SCIRT Rebuilding Infrastructure LEARNING LEGACY

Lessons learned from one of New Zealand's most challenging civil engineering projects: rebuilding the earthquake damaged pipes, roads, bridges and retaining walls in the city of Christchurch 2011 - 2016.

Christchurch Natural Disaster Response and Recovery presentation notes

Story: Asset Assessment

Theme: Programme Management

A document which contains the slide notes to go with the PowerPoint presentation made for the Water Services Association of Australia conference.

This document has been provided as an example of a tool that might be useful for other organisations undertaking complex disaster recovery or infrastructure rebuild programmes.

For more information about this document, visit www.scirtlearninglegacy.org.nz

Programme funded by Christchurch City Council New Zealand Government

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Programme funded by
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Notes for presentation

The presentation requested was Christchurch Natural Disaster Response and Recovery. When considering what to present, it was apparent what a massive topic this is and within the time and format requested there would be difficulty in providing even a light overview of what happened. I have chosen to concentrate on a small aspect of the recovery being asset assessment to determine action with respect to replace, repair, defer, or do nothing, which I had most involvement in. I am fortunate to have Andy Gibson in the chair who also had a large role in assisting this process and can help me answer question. Andy has also kindly agreed to some of his slides being used in this presentation.

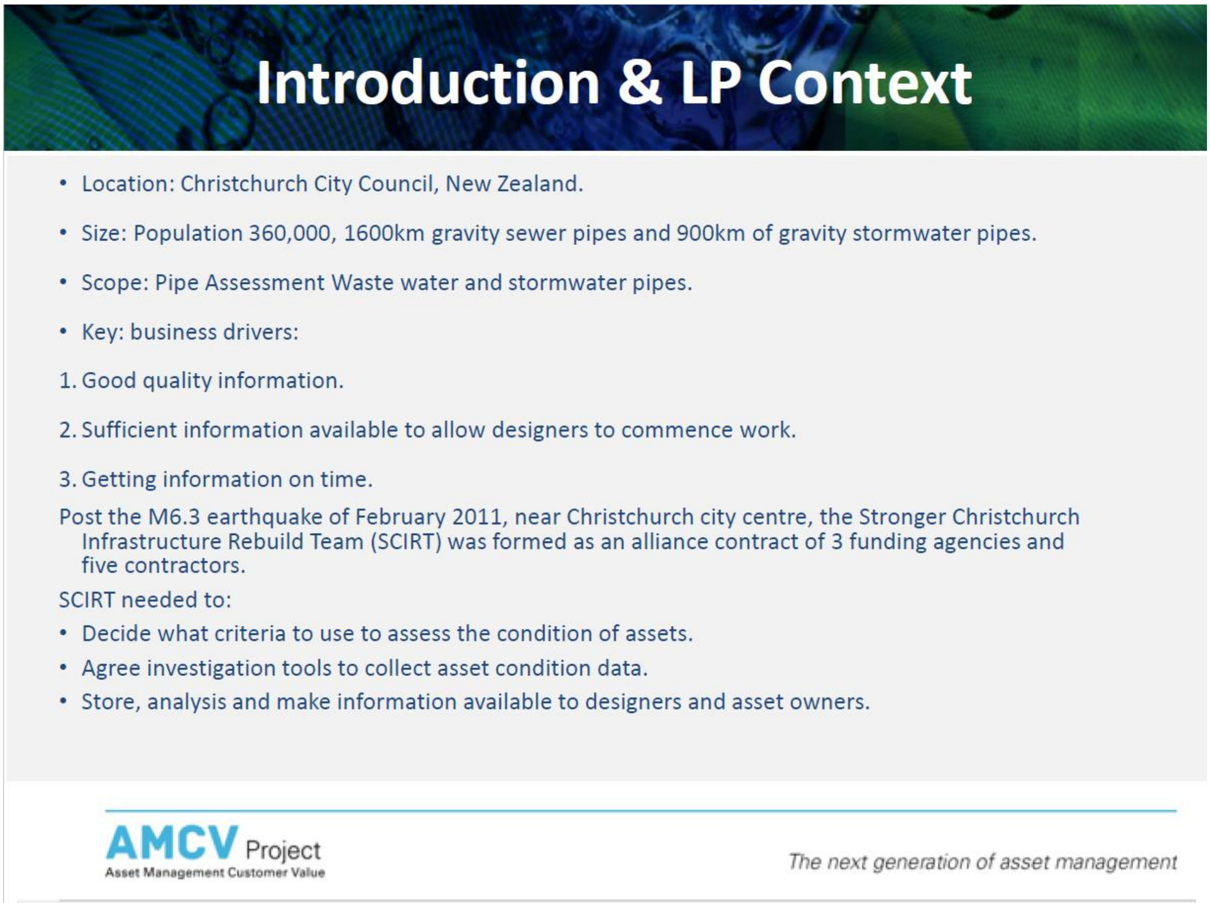
Christchurch February 2011

Christchurch NZ is a city of approx. 360,000 people in the centre of the east coast of the South Island of New Zealand. It was hit by a M7.1 earthquake 40km west of Christchurch causing 2 serious injuries and significant damage close to the epicentre, but less so within central Christchurch. Damage within Christchurch was limited to collapse of chimneys, brick veneers, and liquefaction in eastern suburbs with some broken Water mains and Sewers which largely remained functional although damaged and causing ongoing operational failures

The subsequent M6.3 aftershock on 22 February with the shallow epicentre 10 km from the City Centre claimed 185 lives and destroyed many buildings as well as disabling key infrastructure in the east of the city for weeks and months.

Post the 2010 earthquake the Christchurch City had engaged with key contractors to undertake an infrastructure repair programme. This arrangement had been in place for only a short period when the main event occurred and it became apparent a different delivery model would be required to account for the much increased scale of damage.

This lead to the formation of the Stronger Christchurch Infrastructure Rebuild Team known as SCIRT. This is an alliance of three funding agencies, (CCC, NZTA, and NZ government) and five contractors (McDowell, Fletcher, Downer, Fulton Hogan, and CCL)



Prior to the formation of SCIRT, Contractors were essentially assigned areas to maintain and repair. This resulted in a relatively uncoordinated and inconsistent approach with each Contractor developing their own methodology. There was high demand for CCTV which was being interpreted inconsistently and the information being collected was being held in multiple locations including the cabs of contractor utes.

When SCIRT was formed there was a team of approx. 200 designers waiting for good information to commence design work, so it was clear SCIRT needed to decide:

- The criteria to use to assess the condition of assets and what the intervention points would be to initiate repairs
- Agree investigation tools to collect the asset condition data
- How to store information and make available to designers and asset owners.

To do this, SCIRT took control of the CCTV and other assessment resources and directed where it was deployed under the control of one entity (CCL), coordinating programming, allocation of work, interpretation of results, transfer of information to SCIRT while ensuring QA, and continuing to refine systems, and specification to take account of the unique situation being dealt with.

Initially, the criteria for assessing assets to determine intervention was that any damage observed would be repaired. This low threshold was not critical early on as work commenced in the most damaged areas with no question intervention was necessary. As work progressed to less damaged areas, it became apparent damage could remain as some assets were still functional, and the cost of immediate repair outweighed the benefit. This led to the development of Design Guide 43B which in coarse terms allowed for renewal of pipes where assessment gave a likelihood of failure within 5 years. This is not a long time but imposed by the government as a 60% funder on the basis the CDEM act only requires Govt assistance until the TA is in a position to be self sufficient

This slide shows the kind of damage being uncounted leading to pre EQ CCTV costs escalating from less than $10/m to well in excess of $100/m immediately after the event mostly due to the need for liquefaction to be cleaned out prior to sending the camera down. Often CCTV alone was insufficient to determine the action to be taken, but triggered the use of other assessment tools to confirm damage such as pipe dips.

Other assessment tools were used in place of CCTV where possible such as pole camera or sewer leak technology to speed information gathering as well.

It became apparent early on that CCTV alone was too slow to provide sufficient and timely information to allow designs to proceed in order for Delivery Teams to be fully deployed. Therefore tools to undertake assessment used at the time were, CCTV, Pole Camera, Profileometer, MH level, and Sewer leak technology. Although SCIRT had 20 CCTV crews, the estimated time to complete assessments was more than four years so CCTV data became a critical constraint to the rebuild. This led to the development of a Multi Criteria Analysis tool using seven parameters that gave a better than 90% match with CCTV assessment of damage. (Pipe depth, diameter, direction, Liquifaction Resistance Index, Material, Watercourse proximity, Sub catchment, Ramm data)This was used to direct assessment crews to the most damaged areas and allow designers to start production. At the peak of assessment there were 150 people in the field gathering information at a cost of approximately $5m/ month

Establishing Condition of the Asset

Establishing Condition of the Asset

AMCV Project
Asset Management Customer Value
The next generation of asset management

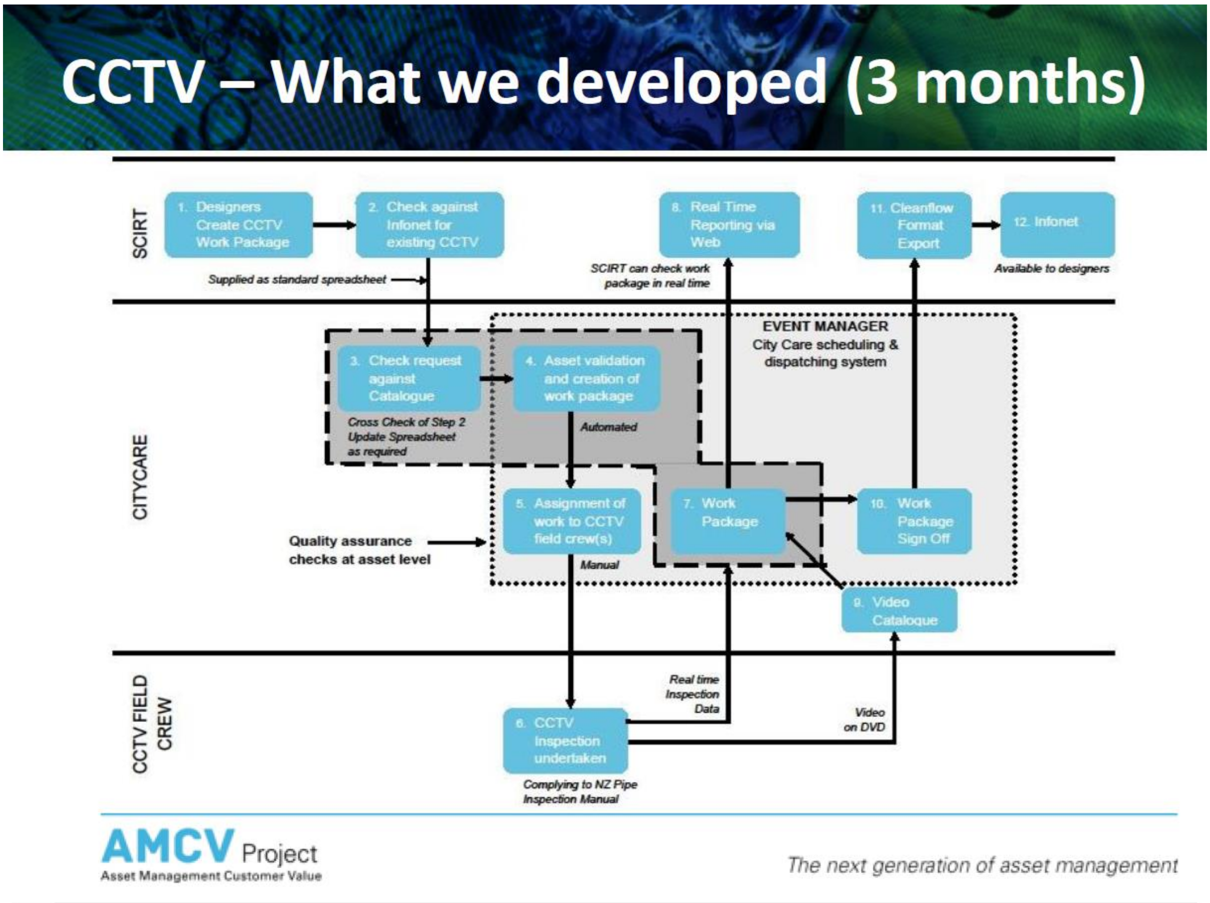
This is to demonstrate some of the logistical issues being faced during pipe assessment. The top left photo shows part of the 400,000 m3 of liquefaction material removed from streets and pipes during the recovery period.

Delivery teams provided numerous innovations and initiatives to achieve a result if not always compliant with the specification. Here a camera is being floated down a pipe where it was not possible to reduce the flow.

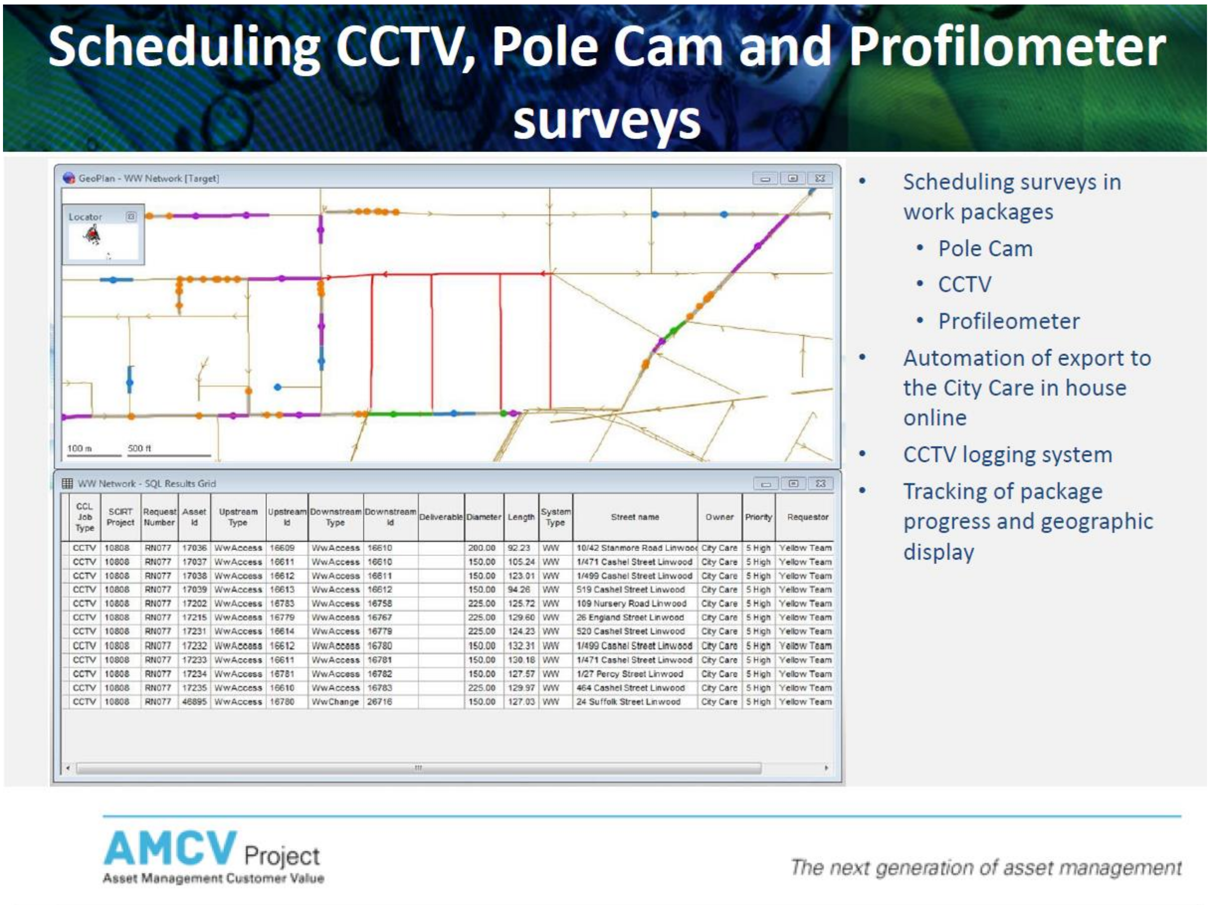
Night work was always problematic along with associated TMP. This was an essential part of the programme to achieve productivity as well as undertake inspections during times of lower flow

The sheer volume of plant needed on site at times to support assessment and pipe cleaning provided significant logistical issues on its own.

To help manage and minimise these issues, sharing innovation, productivity, Health and Safety, time frames, and QA, were some of the KPI’s developed to determine awards and league tables for the allocation of work.

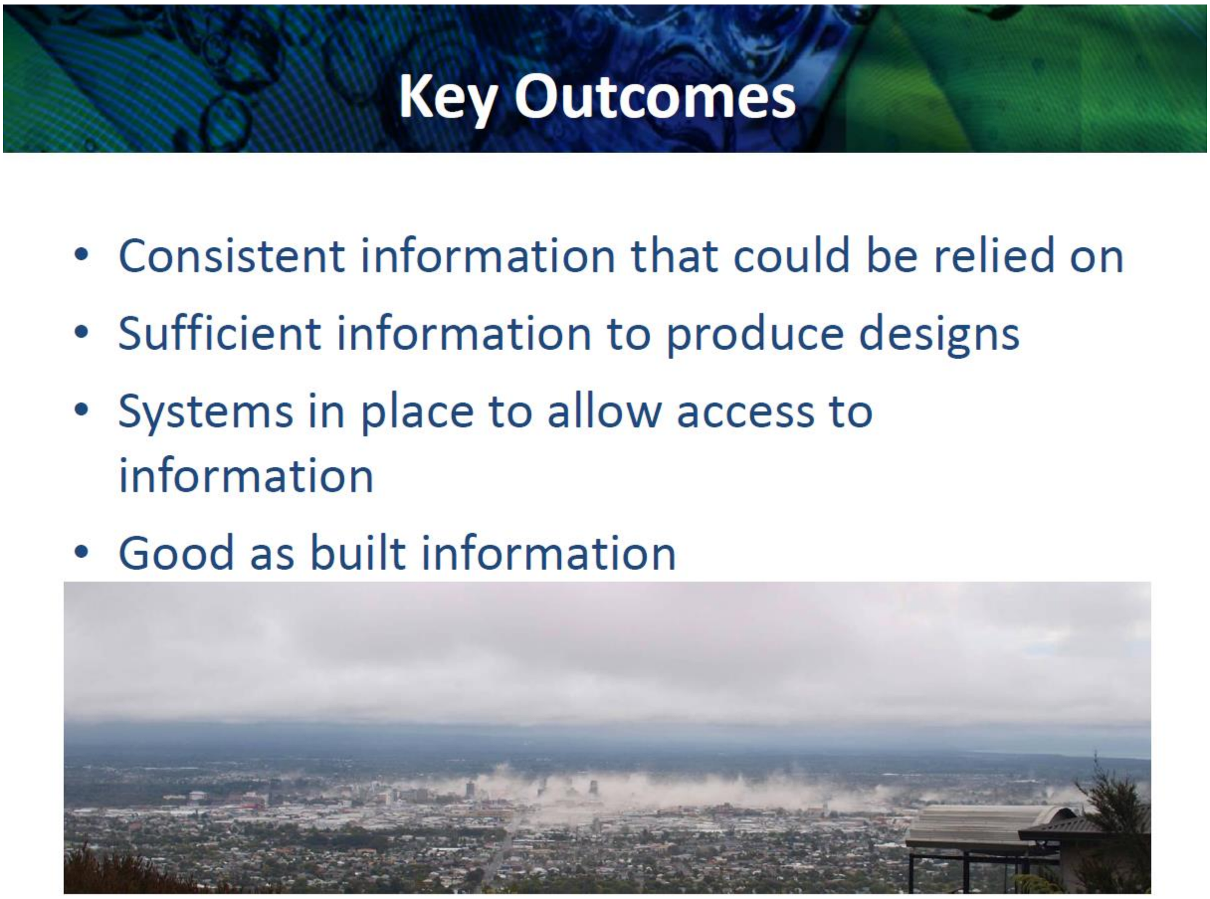


This slide shows the swim lane diagram used to create work packages generated at SCIRT for assessments, including checks against existing information (which may have been collected prior to SCIRT formation) validating the asset id's to give confidence assessments would be for the correct location, allocation of work packages to teams, and management of data as it is collected against the pipe inspection manual, date time and id stamping and return into the video catalogue and export in cleanflow format to infonet where it became available to designers. A brief trial was undertaken using CCTV readers in other parts of the world however QA for this was problematic. Regular QA audits quickly identified the issue and risk with this practice.



CCL Job Type	SCIRT Project	Request Number	Asset Id	Upstream Type	Upstream Id	Downstream Type	Downstream Id	Deliverable	Diameter	Length	System Type	Street name	Owner	Priority	Requestor
CCTV	10808	RN077	17036	WwAccess	16609	WwAccess	16610		200.00	92.23	WW	10/42 Stanmore Road Linwooc	City Care	5 High	Yellow Team
CCTV	10808	RN077	17037	WwAccess	16611	WwAccess	16610		150.00	105.24	WW	1/471 Cashel Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17038	WwAccess	16612	WwAccess	16611		150.00	123.01	WW	1/499 Cashel Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17039	WwAccess	16613	WwAccess	16612		150.00	94.26	WW	519 Cashel Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17202	WwAccess	16783	WwAccess	16758		225.00	125.72	WW	109 Nursery Road Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17215	WwAccess	16779	WwAccess	16767		225.00	129.60	WW	26 England Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17231	WwAccess	16614	WwAccess	16779		225.00	124.23	WW	520 Cashel Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17232	WwAccess	16612	WwAccess	16780		150.00	132.31	WW	1/499 Cashel Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17233	WwAccess	16611	WwAccess	16781		150.00	130.18	WW	1/471 Cashel Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17234	WwAccess	16781	WwAccess	16782		150.00	127.57	WW	1/27 Percy Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	17235	WwAccess	16610	WwAccess	16783		225.00	129.97	WW	464 Cashel Street Linwood	City Care	5 High	Yellow Team
CCTV	10808	RN077	46895	WwAccess	16780	WwChange	26716		150.00	127.03	WW	24 Suffolk Street Linwood	City Care	5 High	Yellow Team

An example of work package creation showing a map of the area, the assets to be assessed, the method of assessment and the schedule of asset IDs. The export of this was automated on line and progress tracked geographically.



Key Outcomes:

Consistent information that could be relied on:

A further benefit for providing this system is Christchurch now has a reliable inventory of 60% of the network available on CCTV for asset management and deterioration modelling.

Because only 3km of CCTV per year was being done prior to the eq for the preparation of the forward programme, there had not been close scrutiny of the specification to check the information was fit for purpose or that what was being specified was being delivered.

Once there was a realization we needed much better consistency between providers the real cost of the BAU work became apparent.

Sufficient information to produce designs:

The systems put in place provided a conveyor belt of asset information which could be monitored against time and quality to allow designs to start. Where delays occurred it was transparent what the causes were in order for appropriate intervention to be put in place.

Good As built information:

The systems put in place for damage assessment out of the earthquake have continued for the production of SCIRT as built information as well as for non SCIRT as built from BAU renewals and new developments.

The picture below was captured moments after the February event showing the dust from collapsing buildings.

Top Lessons Learnt:

Cost of CCTV very high post EQ: No one expected the cost of CCTV would at times get to $150/m or more. This was in comparison to pre EQ CCTV costs more in line with $8/m. This was in part due to BAU poor practice and specification for pre EQ work. The programme of work accounted for 20 specialist CCTV crews which is approximately half the resource available within NZ. Some of those costs related to stamping time and asset ID's on the video, correct speed of camera work, pausing at defects and panning, type of camera being used, and audit control which had not been done well previously. This slowed production but provided a much more valuable resource at a cost now in the order of $30/m. Another issue we needed to beware of was the balance between getting the information and having resource committed that was never going to achieve a result. Someone needs to review what is happening and be prepared to call it quits. Although the cost of cleaning is strictly operational the resource lay with us for the purpose of assessment.

Implement systems early to limit escalation: means the longer poor practices continue the longer expensive resource is producing information of limited value creating delays, and repeat work. In our case it was not just the expense of CCTV but the knock on costs of designers and delivery teams not being able to commence work.

Monitor contractor performance: Even with good specification and QA, regular audit and ongoing training is important to maintain teams on task to maintain quality and consistency.

The picture below is an example of liquefaction created holes claiming several vehicles and on the right lateral spread adjacent a river.