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Restoration of seventeenth century water gardens at Bramham Park

Joseph Holden reports on his research into discovering how the original water features at Bramham Park worked and to suggest how they might be restored to their former glory.

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Bramham Park, near Wetherby, is the only large-scale formal garden in the UK to survive virtually unchanged from the late seventeenth and early eighteenth centuries. During the Victorian period most such gardens were altered as styles and trends changed through time.

At Bramham, however, a large house fire in 1828 meant the site was left vacant until the turn of the twentieth century. While this fire destroyed the records about how the garden's ornamental ponds, cascades and canals were originally connected together and supplied with water, it also meant that the gardens were not altered from their original layout.

The gardens were created by Robert Benson, the first Lord Bingley, with the help of Yorkshire-born architect John Wood the Elder, and the distinguished engineer George London, following visits to the gardens of Versailles and Italy. However, garden designs were necessarily constrained by the physical environment.

At Bramham, the water for the various ponds and cascades was supplied by three natural springs. Between the springs and the formal garden, there was a valley which provided a natural obstacle.

Since gravity was the only feasible mechanism for transporting water at the time this obstacle had to be overcome by contouring the water along an elaborate series of ditches and pipes for over 2 km around the valley edge (Figure 1) with a gradient of only 1:250.

At the beginning of the twentyfirst century, many of the water features no longer operate and research was needed in order to:

- establish how the features originally worked;
- determine whether there was enough water available to feasibly restore the features; and
- make sure that any changes made would not have adverse downstream affects on water budgets and river discharge.

This article explains how, with the use of ground-penetrating radar, it has been possible to establish why the water features no longer function and to make suggestions for restoration.

How were the features originally connected to their water supply?

Figure 1 is a map of Bramham Park showing named working and defunct water features. In order to establish how water was supplied to the now dry Queen's Hollow and associated cascades and how other features were originally connected, ground penetrating radar (GPR) was used (Figure 2).

This technique has been established at Leeds University for detecting underground pipes and water leaks for the water industry without the need for disturbing the ground.

Water enters the T Pond via pipes leading from one of the springs. The GPR survey showed that the T Pond (Figure 3) originally overflowed into a pipe and ditch that sent water to the Queen's Hollow which it then delivered via a 30-step cascade to the mouth of a mythical beast. From here water poured down a further waterfall to a pool in a Parterre (Figure 4).

This system no longer works and maps suggest that it had ceased operation by the early nineteenth century. Cascades leading from the large Obelisk Pond system (Figures 5 and 6) are now covered with turf too and also probably stopped functioning during the nineteenth century.

Is there enough water to enable restoration?

It is therefore questionable as to whether there was ever enough water to supply the system and whether changes such as tree plantation reduced water availability.

The three supply springs in the Park were gauged for discharge by using small automatic water level recorders and by developing a rating equation

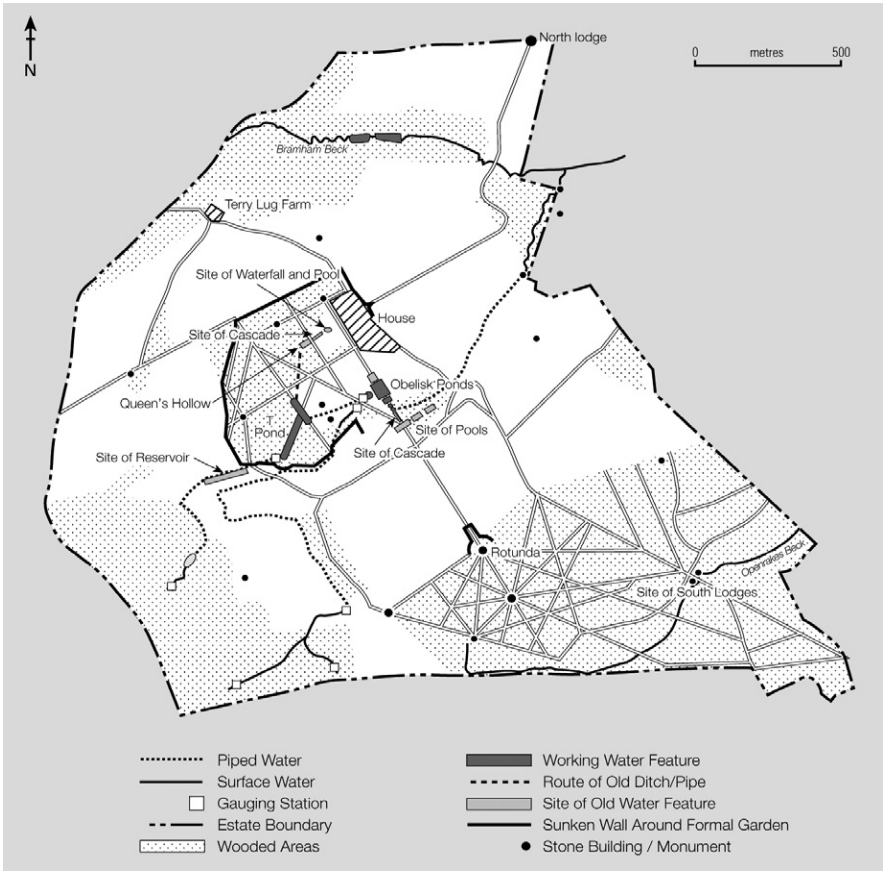

Figure 1. Map of main water features at Bramham

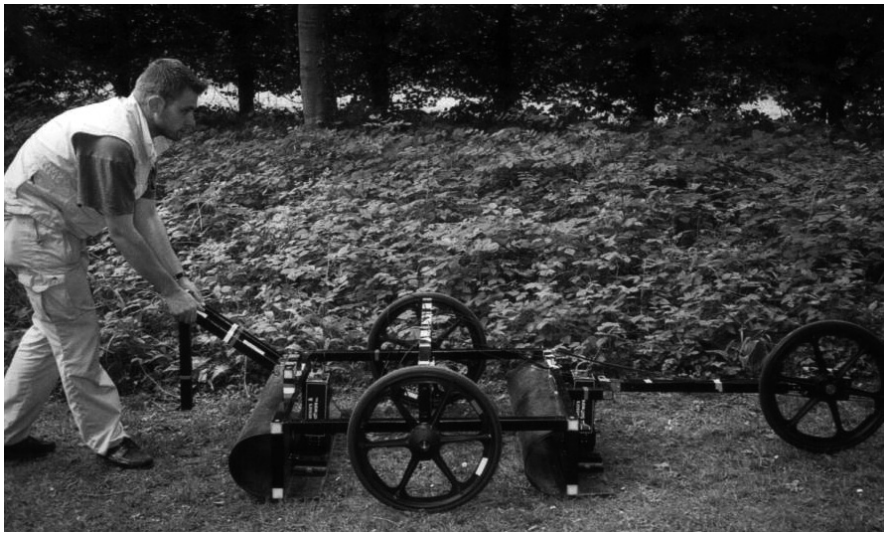

Figure 2. Surveying the old water features at Bramham using GPR

Figure 5. The main Obelisk Pond

linking water level to discharge. The discharge was also automatically recorded at four other sites (Figure 1) to allow determination of where there were leaks or inputs.

Figure 7 shows the discharge for the spring supplying water to the T Pond and the amount of water received at the T Pond. It is evident that there are large gains between the two sites. Because water is piped for most of the distance between the two sites, the extra inputs of water are restricted to hillslope runoff running down into the open stream

Figure 3. The T Pond

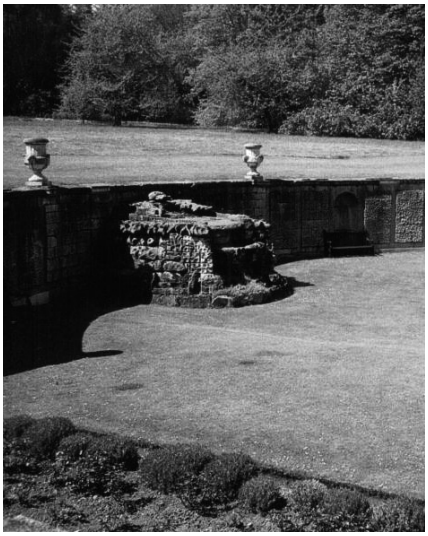

Figure 4. The old waterfall and pond in Parterre once supplied by water from another pond and 30-step cascade which in turn were fed by the T Pond

immediately downslope of the spring.

This shows that while piping the whole course of the system might seem useful in order to prevent sedimentation and remove the need for ditch maintenance, it would result in a large reduction in available water supply. This is because the spring water alone is not the main source of water.

Figure 7 also plots the amount of water reaching the Obelisk Pond system. While there are some losses between its supply springs and the ponds, repairing these leaks would still not be enough to feasibly allow restoration of the Obelisk cascades. This is because each of the two major cascade systems (Obelisk Pond and Queen's Hollow – see Figure 1) would need around 8-10 litres s^{-1} to operate in a satisfactory way. For most of the year this would not be possible.

However, if water reaching the T Pond was added to water reaching the Obelisk Ponds then restoration would be possible for one set of cascades but this would only work during wet winter periods. Nevertheless, this could be achieved by re-routing water from the T Pond to the Obelisk Ponds.

Figure 8 may provide some clues as to why there is insufficient water supplying the water features. This plot shows that there are daily fluctuations in discharge from the springs.

This feature could be caused by instrument readings affected by temperature, groundwater tides resulting from lunar cycles, daily evaporation or groundwater abstraction.

The first three of these factors can be discounted since temperature and tidal cycles are not coincident with discharge fluctuations and the instruments have been carefully calibrated for temperature effects. It is likely that some form of abstraction is taking place which may be affecting supply to Bramham Park.

It should be noted that while the supply springs are within Bramham Park, the topographic boundary to the catchments is not, and in any case groundwater catchment areas can be very different from that expressed by surface topography.

Thus, factors outside of the Estate can affect hydrological processes within the Estate. Farming activity, for example, can influence the nutrient status of the water through leaching of fertilisers into groundwater and may well lead to the frequent algal blooms seen in the summer on many of the ponds. In other words, hydrological management and conservation within any given area often requires not only working outside of landowner boundaries but often outside of topographic catchment boundaries too.

Options for restoration

Many of the ponds (just like the great Yorkshire canals) were lined traditionally with puddled clay. However, some ponds, such as the T Pond, are leaking or are completely dry. Puddled clay requires relining every few decades and this will be the first step necessary at Bramham before any of the other restoration work can take place.

There are then three main options for restoration:

Figure 6. Dragon's mouths at the Obelisk Pond in January 2003 which once supplied water to a long flowing cascade (For most of the year the flow is much less than shown in the figure)

originally supplied with water and we also know that the spring supply system is currently inadequate. Changes to Yorkshire precipitation totals or seasonality over the next few decades are unlikely to alter this.

Nevertheless, there are a range of solutions that can be adopted at Bramham and the owners, Nicholas and Rachel Lane Fox, in partnership with English Heritage and the University of Leeds, are keen to see the project fully completed over the next few years.

This will enable an important part of the UK's cultural heritage and landscape to be brought back to life, rivalling landscape gardens across the world. We are fortunate to have such a place in our region.

- prevent abstraction (which is occurring far outside the Estate);
- re-route water and restore only one cascade system; or
- route the water as in the original Park design so that there is always water moving through each of the ponds and cascades and then supplement low flows during the summer using recirculation pumps at the cascade sites.

The latter two factors would not result in any change to the present hydrology and river regime downstream. The first and third options would be the most satisfying as they would ensure conservation of this rare landscape design. The third option would offer the best return for investment as, even if abstraction was prevented, this would not necessarily guarantee the fully flowing cascade spectacle all year round and it would limit water resource use elsewhere.

Landscape conservation

While the research discussed above has concentrated on water features in the formal gardens at Bramham, one of the best assets of Bramham is the landscape of the Park as a whole. Forming this landscape there is a range of plantations, rides, walks, buildings and stone monuments which are supplemented by water features such as fish ponds and stone arch bridges along Bramham Beck and Openrakes Beck (Figure 1).

In order to fully restore and conserve the features of this rare and historic seventeenth century landscape, the Bramham Estate will need to work in partnership with landowners and water users outside of the Estate boundary and even those outside of the visible catchment boundary because the groundwater system transcends surface topography.

Furthermore a huge investment will be necessary. The first stages have now been completed; we now know through geophysics how the features were

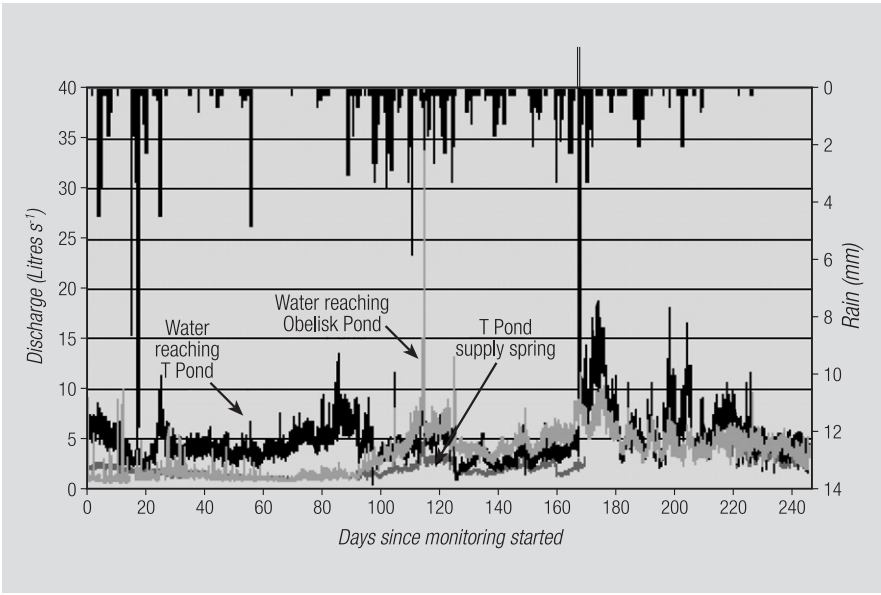

Figure 7. 15-minute discharge and precipitation (vertical bars) for three sites at Bramham since July 15th 2002

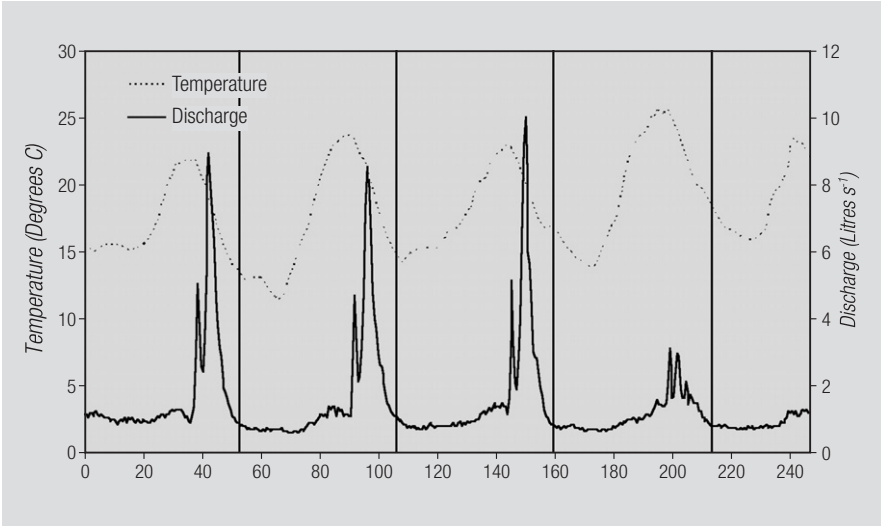

Figure 8. Daily discharge cycles for a spring at Bramham for a 4.5 day period during August 2002