*

   We believe gathering actual baseline information would be useful and we have already had discussions with CH2M about potential locations to maximise data value without causing undue disturbance to the site. We tried to emphasise that the very highly structured nature of the soil (now borne out by the results of the soil-moisture-release curve) make it highly fragile and susceptible to compaction damage if vehicles are run on it whilst wet, so we suggest a high priority for the scheme is to protect the soils from disturbance. Structural damage can take decades to repair.

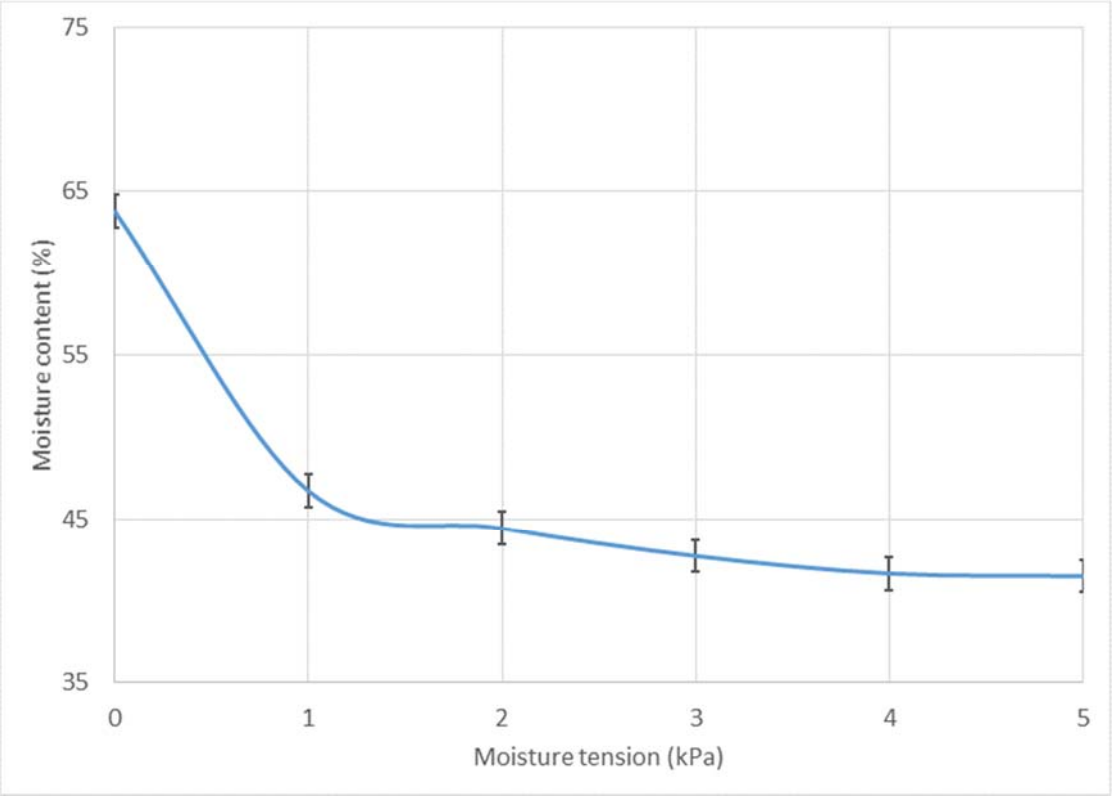

Figure 1. Soil-moisture-release curve for the upper soil horizon of Hinksey Meadow. The curve represents the mean values from six separate cores (sampled from across the meadow,) which were analysed on a sand-table. The error bars represent one standard error of the mean.