

# Three possible reasons for failure of anti-flooding system

Investigations by the Land Transport Authority could not definitively establish what led to the Oct 7 flooding incident, though the LTA said it was down to "a lack of proper maintenance, supervision and audits".



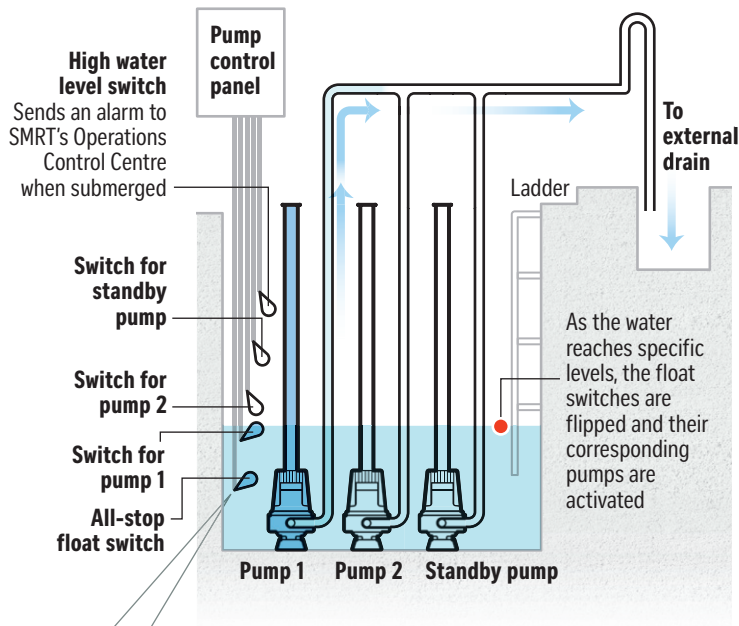
**1** The lowest float switch, which would have activated the storm water sump pumps, was impeded by accumulated silt and sludge in the Bishan storm water sump pit.



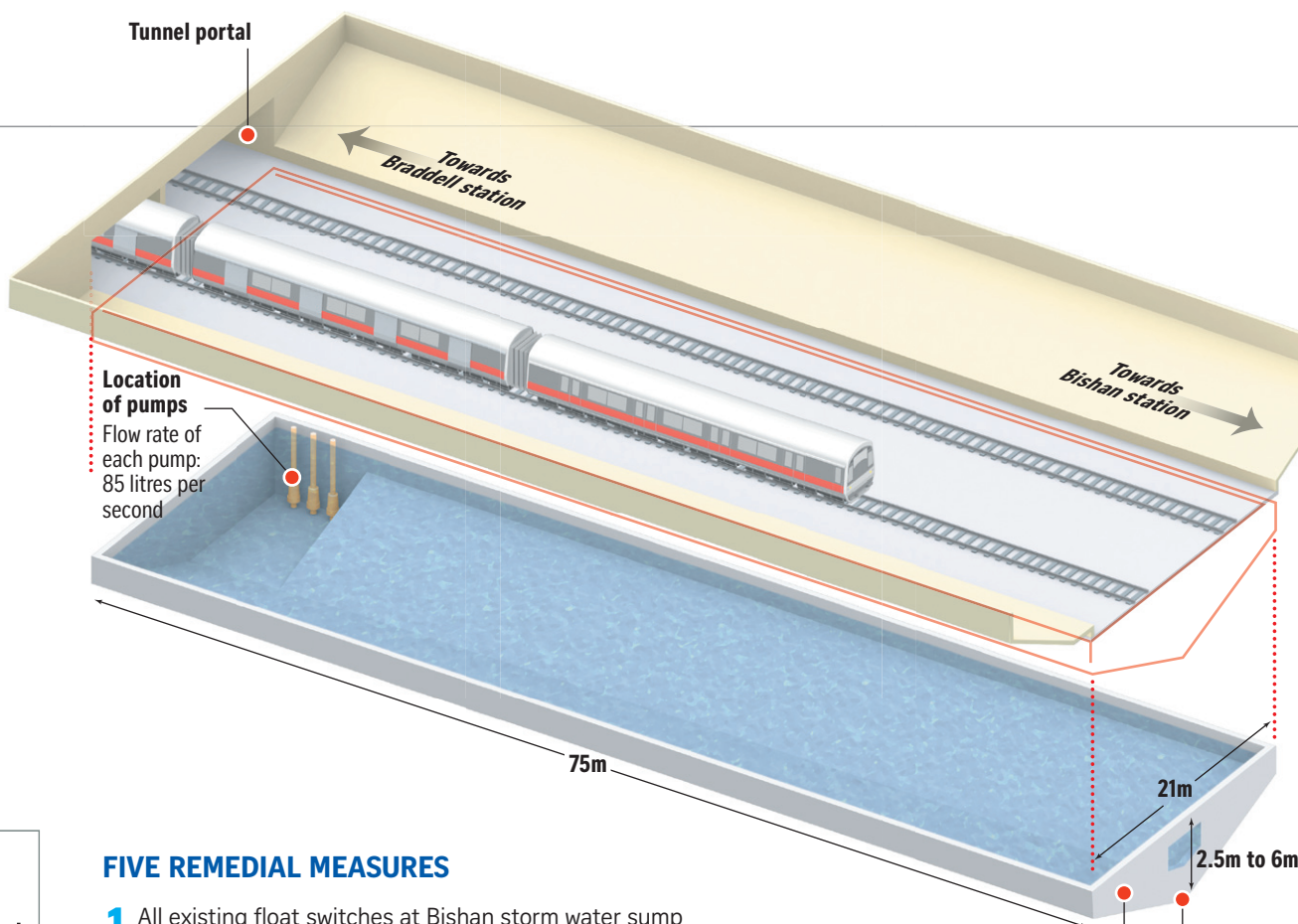
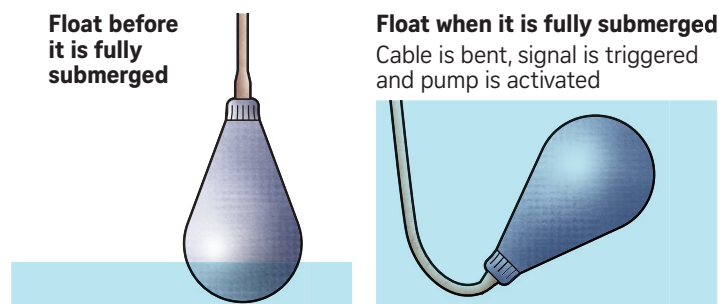
**2** Floating debris in the pit could have impeded the normal functioning of the float switches, in particular the highest float switch, which alerts SMRT's Operations Control Centre to high water levels.

**3** An SMRT maintenance team which conducted corrective work on the pump system on July 13 could also have left the pump controls in manual mode after their work was done.

## THE STORM WATER PUMP SYSTEM



## HOW THE FLOAT SWITCH WORKS



## FIVE REMEDIAL MEASURES

- 1** All existing float switches at Bishan storm water sump pump pit replaced by SMRT
- 2** LTA replaced Bishan pumps with heavier-duty ones capable of handling water with sediment
- 3** New radar-based sensor system added to monitor water levels in the pit
- 4** New sump pump control panel installed, located away from tracks to facilitate access during passenger service hours
- 5** Accumulated sludge, silt and debris removed from pit. All non-serviceable pumps on the North-South and East-West lines replaced, with float switches replaced as a precaution

**Storm water reservoir**

- Located under the train tracks between Braddell and Bishan stations
- Capacity: 5,044 cubic metres, similar to two Olympic-sized pools
- Rainfall data shows water could have filled 87 per cent of pit by Oct 7

**Oct 7**

**5.14pm** Train driver reports water in southbound tunnel between Bishan and Braddell stations on North-South Line  
**5.38pm** Water at deepest section of tunnels has risen to almost come into contact with electrified third rail. Passengers made to leave trains, traction power cut off to affected stretch, and services between Ang Mo Kio and Newton suspended until end of service

**Oct 16**

Addressing the media, Transport Minister Khaw Boon Wan said SMRT's maintenance team "has failed us". SMRT chairman Seah Moon Ming bows in apology

**Nov 2**

ST reports that SMRT offers amnesty to rail staff who admit to work lapses

**Nov 7**

Mr Khaw addresses Parliament on flooding issue, says SMRT board will review the remuneration of senior management. He also says while Bishan pumps were found to be in working order, they had been upgraded following the incident. Faulty pumps detected near Kembangan and Lavender had also been repaired

**TIMELINE**

**Oct 8**

**11.06am** Floodwaters cleared by officers from SMRT, PUB, Land Transport Authority and Singapore Civil Defence Force  
**1.36pm** Normal train services on North-South Line resumed following safety and operational checks of tracks

**Oct 31**

SMRT reveals that team responsible for Bishan pump system may have been falsifying maintenance records since December last year

**Nov 6**

SMRT announces disciplinary action against six on maintenance team, investigations on seven other staff

**Nov 27**

SMRT fires eight staff over falsification of records. Three others disciplined, while two quit