LIDOTT APPLICATION:
TIDAL INFLOW AND INFILTRATION

Coastal communities are at an especially high risk for inflow and infiltration (I&I) as high tides, rising sea levels and oceanic flooding can cause saltwater to enter the sewer system on a regular basis.

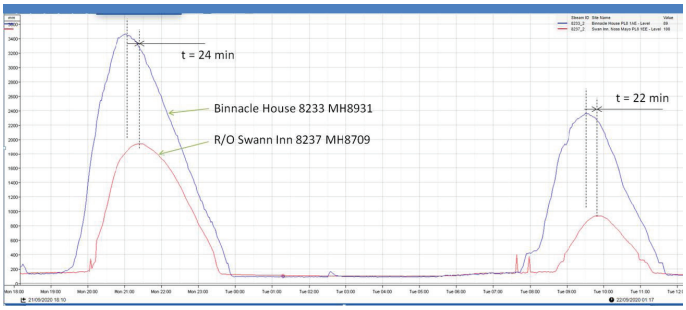
Tidal inflow is defined as seawater entering the sewer system through direct connections such as backflow from overflows. Infiltration occurs when the groundwater enters through broken and defective pipes.

In the following example the purpose of the I&I study was to identify the source and uncover the impact of saline I&I on the sewer network.

The fast rate of rise and high tide levels limits the use of traditional non-contact ultrasonic sensors and the compression sealed manholes prevents the use of vented pressure sensors.

The LIDoTT was selected to gather seamless level data throughout the sealed part of the waste water network under both normal and surcharged conditions and a raingauge was used for reporting surface water.

The horizontal or detailed point of entry is then calculated by evaluating the varying crest height of the transient pressure



between the four monitoring nodes, and the time of transition between the crest traveling along the sewer network.

The above data shows the crest height and time taken for it to be present at MH8709. Time of travel = 9.402m/min

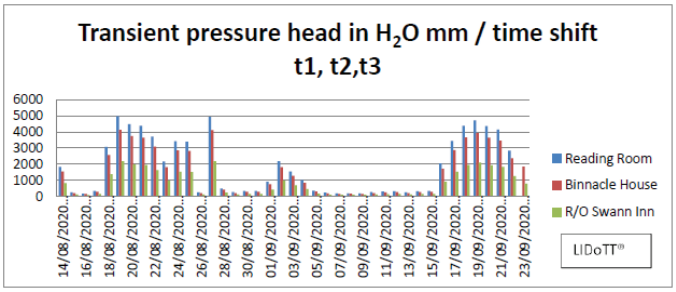
Using this information together with the known height above chart Datum (750mm), it is possible to estimate where the entry point of the river is.

High Tide GMT		
	Time	Height (m)
21/09	20:44	5.47
22/09	09:08	5.25

Transitional distance for crest = 216.25m/23min

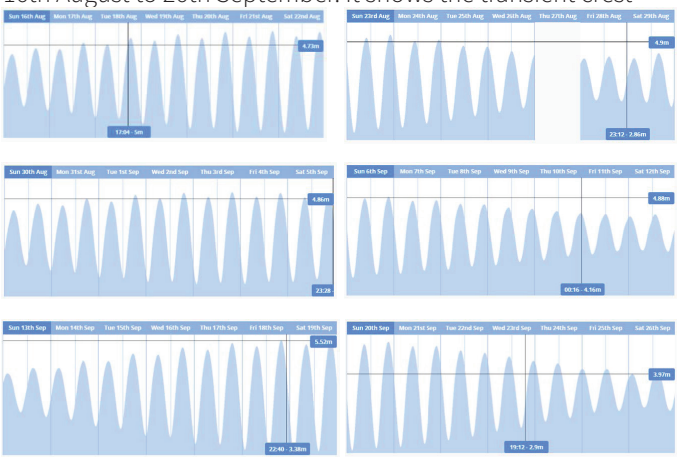
t_x = 9.402m/min

Note: pipe and chamber geometry has slight influence on the transient timing tx and should be taken into consideration when calculating confidence levels.



The chart above shows the transient time of the crest height in H2O mm traveling between t1,t2,t3 (Reading Room MH8701[t1], Binnacle House MH8931 [t2], R/O Swan MH8709 [t3]). t1 is closest to the high tide, where t3 records the furthest transient crest from the high tide. The LIDoTT® provides seamless data transition between normal condition and surcharge, thus allowing the transient crest H2O m to be mapped through the network.

The data below shows the neep and spring tide for the period 16th August to 26th September. It shows the transient crest



only occurring at heights above 4.95m (Chart Datum) in the waste water sewer network. The LIDoTT® provides seamless data transition between normal condition and surcharge, thus allowing the transient crest H_2O m to be mapped through the network.

Transient Crest	Time
High Tide to t1	10 min
t1 to t2	30 min
t2 to t3	23 min

The table shows the time taken for the high tide / Transient Crest to appear at t1, t2, t3.

The data suggests t1 is located close to the entry point, approximately 750mm above chart datum set at 4.2m. Using transient pressure recording from the LIDoTT® (H_2O mm), scaling the spring & neep tides, and a simple timing against distance algorithm, it has been possible to pinpoint with a high degree of confidence where the river is entering the sewer network.

RESULTS

Predicted points of I&I

As a result of the steep catchment, I&I from rainfall precipitation was found to be present throughout the entire wastewater network. The data indicates that high tides below 5m have no influence at this location.

Where peaks in the depth do not correspond with a high tide, or where they correspond with a high tide lower than 5m there is evidence of rainfall which can be attributed to any increase.

Although there has only been a few significant rainfall events, it can be concluded rainfall has a major impact

on the available capacity within the waste water network when coupled with a spring tide.

LIDoTT® Installed in a sealed sewer, with compression surcharge plate.

SUMMARY

Identifying the sewerage infrastructure at risk of damage from tidal and storm events is very important.

Sea water can be damaging to the sewer infrastructure, coroding pipes, steel reinforcements and electrical pumping equipment. It reduces capacity at the wastewater treatment plant and increases the cost of water treatment .

Rising sea levels and an increase in extreme weather events could also cause more water to flow back into the sewerage system. This increases the risk of untreated sewage spilling out into the waterways and causing devasting effects on wildlife and risks to public health.

ABOUT DETECTRONIC

Detectronic Ltd is a water monitoring specialist with its head office based in the North West of England. We work with companies throughout the UK, Europe and rest of the world, helping to prevent flooding, reduce pollution and improve rivers and bathing water.

Detectronic is passionate about quality and efficiency. We are committed to helping customers through an analytical, innovative and creative approach to problem solving.

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