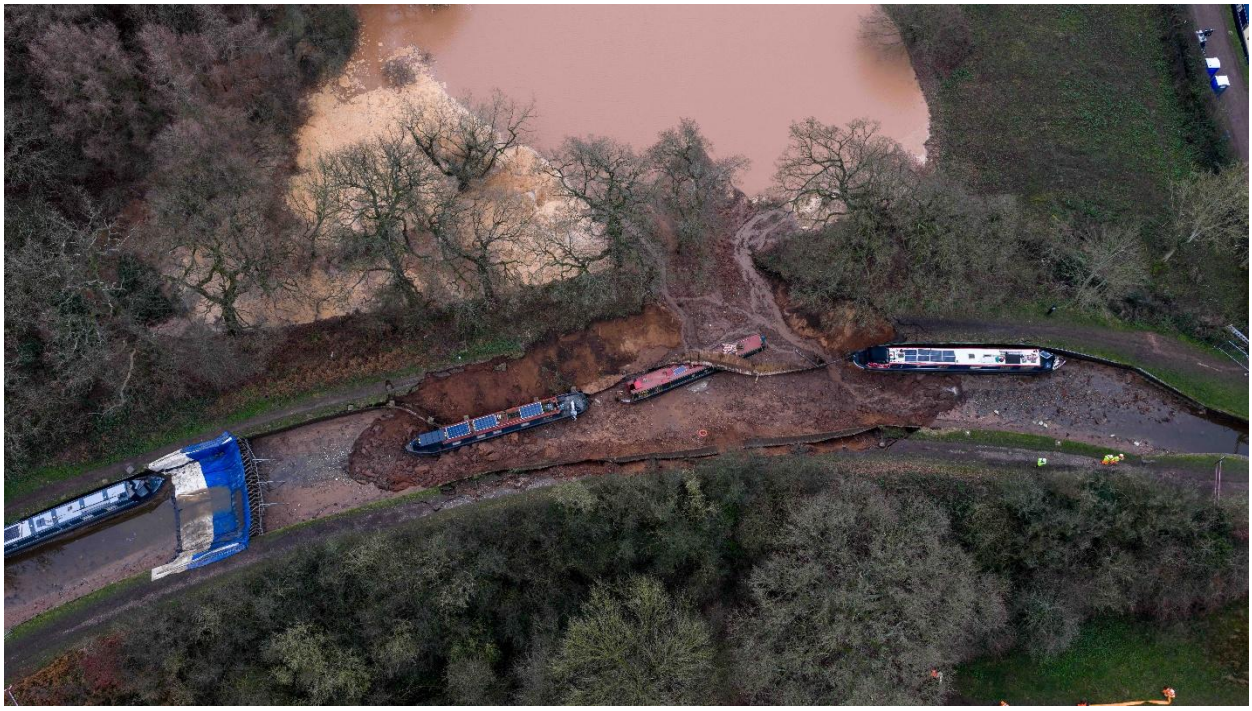
INITIAL REPORT INTO THE LLANGOLLEN CANAL BREACH AT WHITCHURCH, SHROPSHIRE, ON 22ND DECEMBER 2025



INITIAL REPORT
31st MARCH 2026

This document is published by Canal & River Trust

Registered charity no. 1146792

canalrivertrust.org.uk

1. INTRODUCTION

This report presents the initial findings of the ongoing investigation into the Llangollen Canal breach that occurred on 22nd December 2025, at Whitchurch, Shropshire.

The Llangollen Canal is owned and maintained by the Canal & River Trust ("the Trust"), the UK's largest navigation authority, which looks after around 2000 miles of canals and river navigations in England and Wales and their associated infrastructure.

The Trust recognises that the breach on 22nd December 2025 was a deeply distressing and frightening experience for those directly affected and caused significant disruption and uncertainty for boaters and nearby residents. We are deeply sorry for the impact this event has had on individuals, families and the wider community, and we recognise how challenging this has been for those affected.

We would like to express our sincere thanks to the emergency services and first responders whose swift and professional response ensured that everyone was brought to safety. We also want to recognise the calm and prompt actions taken by those at the scene, and to thank the boating community and local residents for their continued patience and cooperation throughout the response, recovery works and ongoing investigation. The Trust is committed to repairing the canal at Whitchurch as soon as possible.

The Trust's preliminary observations are based on its evaluation of the evidence that has been available to feed into the investigation. It has appointed an experienced Principal Engineer, who leads on critical asset work for the Trust and is independent from the teams overseeing this area day-to-day, to investigate the cause of the breach and to draw out the learnings from it. This immediate, Trust-led investigation has drawn on canal expertise and experience to extract the maximum learning as quickly as possible, to inform our inspection and maintenance regimes. The Trust will secure an independent review of its final investigation to provide assurance to the Board.

The investigation is ongoing at the time of writing. It aims to identify the possible cause(s) of the breach and whether it could have been predicted by the Trust's procedures. The conclusions of the investigation will be used to inform improvements to future maintenance and inspection regimes. Its ultimate purpose will be to improve canal infrastructure resilience by identifying features of the incident that may have contributed to the embankment failure, and whose identification could help to mitigate the risk of similar incidents elsewhere. The report identifies a range of initial draft recommendations.

This report is based on initial analysis only; the full investigation requires additional site investigation and inspection which will be completed in the coming months, once those parts of the site still submerged beneath breach debris are cleared.

This initial report analyses historic and current data held by the Trust along with outputs from modelling of soil behaviour and breach characteristics; these modelled outputs will be re-run when full soil sampling and laboratory testing data is available. A final report will be issued once the investigation is complete, which is expected later this year.

The purpose of this investigation is to examine the circumstances surrounding the breach and to understand the factors that may have contributed to it. It has not been undertaken for the purpose of determining fault or legal liability.

A number of interim recommendations and actions are included within the report which the Trust is taking forward with immediate effect.

The report reflects the Trust's current assessment based on the information available at this stage and is prepared in the context of its ongoing responsibility for managing and maintaining the canal network.

Contents

2. EXECUTIVE SUMMARY

This report details the investigation into the breach at Whitchurch, Shropshire, on the Llangollen Canal on 22nd December 2025, an extremely rare but serious incident that has resulted in closure of the canal and towpath until repairs are complete.

The breach occurred on Whitchurch Embankment 2, a high, steep, curved embankment with visitor moorings. Prior to the breach, it had not been classed as an asset of concern or at risk of breaching. It had been regularly inspected in accordance with the Trust's standards, which include a robust inspection regime; no evidence suggested imminent collapse.

Despite the absence of visual indicators, failure of the structure progressed over a short period of time, with no opportunity to intervene. Boats present at the location were drawn towards the breach and several boaters were displaced; a large volume of water drained from the canal onto adjacent farmland.

The initial and still ongoing investigation, led by a Trust Principal Engineer, has explored all plausible contributory factors and delivered its early findings. It suggests the failure was likely caused by a combination of specific physical factors in this location – a steep-sided, very high embankment predominantly constructed of sand – together with suspected slow, low volume leakage under the canal bed over many years.

This long-term leakage, or 'piping', is thought to have eroded material below the canal bed and created a void, ultimately resulting in collapse. The trench sheet pilings that had protected the bank dropped when the void expanded. Modelling carried out to date is preliminary and further testing and analysis will be needed to assess the embankment's susceptibility to internal erosion and piping failure.

Based on the information currently available, no material evidence has been identified to suggest that any of the following could have caused the breach: heavy rainfall, high water levels (overtopping), badger or rabbit excavations or unexpected tree falls. The condition of adjacent assets is also thought to be unlikely as contributory factors; however, two nearby culverts will be examined more fully when site conditions allow.

The embankment channel was trench sheet piled on both sides in the 1960s. Its maintenance history includes repairs to this piling in 2021 where a section of the old piling had rotated away from the towpath. The breach appears to have happened near to the repaired section, and further investigations will assess whether the repair may have contributed to the slow leakage, along with other possible causes such as corrosion of older trench sheet piles. The extent to which prop-wash from the engines of moored boats running in gear may have impacted on the integrity of the pilings or exacerbated leakage is not yet known and will be considered further.

As part of the ongoing investigation, a number of actions and initial recommendations have been identified to further investigate root causes and extract key learnings to mitigate future risks. Many of these actions and recommendations are already being progressed. The Trust is committed to take learnings from this investigation to inform how it continually improves the maintenance of canal infrastructure and its inspection regimes.

Initial actions include identifying other locations where a comparable combination of characteristics may exist and undertaking any additional checks considered appropriate, exploring new techniques to detect sub-surface erosion, and reviewing the risk assessment

regimes for earth structures. Further investigation and assessment are likely to suggest more actions and recommendations.

Given the extent of the damage to the embankment and the number of potentially interacting factors, it may not be possible to identify a single definitive cause. The investigation is therefore focussed on identifying plausible contributing factors in order to inform future monitoring, maintenance and intervention strategies.

Acting on the recommendations and progressing the repair works are not dependent on the formal conclusion of the investigation, and these are being taken forward in parallel.

Appendices give further details of the Trust's asset inspection regime and inspection history of Whitchurch Embankment 2.

3. INCIDENT SUMMARY

At around 0400-0430 hrs on Monday 22nd December 2025, the Llangollen Canal suffered a major breach at Whitchurch in Shropshire. The breach caused the collapse of a 25m section of embankment and the rapid loss of a large volume of water and debris from the affected section of the canal into surrounding farmland.

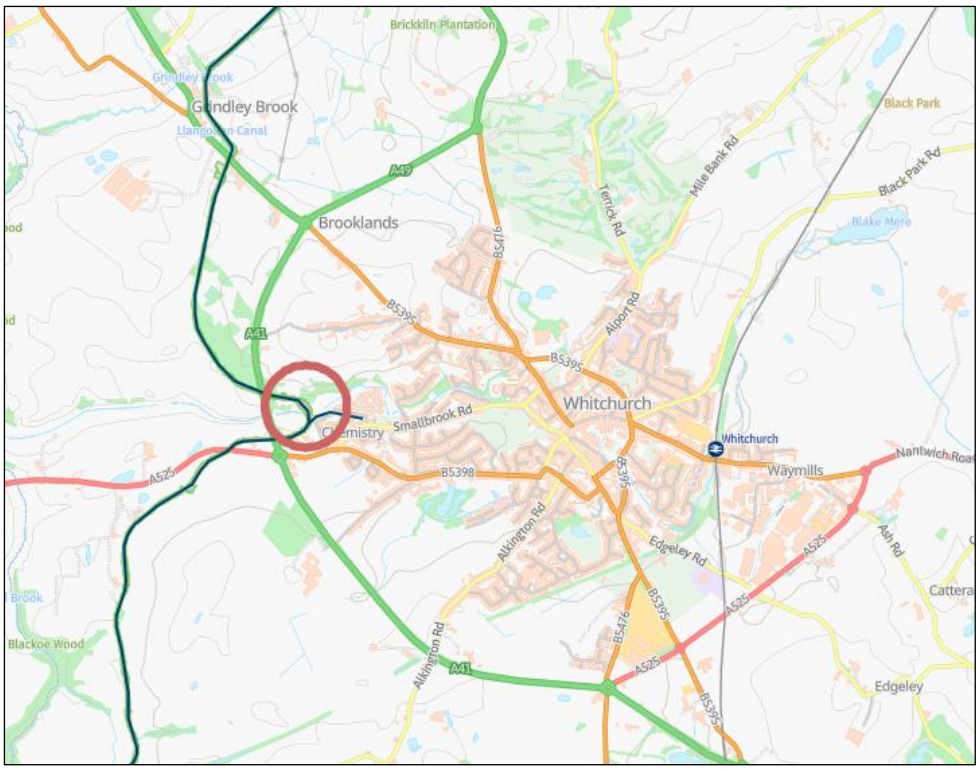


Figure 1: Position of Whitchurch Embankment 2 in relation to the town of Whitchurch

The breach occurred on Whitchurch Embankment 2, a high, steep-sloped embankment with moorings, situated just north of Whitchurch Arm (which is not Trust-owned) and 1.5km south of Grindley Brook Locks. The site is on the 33km canal pound (the length between two locks) leading to New Marton Locks.[1]

This is a Principal Embankment as defined by the Trust's Asset Inspection Procedures 2024, described in Appendix A. It is 125m long and 7.5m tall at its highest point. It has been a popular 48-hour visitor mooring location for over 20 years. The embankment crest carries a pedestrian pathway for access to the moorings and public access to the nearby Country Park.

Three narrowboats moored in the immediate vicinity were directly affected: two boats (Boats A and B) were drawn into the breach site, Boat B sustaining significant impact, and a third (Boat C) was left positioned on the edge of the breach site. A fourth boat (Boat D) was located nearby.

[1] This report uses references from the Trust's asset identification scheme. The breach occurred on Whitchurch Embankment 2, asset LA-022-013-L.

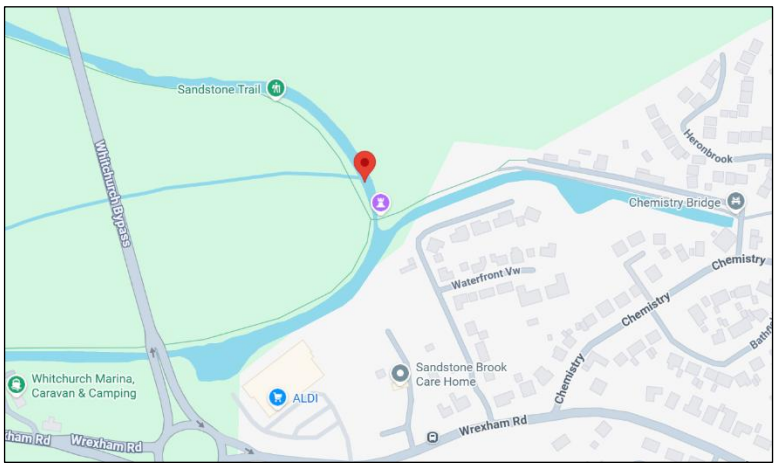


Figure 2: Location of incident, just north of the junction with Whitchurch Arm

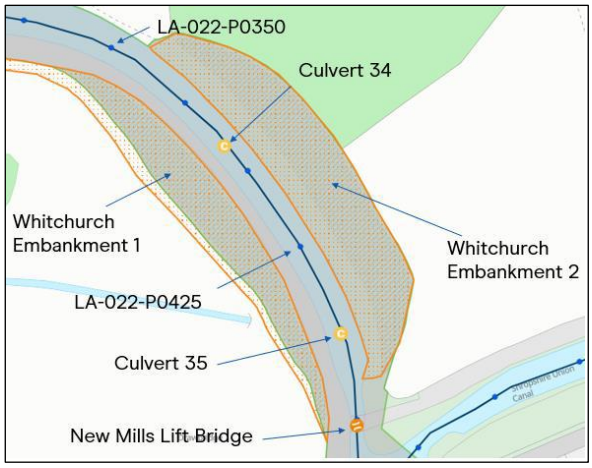


Figure 3: Breach site, Whitchurch Embankment 2

Six boats positioned along the dewatered downstream section of the canal were left grounded directly on the exposed canal bed. Despite the early hour and the progression of the breach, all occupants were able to leave their boats safely. No injuries were reported.

A large volume of water from the immediate 33km section of the canal flooded adjacent fields, although temporary dams were installed in the canal before it fully dewatered.

Incident response

Shropshire Fire & Rescue responded quickly to the initial emergency call and evacuated 10-15 people from boats. Trust staff were alerted to the incident by SCADA alarms and mobilised to site to support the initial response. A Major Incident was declared shortly before 0530 hrs. The Trust activated its emergency plan, establishing a full strategic, tactical and operational (gold, silver and bronze) command structure. Early efforts focused on containing the breach, establishing emergency cordons, putting initial dams in place to stop the water flow, site safety, and securing the remaining vessels. The Major Incident was stood down shortly after 1630 hrs.

Responders to the incident ensured effective coordination between organisations, with West Mercia Local Resilience Forum key to this coordination. Shropshire Council arranged welfare support and temporary housing for those affected, with some finding temporary accommodation with friends. Local boating businesses and the community also provided support, some providing temporary boats. A number of boaters remained onboard their boats, where it was possible and deemed safe to do so. The Trust customer and licensing teams also maintained communication with impacted boaters during the immediate aftermath and through the holiday period, offering ongoing support, including financial.

The Trust is conducting a post-incident review specifically into its emergency response, to assess what went well and any areas for improvement. This was shared in draft with the Police, Fire & Rescue Service, Shropshire Council, United Utilities and all other responders at the West Mercia Local Resilience Forum multi-agency debrief on 4th March 2026. Additional learning and actions from this multi-agency debrief will be incorporated into a final version of the Trust's post-incident review.

On 23rd December, the Trust installed temporary dams nearer to the breach location – this shortens the length of canal that will remain dry until it is rebuilt and restored for navigation. Canal water was then over-pumped (passed from one side of the breach site to the other using specialist pumping equipment) into the dammed sections, allowing water levels to recover. Boat C was winched to safety from the edge of the breach hole along the drained canal using a specialist heavy-duty tracked winch.

By 24th December, the previously dewatered shorter downstream section had been successfully replenished and the downstream boats all refloated. The Trust resumed full control of the site.

On 27th December, Boat D – one of the four boats originally within the breach cordon – was also refloated and relocated downstream, allowing her owners to return.

On 12th-13th January 2026, a further dam was constructed beyond Boat C in order to refloat her and take her to nearby Whitchurch Marina.

An excavator was brought in to reprofile the steep side of the breach hole, creating a gradual slope. On 15th-16th January 2026, both Boat A and Boat B were recovered by winching them up this slope up and away from the breach site. Both have since been refloated successfully.

Current situation [as at 25th March 2026]

The floodwater that had entered adjacent fields is being pumped in a controlled manner to the nearest adjacent foul sewer to limit any environmental impact. A fish rescue was carried out once water levels had lowered sufficiently.

Now that the boat recovery phase is over, work is underway to design and carry out the permanent repair to the canal. Land access agreements have been finalised for the main works and a temporary access track has been created into the site from the A41. A design options report has been produced and a preferred design chosen, using a reinforced soil slope to rebuild the embankment, with specialist contractors identified. The design is being finalised to allow construction to begin as soon as possible, with the vegetation management that will be essential for the rebuild now well progressed.

Before any rebuild works can commence, it will also be necessary to remove a significant amount of embankment material and conduct more detailed ground investigations. Engineers have estimated a timescale of approximately 40 weeks for the repair, following boat recovery, with costs in the order of £4m to £6m, inclusive of pumping costs.

Water supply along the Llangollen Canal

The Llangollen Canal forms part of a long-standing water transfer arrangement under which water is transferred along the 72km length of the Llangollen Canal from Horseshoe Falls near Llangollen in North Wales to Hurleston Reservoir, which is owned and managed by the Trust. The agreement continues today supported by a water supply contract between CRT and United Utilities.

The transfer was temporarily interrupted by the breach. Restoration of flow was therefore treated as a priority, with the Trust and United Utilities working closely together throughout

the initial response and over the Christmas period. Trust contractors mobilised temporary pumps to over-pump the breach site; these pumps arrived on site late on the day of the breach, 22nd December. The Trust also installed additional temporary dams which were in place by early afternoon on 23rd December, with pumping operational by the end of the day, to maintain supply. United Utilities also initiated further abstraction from the Shropshire Union Canal to supplement the feed into the reservoir, given the proximity to Christmas.

United Utilities subsequently installed a pumping system that became operational on 5th January 2026, and this was handed over to the Trust for operational control. Canal water continues to be pumped past the breach to maintain water levels and supply Hurleston Reservoir.

As a result of these coordinated measures, there was no interruption to public water supply as a result of the breach.

4. INITIAL INVESTIGATION OVERVIEW AND SUMMARY FINDINGS

On 5th January 2026, the Trust appointed an experienced Principal Engineer, who is independent of the teams overseeing this area day-to-day, to conduct the post-incident investigation into the possible cause of the embankment failure and any relevant factors.

The investigation has been informed by first-hand witness reports at the time of the breach and during the response, examination of physical structures and multiple site visits, all used to build a picture of the event alongside technical analysis and modelling. The table below presents a summary of the additional modes of investigation undertaken to date along with the Trust's current assessment in relation to each.

It is important to note that these are the **initial findings** of the investigation, which is not yet concluded. Surveys are planned of the culverts (one of which cannot be accessed until the debris is cleared) and further geotechnical analysis, all of which will take several months to complete. The Trust does not anticipate that these will materially change the initial findings but needs to understand if there are any other factors at play. The full analyses are needed for completeness, to build understanding of the possible causes of the breach and to aid application to other embankments.

Investigation methodology and summary findings by area to date

Area of Examination	Initial summary conclusions
Data from water monitoring records (SCADA) and preliminary hydraulic modelling.	SCADA (Supervisory Control and Data Acquisition) is the accurate digital water monitoring control system that the Trust uses across the canal network to give instant access to operational data, and it allows real-time informed decisions to support canal operations. The SCADA monitor for this stretch of canal is approximately 1.2km north of the breach site. Levels were within the normal operating range and there is **no indication that any overtopping occurred** (where the water level in the canal rises above the level of the canal wall, which could cause erosion of the slope face) prior to the breach. The data shows that **the breach was very sudden**. While water levels were found to be normal until 04.10 on the morning of the breach, within ten minutes the level had fallen by 42mm. At 0420 the rate of loss increased further and the water level fell by a further 413mm within the next 29 minutes. Rainfall data from the nearest gauge (at Cholmondeley, c.11km north of Whitchurch) shows that December had been a wet month with rainfall occurring on all but four

	days. Rainfall of 75mm was recorded over the seven days prior to the breach, with 2.95mm falling on the day before the breach. There is no evidence of external erosion on either the remainder of the offside embankment, or on the towpath side embankment. We do not believe the **wet weather conditions caused the breach via external erosion. Further geotechnical assessments are ongoing to inform this.**
Inspection History of Whitchurch Embankment 2.	This confirmed that regular inspections had been completed in accordance with the established Trust Asset Management Procedures 2024 (see Appendix A) by specialist and certified inspectors and engineers. The asset is classed as a Principal Embankment, which brings with it a specified frequency (of every 10 years) for the most thorough inspection, known as a Principal Inspection. Principal Inspections have been undertaken on this embankment in 2004, 2014 and 2025. At the most recent Principal Inspection of the embankment, on 24th April 2025, the condition was rated as 'C – Fair' and its serviceability rated '1 – Fit for Purpose'. The last General Inspection was 13th July 2022; the General Inspection due in 2024 was deferred due to the timing of the 10-year Principal Inspection in 2025. The two culverts in the vicinity of the embankment were last inspected in 2022 and rated 'C - Fair' and 'B – Good'. 'Safety and Service' inspections are carried out every two months on this length, with the last one undertaken on 20th November 2025. The last Principal Inspection (2025) identified a number of features of the embankment – see Appendix B. These have been **discounted** as likely sources of the failure. No defects or features were observed that would indicate instability in the embankment or that any intervention was required. The only point where any seepage was observed is 50m north of the breach site and this distance discounts it as a factor. The minor seepage was unchanged when subsequently inspected in November 2025. While badger excavations have been noted on the Llangollen Canal in the past 25 years and have contributed to historical embankment leaks in other locations, none of the inspections noted above have indicated the presence of badgers. A small amount of rabbit activity to the north

	of the embankment is insignificant in respect of the breach. **All inspections were undertaken to the required quality and frequency, and none identified any defects that would be considered a precursor to the breach event.**
Examination of asset condition records ('ZX notification history') – information collected on asset condition, defects or faults.	The Trust records information relating to asset condition, defects and faults in its SAP database as 'ZX notifications'. Three open ZX notifications are recorded against the length of Whitchurch Embankment 2. All were raised or commented on in the 2025 Principal Inspection and are noted in Appendix B below. All are considered unrelated to the breach. There are no open notifications referring to issues in the area of the breach. 13 closed notifications for the embankment include references to repairs to the trench sheet piling that provides bank protection. One of these closed notifications, raised in 2018, refers to the trench sheet replacement that was subsequently carried out at the south end of the breach site – see Maintenance History below.
Maintenance history (predominantly from 2012 when the Trust was established)	Maintenance since 2012 has been recorded in the Trust's SAP system. Trench sheet pilings provide support for waterway banks and serve to reinforce the canal sides. These have been in place at the breach site since the 1960s. Records indicate three sections of new trench sheet piling have been installed on the embankment. Damaged piling had been noted in a 2018 inspection in the southern end of the breach extent, where existing trench sheets were over-turning (rotating over, away from the canal edge towards the canal). The repair was designed in 2019 and carried out in 2021, when a short length of the existing trench sheets were replaced with longer ones to provide greater stability. The repair was overlapped with the existing sheets. The section was noted as repaired on the last Principal Inspection in April 2025. On-site observations appear to show the trench sheet piling to have extended through the canal bed liner into the embankment construction materials. The breach is currently understood to have occurred near to the repaired section, which is subject to further technical assessment.

Records of vegetation management around the site; examination of photographic records of the site and comparison to the site after the breach occurred.	This shows no unexpected tree fall that could have destabilised the slope.
Condition of adjacent assets	There are four Trust assets connected to Whitchurch Embankment 2, all subject to the same inspection regime. Whitchurch Embankment 1, directly opposite, underwent a Principal Inspection on the same day in April 2025 and was assigned Condition Grade C – Fair and Serviceability 1- Fit for Purpose. No defects were identified in the area of the breach on this embankment. Culvert 34 passes under the embankment approximately 10m to the north of the breach. A Principal Inspection including CCTV survey was undertaken in August 2016 and it was assigned Condition Grade C – Fair and Serviceability 2 - Restricted Use. There is one open defect notification for this asset, which relates to the loose handrail on the access steps. Culvert 35 passes under the embankment to the south of the breach extent. A Principal Inspection including CCTV survey was undertaken in August 2016 and it was assigned the Condition Grade B – Good and Serviceability 1 – Fit for Purpose. There are no open notifications for this asset. It is not possible until CCTV surveys are done to rule out culvert failure, but this is deemed unlikely due to their positions relative to the breach site and previous inspected condition. Culvert 34 is currently submerged below the debris from the breach. Culvert 35 is currently flowing unhindered, likely indicating it is in good condition. New Mills Lift Bridge, a small lifting accommodation bridge, is 40m to the south of the breach extent. A Principal Inspection was undertaken in November 2020 and assigned Condition Grade C - Fair, Serviceability 1 – Fit for Purpose. The Condition Grade was lowered to D - Poor at a General Inspection in October 2025 due to the deterioration of brickwork abutments. The bridge is deemed to be at a sufficient distance not to have had a material effect on the breach. There are ten open notifications to this asset relating mainly to paint protection and masonry, none of which are considered relevant to the breach cause.

	No adjacent assets are considered a likely cause of the breach.
Geological records	The investigation has referred to the British Geological Survey (BGS) Onshore GeoIndex website, as at 7th January 2026. No geological faults are shown to be present within the immediate vicinity of the site. Geological maps indicate the foundation soils to comprise glaciofluvial sand and gravel. Observations of the breached embankment cross-section on site indicate the embankment to be formed from a predominantly sand matrix, although it appears to have a significant secondary silt or clay fraction. The bed of the canal appears to have a cohesive clay liner (indicated by its dark colour and "clumping" of material). However, borehole records nearby indicate several subordinate bands of cohesive material (sandy gravelly clay) and therefore the true nature of the foundation is unknown. Groundwater strikes at approx. 2.5m below the natural ground level (i.e. below the embankment foundation level). Bedrock depth is assumed to be >15m below ground level. Further ground investigations will take place.
Initial modelling of embankment behaviour to predict geotechnical stability and seepage.	Modelling has been undertaken to analyse how the embankment would behave before and after a bed leak was introduced. To date this has been based on assumptions for the geotechnical parameters of the embankment and underlying foundation soils. These assessments will be refined and improved as geological investigation is undertaken and the parameters used can be confirmed. Samples have been sent for geotechnical laboratory analysis which will inform causation hypotheses. **The analysis cannot be concluded until further site investigation and geotechnical modelling are complete.** Preliminary assessment of the embankment material and underlying structure indicates that **a leak in this location would likely have stayed within the embankment** and **would not have been identified on a visual inspection.** The geotechnical analysis using site specific parameters is needed to confirm if a leak in this location *could* cause failure of the embankment and a shear failure of the slope.
Records of hydrographic surveys of canal bed profile	Hydrographic surveys are undertaken across the navigable stretches of Trust canal and river navigations at intervals of up to 8 years in accordance with the Trust's asset management regime. The primary purpose of these

	surveys is to monitor navigable channel compliance and inform dredging strategy. Hydrographic survey results of the breach location from 2017 and 2023 do not show any notable depressions or unusual features (accepting that, since these surveys are undertaken for dredging purposes, they will have limitations in terms of useful data, particularly towards the canal edges). The data shows that the canal bed profile appears to have been affected by boat propeller wash – there are two distinct lower areas, one in the main channel where boats would navigate and the other closer to the wash wall aligning with the propeller position of moored boats. The significance or otherwise of this is yet to be assessed.

5. EARLY HYPOTHESIS

The cause of earth embankment failures is not always clear: they are generally old structures that are formed of the local materials available at the time; they can be complex, and they are difficult, if not impossible, to inspect internally.

The information currently available suggests the most likely cause of the breach was an unusual congruence of multiple factors: specific physical factors in this location (notably a steep, high, sandy embankment), coupled with a suspected slow, low-volume leakage over a number of years that caused piping and internal erosion. Piping can occur if seepage through a soil embankment becomes strong enough to carry soil particles away, forming internal erosion channels. It is possible that the cumulative effect of propeller wash ('prop wash') from engines left in gear on moored boats over time could have contributed to an increase in the rate of leakage.

The extent of the damage to the embankment and the number of potentially interacting factors mean it may not be possible to identify a single definitive cause. The investigation seeks to identify plausible contributory factors in order to inform future monitoring, maintenance and intervention.

It is also important to note that the modelling undertaken to date is preliminary. Until soil samples are tested and analysed it is not possible to confirm the embankment's susceptibility to internal erosion and piping failure.

The following represents a provisional working hypothesis based on the information currently available for how the breach occurred. It remains subject to further technical assessment:

1. Over several years prior to the breach occurring, there was an early, slow phase of undetected, low-volume leakage of water from the canal bed. It has not been possible to determine the exact source of any leakage as relevant physical evidence has been disrupted by the breach.

2. Such leakage may have led to undetected internal erosion, known as 'piping', to an area below the canal bed at or near the canal edge, leading to the formation of a void. Based on current understanding, any such void would not have been visible to inspection.

3. It is likely that any leakage from the canal drained away to ground water. Available data does not indicate any material increase in water flow in the canal. Seepage or leakage in the embankment in the area of the breach was not visible on the embankment face.

4. It is currently understood that, at 04:10 (estimated) on 22nd December 2025, a localised failure of the canal bed occurred. This may have been associated with the void and would likely have resulted in an increased water flow and further erosion in the vicinity of the breach. It is possible that this process led to destabilisation of the bank protection, including displacement of the trench sheet piles.

5. A full breach occurred at 04:20 (estimated) on 22nd December 2025. The embankment suffered a catastrophic failure. Based on information presently available, this appears to have involved the interaction of several factors, including long-term erosion, localised collapse of the canal bed, loss of bank protection and shear failure of the slope. This remains subject to further detailed analysis.

The investigation is considering a number of possible causes of the leakage that may have led to internal erosion of the embankment:

1. The leak could have developed if the replacement trench sheets installed in 2021 pushed through the clay canal bed layer and into the embankment material below. The clay bed thickness at the breach site is (and will remain) unknown due to the loss of materials in the breach, however nearby thickness indicates that the toe of a 2400mm trench sheet could have protruded 150mm through the bed into the embankment material below. Continuing this theory, a small leak could have developed down the face of the replacement trench sheet, leading in time to a piping failure and a void forming below the canal bed as described above.

2. Alternatively a leak could have developed at the toe of the older (1960s) trench sheets or through the clay canal bed layer if the clay layer was reduced in thickness, developing into a piping failure and void as described above; as noted above the hydrographic survey of the site shows a channel that would align with the position of propellers of moored boats.

3. The leak could have formed through corroded older trench sheets, which were in poor condition in places below the water level. It is difficult to identify this type of failure on a visual above-water inspection. This is, however, not thought likely as a cause as leaks of this kind usually cause a shallow void at towpath level, and no voiding was observed behind the trench sheets in the inspections or was reported.

The hypothesis and possible causes will continue to be examined in greater detail.

6. INVESTIGATION NEXT STEPS

The initial findings of the investigation will be followed up by further steps in the short to medium term. The investigation is still ongoing and, due to the significant task of removing both water and embankment material, is predicted to take several more months. However, some actions can be identified at this stage:

Culverts: As soon as site conditions permit access, to ascertain whether either of the two culverts in the vicinity collapsed or contributed in any way to the breach, CCTV examination (an industry standard visual survey inside the culverts using remote controlled cameras) will be undertaken. There is no evidence to suggest the culverts caused the breach; however, this will be confirmed following completion of the planned inspections.

> Examinations show that Culvert 35 is still running freely and is assumed to be in good condition, but this will need to be verified.
>
> The inlet to Culvert 34 is approximately 10m to the north, so is likely unrelated, but this requires further investigation. This inlet is currently submerged in the debris from the breach, and until the debris is removed it cannot be inspected.

Site sampling: Taking further soil samples and undertaking more detailed geotechnical modelling to assess for any possible local embankment slip caused e.g. by saturation from rain or whether there was an inadequate factor of safety for the embankment (too steep to support itself) in its profile.

Further Geotechnical Analysis: In parallel with the above, to fully understand the soil characteristics and mode of failure, soil samples have now been taken and are being analysed. Boreholes are required within the breach site to further expand our understanding of the sub strata and provide information to inform the design of the repair. These cannot take place until safe access is provided.

Piling design: The design and potential failure modes of the pilings need to be reviewed to ascertain whether there were any contributory factors. Any learnings will need to be applied to piling design on future projects.

Moorings: More information needs to be gathered and assessed as to whether the presence of moored boats could have created additional risk factors such as engine/propellor activity when combined with the other physical characteristics of the site as described above. If this is thought to be the case, it will need to be factored into future risk assessments for mooring locations.

7. INITIAL RECOMMENDATIONS

The Trust is committed to take any learnings from this investigation to inform how we continually improve the maintenance of canal infrastructure and our inspection regimes. Noting that the investigation has not yet concluded and that further data may become available, a number of initial recommendations have been identified and are being progressed. These may be refined or supplemented and will be augmented on completion of the full investigation. We are tracking progress on these on a two-weekly basis to completion.

Recommendation 1: Identification of Trust embankments with similar characteristics

As a priority, work has started to identify and assess any Trust embankments that have a comparable combination of characteristics: being constructed from sand, are over 4m high, have trench sheet bank protection, and are designated mooring sites. Follow-up work to be undertaken as in Recommendation 4 below.
Timescale – by April 2026.

Recommendation 2: Risk assessment
Our approach to risk assessment of earth structures will be reviewed, potentially including an additional vulnerability assessment.
Timescale – by August 2026.

Recommendation 3: Trial new techniques of surveys and monitoring

Current inspection techniques rely heavily on visual inspection; in this case it was not possible to detect signs of leakage or intervene in time. Reviews of alternative means of survey and monitoring (already in place on some assets) are needed to assess the viability of identifying early signs of leaks and voiding on embankments with similar characteristics.

While we are assured by external benchmarking of our inspection procedures, we will be looking urgently at new techniques to detect the presence of voids below canal beds. These are inherently difficult to detect with the technologies currently available to the Trust. We will be exploring scalable technologies that are both more effective and more cost-effective. A trial has already been commissioned from one of the Trust's specialist framework ground investigation contractors to test and compare different methods of geophysical survey techniques to determine their applicability and accuracy at detecting and mapping subsurface voids, disturbed ground and/or leaks in sandy canal embankments. The methods to be trialled are Ground Penetrating Radar, Electrical Resistivity Tomography, Multi-Channel Surface Waves (MASW) and Microgravity. The trial is due to begin on site by the end of March 2026.
Timescale – by July 2026.

Recommendation 4: Further investigation and assessment

Following completion of Recommendation 1 above, we will undertake 'susceptibility to internal erosion' assessments prioritised on a risk basis. This may include ground investigation. The risk matrix is not yet finalised, but may include and not be limited to history of leakage and repairs, height, presence of moorings, existing Consequence of Failure etc.

Dependent on the success of the trials in Recommendation 3, one or more of the geophysical survey techniques will be adopted in addition to the existing inspection regime where susceptibility to internal erosion has been identified. We will also extend geotechnical assessments and seepage analysis to evaluate leakage pathways and modes of failure, and

explore the use of these both to detect failure modes on other earth structures and to inform monitoring and inspection approaches.
Timescale – by November 2026.

Recommendation 5: Review repair methods

We will review works that are currently being planned on sand embankments (before they mobilise to site) to assess them for any risk of internal erosion and suitability of the design.
Timescale – by May 2026.

In addition, we will undertake a review of the design and construction of repair methods used on sand embankments for the susceptibility of introducing leakage paths and/or bed disturbance leading to the risk of internal erosion. We will update the guidance on repair design options if required.
Timescale – by June 2026.

Recommendation 6: Review suitability of existing repairs

Following review of Recommendations 1, 4 & 5 we will consider whether to reinforce any existing repairs where they have been assessed as not in line with the output of 'Review repair methods' above. Provide guidance to designers of the suitability of design options for added reinforcement. The inspection regime for sites of previous repairs will also be reviewed.
Timescale – by November 2026.

Recommendation 7: Review mooring locations and Consequence of Failure guidance for embankments

A risk matrix will be developed to assess whether existing moorings should be suspended or relocated and the process for approving new mooring sites will be updated. In parallel, we will review how the presence of moorings and impact on boats is factored into assigning a Consequence of Failure grade to embankments.
Timescale – by August 2026.

APPENDIX A – ASSET INSPECTION PROCEDURES (AIP 2024)

Ensuring our 250-year-old network is safe is, and always will be, our top priority. At the heart of our approach to safety is a rigorous inspection and monitoring regime.

The Trust's approach to asset inspection is detailed in the Trust's Mandatory Standard: Asset Inspection Procedures (AIP 2024) which aligns with the ISO55001 standard to oversee such structures. The Trust benchmarks against, and has comparable inspection regimes to, similar organisations looking after infrastructure. We demonstrate alignment with ISO55001 through regular self-assessments in accordance with Institute of Asset Management self-assessment methodology to audit our wider asset management system, including AIP and our inspection approach. In addition, our inspection regime is regularly externally audited and validated.

AIP is regularly reviewed and benchmarked against other authorities to ensure we learn from our experiences and follow best practice. For example, in 2021 we increased our Principal Inspection frequency for major embankments from 10-20 years to 6-12 years. For major embankments such as the Whitchurch Embankment on the Llangollen Canal the frequency and detail of inspection is:

Inspection Type	Frequency	Detail
Safety & Service Inspection	Every 2 months	To ensure waterway is safe and customer service standards are being met. To report significant change in condition.
General Inspection	Every 2 years	To monitor condition and provide advice and guidance to SSI inspector. To provide up to date information for work plans.
Principal Inspection	Every 6-12 years (see Condition/Consequence Matrix below)	A comprehensive inspection and written report addressing condition, maintenance, compliance, and risk. To include advice to SSI (Safety & Service Inspection) & General Inspection (GI) inspectors together with longer term recommendations.

The condition/consequence matrix for principal embankment inspection frequency is below. Inspection frequency is based on combination of condition and consequence of failure. For example, in Whitchurch the embankment was grade C and consequence of failure 2. Hence, the frequency of a Principal Inspection would be every 10 years.

	Condition Grade				
	A	B	C	D	E
1	12	12	12	10	10
2	12	12	10	10	8
3	12	10	10	8	6
4	10	10	8	6	6
5	10	8	6	6	6

Inspections are undertaken by professionally certified Trust employees, with specialist engineers for earth structures (such as embankments) as well as for tunnels, bridges and reservoirs, as detailed below:

Inspection Type	Inspection Undertaken By	Competency
Safety & Service Inspection (SSI)	Trust-employed dedicated Asset Inspectors	Trust-certified SSI inspector
General Inspection (GI)	Trust-employed Asset Inspectors / Asset Engineers.	Trust-certified GI Inspector for Major Embankments.
Principal Inspection (PI)	Largely completed by Trust-employed dedicated Earth Structure Inspectors. Occasional use of PSC Framework Consultants when required.	Trust-certified PI Inspector for Major Embankments.

APPENDIX B – INSPECTION HISTORY, WHITCHURCH EMBANKMENT 2

Whitchurch Embankment is subject to inspections in accordance with the Trust's Asset Inspection Procedures 2024 (AIP) and previous versions.

Principal Inspection (PI)

The embankment is a Principal Embankment and falls into the Tier 2 Inspection Frequency for Principal Inspections. There have been 3 Principal Inspections undertaken on the following dates by certified Principal Embankment inspectors:

PI Date	Condition Grade	Consequence of Failure	Serviceability
06/06/2004	C- Fair	3 – Serious Injury	1 - Fit for Purpose
05/08/2014	C- Fair	3 – Serious Injury	1 - Fit for Purpose
24/04/2025	C- Fair	2 – Minor Injuries	1 - Fit for Purpose

Note: embankments of this age can very rarely achieve condition A, owing to the generally steep angle of the slope and on account of the materials they were built from.

The latest PI (2025) identified the defects and features in the table below:

Extract from 2025 Principal Inspection	Feb 2026 Comment from investigation
LA-022-P0350L to P0375L– **P0350L Seepage at toe** – Wet boggy ground was present at the slope toe over a 25.00 m (l). The water from this area was noted to flow along the base of the toe at a rate of <0.10 l/s down topography towards P0375, where an area of boggy ground 3.00 m (Dia) was noted at the toe. A ranging pole could be pushed into the ground to 0.20 m. This was not noted during the previous PI (2014). It is unclear if the water represents canal seepage or signifies the natural flow of surface water down the adjacent valley sides. It is recommended that the area is monitored for seasonal change and increase in flow or boggy area during subsequent length, general and principal inspections. Should the water remain during prolonged periods of dry weather or an increase in flow rate be noted, leakage investigation and appropriate leak stopping works will be necessary.	This area of seepage is approx. 50m North of the breach site on the mitre of the embankment. No other seepage was noted, and no change was recorded in the Safety & Service Inspection. The distance from the breach site discounts it as a likely source of the failure. Position of this seepage relevant to the breach is shown in the figure below this table.
LA-022-P0365L– **P0365L Upstand filled** – During the previous PI (2014), *'An upstand up to the piled bank edge was noted at this location. This measured 6.5 m in length and was up to 0.45 m deep'.* This was not recorded during this PI, assumed levelled. No action required at this time	Defect noted on 2014 PI, now noted as no longer present, assumed repaired.

LA-022-P0400L– **P0400L Loose handrail to access steps** – The timber handrail adjacent to the timber access steps leading to Culvert 35 (LA-022-004) was loose and unstable. This was not recorded during the previous PI. It is recommended that the handrail is replaced.	Not related to embankment stability.
LA-022-P0400L– **P0400L Fall to shoulder** – A distinct fall to shoulder of 0.15 m was noted at the crest, over a 2.00 m length adjacent to the timber slope access steps. However, an effective freeboard of 350 mm is still being maintained by the bank protection. This was noted during the previous PI and does not seem to have deteriorated between inspections. It is recommended that the area is monitored during subsequent general and principal inspections.	Defect noted on 2014 PI, no change in the defect, assumed stable.
LA-022-P0455L– **P0455L Bank protection fixed** – The previous PI (2014) noted that the masonry bank protection was in a poor condition length and had previously had a 3m length of concrete bag work repairs. The bank has now been repaired with the installation of trench sheet piles and wailing, in a good condition. No action required.	This relates to a repair close to New Mills Lift Bridge, noted repaired since last inspection and south of the breach site so discounted as the source of the failure and any concern over stability.
LA-022-P0485L– **P0485L Bank protection fixed** – The previous PI (2014) noted that *'The bank edge at this location has a large embayment present due to a masonry edge collapse over a length of 3m'.* The bank protection was noted as repaired during this PI and was generally in a good condition. No action required.	This relates to a repair on the entrance to the Whitchurch Arm, noted repaired since last inspection and south of the breach site so discounted as the source of the failure and any concern over stability.

Table: Defects noted on 2025 PI and comments relating to significance of possible cause of breach or embankment stability.

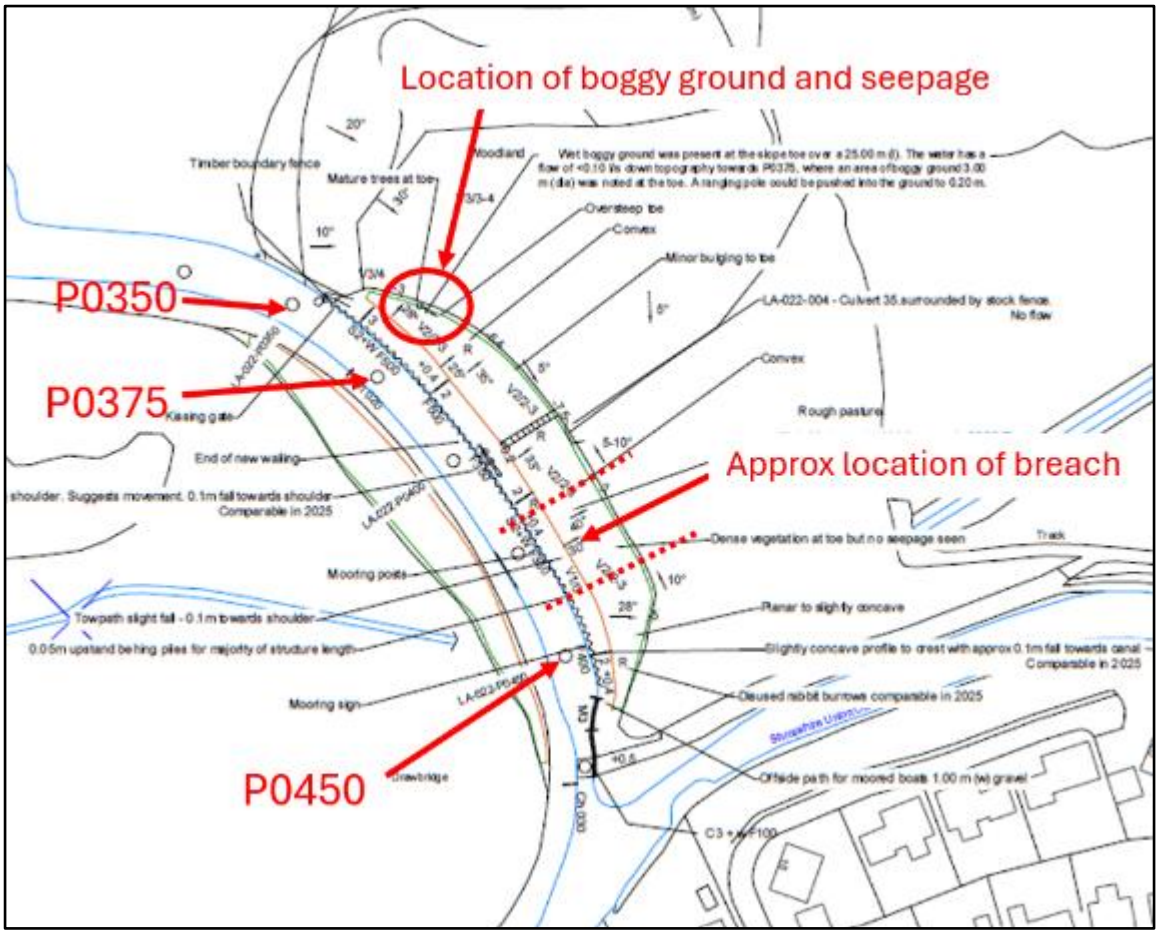


Figure: Part copy of PI drawing with annotated notes from February 2026 indicating seepage and breach location.

The PI also comments on the geology in the area of the breach site stating, "According to BGS data accessed via the BGS website (May 2025) the embankment is underlain by the 'Wilkesley Halite Member' of mid-Triassic Period. This member is typically described as, *'Halite of varied purity with mudstone partings'*. As Halite is an evaporite mineral, dissolution of halite formations can potentially cause ground subsidence, collapse of structures, and ground instability. Superficial deposits comprising Glaciofluvial Deposits (sand and gravel) were noted to overlie the solid geology." And goes onto state, "No ground investigation data or pertinent BGS borehole records were available for this site."

The presence of this layer will be further analysed when it has been possible to complete Ground Investigations at the breach site. It should be noted that there is no historical or active salt exploitation/mining/brining.

The 2025 PI was completed to a standard commensurate with the requirements of AIP, by a certified inspector, quality assured and approved by a second certified inspector. **The PI identified no defects or features that would indicate the embankment was unstable and required any urgent intervention.**

The overall grade assessment from the Principal Inspection (Condition Grade C – Fair, Consequence of Failure 2) is in line with the guidance in AIP and gave no specific cause for concern.

General Inspections (GI)

The latest general inspection was conducted in July 2022 by a certified inspector and identified no change in the embankment's condition. The general inspection programmed for 2024 was postponed due to the Principal Inspection becoming due.

Safety and Service Inspections (SSI)

The latest Safety and Service Inspection was carried in November 2025 by a certified inspector, no change in the condition of the asset was noted. SSI inspections have been undertaken in accordance with AIP. The September 2025 SSI included the 8 yearly Attribute Survey where the towpath attributes are updated.

Inspection Summary

All inspections have been undertaken to the required quality and intervals of AIP, and none identified any defects that would be considered a precursor to the breach event.