



# Middle Level Commissioners

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## St Germans New Pumping Station.



The new pumping station replaces one built in the early 1930s and at 100cumecs has a capacity some 42% greater than that of its predecessor. It has cost £40M of which £26M has come from government grant-in-aid. The remainder was funded through a 30 year public works loan and from reserves. The station is owned and operated by the Middle Level Commissioners who were created by Act of Parliament in 1862. They are similar in function and size to a large Internal Drainage Board but additionally control approximately 120km of navigation.

The station is the only drainage outlet for 700km<sup>2</sup> of land, much of which is high grade agricultural land, and which encompasses 22,500 houses and 3,500 businesses. These together were valued in 2004 at £3.6 billion. This region is often referred to as England's 'Bread Basket' and it is not difficult to see why when viewing the landscape. The fenland area, however, is very flat being originally composed of peat and is shrinking, hence much of it is now at or below sea level. The lowest area is furthest inland (close to the A1(M)) being as low as 4m below sea level. This water will have been pumped twice before arriving at St Germans.

Construction of the new station started in December 2006 and continued until the summer of 2011. The new station became operational before all works had been completed on site on April 26<sup>th</sup> 2010 when it took over pumping duty from the old station which was then demolished.

To facilitate the works £0.5M was spent on upgrading a local road to take construction traffic, £0.2M on undergrounding existing overhead electricity cables and £0.8M to replace and upgrade the existing electricity substation. A temporary bridge was built and a 1.7km haul road constructed to ensure that the construction traffic avoided passing through the village within which the station sits.

The station which was architect designed has many unique features which are described later and is dominated by the large glazed frontage and black cladding, which helped it win a local design award recently. Construction for tender purposes was divided into the pumps, the mechanical and electrical equipment and the civil engineering works. Each element was tendered separately with the glue linking them being a jointly agreed programme. The successful tenderers were KSB/Bosman (joint venture), Birse Water and Costain respectively. The design was carried out by Atkins Water, who also supervised the construction.

The station is built on-line and hence it was first necessary to locally widen the channel and then to install a cofferdam within which the station could be built. The cofferdam was of the twin wall cellular type and was formed of 16 cross tied cells filled with granular material to create a rigid structure. The external face which formed a tidal barrier utilized 21m long piles driven down into clay.



Some construction facts and figures are given below:-

### *Civil Engineering Works*

- 3912 cubic metres ( 940 tonnes) of concrete for the base alone.
- 13,000 cubic metres (31,000 tonnes) of concrete for the station.
- Rests on 465 continuous flight auger piles, which if placed end to end would span nearly 6km.
- 220 tonnes of steel frame.
- Suction bays each 10m wide x 6m deep.
- Discharge channels 3.5m wide x 3.75m deep.

### *Mechanical*

- 6 pumps, type: Axial flow concrete volute.
- Impeller diameters: Major 2.65m, Minor 2.10m.
- Impeller material: Tin bronze, weight 5 Tonnes.
- Pump weight 19.1 tonnes plus 10 tonnes of seal water.
- Gearbox, type: Planetary, vertically mounted with 7.7 reduction.
- Gearbox weight 4.5 Tonnes.
- Motor: 6 pole, fan cooled vertically mounted weight 4.7 tonnes.
- Total pump and drive train weight including support frame, couplings and seal water 48.5 tonnes
- Overhead crane maximum load 25 tonne.

### *Electrical*

- Main supply voltage 11,000v.
- Supply to pump motors 690v.
- Main pump motor rating 1.25 megawatt @ 990rpm.
- Main pump drives: ABB ACS800 inverter drives.
- 6 Pump generators: 12 cylinder caterpillar diesel with a maximum electrical output of 1700kVA prime. (Eg 1360kW @ 0.8 power factor).
- 240,000ltrs of diesel storage for long periods of continuous pumping without reliance on external power.

## Pump Capacities

- Max flow 22 cumecs (22,000 litres per second or 22 tonnes per second)
- Max head 8.5m
- Duty flow 16.67 cumecs @ 4.25m static (4.85m total head) @ 127rpm
- Theoretical station output approximately 100 cumecs, but would be less or more dependent upon tidal conditions.

## *Control options*

- Fully automatic: No day to day human intervention required.
- Manual with automatic start/stop sequencing.
- Fully manual in the event of PLC failure.

The station has many features which reflect how critical its function is to the people who live and work in the area. Amongst these are the inclusion of a full set of backup power generators and enough fuel to run all pumps for ten days without a break. Also a live link is incorporated within the SCADA (supervisory control and data acquisition) station control which monitors water levels 46km upstream and is used to adjust how much water is pumped by the station to ensure that the effects of lowering water are not just local but extend into the heart of the district. Perhaps quite surprisingly the station has been designed to cope with internal flooding. This was included following a tidal defences breach analysis which modelled a scenario of a 300m long breach occurring and being in place for several weeks. In such circumstances the station would flood but could continue to operate until the breach was repaired.

Station control is via a variety of automated and manual modes which can be monitored and adjusted locally and remotely from office, or if necessary from home, by key designated personnel and whilst the station is largely unmanned for the bulk of the time security is covered by 24 hour 7 day per week CCTV monitoring with links to police and fire brigade.

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