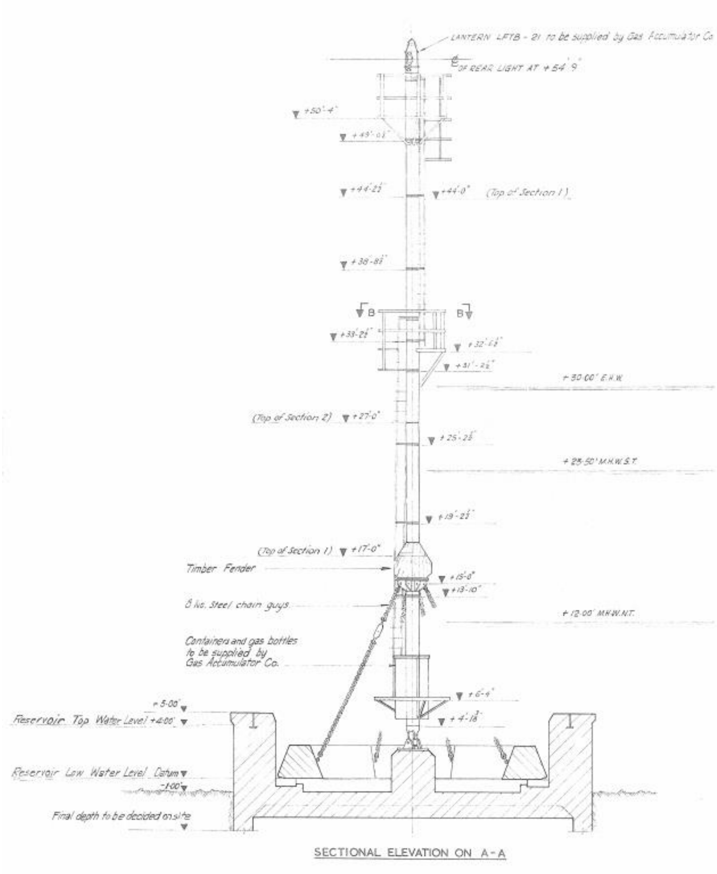
Narlwood Leading Marks and Lights – 1900 to 2018

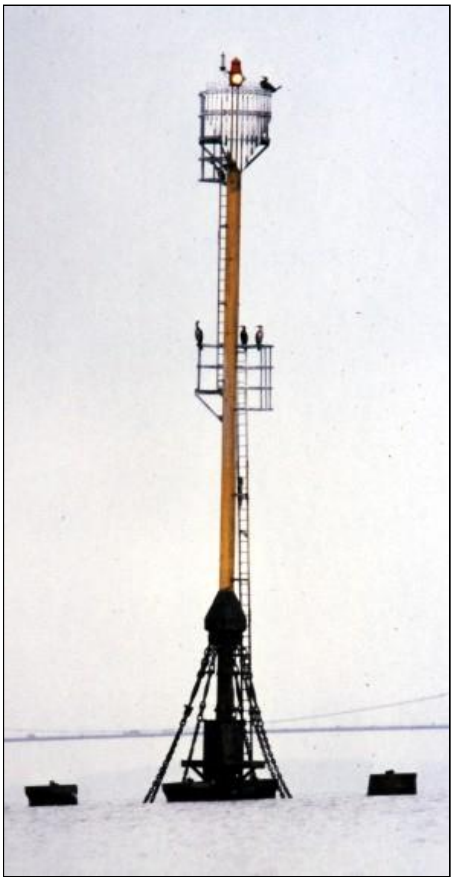
The original installation established in 1900 comprised fixed white lights (oil burning) on timber poles *(see cover)* supported by chains attached to pegs driven into the rock. The lighting was changed in 1926 to gas-powered automatic flashing white lights. The timber posts thus remained in place for over 60 years, just a few years longer than the steel columns which replaced them in 1964.

The construction of the nuclear power station at Oldbury in the early 1960s brought with it a requirement for an uninterrupted supply of cooling water. This was provided from an offshore reservoir which was created by the installation of over 4.5km of concrete wall over the flat surface of the Narlwood ledge, adjacent to the power station site.

The wall would retain a depth of water of up to 1.2m which would keep the power station supplied with cooling water during periods of low tide.

The old timber posts and support chains would thus no longer dry out with the tide to facilitate maintenance. They were replaced by the CEGB in 1964 by a complex design (by Rendell, Palmer & Tritton) of "self-righting" beacon, which resisted toppling by tensioned chain connections from the steel column to a heavy, submerged concrete ring.





The gas lighting was replaced by solar panels and batteries in 1987 and following failure of the synchronising cable laid between the two beacons, l.e.d. lanterns featuring GPS synchronisation were fitted in December 2005.

The vibration induced by the fast-flowing and heavily silt-laden estuary water caused wear in the links of each of the eight supporting chains, and regular attention was required to remove the slack in the chains by adjustment of the heavy rigging screws that were part of the chain support system. Beneath the water it was necessary to periodically replace the shackles which attached the chains to the concrete counterbalance ring.

By 2009 major wear had been noted in the underwater terminations of the chain guys, and the chains were reduced in number from eight to four at each beacon, the four remaining being connected to the underwater components showing least signs of wear. This was a far from satisfactory arrangement, and since the power station operator (Magnox) was unwilling to replace the beacons, additional measures were considered to compensate for the increasing wear taking place to the remaining components.

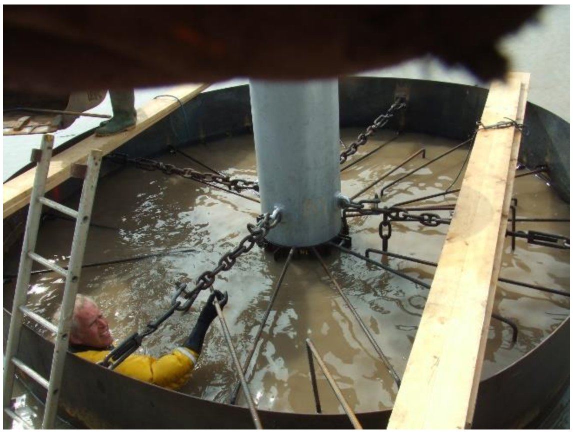
In July 2015 GHT fitted tubular legs to each of the beacons. These were of a 'telescoping' design which permitted adjustment of the beacon towers to a vertical position, at which point the telescoping sections were welded together thereby providing rigid support to the beacon towers.

By the middle of 2017 welded joints at two of the legs at each beacon had failed as a result of the heavy vibrations set up by the vortices which developed around the legs in the fast flowing water. Temporary repairs were effected by installing sleeves over the affected joints, but a more permanent solution was required.

After lengthy discussions, Magnox eventually agreed to the installation of two new beacons in early 2018. The problem of how to install new towers in an economical manner in an underwater environment was resolved by a proposal to position two mass concrete bases on the rock bed of the reservoir, onto which the new towers could be attached.

Calculations carried out by a qualified civil engineer specialising in marine work confirmed that the proposed dimensions of the bases and beacon columns would resist the overturning and shearing forces exerted by the water and wind flows with a significant safety margin. Historic float test data and local flow measurement were used to establish maximum possible flows of 2.5m/s (5kts).

Thus two mass concrete bases (3.8m diameter x 2.0m high) were installed on the rock bed of the reservoir in early June 2018. Set into each base is a 3.0m flanged 'stub' onto which the above-water tower sections would be bolted; steel reinforcing bars also being attached to both the stub and the circular base formwork to provide additional strength.

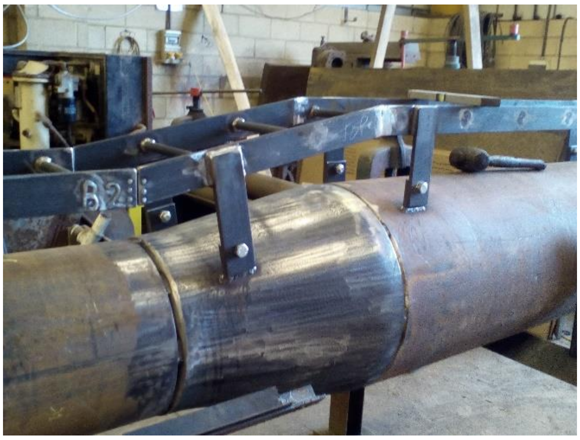


The base formwork, fabricated by Sharpness Shipyard, included a means of adjusting and maintaining the flanged stub in a vertical position during the concrete pour. The bases were positioned carefully to ensure that the new beacons would be exactly aligned on the required navigational bearing.
The concrete was mixed on-site in batches; the first batch being poured through the water (all mixes had additives to reduce the risk of washout) to fill the formwork to a depth of around 600mm. During the subsequent low tide the formwork was pumped out and the remainder of the concrete poured in dry conditions. Each base has a submerged mass in excess of 300kN.

The new towers were fabricated by Sharpness Shipyard and were designed to be capable of being lifted with equipment that was locally available to contractors. Of particular benefit was the incorporation of a hinge which, once connected, would hold the lower part of the column safely in place during lifting operations and ensure that once upright the flanges would be in perfect alignment. This arrangement worked very well, reducing strain on the lifting equipment, reducing risk to personnel and enabling the installation work to be carried out swiftly. The columns are fabricated from 500mm x 10mm reducing to 350mm x 10mm steel tube, galvanised and painted.

The installation of the columns was carried out on 12/13 July 2018 by GHT staff and local contractors.

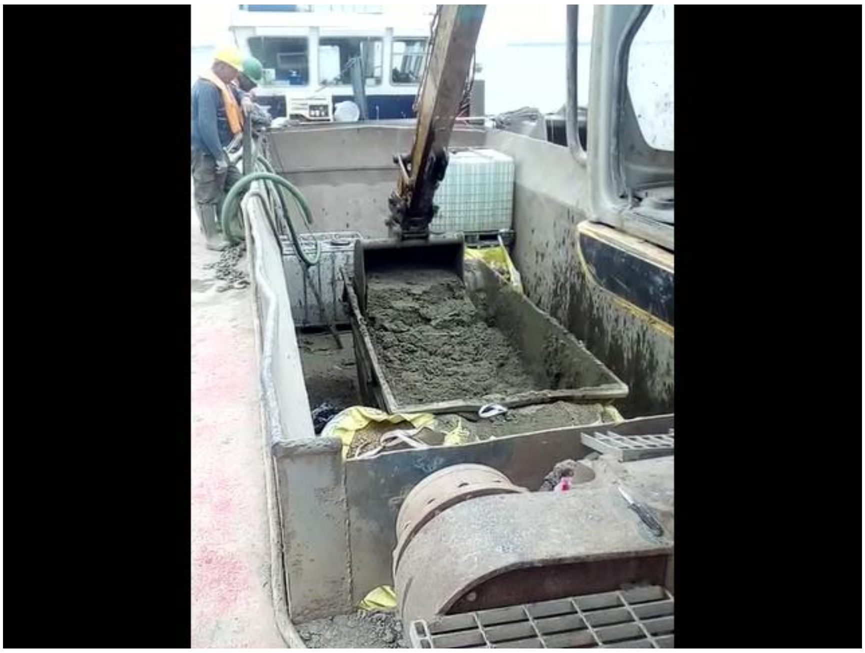
New columns under construction, Sharpness Shipyard.



Reinforcement to base flange, hinge arrangement (prior to fitting of reinforcement), taper section, columns during painting, top gallery/platform.

Mixing the concrete.

Cement was provided by Dragon Alfa (Sharpness) in 1,000kg bulk bags and ballast from Cullimores in 900kg bulk bags. Potable water was pumped from IBCs carried in the hold.



The concrete was mixed in a skip (*left*) aboard the 'Riparian' in batches of about 5 tonnes. Although additives (Sika UCS) reduced the workability time considerably, a plasticiser was added to the water to improve workability prior to pouring and to reduce the overall water content.

The mixed concrete was placed into the steel formwork directly from the bucket. The consistency of the concrete after mixing was stiff due to the admixtures used, but very little washout of fine material was noted. The formwork was pumped out following the initial pour and the remainder of the concrete was added in dry conditions.

Participants in this project:

Sharpness Shipyard & Drydock
Dragon Alfa Cement
Cullimores Aggregates
Guagan Jackson
Sharpness Dock Limited
F C Larkham & Son Ltd