



W E L M O R E L A K E S L U I C E
R E C O N S T R U C T I O N



ENVIRONMENT AGENCY

A B O U T T H E O U S E W A S H E S

The Ouse Washes are the largest example of regularly flooded washland in Britain. Surrounded by the most fertile agricultural land in the country, the Washes protect over 29,000 hectares of high quality fenland, including 830 residential properties. The Ouse Washes hold a special ecological significance as one of the last remaining regularly grazed freshwater marshes. Internationally important numbers of migrating wildfowl including Bewick's and whooper swans, teal, widgeon, gadwall, shoveler, pintail, pochard, tufted duck, coot, mute swans and cormorants visit each year. Conservation groups such as the RSPB, and The Wildfowl and Wetland Trust have sites in the area. The Washes have been designated a Site of Special Scientific Interest, a Special Protection Area and a RAMSAR site.

The Washes are an intrinsic mechanism that depends on the maintenance of an open grassland that is regularly flooded in winter, but as dry as possible in summer. Recently, however, summer flooding has increased, threatening both the agricultural and domestic residents as well as the many rare species of birds and other wildlife.



The Ouse Washes in flood

I M P O R T A N C E O F W E L M O R E L A K E S L U I C E

The sluice at Welmore Lake is the only means of removing water from the Ouse Washes into the tidal Hundred Foot River. From there, excess water drains into the sea.

Welmore Lake Sluice must deal with a double threat to the environment. It is there, 20 km south of King's Lynn, that the River Delph and the tidal River Great Ouse meet. The sluice holds back waters stored on the Washes during a flood. Once the peak flood has passed, it allows these waters to flow through and rejoin the Hundred Foot River and so to the sea. The structure must also keep saline water from the Tidal River out of the River Delph and the Ouse Washes.

History

The importance of the Welmore Lake site was recognised long ago. In 1756, more than 100 years after the first attempts to drain the area, it was decided to construct a new embankment across the Washes at Welmore Lake. For the first time the Washes were protected against tidal flooding. However, the method was not sophisticated. The only way to let the waters out following a flood was to deliberately breach the embankment, which would be reconstructed once the flood was past.



L O C A T I O N

O B J E C T I V E S F O R R E C O N S T R U C T I O N

After 60 years the sluice had come to the end of its design life. In 1997, the Environment Agency began work on the new sluice. Specifically, the objectives of the programme included:-

Relocation

The new sluice is relocated 70m downstream of the older structure. This is a key factor in reducing the problems associated with siltation as the sluice is now closer to the confluence with the Hundred Foot River, resulting in an improved discharge of floodwater into the Tidal River.

Increased Capacity

Three sluiceways were built, instead of the existing two. This has increased the amount of water that can flow through the sluice by 50%.

Permanent Pumping Facility

This is a major improvement which has two significant benefits:

- The new sluice incorporates two separate land drainage pumps, used to evacuate the last remaining volume of flood water which cannot be discharged by gravity into the tidal Hundred Foot River. Provided there are no high flood flows during spring and summer, which would cause the flood control sluices at Earith to operate, environmentally beneficial target water levels in the River Delph can be achieved and maintained.
- The permanent pumping facility replaces the temporary one which did not adequately discharge summer floodwater. The new installation, with a total of six discharge points, can also be used to facilitate the dispersal of silt in front of the tidal gates.

Silt Jetting

Although repositioning the sluice helps to alleviate the problems of siltation, it is not the complete answer. To further combat this problem and ensure that the tidal doors can always open when needed, a purpose built system of high pressure silt jetting nozzles has been incorporated into each of the tidal pointing doors. When the sluice is not discharging water, this equipment can be operated, thus avoiding a build up of silt in front of the pointing doors.

Pipework within the piers of the new sluice for land drainage pumping



Temporary pumping at the 1933 sluice

RECONSTRUCTION DETAILS

The Contractors

Separate contracts were awarded for the civil works and the mechanical & electrical works. The team comprised:-

- Project Management - The Environment Agency
- Consulting Engineers - Lewin, Fryer & Partners
- Civil Contractor - Jackson Civil Engineering
- Mechanical & Electrical Contractor - Waterlink (UK)



Timing

Work began in July 1997 and was substantially completed in September 1999. It is interesting to note that during this period the 1933 sluice was required to deal with the Easter Floods of 1998, evacuating some 60 million cubic metres of water over a period of several weeks.

Cost

The overall cost of the two year project was £5.2 million. The reconstruction is a major part of the £8 million Ouse Washes Flood Control Strategy which will have flood defence benefits of over £70 million.



Temporary cofferdam



The new structure within the cofferdam



Mitre gates





The 1825 sluice



The 1933 sluice

This less than ideal method was used until 1825 when a sluice was first built at Welmore Lake. This was a timber and brick construction with four sluiceways, which lasted over 100 years.

A new sluice constructed from reinforced concrete and steel was completed in 1933. Although this later construction had only two waterway openings, these were bigger and more efficient than the four openings in the earlier construction.

Problems with the 1933 Sluice

The sluice was built upstream of the original structure to avoid tidal flooding during construction. Although this helped the construction work, it eventually created problems due to a build-up of silt. As the structure was now further away from its outfall into the Tidal River, silt began to build up immediately in front of the tidal flap gates which inhibited the flow of waters and prevented the tidal flap gates from opening when required. This resulted in the need for dredging during the summer period.

Over the years, the tidal flap gates became distorted because of their susceptibility to damage from trapped debris, resulting in inadequate protection against saline and silt incursion.

Expensive temporary pumping equipment had to be used, particularly in the summer months, when gravity alone is not sufficient to get all the waters through and off the Washes.

From Kings Lynn



NEW THREE SLUICEWAY SLUICE OFFICIALLY

Technical Interest

The reconstruction was an ambitious project with interesting technical details:

- Temporary cofferdam. A cofferdam is a watertight structure which allows underwater structures to be built in the dry. The new sluice was built within a temporary cofferdam, 45m in diameter. A length of the south bank of the River Delph was excavated to divert water flow around the cofferdam, thus ensuring continued management of the Washes during the rebuilding of the sluice.
- The sluice has three upstream vertical steel mitre gates, approximately 7.4m wide and 6.7m high, each weighing 25 tonnes.
- The three pairs of mitre gates, made of ekki timber, are 4.7m x 7.0m and each gate weighs 12 tonnes.

The permanent pumping installation utilises two submersible canister type pumps installed in chambers in the upstream end of the piers. Their combined capacity is 1.5 cubic meters per second.

The completed structure - viewed from up stream



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LOOKING TO THE FUTURE

The new sluice discharges 50% more water than its predecessor. Its permanent pumping facility will improve the summer drainage of the Washes. Relocation of the structure along with the installation of silt jetting equipment will reduce the consequences of siltation.

The importance of the Welmore Lake sluice in the fight against flood cannot be overstated. It is a crucial element of the Ouse Washes Summer Flooding Strategy. The strategy will improve the drainage of the Washes and could reduce the duration of summer flooding by half.



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