

## Background

Rusland Valley Mosses Site of Special Scientific Interest (SSSI), South Cumbria, is a raised mire system with three distinct domes: Hay Bridge Moss, Hulleter Moss and Rusland Moss. The mosses originally developed through the infilling of a former lake which occupied the western side of the Rusland Pool valley (Dickinson, 1973). Initially a fen developed and then raised bogs formed as the peat gradually built up above the level of the surrounding land. Around the edges of the raised bogs a transitional lagg habitat formed, bounded to the east by the original course of Rusland Pool.

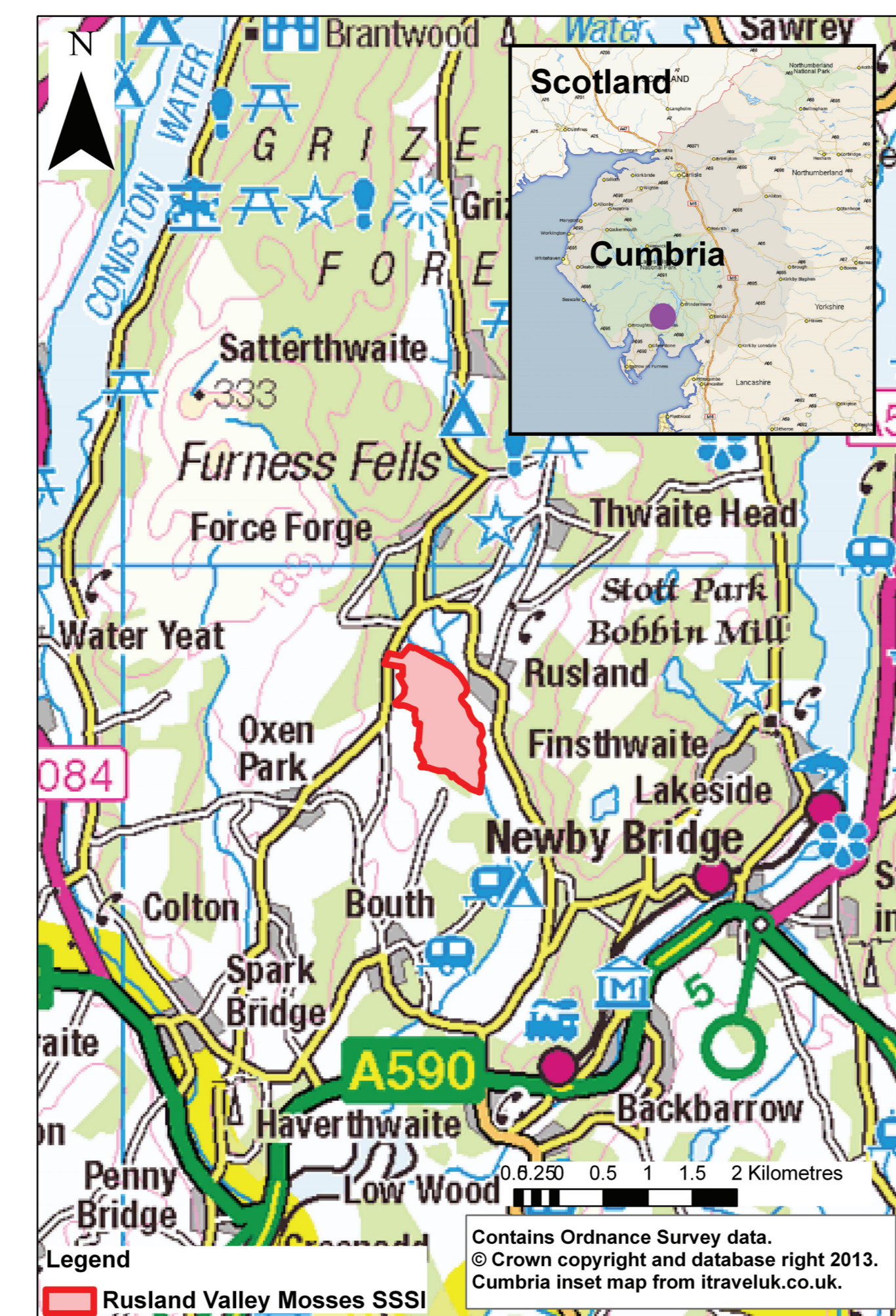
Significant modifications have occurred to the hydrological regime at Rusland Valley Mosses since their formation. Peat cutting, artificial drainage and the encroachment of non-mire vegetation (including scrub and woodland) have all contributed to a general fall in the level of the watertable and an increase in the rate at which water discharges from the site. Natural England is committed to restoring the mosses to intact, fully-functioning, peat bogs. This will require the maintenance of a high and stable watertable over most of the area, giving ideal conditions for the active growth of *Sphagnum* moss and the subsequent accumulation of peat.

## Hydrogeological and Eco-hydrological investigations

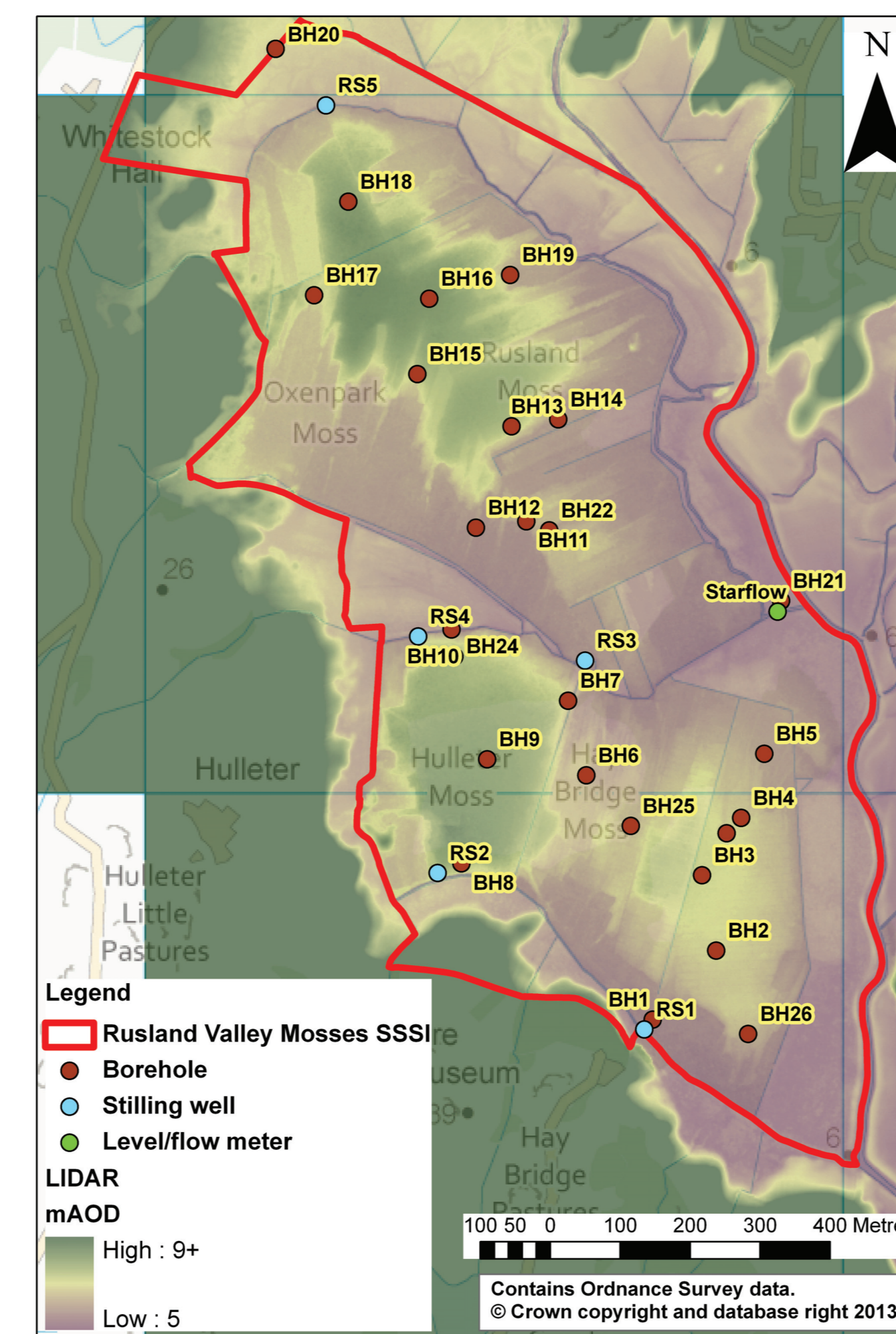
JBA has been working with Natural England to develop a detailed conceptual understanding of the eco-hydrology of the mosses and to explore options for their restoration. The work has included detailed topographic analysis (using a LIDAR DTM), vegetation mapping and the installation of a network of automatic water level monitoring devices in ditches and shallow boreholes in the peat. A wetness classification (based mainly on vegetation types and topographic features) was developed before monitoring data were available, and was used to inform an early assessment of the mosses.

The classification ("sufficiently wet", "slightly dry", "too dry") has now been tested using the water level monitoring data collected during the study, and there is good agreement with observed groundwater levels. This suggests that the classification may be useful as a water level indicator on sites with no direct monitoring of water levels. Note that the wetness classification takes into account the target habitat: for example, "sufficiently wet" for an area of mire expanse indicates a high and stable watertable, whereas the same classification for a lagg area allows for greater watertable fluctuations.

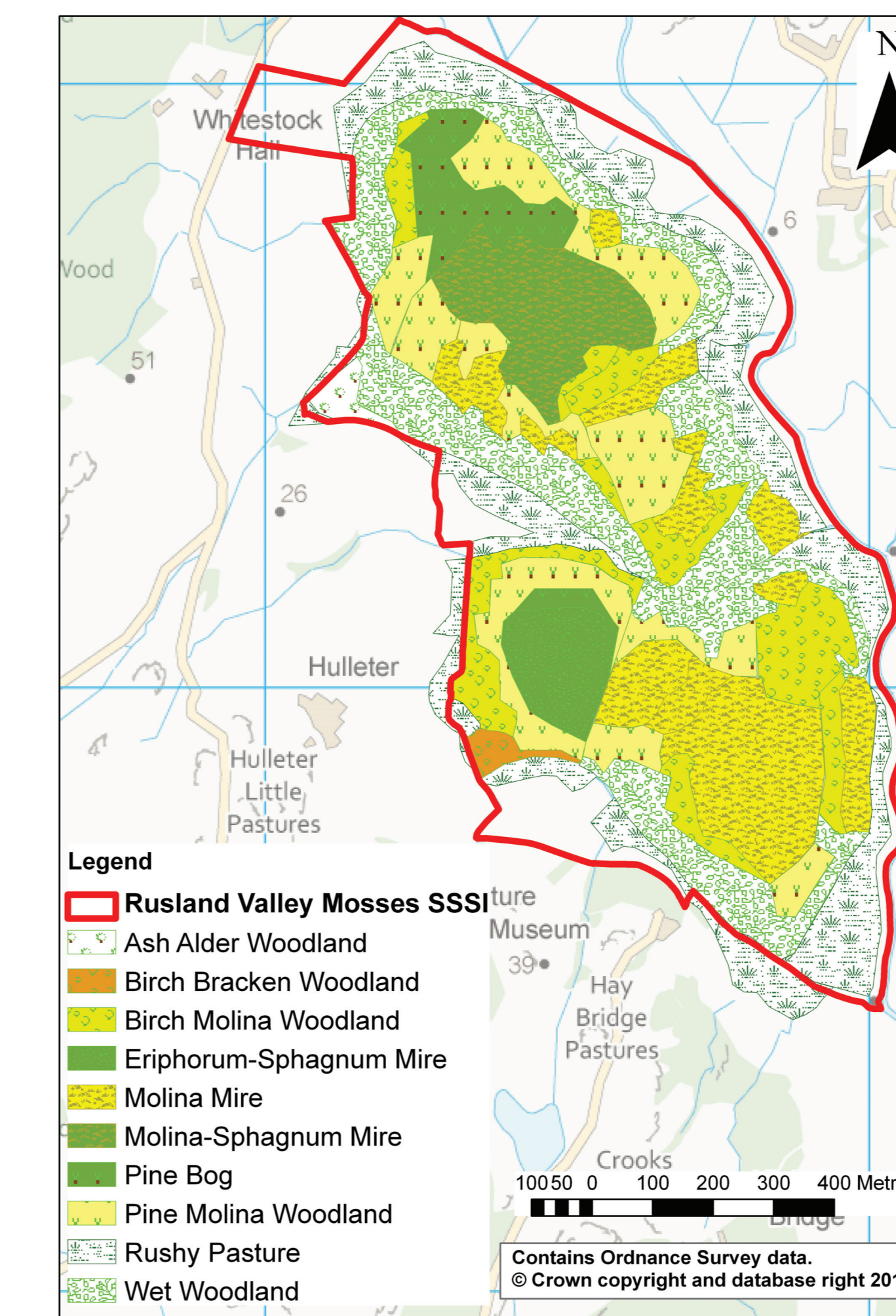
## Location Map



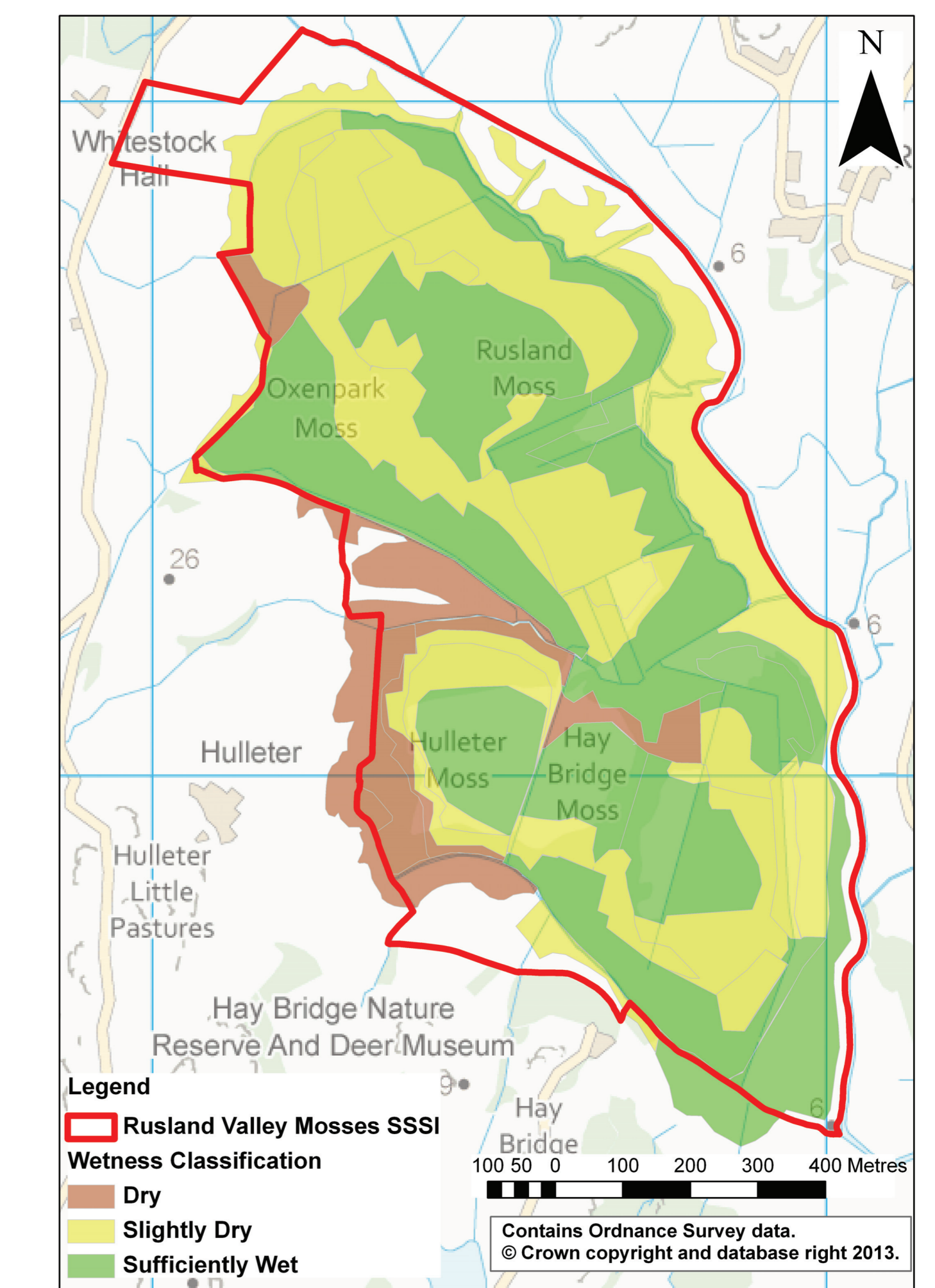
## Topography and Monitoring Network



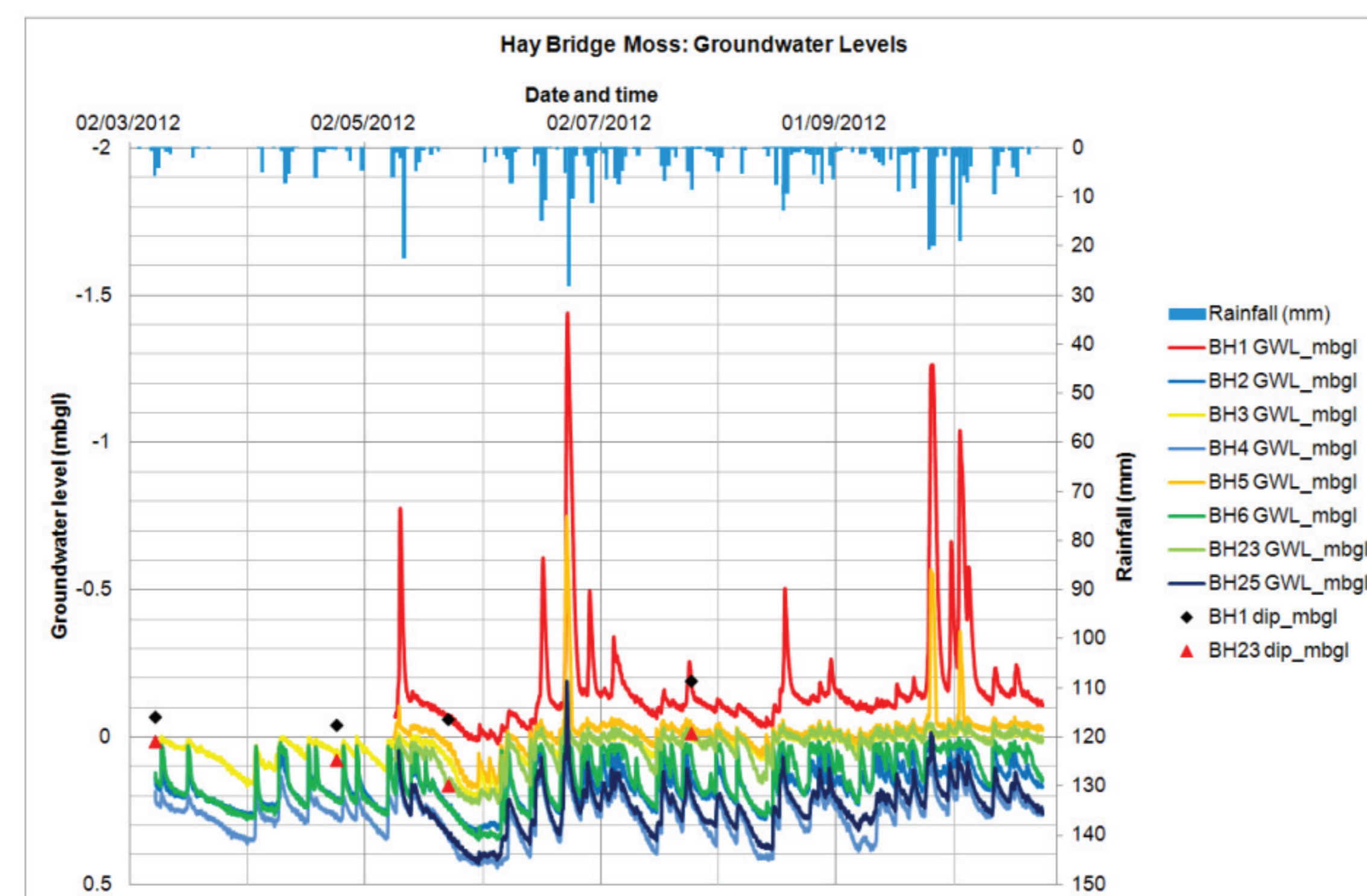
## Habitats



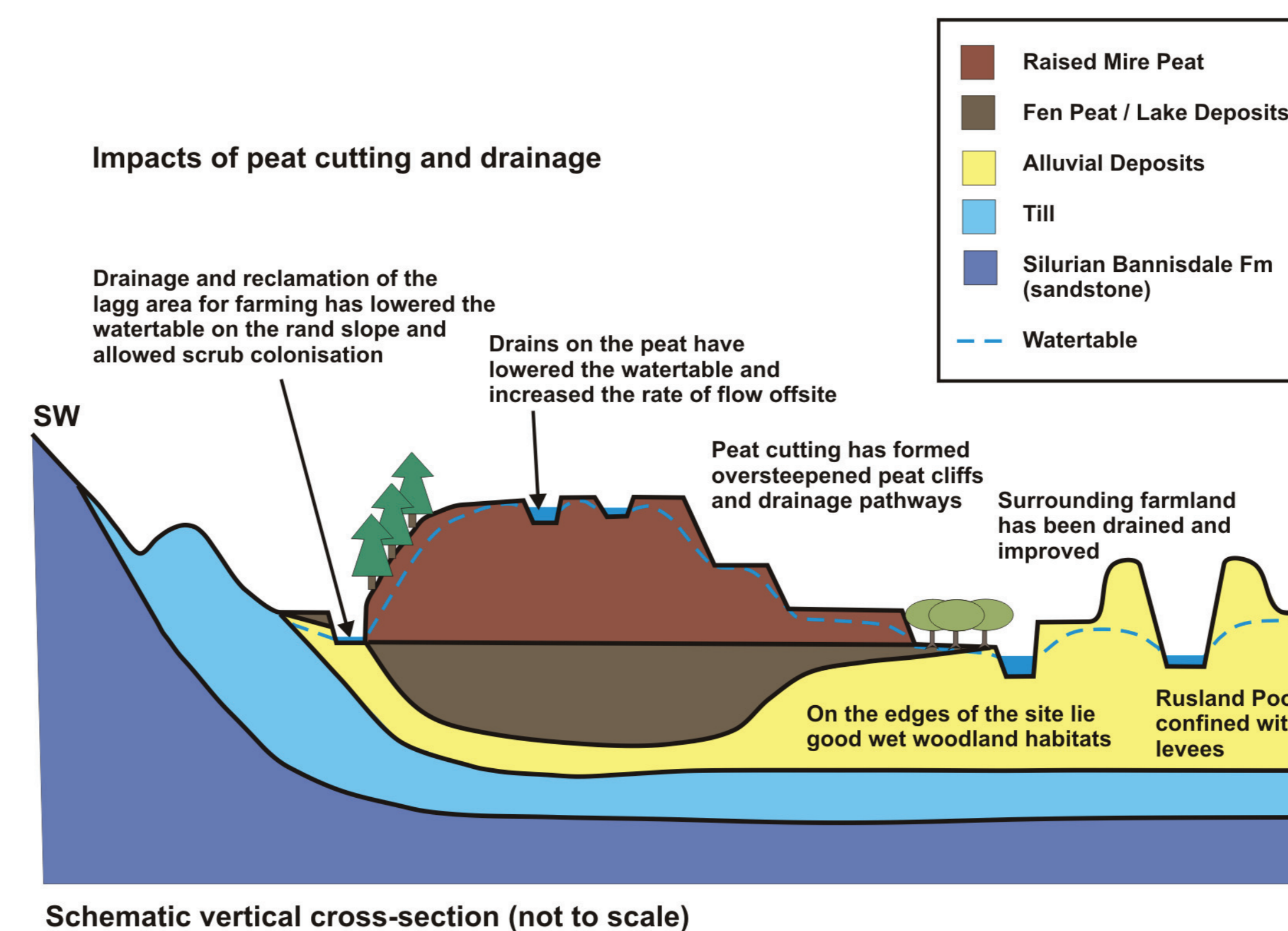
## Wetness



## Water level monitoring: Hay Bridge Moss



## Conceptual model showing the impacts of peat cutting and drainage



## Findings

Groundwater levels on the dome of a raised bog should be at, or close to, the ground surface all year round: ideally no more than 0.1 m below ground level. Water level monitoring on Rusland Valley Mosses has revealed a mixed picture: some areas have water levels that are appropriate for the target habitat (at least during the limited monitoring period to date), but others display water levels that are too low and/or that fluctuate too widely.

All the groundwater level records show sharp rises in response to rainfall recharge, followed by more gradual recessions. Very spiky (flashy) groundwater level variations are likely to reflect the influence of artificial drainage or the presence of more degraded peat with a lower storage capacity (specific yield). In general the flashier responses to rainfall events occur in boreholes with deeper background groundwater levels. This pattern suggests that the peat is more degraded where the watertable is lower.

## Restoration

Restoration proposals for Rusland Valley Mosses include:

- Lagg creation - creation of a fen around the site in order to restore a more natural hydrological and ecological transition.
- Bunding to reduce the loss of water from the site and to raise the watertable within the main peat mass.
- Re-profiling of the surface topography where required.
- Scrub clearance and tree felling, including the removal of pine and the removal/thinning of birch stands where trees affect the hydrology or impede access for hydrological restoration works.

JBA has used photographic imaging techniques to produce "before and after" visualisations showing the likely changes that restoration would cause to the appearance of the landscape. One of the main challenges facing Natural England is the need to positively engage with local stakeholders to explain the need for restoration measures such as ditch blocking and tree felling. Clearly presented water level monitoring data and landscape visualisations will play a vital role in communicating the conservation issues and restoration proposals.

## References

Dickinson, W., 1973. The Development of the Raised Bog Complex near Rusland in the Furness District of North Lancashire. *Journal of Ecology*, Vol. 61, No. 3, pp. 871-886.

## Landscape Visualisations: Hay Bridge Moss

