Visit to Harry Clarke's Hydro Installation, 6 July 2024

Keith Andrews

Ten members visited the hydro-installation (mill!) at Sherborne St John. We were warmly welcomed by the owners Harry and Devika, and would like to thank them for being such informative and enthusiastic hosts.

Progress has been impressive since Ruth and I last visited in early 2020, with the mill building almost complete and the gardens neatly laid out.

In action – *Keith Andrews*


Harry & Devika – *Sheila Viner*

Over refreshments in the function room in the new mill building Harry gave a short talk about the hydro-installation and some of the successes (and pitfalls!) of undertaking such an adventurous project, and which required great ingenuity.



The mill building forms the dam; inside is a function room – *Ruth Andrews*

Then we had the 'tour' to see the mill pond and its overflow system, the inlet for the ram pump, the headrace with its automatically controlled sluice, and the garden where the outlets from the underground overflow spillway and tailrace have been made into features. After admiring the wheel and cascade at close quarters, we went into the building to see the gearbox, alternator, and specialised electrical control equipment.


Pond and overflow – *Sheila Viner*


Ram pump inlet – *Keith Andrews*

Headrace – *Keith Andrews*

Automatically controlled sluice – *Sheila Viner*

The tailrace outlet is a garden feature
Keith Andrews

The 1890 shed moved from alongside the mill which housed a steam engine – *Sheila Viner*

Following are some points from Harry's talk; a more detailed account about the hydro-installation is in his article in newsletter 128 (spring 2020).

The site: It was Sherborne (Corn) Mill, an original mill site dating back to Domesday. The 1797 mill was in ruins; the bypass tunnel, control sluice, and wheel pit remained but in poor condition. The mill pond was full of silt and reeds.

Why rebuild the mill? The earth dam was unstable and so a retaining wall was required; the retaining wall needed to be L shaped, and piled, given the poor soil condition; water was flowing through the middle of the site anyway.

The wheel: Overshot, 3.8m diameter steel constructed as a specialised one-off by Smith Engineering of Maryport, Cumbria. It is rated at 3.4Kw at 8rpm. It was commissioned in 2018.

Top: The site as found in 2015
Bottom: Installing the wheel – *Harry Clarke*

Fundamental learnings:

- A Dutch Archimedes screw was considered, but it would have been ugly, dangerous, and too expensive.
- Overshot is a great choice because of its high efficiency in turning potential energy into kinetic.
- Climate change will change things in the lifetime of the installation.
- Do not undersize your waterways – multiply by a factor of 4 from the maximum known flows.
- The bureaucracy is overwhelming – to some extent do it first and then seek forgiveness rather than permission upfront.

Site-specific considerations:

- It is spring water which deposits limescale – this protects but clogs. There is as much as one inch of deposition per year.
- Think about the run-off in your catchment area from newly built hard surfaces from new house-building.
- A mill pond will gather silt; it's a dam.
- Following the collapse of Toddbrook Reservoir's dam in Whaley Bridge, there are new restrictive rules for dams of certain size reservoirs, and they now require inspection. Fortunately this one is small and exempt.

Mechanical learnings:

- The torque involved is colossal.
- Do not weld anything – flexing will cause propagation of the inevitable microscopic cracks in welds.
- Mechanical devices wear and fail – have a maintenance routine and a budget.
- Ensure there is a designed break point, such as the rubber coupling in this case.
- Gearbox cooling is required. There is a mechanical fan!
- Safety is a factor.

Alternator, gearbox with fan, Fenner-flex rubber coupling – *Keith Andrews*

Things that worked: Spherical roller bearings; they are bombproof; the Brevini Italian-made gearbox; the electric synchronisation box from Sustainable Control Systems; home-made automatic electric control actuator (using hospital bed parts!) for moving the sluice gate.

Things that didn't:

- Dunlop tyres for the break point – use genuine Fenner-flex.
- The undersized shaft, originally 80mm, replaced by 100mm.
- Keyed or welded connections between the hub and shaft, replaced by a new hub connection – a radial wedge with B-loc compression fittings. The failing welds were the cause of a catastrophic failure in January 2023.

The wedge grips by utilizing axial compression to hold the hub in place, while simultaneously using radial pressure to generate an interference fit between itself and the shaft
Harry Clarke

Far left: The catastrophic failure – *Harry Clarke*

Left: The broken axle (with limescale build-up) – *Ruth Andrews*

Below: With a roof over the wheel, a special 'spider-crane' was needed to extract and replace the wheel after the axle broke – *Harry Clarke*

Summary:

- The power generation has been about 20Mwh per year.
- It has taken several years to get this site generating smoothly.
- The cost/benefit is questionable, however, the waterwheel undoubtedly allowed the development of the site. (*Editor: The ongoing environmental benefit will be considerable.*)
- Used ground-mounted solar panels would have been far more cost-effective but less challenging or fun, but a few have been added to the shed in the garden.
- Unlike solar, the electricity is produced at the times that it is needed.
- The site's expected lifetime is 200 years with a machinery refresh every 25.

The new mill building – *Keith Andrews*