JBE Properties Pte Ltd and another *v* Handy Investments Pte Ltd and another [2013] SGHC 184

Case Number : Suit No 15 of 2011

Decision Date : 23 September 2013

Tribunal/Court : High Court

Coram : Lai Siu Chiu J

Counsel Name(s) : Simon Goh Keng Yeow and Wang Ying Shuang (Rajah & Tann LLP) for the plaintiffs; Giam Chin Toon SC, Santhanasamy Gerard Vincent and Hui Choon Wai (Wee Swee Teow & Co) for the defendants.

Parties : JBE Properties Pte Ltd and another — Handy Investments Pte Ltd and another

Tort – Negligence

23 September 2013 Judgment reserved.

Lai Siu Chiu J:

Introduction

1 This case involved a most unfortunate incident which took place on Sunday, 10 August 2008, the day after National Day. On that fateful day, there was a downpour and rain flowed into an eight-storey commercial cum residential building (with a basement) known as The Luxe ("the Luxe Building") located at No 6 Handy Road ("the Luxe site"). The Luxe Building is owned by JBE Properties Pte Ltd ("the first plaintiff"), and the main contractor for its construction was Gammon Pte Ltd ("Gammon"). The event on 10 August 2008 will hereinafter be referred to as "the flooding incident".

2 At the material time, construction was going on at a site adjoining the Luxe Building, at No 20 Handy Road ("the Nomu site"), of a twelve-storey mixed development project called The Nomu ("the Nomu Building") which is owned by Handy Investments Pte Ltd ("the first defendant"). The first defendant had engaged Seng Systems Engineering Pte Ltd ("the second defendant") as the main contractor for the construction of the Nomu Building ("the works").

3 The managing-director of the first plaintiff is Patrick Lam Kong Yin ("Patrick Lam"), while his wife Christina Sui Fong Fong ("the second plaintiff") is the sole-proprietor of Yisulang Art Gallery which is in the business of selling handicrafts, collectibles and gifts. The first defendant's general manager (and its witness) is Ow Peng Seang ("Ow"), while the second defendant's director who testified on its behalf is Ke Koon Seng ("Ke"). The other witnesses in the trial that was spread out over four tranches will be identified later.

4 The Luxe Building sits at the front and bottom of the steep slope that is behind Handy Road ("the slope"). Indeed, the level of the roads behind the Luxe Building and Handy Road, *viz*, Mount Sophia Road and Adis Road ("Mount Sophia/Adis Road") is about 12m higher than the 3rd storey of the Luxe Building. The Nomu Building on the other hand is built from the road level of Handy Road into the slope such that its floors rise up to almost the level of Mount Sophia/Adis Road. There is a boundary wall built alongside the Nomu Building ("the Nomu boundary wall") that separates the Nomu site from part of the Luxe site. There is one point along the boundary line where the Nomu boundary wall meets the Luxe Building's curved retaining wall ("Luxe wall") that the first plaintiff had constructed. The

point of contact forms a triangular-shaped area near where the Luxe sump (see [10] below) is located.

5 There is a gap between the Nomu boundary wall and the Luxe side of the slope which is shotcreted and filled with concrete. The plaintiffs referred to this gap as "the Luxe gully" in their submissions. Immediately below the Luxe gully is an area which the plaintiffs in their submissions called the "Workspace", and is shown in the photograph at p 1041 of the agreed bundle of documents ("AB"). The plaintiffs alleged that it was the defendants who had backfilled the Workspace ("the backfilled area"). Beside the backfilled area, Gammon's landscaping subcontractor Tropical Environment Pte Ltd ("Tropical") had covered an area of the Luxe side of the slope with wire mesh materials called "geotextile" and/or "geogrid" to prevent and arrest soil erosion. Tropical then planted that area with a plant known as Wedelia Trilobata ("Wedelia"). Gammon had in fact installed geogrid at this area even before the adjoining Workspace had been backfilled.

6 A large part of the slope belongs to the Cathay Organisation, which owns and operates the Cathay chain of cinemas in Singapore. The Nomu site was previously a car park for the use of Cathay cinema patrons before the first defendant purchased it and developed the Nomu Building.

7 Construction of the Luxe Building ("the Luxe project") started in April 2006 and it was completed in the first quarter of 2008 with the Temporary Occupation Permit ("TOP") being issued on 30 April 2008. The construction of the Nomu Building ("the Nomu project") began around January 2007 and its TOP was issued on 16 March 2009.

8 A part of the rain and surface run-off from Mount Sophia/Adis Road flows into a storm drain in existence before the construction of either the Luxe or Nomu Buildings. This storm drain runs alongside the road and, from there, the run-off goes through a culvert pipe underneath Mount Sophia Road, enters a cascading drain ("the cascade drain") that runs down the slope, and then goes into a pre-existing sump ("the Nomu sump", also referred to by the defendants as "the Nomu shallow sump") situated within and partly outside the boundary line of the Nomu site near the top of the slope. Neither the cascade drain nor the Nomu sump was constructed by the defendants.

9 From the Nomu sump at the upper level, water would be carried down to Handy Road by an open drain inside the boundary of the Nomu site. The open drain was removed in the course of construction of the Nomu Building and replaced by an internal drainage system constructed by the first defendant within the Nomu site. Rainwater is now discharged from the Nomu sump via a 300mm conduit pipe to a newly constructed deep sump ("the Nomu deep sump") built within the Nomu site, and in turn the Nomu deep sump discharges the water through the new drainage system down the slope to Handy Road.

10 On the Luxe site, there is an internal drain at the rear of the Luxe Building to cater for the rain and surface run-off from the slope ("the Luxe drain"). The Luxe drain discharges into an internal sump ("the Luxe sump") that is located next to and at the bottom of the Luxe wall. For ease of reference, Annexure A to this judgment is a plan showing the locations of the three sumps referred to earlier, the planted area, the backfilled area, as well as the Luxe wall and the Nomu boundary wall.

11 On that pluvious Sunday, moderate rain (about 23.4mm) fell between 12.00 noon and 1.00pm. According to the plaintiffs, the volume of rain resulted in an accumulation of sand, silt and mud that first flowed into the Nomu sump and, when that sump could not cope, overflowed and entered the Luxe sump, causing the Luxe sump to choke. Consequently, sand, silt and mud outflowed from the Luxe sump and entered the Luxe Building through an exhaust pipe outlet and a mechanical ventilation opening ("the MV opening") (collectively referred to hereinafter as "the Openings") which were

located at the rear of the Luxe wall, near the Luxe drain and the Luxe sump. (The Openings were relocated after the flooding incident – the exhaust pipe outlet now sits on top of the Luxe wall which height is about 2m, while the MV opening is now inside the Luxe Building.)

12 It was unfortunate that the second plaintiff had arranged to hold an exhibition of contemporary Chinese ink paintings ("the exhibition") between 7 August and 7 September 2008 in the halls on the 1st and 2nd storeys of the Luxe Building. To that end and purpose, the second plaintiff had engaged a third party graphic designer to design and print banners, posters, brochures and other promotional materials, and had also advertised the exhibition in magazines and periodicals. The second plaintiff had hosted a party for invited guests at the exhibition's opening on 6 August 2008.

13 The water ingress into the Luxe Building flooded the halls on the 1st and 2nd storeys, resulting in fixtures and contents therein being partially submerged and damaged by muddy water. Even after the subsequent clean-up, the false ceiling, walls and flooring of the halls were covered with unsightly yellowish-brown stains. After discussions with the first plaintiff, the second plaintiff decided to and did cancel the exhibition.

14 Not surprisingly, the plaintiffs held the defendants responsible for the damage caused to the Luxe Building arising out of the flooding incident and commenced these proceedings in January 2011.

The pleadings

15 In their statement of claim, the plaintiffs alleged, *inter alia*, that the two defendants owed them a duty to exercise reasonable care in carrying out the construction of the Nomu Building such that the works did not cause damage to the adjoining properties, especially the Luxe Building. In the alternative, it was alleged that the first defendant owed the plaintiffs a duty to use reasonable skill and/or care in carrying out the works as the nature of the works involved a special danger to others including the plaintiffs.

16 The plaintiffs alleged that the flooding incident was caused by the defendants' negligence or breach of duty which they particularised, *inter alia*, as follows:

(a) causing to be disposed in the Luxe sump materials which included construction debris, leaves and plastic sheets, resulting in the Luxe sump being blocked or choked so that it could not function or function at its optimum capacity;

(b) failing to exercise reasonable or any care in maintaining the tidiness and/or cleanliness at the Nomu site and/or the Nomu sump;

(c) failing to erect or build any temporary or permanent barrier between the Luxe Building and the Nomu site; and

(d) failing to prevent materials including construction debris, leaves and plastic sheets from being disposed in the Luxe sump.

17 In the alternative, the plaintiffs alleged that the defendants had caused a nuisance by allowing rainwater and surface run-off to escape from the Nomu site and be discharged into the Luxe site.

18 In the further alternative, the plaintiffs alleged that the defendants had failed to comply with cll 6.1.1 and 6.1.2 of the Code of Practice on Surface Water Drainage issued by the Public Utilities Board ("the PUB Code").

19 The plaintiffs' final claim was based on the doctrine of *res ipsa loquitur*.

20 The common defence filed by the defendants essentially denied liability for the damage resulting from the flooding incident. The defendants contended that the alleged flooding and loss was not caused by the second defendant's construction activities on behalf of the first defendant, nor did any accumulation of debris and/or planks (if any) around the Nomu sump cause or contribute to the flooding incident. The defendants contended that the sump and drains in the Nomu site were functioning properly, and that any planks and/or scaffolding erected by the second defendant at the first defendant's premises did not cause or contribute to the alleged flooding of the Luxe Building. The defendants added that the run-off from the Nomu site did not cause or contribute to the flooding incident.

21 The defendants averred that the alleged flooding was caused by the overflow of water from the open drain (measuring 300mm) from Mount Sophia/Adis Road and/or the area above the Luxe site.

22 In the alternative, the defendants contended that the alleged flooding was not caused by the works, but was instead caused by, resulted from and/or contributed to by the first plaintiff's earthworks, slope works, planting and gardening works at the slope of the Luxe site and/or by the design of the Luxe Building.

23 In the further alternative, the defendants contended that if the works caused or resulted in the alleged flooding (which was denied), the same was caused or contributed to by: (a) the failure of the first plaintiff to maintain its drains and/or the Luxe sump in proper working order; and/or (b) the erection and/or building of the Openings too close to the drains and/or the Luxe sump.

24 Although neither the cascade drain nor the Nomu sump were constructed by or belonged to the first defendant, the first defendant accepted that as the owner and occupier of the Nomu site, it was responsible for the maintenance of the Nomu sump which it contended operated normally on the day of the flooding incident.

25 I should point out at this juncture that the defendants' complaint (in its closing submissions at paras 10 and 11) of difficulty in understanding and meeting the plaintiffs' allegedly ambiguous case is without merit. The plaintiffs' pleadings were clear and precise enough for the defendants to meet the case.

26 As for the Reply, in essence the plaintiffs averred that between the dates of the TOP of the Luxe Building and the flooding incident, no works including earth or slope works were carried out by the first plaintiff at the Luxe site or the slope. The plaintiffs contended that the height of the MV opening was adequate while the Luxe sump as well as the Luxe drain were suitable for surface run-off from the Luxe side of the slope.

27 The first plaintiff also denied that it had allowed or caused any construction (or other) debris to accumulate in the Luxe drain or the Luxe sump. If the Luxe drain and/or the Luxe sump were either not functioning or not functioning at their optimum capacity, it was due to or contributed to by the construction (and other) debris that overflowed from the Nomu site.

The issues

28 The factual and legal issues the court must determine are:

(a) Did the construction (or other) debris that flowed into the Nomu sump and the Nomu deep

sump come from the Nomu site or from somewhere else?

(b) Would the Luxe sump have been able to cope with the volume of rainfall on 10 August 2008 had there been no construction (or other) debris flowing into the Nomu sump and the Nomu deep sump?

(c) Was it the rain on 10 August 2008 that washed the construction (or other) debris down the slope or was it some other cause?

(d) Were the exhaust pipe outlet and the MV opening of the Luxe Building too low or incorrectly located, which caused the water inflow into the Luxe Building from the Luxe sump?

(e) Can the plaintiffs rely on the doctrine of *res ipsa loquitur* to hold the defendants liable?

The evidence

29 The plaintiffs and the defendants called 14 and eight witnesses respectively for the 18 days' trial which was only to determine liability. Depending on the findings of this court, the issue of assessing damages for the plaintiffs' loss would be dealt with at a later stage by the Registrar of the Supreme Court. The plaintiffs had two experts while the defendants had three, not including an engineer, Stephanie Chew, who was subpoenaed from the PUB by the defendants to rebut the plaintiffs' allegation in [18] above – that the defendants had breached the PUB Code by failing to provide proper or adequate drainage facilities for the Nomu site.

30 At the behest of the parties and accompanied by the representatives from both parties, their counsel as well as their experts, the court made a site visit on 25 September 2012 to the Nomu Building as well as the premises of the former Methodist Girls' School ("MGS") at Mount Sophia/Adis Road, for the purpose of ascertaining the path of the run-off that flowed from the slope and the two roads. The site visit established that Mount Sophia/Adis Road, MGS and other buildings in the locality have their own drainage system down to Handy Road. Save for a plot of land approximating 2,093m², rain and run-off from that high area does not enter the cascade drain or the Nomu sump. Some rain from a separate (and smaller) plot of land (164m²) also flows into the Nomu sump.

31 I should also add that amongst the exhibits tendered in court (see N/E 414–415) were: (a) ten soil samples taken from different locations on the Luxe side of the slope; (b) the same soil samples after they had been washed; (c) samples of concreting and plastering sand; and (d) the same concreting and plastering samples after they had been washed. Samples of wire mesh materials used by the first plaintiffs (as well as other commercial alternatives like "geocell") to prevent soil erosion on the slope were also exhibited in court, of which more will be said later. Two of the many volumes of agreed bundles of documents in court (*ie*, vols 5 and 6) comprised photographs of the Nomu and Luxe sites taken at various times before and after the flooding incident.

The plaintiffs' case

32 The plaintiffs asserted that the rainfall on 10 August 2008 was moderate and unremarkable. Because of conditions around the Nomu sump, however, that sump was not able to fully discharge the rain that entered the same. Consequently, water from the top of the slope (Mount Sophia/Adis Road) which was supposed to be discharged into the (lower) Nomu deep sump overflowed into the Luxe sump. The sudden rush of water from the Nomu site caused construction debris, sand, silt and/or other materials to be washed into the Luxe sump. The materials ended up choking the Luxe sump such that it could no longer discharge or cope with the already large volume of rain overflow; the

subsequent water ingress into the Openings culminated in the flooding incident. Consequently, the proximate cause of the flooding was the surge of water which overflowed from the Nomu site.

33 In support of its case, the plaintiffs called the following factual witnesses:

(a) Patrick Lam;

(b) Naim Bin Kamis, a general worker employed by the first plaintiff who works at the Luxe Building;

(c) Lim Kok Kim ("KK Lim"), an engineer from TY Lin International Pte Ltd who were the structural engineers for the Luxe Building;

(d) Ho Wan Fong ("HWF"), an engineer and Qualified Person ("QP") from J Roger Preston (S) Pte Ltd ("J Roger Preston") who were the appointed mechanical and electrical ("M&E") consultants for the Luxe Building in 2005;

(e) Gan Chee Keong ("GCK"), a project manager from Gammon;

(f) Kerk Yau Lan ("Kerk"), the site foreman of the second defendant in 2008;

(g) Seow Seng Cheong ("Seow"), the project manager of the second defendant in 2008;

(h) Tan Beng Cheng ("TBC"), a structural engineer from CS Consulting Engineers Pte Ltd ("CS Consulting") who were the structural engineers for the Nomu Building;

(i) Ng Kok Yang ("Ng"), an architect from SCDA Architects Pte Ltd ("SCDA") who designed the Luxe Building;

(j) Muthukumaraswamy Ramamurthy ("Rama"), a senior engineer from Gammon who was in charge of the Luxe project from April 2006 to October 2007; and

(k) Manimaran ("Mani"), a senior project engineer from Tropical.

By consent of the parties, the second plaintiff did not have to testify even though she had filed her affidavit of evidence-in-chief ("AEIC").

34 The plaintiffs had two expert witnesses in:

(a) Teh Eng Aun ("Teh"), a mechanical engineer who is the principal partner of Megatrend Consulting Engineers, which is involved in mechanical and electrical engineering; and

(b) Kenneth James Patterson-Kane ("Patterson-Kane"), who is a chief civil engineer from SKM (Singapore) Pte Ltd, a company engaged in civil and structural engineering works.

The plaintiffs' third expert Kenneth Hugh Jones, a surveyor, did not take the stand as his evidence pertained to damages which issue was not for this court's determination.

35 Needless to say, the plaintiffs' witnesses (both factual and expert) came in for heavy criticism from the defendants. In their closing submissions, the plaintiffs (at para 88) described the criticisms as "outrageously unfair, unreasonable and unsubstantiated".

36 I turn now to review in brief the evidence that was adduced from the plaintiffs' factual witnesses. As Patrick Lam's testimony touched on the flooding incident itself, it is not necessary to consider his evidence. The focus of the dispute essentially concerned technical issues as to whether the construction activities at the Nomu site caused the flooding incident or whether it was the inadequacies associated with the earlier construction of the Luxe Building that was the cause, or a combination of both and/or other factors.

37 It would be more appropriate to start my review of the evidence of the plaintiffs' witnesses with that of Ng. Ng was not the person from SCDA who designed the Luxe Building but he assisted the designing architect. Ng testified that he had intended the rain and run-off from the Luxe site that was not discharged into the Luxe drain or Luxe sump to go into what he thought was the "common drain" on the Nomu site (notwithstanding that the drain was inside the Nomu site's boundary). This "common drain" is the open drain referred to at [9] above. Ng had assumed that the "common drain" was a public drain and part of a drainage reserve. This assumption was wrong. If indeed the "common drain" was part of a drainage reserve, the PUB would not have allowed the first defendant to remove the same and replace it with the first defendant's own drainage system.

38 Ng testified that the issue of erosion on the slope was resolved by planting works carried out by Gammon's subcontractor, Tropical. This aspect of the evidence will be dealt with in greater detail below as the question of soil erosion emerged as an important issue in the course of the trial.

39 Ng also addressed the platform and crest levels of the Luxe Building in conjunction with the height of the Openings (in the light of the alternative defence pleaded at [23] above).

40 In his AEIC, Ng deposed that the platform and crest levels of the Luxe Building complied with the PUB Code. Based on cl 2.1.1(a) of the PUB Code, the minimum platform level of a development should not be lower than the adjacent road or ground level or other levels as may be specified by the PUB. Ng deposed that the minimum platform level for the Luxe Building was FFL 106.6m.

41 The minimum crest level is defined under cl 2.2 of the PUB Code as that required for an entrance, exit or opening to a basement or underground structure (basement, tunnel, underground facility, *etc*). For basements, underpasses and sunken or underground facilities, the minimum crest level is to be at least 150mm above the minimum platform level.

42 Ng claimed that the height of the Openings complied with the PUB Code. He pointed out that the ground level adjacent to the Openings was at least 450mm lower than the MV opening. Therefore, the MV opening must have been at least 150mm above the adjacent ground level, in compliance with cl 2.2 of the PUB Code. The bottom level of the MV opening was also higher than the platform level of FFL 106.6m for the Luxe Building. In his AEIC, Ng deposed that the placement of the Openings was decided after discussion and close co-ordination between SCDA, the structural engineer KK Lim and J Roger Preston, the engineering consultants. (In this regard, the defendants' claim at para 51(a)(iii) of their closing submissions that they remain in the dark as to who had approved the Openings is unwarranted since Ng had testified that he designed the aluminium louvered grille over the MV opening.) Ng alleged that the ground level adjacent to the Openings subsequently became higher due to backfilling, when the Nomu boundary wall was constructed.

43 It may briefly be observed here that Stephanie Chew, the PUB engineer, gave independent evidence that the PUB Code would apply to the location of the Openings, if connected to an underground facility (N/E pp 1015–1016 and 1029). However, the PUB only required that the minimum crest level be at least 150mm above the minimum platform level, *regardless* of the surrounding terrain of the land (N/E pp 1000–1001). The PUB would not itself impose a higher figure than that stated in the PUB Code, *viz*, 150mm.

44 I move on to consider the testimony of the plaintiffs' witnesses who had previously worked or are currently working for the first plaintiff. The first of these three witnesses was GCK who used to be a project manager with Gammon. After the Luxe Building was completed, GCK, a civil engineer, took many photographs of the Nomu site on the day of, as well as after, the flooding incident and even at the time of the trial. During cross-examination, GCK was questioned extensively on the photographs he had taken as well as on his AEIC. The defendants contended that GCK's testimony should be disregarded as it was unreliable and biased because he was employed by the first plaintiff as a project manager in September 2008 after he left Gammon's service.

45 KK Lim was the civil and structural engineer for the Luxe Building. He was criticised by the defendants for being unaware (until he was cross-examined) that the open drain mentioned at [9] above which he referred to in his AEIC (and which he recalled from memory) had been removed by the first defendant and replaced with a new drainage system. Worse, portions of KK Lim's AEIC were premised on the open drain still being in existence (he wrongly assumed that the open drain was obscured from sight by scaffolding and construction work on the Nomu site) and he made the further assumption that the choked Luxe sump he saw on the afternoon of 10 August 2008 was due to mud that had flowed (seen in his photographs taken on 11 August 2008) from the Nomu site and the Nomu shallow sump. The defendants said KK Lim's assumption was incorrect as the photographs showed mud flowing downwards *to*, not from, the Nomu shallow sump. The defendants' case was that the terrain also slopes from the Luxe site towards the Nomu site. In other words, the defendants alleged that rain and surface run-off would be washed down the slope diagonally from the Luxe site to the Nomu site, in support of their contention that they were not responsible for the flooding incident.

46 Another witness of the plaintiffs criticised by the defendants was HWF, an engineer and QP for the Luxe Building. HWF had designed and prepared the drawings for the MV opening of the Luxe Building without doing a site inspection either at the time he prepared the design or when the Openings were built. HWF said he did not know who had approved the Openings.

47 The defendants noted that HWF's measurements of the distances between the Openings corresponded exactly with those taken by the plaintiffs' M&E engineering expert, Teh. Further, like Teh, HWF said the Openings were above when in reality they were below the Luxe sump. The defendants suspected that the two witnesses had acted in concert in the preparation of their

respective AEICs, as seen from them having the same measurements and making the same mistake.

48 It was HWF's view that the PUB Code did not apply to stipulate the minimum height above ground required of either of the Openings. In cross-examination (at N/E 271), however, he conceded that the PUB Code did apply. HWF claimed in his AEIC to be familiar with the platform and crest levels of the Luxe Building but this was proved to be untrue during his cross-examination. It was obvious from HWF's testimony that he had paid no regard to the platform or crest levels when he prepared the drawings of the Openings based purely on specifications given to him, which he did not question.

49 As Teh was one of the plaintiffs' two experts, his evidence will be reviewed when the court deals with the expert testimony of both parties later.

50 Another witness called by the plaintiffs was Kerk, the second defendant's former construction foreman. Kerk deposed in his AEIC that in the course of constructing a wall at the back of the Nomu Building (very near the Nomu deep sump) in late July to early August 2008, the second defendant's workers poured concrete into a timber formwork. In the process however the timber formwork gave way, causing the concrete poured inside to leak and flow into the Nomu deep sump. On the instructions of Seow (the second defendant's project manager), the second defendant's workers cleaned up the leaked concrete.

51 Kerk testified that he had visited the site on 11 August 2008 after the flooding incident. Some days later, he and Seow found that a pipe (at the 2nd storey of the Nomu Building) that was part of the new internal drainage system on the Nomu site discharging water from the Nomu deep sump, contained hardened concrete which filled about a third of the pipe. When he poured water into that pipe, water was discharged therefrom very slowly. Kerk said he had to remove the hardened concrete by a mechanical breaker, an operation which took five days.

52 Kerk agreed with counsel during cross-examination (at N/E 713) that the debris found in the Nomu deep sump after the flooding incident was probably washed down from the cascade drain. Kerk said that when he saw that sump on the 11 August 2008, there was very little water inside. He explained that a plastic sheet found inside was used to prevent leaves from entering the Nomu deep sump and opined that the force of the water probably washed the plastic sheet, which was initially outside, into the Nomu deep sump.

53 Another former employee of the second defendant who testified for the plaintiffs was Seow, who said that when the Nomu boundary wall was built, a gap (*ie*, the Luxe gully) was created where the second defendant excavated the land to erect the wall. He said the second defendant subsequently backfilled the gap.

54 The defendants however disputed Seow's evidence, alleging that the space at the Luxe gully was created by Gammon when the latter raised the level of the slope for planting purposes. The defendants contended (to which Seow agreed) that the slope near the Luxe gully was shored up by Gammon using a sandbag wall situated some distance away from the Nomu boundary wall (as seen in a number of photographs tendered in court such as AB983); therefore they said that the Luxe gully had nothing to do with any excavation work carried out by the second defendant which was in any case not in that area.

55 During cross-examination, it was established that Seow had no personal knowledge of the alleged excavation or backfilling works carried out by the defendants; such work was done in October 2007, whereas Seow only joined the second defendant's employment in February 2008. Seow had relied on photographs of the Nomu site that were shown to him.

56 However, I believed Seow's evidence on an important point. This was in relation to the construction of the wall at the back of the Nomu Building (see [50] above). In his AEIC (para 16) and in court (N/E 737 and 774–776), Seow said that he had monitored casting of that wall, which started in late July or early August 2008. Construction material like pipes, concrete, timber pieces and scaffolding would therefore have surrounded the area where the Nomu deep sump was located at the time of the flooding incident. In the course of his cross-examination (at N/E 775-776), it was apparent that Seow had made a mistake – he called the wall he was monitoring a retaining wall, when in reality it was part of the Nomu Building (and therefore could not have been a retaining wall). However, Seow's mistake does not detract from the fact that he did monitor the second defendant's construction of a wall and he photographed scaffolding and formwork on the Nomu site. Indeed, a photograph (AB1269) taken a few weeks *after* the flooding incident showed that the wall at the back of the Nomu Building was *still* being constructed.

57 Turning to TBC's evidence next, the responsibility of TBC as the first defendant's structural engineer was to supervise the construction of the Nomu boundary wall. Like Seow, TBC maintained that the Luxe gully next to the Nomu boundary wall was created by the second defendant in the course of erecting the wall, near the Luxe sump. Contrary to the evidence of the defendants' witness Soo Chee Sern (see [61(d)] below), TBC disagreed that the Luxe gully was concreted even though there were photographs (such as AB1026) clearly showing the concrete.

58 An additional witness, Mani from Tropical, was called by the plaintiffs when it became apparent that it was important to ascertain how the landscaping works on the Luxe side of the slope had been carried out. I turn then to consider his evidence. Mani testified that a strip of land at the slope was planted with 30m² of Wedelia by Tropical in or around October and November 2007, after Gammon had backfilled the strip of land. In his AEIC, Mani deposed that Wedelia does not require much top soil, and so that strip of land on the slope was filled with around 150–200mm deep of top soil. Wedelia was chosen because the plant is commonly used to prevent soil erosion and it does not require much maintenance or frequent trimming.

59 To allow the planted Wedelia to take root and to reduce soil erosion, Tropical installed geogrid (*ie*, black wire mesh) above the layer of top soil; the material was then pegged and secured to the slope using steel rods. Small slits of 50–80mm were then made in the geogrid in order to plant the pre-rooted Wedelia. Mani added that this method of landscaping was not uncommon in Singapore and had been carried out on slopes steeper than the slope at places like Resorts World Sentosa and the Singapore Botanic Gardens. (Mani estimated the gradient of the slope to be around 60°.) Besides geogrid, Tropical had also used geotextile (in particular, a variety called "Tensar") in planting the Wedelia. In this regard, the parties and their experts did produce in court samples of different types of wire mesh material available in the market to prevent soil erosion (for example, the defendants' expert Chew showed the court a sample of another type of wire mesh used for soil erosion called geocell). For ease of reference, a plan of the Luxe site showing the part of the slope that was planted with Wedelia and covered with geogrid and geotextile, as well as the locations of the Nomu and the Luxe sumps is attached to this judgment as Annexure B.

60 The evidence of Patterson-Kane, the plaintiffs' second expert, will be dealt with later (see [81] below) when I review the expert testimony of both parties.

The defendants' case

61 The defendants' factual witnesses were:

(a) Ow;

(b) Ke;

(c) Loke Kong Fai ("Loke"), the clerk of works of the second defendant; and

(d) Soo Chee Sern ("Soo"), the managing director of CS Consulting and the professional engineer ("PE") for the Nomu Building;

as well as the following experts:

(e) Dr Liu Bai Lin ("Liu"), a director of Associated Geotechnical Services Pte Ltd who was the defendants' soil expert;

(f) Ng Yan Heng ("NYH"), a PE who filed a total of six AEICs; and

(g) Dr Chew Soon Hoe ("Chew"), an engineer who is a specialist in geotechnical engineering from the National University of Singapore's Department of Civil and Environmental Engineering.

Not surprisingly, the plaintiffs had nothing good to say of the two main factual witnesses of the defendants, namely, the first defendants' general manager Ow and the second defendant's director Ke, both of whom were accused of being untruthful in their testimony. The wholly unflattering comments on Ow and Ke were set out extensively in the plaintiffs' closing submissions. (Both Ow and Ke were recalled to the stand at the defendants' behest after Rama from Gammon had testified.)

62 It was the plaintiffs' case (which the defendants vigorously denied) that the second defendant had carried out backfilling at the Luxe gully and the Workspace and its negligence in so doing caused the flooding incident.

63 In this regard, Ow was accused by the plaintiffs of misrepresenting the facts and overstepping his role as a factual witness by putting forward a (flawed) theoretical hypothesis. The plaintiffs also made much of the fact that Ow's AEIC exhibited photographs (taken by Loke) purportedly showing conditions on the Nomu site after the flooding incident. It was subsequently ascertained that those photographs were actually taken two days later on 13 August 2008. Ow had deposed that Loke's photographs were taken on 11 August 2008 and that they showed workers clearing and putting sand and silt into bags from the area around and from inside the Luxe sump at the lowest corner of the Luxe wall, and that the sand and silt extended some distance up the slope along the Luxe wall but away from the Nomu boundary wall.

64 Ow's AEIC further stated that after the flooding incident there was no sand or silt or residue or any semblance of the same at the concrete screed area, whether next to the Nomu boundary wall or the Nomu deep sump or on the slope next to the Nomu boundary wall. He claimed he checked and found that the concrete screed on the slope was intact and there was no evidence of erosion or landslip on the slope behind and above the Nomu site. He then reviewed the situation with Loke and

the second defendant's staff and they unanimously agreed that the sand and silt came from the planting done on the slope just behind the Luxe wall; there had been erosion and the soil completely filled the Luxe sump. Ow claimed that there were no signs that the leaves and debris around the Nomu sump were brought down by the water to the Luxe sump. He added that the concrete screed area adjacent to the Nomu boundary wall formed a gully that directed the water flow, if any, down the slope alongside the Nomu boundary wall.

65 For added measure, Ow's AEIC referred to the first plaintiff's planting works in January 2008 on the slope behind the Luxe wall. He opined that because there was no slope reinforcement work carried out, such as the planting of cells and stepped retaining walls (there was only a thin plastic sheet covering the planting area), it was most likely that the sand and soil that was washed down the slope towards the Luxe sump came from this area. He added that erosion must have taken place over a period of time resulting in an accumulation of large quantities of sand and silt at the Luxe sump, which caused the chokage and resulted in the flooding incident.

66 Ow went further in his AEIC to give his (unnecessary and irrelevant) views on the suitability of the location (and height) of the Openings and opined that they did not conform to the PUB Code. He concluded that this was the second main factor that caused the flooding incident.

67 I accept the plaintiffs' submission that Ow in his AEIC clearly overstepped the boundaries of a factual witness; I am therefore not prepared to accept his hypothesis of how the flooding incident occurred. I should add that it was because of Ow's hypothesis and Ke's testimony that representatives from Gammon (Rama) and Tropical (Mani) needed to testify.

68 As for Ke, he was not spared from the plaintiffs' criticism. Indeed, the plaintiffs considered Ke to be as equally unreliable a witness as Ow and urged this court not to accept his testimony.

69 In his AEIC, Ke deposed that before commencement of the works, the second defendant had laid the rear slope of the Nomu site completely with concrete screed in 2007 to prevent soil erosion. The second defendant also provided a concrete screed of 1–2m wide immediately adjacent to the Nomu boundary wall on the Luxe side of the slope. In order to construct the Nomu boundary wall, the second defendant had to provide wooden formworks to hold both the steel and the concrete. These items were removed in early 2008 after the wall was completed leaving behind a small gully (the Luxe gully) between the Nomu boundary wall and the Luxe side of the slope. Ke's AEIC mirrored Ow's in his observations after the flooding incident, stating to the effect that he noticed neither sand nor silt at or near the Nomu deep sump. I should point out that Ke was extremely coy in his AEIC and oral testimony – he never gave a precise date as to when construction of the Nomu boundary wall was completed (for reasons that will become apparent later). Ke only gave a vague estimate of early January 2008 as the completion date both in his AEIC and supplemental AEIC. However, as stated earlier (see [31] above), the plaintiffs had two volumes of photographs taken at various stages of the construction work on the Nomu site. It was clear from the photographs that the Nomu boundary wall could not possibly have been completed in early 2008 (see AB1032, 1034). It was not fully completed as at August 2008.

70 Ow and Ke were recalled to the witness stand on 12 July 2012 and 10 October 2012 respectively. Ow's supplemental AEIC ("Reply AEIC") focussed on the testimony of TBC and Seow as well as the planting works carried out by Tropical for the first plaintiff, whilst Ke's fresh evidence dealt with the planting works as well as the issue of backfilling carried out just below the Luxe gully area; both Ow and Ke repeatedly denied that the backfilling work was done by the second defendant. Indeed, in the defendants' closing submissions, they contended that workers shown in photographs of the backfilled area were not the second defendant's but either those of Gammon or Gammon's

subcontractors, based on the colour of the safety vests worn by the workers. I note that counsel for the plaintiffs did raise, in the course of Ke's cross-examination, the possibility that the second defendant's workers were made to wear Gammon's safety vests when they crossed over to the Luxe site to do work in the course of constructing the Nomu boundary wall. The evidence in this regard is inconclusive.

71 Rama was in charge of slope stability work for Gammon for the Luxe project until mid-October 2007. He explained that in October 2007 Gammon's works on the Luxe side of the slope ended 2–3m away from the Nomu boundary wall, and sandbags had been placed where Gammon had stopped work (see AB983 and AB990). This unworked space on the Luxe site was intended for use by the second defendant to continue its construction of the Nomu boundary wall, which had not been completed then by the defendants. However, there was no formal arrangement between Gammon and the second defendant on the latter's use of the Luxe site. Gammon had in March 2007 requested of the second defendant (who failed to provide) the structural construction programme of the Nomu Building so as to co-ordinate both parties' site activities. After the Nomu boundary wall was constructed, the second defendant "returned" the unworked part of the Luxe site area to Gammon, again without any formal documentation.

72 The defendants' rebuttal of Rama's testimony came from Ke. In his second AEIC, Ke deposed that sometime in 2007, Gammon had requested permission from the second defendant to use part of the Nomu site to construct the Luxe wall. Gammon subsequently reciprocated the second defendant's gesture by allowing the second defendant access to the Luxe site in January 2008 to construct the Nomu boundary wall.

73 There were photographs (such as AB1003) taken in or about October and November 2007 of the area just below the Luxe gully which showed that backfilling had been done. Ow and Ke were also referred to a photograph (at AB1027) taken on 27 January 2008 which showed, on one side, the fully planted Wedelia, while the other side (the backfilled area) still had wooden scaffolding with construction debris and timber pieces, *etc*. Ke denied that the second defendant had backfilled the area in order to level the ground so as to be able to erect a platform to build the Nomu boundary wall. For example, he pointed out that the second defendant used red bin chutes to transport concrete and sand (see AB1007), whereas a photograph taken in October 2007 of the backfilling process showed open metal sheets being used to transport sand from the upper parts of the slope. Ke therefore said that it was Gammon, and not the second defendant, who had carried out the backfilling in the Workspace. This contention was in my view improbable. First, Ke did not give a straight answer as to why it was *Seow* (the second defendant's project manager at the time) who had photographed the backfilling process, if indeed the second defendant had not done the work. All Ke could say was that Seow must have taken the photographs for their records (N/E 2481), but Seow himself said that it was the second defendant who presumably had used the open metal sheets. Seow went so far as to say that Gammon, being a reputable company, would not use metal sheets to transport backfill material (N/E 759–760). Second, there was Rama's evidence that Gammon actually used a crane at the time for transporting earth for backfilling (N/E 2385); Gammon would *not* have had to use open metal sheets to transport backfill material. Third, a photograph (see AB1007) which the defendants said showed *their own* backfill work on the Nomu site (N/E 770) revealed that *both* red bin chutes and open metal sheets were used to transport backfill material. There was no suggestion at all that Gammon ever did any backfilling work on the Nomu site. Given this evidence, it seemed more likely than not that the second defendant had utilised both red bin chutes as well as open metal sheets to transport materials such as concrete and sand down the slope to the backfilled area after they were delivered to the site via Mount Sophia/Adis Road.

74 Counsel for the plaintiffs also drew Ke's attention to a photograph (AB1041) taken in April 2008

of planting works carried out by Tropical and compared it with another photograph (at AB1042) of the backfilled area taken in May 2008 showing haphazard planting works, and suggested that the latter works were carried out not by Tropical but by the second defendant, who was not a planting specialist. Ke said that the second defendant did not do the haphazard planting.

75 Ow had obtained leave from the court to file the Reply AEIC before he was recalled to the stand. His Reply AEIC sought to rebut (more by arguments than facts) the testimony of TBC and Seow. During his further cross-examination, Ow was also shown a photograph (at AB1032) taken on 13 February 2008 which revealed that the Luxe gully had been backfilled. Ow (like Ke) denied that the second defendant did the backfilling – he contended that the second defendant had merely screeded the slope along the Nomu boundary wall where it met the Luxe wall.

76 In the Reply AEIC, Ow (at para 40) addressed the issue of blockage by concrete in the piping from the Nomu deep sump that Kerk had alluded to in his AEIC (see [51] above) as follows:

> Some concrete was found in the tunnel pipe on the 2nd storey covering approximately one third of the pipe. It should be noted that when one test [*sic*] a semi choked sump with some water, the discharge would be slow because you have to first get over the one third level before the water starts flowing out. The discharge would therefore be slower because of this.

Ow deposed that water from the Nomu deep sump (on the 4th and 5th storeys of the Nomu Building) flows through a series of sumps from the 5th storey to the 3rd storey and from there to the blocked pipe on the 2nd storey, and then to the 1st storey where it flows out of the Nomu Building.

77 Ow then stated (in para 42 of the Reply AEIC) the following:

> I would point out that the sump covers were not yet installed. I have confirmed with the 2nd Defendant that the sump covers were ordered in September 2008 and was covered only by pieces of wood. Furthermore, there is an open drain on the 4th floor carpark connected to the sump by a 300mm pipe. Water backing up would have overflowed at this point into the 4th storey carpark. Hence even if the Tunnel Pipe was fully choked, the water from the Deep Sump would have flowed out of all or any of these openings. Consequently, no water would have back [*sic*] up to the 5th Storey sumps. It would not have any consequence on the flow of water through the Deep Sump in the first place contrary to the conclusion the Plaintiffs are trying to draw from this.

From the two extracts above it is clear that Ow implicitly acknowledged the blockage in the pipe. In the defendants' closing submissions, there was also no denial of the blockage, and no arguments were raised on this. In fact the blockage was not addressed at all. However, during Seow's cross-examination (at N/E 784), counsel for the defendants did contend that the one-third blockage was "no issue" because the pipe's remaining capacity (400mm of 600mm) was enough to carry all the water that came from the 300mm pipe connecting the Nomu shallow sump to the Nomu deep sump. Ow himself repeated this contention in his further cross-examination (at N/E p 1260).

78 In Ow's cross-examination, contrary to his and Ke's testimony (that no construction debris from the Nomu site flowed onto the Luxe site), Ow was shown a photograph taken on 10 August 2008 (see AB1118) which clearly showed broken concrete pieces and other construction debris in the Luxe gully, which counsel for the plaintiffs contended had been washed down by the rain.

79 While Ow and Ke insisted that the Nomu sump and the Nomu deep sump's interiors were clear of debris (although they did say that there were leaves and debris around the two sumps), they failed to explain why the photographs at AB1104, AB1108–1109, AB1181 and AB1188 showed that the Nomu shallow sump was filled with construction debris and other materials (including the controversial plastic sheet), while AB24 showed the untidy condition of the Luxe gully, also covered in construction debris, in the aftermath of the flooding incident. The proverbial saying that a picture speaks a thousand words could not be more apt. Conversely, the photographs at AB1019–1020 showed how well the planted Wedelia had grown by December 2007. Indeed, by April 2008 (see AB1039) the Wedelia was a lush vegetation, and it survived intact after the flooding incident (at AB1073). However, the plants at the Luxe gully and/or the Workspace appeared to have been buried by sand after the flooding incident (see AB1074–1075). Where could the sand have come from if not from the backfill?

The expert testimony

80 The defendants' three experts were not spared from the plaintiffs' criticism. As indicated earlier (at [60] above), the expert testimony of both parties will be dealt with separately which I do now. The plaintiffs argued that the testimony of the defendants' three experts should not be accepted by the court as they were neither objective nor reliable. A similar submission was made by the defendants of the plaintiffs' experts and of Patterson-Kane in particular.

81 I start my review with the evidence of Patterson-Kane. His brief from the plaintiffs (according to his first report dated 16 November 2011) was to:

(a) determine whether the design of the drainage system at the rear of the Luxe site was adequate to accept the run-off from rain which could reasonably be expected to fall on the catchment area, which comprised the slope;

(b) do a qualitative comparison between the rainwater volume for the slope catchment at the rear of the Luxe site and that of the Nomu sump;

(c) determine whether there was any slope failure or significant scouring of soil from the slope of the rear of the Luxe site during the flooding incident; and

(d) determine the probable source of the material which blocked the Luxe sump and resulted in the ingress of water into the Luxe Building.

82 Patterson-Kane arrived at the conclusions in his first report after visiting the Luxe site on 21 October 2011. He visited the site again on 21 December 2011 after Liu (the defendants' soil expert) had taken soil samples from the slope. Patterson-Kane's first report stated that:

(a) Unless there was obstruction by foreign material, the drainage system at the rear of the Luxe site had adequate capacity to accept the rainfall on 10 August 2008.

(b) He had calculated the flow rate for the catchment at the rear of the Luxe site during the heaviest rainfall on 10 August 2008 to be only 7.4 litres per second (which was less than a typical domestic plastic bucket per second). Such a small flow distributed over the slope would not have caused any significant scouring of soil.

(c) Any small amount of soil carried by such small flows from the Luxe catchment area would be flushed through the drainage system of the Luxe site and would not block it.

83 In arriving at his above findings, Patterson-Kane made a number of assumptions, including that the catchment area for rain was bounded by the rear wall of the Luxe site, the Nomu boundary wall and the Luxe wall. Patterson-Kane included in the catchment an area beyond the road reserve line of Mount Sophia/Adis Road. He also made certain assumptions to calculate the volume of rainfall of various durations on 10 August 2008. Even so, Patterson-Kane was unable to calculate the flow volumes of the cascade drain at the rear of the Nomu site that led to Handy Road. He had seen videos taken by Patrick Lam during rainstorms after the flooding incident and opined that those flows had considerable velocity and energy by the time they reached the Nomu sump.

84 Patterson-Kane's subsequent three reports (with an amended second report) in his later affidavits were, according to the plaintiffs, necessitated by the AEICs of the defendants' experts. Patterson-Kane's second AEIC/report was his response to the first AEIC (and report) of NYH. Patterson-Kane took issue with, *inter alia*, NYH's calculations of the volume and flow rate of rainwater run-off from the Nomu rear boundary into the cascade drain, as well as the flow rates into the Nomu sump.

85 Patterson-Kane's third affidavit/report commented mainly on photographs that he had seen after the completion of his second report. The photographs are those found in vols 5 and 6 of the AB. Patterson-Kane also had sight of drawings, survey plans, as well as the AEICs of Seow and TBC. His fourth affidavit/report was to comment on the report of Chew, the defendants' third expert.

86 Patterson-Kane opined that Chew's report did not address the issue of whether the Wedelia plants would still remain on the slope if erosion had taken place. Patterson-Kane also observed that neither Chew nor he could answer the question "what was [the] layer of [soil in between the geogrid and geotextile where the Wedelia grew] and whether this layer of soil was still intact after the flood took place" because they did not have any reliable information on the thickness and distribution of the soil layer, either as originally placed or immediately after the flooding incident (although Liu's report did state that the soil in between the geogrid or geotextile where the Wedelia grew was silty with a small amount of clay). Patterson-Kane further noted that Chew had inspected the site almost four years after the flooding incident, so that the latter's observations of the condition of the geotextile and planted soil could not be representative of conditions immediately after the flooding incident. Patterson-Kane made numerous other adverse comments on Chew's report. He rejected Chew's conclusions as lacking any sound basis.

87 It would not be a fruitful exercise for this court to dwell on Patterson-Kane's criticisms. Suffice it to say, the reports of all the experts of both parties (including Patterson-Kane) contained shortcomings which will be addressed later.

88 The defendants not surprisingly criticised Patterson-Kane heavily. They pointed out that he had changed his positions, citing as an instance how he had stated that the Luxe gully was not concreted in his first report but then changed his opinion in his third report. Further, Patterson-Kane had initially opined that the backfill from the Luxe gully was the source of the material that choked the Luxe sump. In his third report, however, Patterson-Kane stated that the soil deposited into the Luxe sump comprised predominantly/entirely of material scoured from an area close to the Luxe gully.

89 The defendants even questioned Patterson-Kane's site inspections, saying that these inspections were limited because Patterson-Kane had only observed from the 3rd and 4th storeys of the Luxe Building and from Mount Sophia/Adis Road (unlike NYH who had personally gone onto the slope to take measurements).

90 The defendants also complained that Patterson-Kane's evidence was unreasonable. Patterson-

Kane refused to calculate the flow volume of the cascade drain leading to the Nomu shallow sump without which (it was contended by the defendants) he could not actually say how much rainwater overflowed from the Nomu shallow sump. Yet, he calculated the capacity of the Luxe sump on a maximum basis (based on rainfall intensity, the size of the catchment area, and the run-off co-efficient) to support his view that the Luxe sump would have had more than adequate capacity to discharge the ordinary volume of water flowing down from the slope and draining into the Luxe sump.

91 Patterson-Kane was therefore accused by the defendants of being selective in his estimates. They said he chose to make estimates where or when it suited his purpose but not otherwise. The example cited was Patterson-Kane's choice of adopting 15 minutes' duration of rainfall at 18mm on 10 August 2008 based on maximum rainfall recorded on 24 August 2008 of 19mm, when the actual rainfall recorded on 10 August 2008 between 12.00 noon and 1.00pm was 23.4mm.

92 I would add that there was a wide discrepancy between Patterson-Kane's estimate of the catchment area (7,760m²) and NYH's estimate (revised upwards from 1,800m² to 2.200m^2 after a site visit). The defendants submitted that Patterson-Kane's figure was unreliable as he had obtained it from a satellite image of the catchment area and not by measurements. I should point out however that after the site visit mentioned in [30] above, Patterson-Kane said that he estimated the catchment area to be "much less than 7,760m²" (N/E 1576). Although he was pressed by the court for a number (after being directed to revisit the site to check), Patterson-Kane did not subsequently revise his estimate of the catchment area.

93 Consequently, the defendants contended that Patterson-Kane was not an objective witness; he was only interested in advancing the plaintiffs' case and he relied on far-fetched theories and assumptions to reach his conclusions.

94 Leaving aside the defendants' criticisms, there was one aspect of Patterson-Kane's testimony (in his third report at para 5.3) that I consider to be completely irrelevant; this was his reference to a phenomenon called a hydraulic jump, using as an illustration the St Anthony Falls in the upper reaches of the Mississippi River. Patterson-Kane theorised that the flow of water down the steep slope on the Luxe site would be shallow but it would have had a very high velocity when it reached the bottom; this was known as supercritical flow. Although he said that it was not possible to accurately calculate the flow velocities, this being a complex process requiring knowledge of the flow rate and other parameters, Patterson-Kane nevertheless proceeded to do so based on certain assumptions – that the total height of the slope was 6m, that the flow had zero velocity where it overflowed the Nomu site, and that the friction between the flow and the slope was negligible (less than 5%).

95 According to Patterson-Kane, when supercritical flow is obstructed (as theorised in this case) by a sudden reduction in the slope of the base of the flow channel, the flow changes suddenly to a slower velocity, or subcritical flow. Because of the slower velocity, a greater depth of water is required to accommodate the flow volume. The change in velocity and water depth over a very short distance results in a hydraulic jump phenomenon where the water is very turbulent and any scoured soil carried by the flow may be deposited over a significant area. Patterson-Kane opined that the overflow from the Nomu sump into the Luxe site would have had similar characteristics.

96 I accept the defendants' submission in this regard (at para 171 of their closing submissions) that the hydraulic jump theory is fanciful. There is some credence in the defendants' argument that Patterson-Kane needed the theory of a hydraulic jump in order to explain how material was scoured and deposited by the large volume of water flowing down from the Nomu sump on 10 August 2008. I am not persuaded that the hydraulic jump theory pertaining to rivers such as the Mississippi apply to run-off on a slope, albeit a steep one.

97 Teh's testimony did not fare any better than Patterson-Kane's with the defendants. First, as alluded to at [47] above, the defendants said it was highly suspect that in his first report, Teh's measurements of the Openings coincided with those of HWF (the QP from J Roger Preston) and he was mistaken as to their locations, just as HWF was. I should add that in his first report (at para 39), Teh said the heights of the Openings were "immaterial".

98 Teh expressed serious doubts on the measurements taken by NYH but he then incorporated the measurements of HWF into his report without disclosing the source. Far worse, Teh not only used Patterson-Kane's measurements (see para 44 of his first report) but lifted (almost verbatim) and adopted entire extracts from the latter's first report. When cross-examined (at N/E 1439), Teh professed that he could not remember if he had copied from Patterson-Kane's report, but admitted that he had had a discussion with Patterson-Kane.

99 The defendants complained that in his haste to disagree, Teh misread NYH's report but would not admit to it. Teh said in his third report that NYH had relied on an "as built" drawing when the latter had only referred to a construction drawing. Teh refused to concede his error. Then, in another part of his cross-examination, Teh said the PUB Code applied "indirectly", ignoring the fact that the code was issued under s 32 of the Sewerage and Drainage Act (Cap 294, 2001 Rev Ed), which Act clearly applied.

100 The defendants (quite rightly I would add) criticised Teh's conduct as unprofessional and lacking integrity. In view of his failure or inability to explain why he had obviously and blatantly copied entire passages from Patterson-Kane's report, I accept the defendants' submission that Teh's AEICs and his three appended reports should be disregarded – he lost all credibility as an expert witness. In this regard it is noteworthy that the plaintiffs' submissions made no attempt to salvage Teh's credibility.

101 I move next to the defendants' experts who unsurprisingly were criticised in equal measure by the plaintiffs, starting with Liu.

102 Liu had taken the various soil samples exhibited in court (see [31] above). Some of these samples, which were taken from the planted Wedelia area, resembled the light colour of the mud which had collected around the Luxe sump on the day of the flooding incident. However, the plaintiffs pointed out that when Liu tested the collected samples, he had, according to his first report, first washed the top soil samples for two hours with a solution of sodium hexametaphosphate; this gave the light colour shown in Liu's report which differed from the samples' actual colour. Therefore the light colour had been artificially induced by washing away the dark colour of the original soil samples taken from the slope.

103 Moreover, Liu revealed during cross-examination (at N/E 1489) that while sodium hexametaphosphate breaks down the binding effect of clay particles and separates them from the rest of the soil samples, that chemical compound is *not found naturally in rainwater*. Consequently, Liu's tests did not simulate the conditions of the rainfall on 10 August 2008 and were unhelpful to the court. I therefore disregarded them.

104 As stated earlier (see [61] above), NYH filed six AEICs. He was tasked by the defendants with establishing the probable cause(s) of the flooding incident. To that end and purpose, NYH made several site visits with the first being on 10 May 2011 and the last on 25 September 2012. NYH's second affidavit contained his critical comments on the AEICs of the plaintiffs' witnesses, including Teh and Patterson-Kane. In his sixth affidavit, NYH criticised Patterson-Kane's use of the St Anthony Falls as an illustration of a hydraulic jump and opined that it had no application (like critical flow) to

the slope. In his other affidavits, NYH amended his initial report as he had revised his calculations on the capacities of the Mount Sophia/Adis Road culvert pipe, the cascade drain, the Nomu sump and the Luxe sump.

105 The plaintiffs were highly critical of NYH and his reports, which they described as unintelligible and confusing. They contended there were no discernible bases for NYH's opinions. NYH had used ratios of 1:400 and 1:200 respectively for the gradients of the Mount Sophia/Adis Road culvert pipe and the cascade drain. Those ratios it was contended was for slopes far gentler than the slope, something which NYH himself acknowledged during cross-examination. Patterson-Kane on the other hand had estimated the ratio of the Mount Sophia/Adis Road culvert pipe to have a steeper gradient of 1:55. The plaintiffs pointed out that NYH could easily have obtained the correct gradients from the topographical survey map found in the AEIC of the plaintiffs' surveyor Lau Hua Peng (who did not testify).

106 NYH was further criticised for using the Manning formula to calculate the discharge of the cascade drain because the Manning formula is only suitable for non-cascading drains. Nor could the plaintiffs accept NYH's calculations of the height of the water level on the slope on the day of the flooding incident, as the slope had an irregular terrain. To have assumed a level ground for his calculations was simply wrong. The plaintiffs then referred to an exchange between the court and NYH (at N/E 1921–1922) where the court inquired of NYH (without success) for the bases of his many assumptions in his report and calculations. The plaintiffs submitted that the court should accord little weight to NYH's evidence as his conclusions were baseless.

107 The last expert called by the defendants was Chew, whose testimony was described as being slapdash and sloppy by the plaintiffs. Chew fared poorly in the eyes of the plaintiffs because sometimes his facts and/or information were wrong. For example, his report contained incorrect timeframes for the placing of top soil on the geogrid and when the planting works were actually completed by Gammon/Tropical. Chew had also over-estimated the planted Wedelia area on the slope as well as the thickness and depth of the top soil and soil used for the planting.

108 Chew selected six rainfall events between April and August 2008 to calculate the soil loss from the planted area of the slope. However, he had only visited the site in 2012. To do his calculations, Chew applied the Modified Universal Soil Loss Equation method. To do so, Chew needed to establish these key parameters:

(a) the C factor – the cover management factor, *ie*, the degree of protection afforded on the ground;

(b) the LS factor – the topographic factor which depends on the slope's length and steepness; and

(c) the volume of run-off.

109 The plaintiffs criticised Chew for using too high a C factor as he had failed to take into account that the planted Wedelia was fully grown and would have reduced the volume of run-off.

110 Chew's gradient for the LS factor was also too high and inappropriate, as the slope was not a constant or regular slope. Chew should have, but failed to, split the slope into (three) segments and apply a different LS factor to each segment.

111 The plaintiffs also took issue with Chew's comment (based on a selection of photographs he

had produced) that there was no soil on various parts of the slope, pointing out that Liu managed to obtain 9kg of soil as samples for testing from the lower, middle and upper parts of the slope.

112 The plaintiffs then challenged Chew's assertion in his report that there had been significant soil erosion from the planted area prior to 10 August 2008. According to the plaintiffs, it was inconceivable that significant soil erosion could have occurred after the Wedelia had taken root. Prior to the plants taking root, the geotextile and geogrid placed on the ground would have been effective in preventing any soil erosion.

113 Following their scathing comments on his evidence, the plaintiffs alleged that Chew's testimony was replete with grossly estimated numbers and superlatives to support his theory that a large amount of the top soil initially placed on the planted area had been eroded. They therefore contended that his evidence should be discounted.

114 If nothing else, I concur with the plaintiffs on one aspect of Chew's testimony (at N/E 2070) that water from the weep-holes in the shotcrete wall could move the soil in the backfill. I reject that possibility altogether; there was no evidence to support his theory bearing in mind that a sandbag wall was built at that location by Gammon and it was wrapped in geotextile (see AB1010) to prevent soil erosion before the Wedelia took root. Even if the weep-holes were a source of erosion, Chew himself acknowledged that it would be minimal. Nor could the water from the weep holes (if any) have had the velocity to sweep any debris down the slope towards the Luxe sump on 10 August 2008.

115 In view of the divergence of views between the experts and by consent of the parties, a "hot-tubbing" session was held with Patterson-Kane and Chew in the fourth tranche of the trial in an attempt to reach consensus on various issues. The two experts disagreed on how geogrid should be laid on a slope, whether horizontally or transversely, to prevent soil erosion. While Patterson-Kane opined that it did not matter how the material was laid so long as it was laid in a continuous strip, Chew insisted that it should be laid horizontally (whereas the geogrid on the slope had been laid transversely). Patterson-Kane opined that the geogrid would absorb the impact of rain falling on the slope. Chew thought that geocell (see exhibit D16) being a thicker material would have been better to prevent soil erosion than the porous geotextile (exhibit P6) that Tropical laid.

116 Both experts agreed that the geogrid used was a short-term erosion prevention measure until the Wedelia that was planted could take root and grow. However, Chew opined that geogrid was not the appropriate material as the slits cut to accommodate the Wedelia would expose the soil and subject it to erosion. It was difficult to see his point here since he actually conceded that the geogrid did not fail. The experts accepted that if the Wedelia had been newly planted before 10 August 2008 (which was not the case), then it would likely have been eroded away by the rain that day. Both experts also agreed that the backfilled area was the source of the material carried down by the rain on 10 August 2008 to the Luxe sump. They further agreed that the Nomu boundary wall slopes downwards from the Luxe gully towards the Luxe sump.

The findings

117 Although each and every one of the experts deposed in their AEICs that their duty was to the court and they had complied with that duty, they merely paid lip service to O 40A r 2 of the Rules of Court (Cap 322, R 5, 2006 Rev Ed), which states:

> **Expert's duty to the Court (O. 40A, r. 2)**
>
> **2.**—(1) It is the duty of an expert to assist the Court on the matters within his expertise.

(2) This duty overrides any obligation to the person from whom he has received instructions or by whom he is paid.

118 I am of the view that none of the five experts who testified were objective or unbiased. It was clear from their testimonies that they were beholden to the party who had engaged and paid for their services. On this observation alone I would have hesitated greatly to accept the testimony of all the experts. However, a far more serious shortcoming of the experts' testimony was the fact that none of their reports was based on concrete or reliable data. There were too many assumptions or unknown parameters in the experts' reports rendering it unsafe for the court to accept many of the conclusions proffered in those reports. I should add that while the defendants' experts (NYH and Chew) were quick to make assumptions (of any manner), the plaintiffs' expert Patterson-Kane was reluctant to do so or to offer alternatives when he criticised the defendants' experts on their assumptions or findings; this can be seen from the comparative table in exhibit D-11 of the calculations made by NYH and Patterson-Kane of the volume of rain that reached the cascade drain on 10 August 2008 from Mount Sophia/Adis Road. Unlike NYH, Patterson-Kane had no calculations for the volume of water that could enter the 600mm culvert pipe, the percentage of water flowing to the cascade drain and the capacities of the Nomu and Luxe sumps. Patterson-Kane's testimony was not very helpful.

119 In fairness to the experts, the issues in this case were not easy to resolve. Calculations had to be made by the experts using formulae and technical jargon which the average layman would find very difficult to comprehend. At best, I found the experts' reports inconclusive, and at worst they were unhelpful to the court's difficult task of arriving at its findings.

The findings

120 It is settled law that the issue of causation in negligence is to be determined through a two-stage inquiry:

(a) whether there was causation in fact, using the "but for" test;

(b) whether there was causation at law, *ie*, whether the defendants' acts or omissions were the proximate cause of the loss suffered by the plaintiffs.

121 It cannot be disputed that the defendants owed the plaintiffs a duty of care at law to ensure that their construction activities and the works did not cause loss and damage to the Luxe site. To succeed in their claim, the plaintiffs must prove on a balance of probabilities that: (a) but for the overflow of water from the Nomu site, water would not have entered the Luxe Building on 10 August 2008; (b) it was the defendants' acts or omissions which were the proximate cause of the water ingress to the Luxe site and into the Luxe Building; and (c) the first plaintiff's location of the Openings was not the intervening act that broke the chain of causation.

122 I start with my assessment of the evidence. The factual witnesses who were most credible in my view were Mani from Tropical and Rama from Gammon. I gave greater credence to the testimonies of these independent witnesses as compared with the evidence of the other witnesses. Contrary to the defendants' submissions, I am of the view that both Patrick Lam and Ng were truthful in their testimony. While the other witnesses called by the plaintiffs had their shortcomings, I generally preferred their testimony (save for Teh) to that of the defendants' witnesses, Ow and Ke.

Soil erosion

123 It would be appropriate to first deal with the lesser issue of soil erosion before going on to

address the main issue of the cause of the flooding incident.

124 I do not find it useful in this regard to determine whose expert testimony is right on the amount of top soil that was laid before the planting of the Wedelia. I accept Mani's evidence (see [58] above) that the planted area of the slope was filled with 150–200mm depth of topsoil as this was reflected in Tropical's "as built" drawing (at AB2190) pursuant to which Tropical was paid for its landscaping work *after* certification by SCDA. It was Mani's evidence (at N/E 2440), which I accept, that the Wedelia was planted in a zigzag fashion 300mm apart, that the plants took root in 1–2 weeks, and that it was fully grown in 2–3 months. Certainly on the issue of soil erosion I have no hesitation in accepting Mani's testimony that there could not have been any marked soil erosion to the extent that the soil filled the Luxe sump on 10 August 2008.

125 It was Rama's evidence that holes were drilled by Gammon's other subcontractor into the shotcrete; angled bars were then driven into the holes to secure the geogrid to prevent it from sliding. The manner of planting carried out by Mani and the preventive measures for erosion taken by Rama, coupled with the evidence that the Wedelia plants were intact but buried under sand (see [79] above) after the flooding incident, rebutted Chew's contention that the geogrid/geotextile should not have been laid horizontally. Consequently, I do not accept Chew's testimony that the top soil would have been "lost" after April 2008. The top soil would not have been "lost" as the geogrid/geotextile was secured to the ground by pegs/bars. Annexure A shows where the planted area of the slope had both geogrid and geotextile installed to prevent soil erosion. Against such evidence, the defendants only had speculative hypotheses from Ow.

126 I find the testimony of Mani and Rama to be more credible than that of Ow, Ke and Chew. Mani however was incorrect in thinking that it was Gammon who did the backfilling in the Luxe gully area. He would not have known of the arrangements made between Gammon and the second defendant. But this error does not detract from the overall credibility of Mani's testimony.

What was the cause of the rain overflow from the Nomu site to the Luxe site?

127 What then caused rain to overflow from the Nomu site and the Nomu sump into the Luxe site and the Luxe sump on the day of the flooding incident?

128 In my view, it does not take rocket science to know that rain/run-off falling on the (steep) slope at Mount Sophia/Adis Road will make its way down to Handy Road by taking the path of least resistance where channels for its discharge are inadequate, as was the case of the Nomu sump and the Nomu deep sump which were both choked on the day of the flooding incident. Where there were obstructions, the rainwater made its way around those obstacles to accumulate around the Luxe gully space, and the level rapidly rose when the Nomu deep sump could not discharge the water fast enough into the public drain at Handy Road, due to blockage by hardened cement inside the 2nd storey pipe of the Nomu site's internal drainage system. Water in the Luxe sump then overflowed and entered the Luxe Building through the Openings.

129 The laws of physics dictate that if rain or run-off has debris in its path on its way down the slope, such debris would be carried down with the rain or run-off. This was exactly what happened that Sunday. Even if the slope itself was in the direction of the Nomu site from the Luxe site (as the defendants contended), the rain would still flow downwards albeit in a diagonal fashion. I note however that in the hot-tubbing session the two experts agreed that the Nomu boundary wall slopes downwards from the Luxe gully towards the Luxe sump, where the water accumulated and then overflowed into the Luxe Building.

130 As I had observed earlier (at [118] above), the experts' testimony is of limited help in this regard. Taking a broad overview of the evidence and looking at the photographs contained in the agreed bundles, it seems to be quite clear that a main cause of the flooding incident was poor housekeeping on the Nomu site by the second defendant's workers. I have already mentioned Seow's and Kerk's evidence that construction of a wall at the back of the Nomu Building was taking place at or just prior to the time of the flooding incident (see [50] and [56] above). As seen from the photograph at AB1269, construction material would have been placed very close to the location of the Nomu deep sump. This was very likely one of the sources of material which clogged the Nomu deep sump on the day of the flooding incident.

131 Even if this court were to accept the claim by Ow and Ke (which I do not) that the interior of the Nomu sump and the Nomu deep sump were in pristine condition when checked on 11 August 2008, and Loke's evidence that the Nomu sump was last cleaned on 8 August 2008, the fact that was completely overlooked by all three witnesses was that the Nomu site itself was untidy – it contained all manner of construction debris, including sizeable concrete and pipe pieces, which was washed down in the flooding incident. The rain on 10 August 2008 swept the debris into the Nomu sump and the Nomu deep sump, causing them to choke. In addition, the Nomu site's internal drainage system could not discharge water to its full capacity due to the blocked 300mm tunnel pipe. This caused the water to overflow into the Luxe gully and the Workspace, where material from the backfilled area was swept into the Luxe sump. The Luxe sump could not discharge this overflow of water, soil, sand, silt and mud, resulting in the overflow entering the Openings and into the Luxe Building.

132 Despite Ke's denial, I have no reason to doubt that it was the second defendant who did the backfilling at the Luxe gully area and the Workspace after it had built the Nomu boundary wall and before it handed back that area to Gammon. That was why the ground level around the Luxe sump was raised. In this regard I note that, in their closing submissions (at para 12), the plaintiffs contended that the original locations of the Openings were in compliance with the PUB Code and reasonably adequate, adding also that "the heights of the Openings are immaterial as the [flooding incident] would have happened regardless of which part of the Luxe Wall the Openings were located". I accept this submission. The first plaintiff would not have raised the ground level at the Luxe gully knowing full well the requirements under the PUB Code for the minimum crest, platform and ground levels. My view is reinforced by the photograph at AB1042 showing the haphazard planting works (likely to have been carried out by the second defendant) at the Luxe gully area which were in marked contrast to the planting works done by Gammon/Tropical at the sandbagged area (see AB1010). In this connection, it was absurd of Ow and Ke to say in their respective AEICs that the second defendant was never in control of the Luxe site. There was no question of control as Gammon, in reciprocating the defendants' gesture in previously allowing Gammon access to the Nomu site to build the Luxe wall, similarly granted the second defendant access to the Luxe site to build the Nomu boundary wall subsequently.

133 Both Ow and Ke deliberately misstated the TOP inspection for the Luxe Building as having taken place in April 2008 – TOP was *obtained* by the Luxe Building in April 2008 (see [7] above). The TOP inspection took place on 21 February 2008, as reflected in a letter (at AB2176) dated 14 February 2008 from the Building and Construction Authority to SCDA. Ow and Ke's misstatement was intended to give the (wrong) impression that Gammon were still doing construction work on the Luxe site in early to mid-2008. Then, as mentioned (at [72] above), Ke had said that the second defendant was granted permission by Gammon to use a small strip of land on the Luxe site to build the Nomu boundary wall sometime around January 2008. Since Rama had left the Luxe site in October 2007, that meant he could not dispute what Ke claimed. Ow and Ke had to say that the second defendant "returned" the Luxe site to Gammon in January 2008 because they claimed that the Nomu boundary wall was already completed in early 2008.

134 I note that Ke's first AEIC (at para 6) stated that the wooden frames set up to hold the steel and concrete of the Nomu boundary wall were removed when construction of that wall was completed in early 2008. I had earlier found (see [69] above) that Ke's estimate of the timeframe was completely off the mark. It reinforces my finding that construction debris was still present on the Nomu site on 10 August 2008 because the Nomu boundary wall was not yet fully completed then. Hence, wooden planks (used in formwork for concreting or in platforms for scaffolds to reach higher parts of the Nomu boundary wall) were part of the debris found in the Nomu sump.

135 Earlier, I had referred to Ow's testimony (see [76]–[77] above) where he admitted that the pipe in the Nomu site's internal drainage system was partially blocked by hardened concrete inside, thereby accepting Seow's testimony as correct. Granted, the blockage was only one-third of the interior of the pipe, but coupled with construction debris at the Nomu sump and the Nomu deep sump at the upper level, the discharge of water by the Nomu site's internal drainage system would have been severely impeded. It was more likely than not that this drainage system could not have coped that Sunday with the rain coming down the slope from Mount Sophia/Adis Road via the cascade drain, or which fell on the slope itself. Ultimately, I find that the raised level of the slope where the backfill had been carried out by the second defendant, coupled with the aforementioned blocked pipe and construction debris, caused water to enter the Openings and the Luxe Building when the Luxe sump could not cope with the volume.

136 Consequently, on the issues set out at [28] above, this court finds that:

(a) it was the rain that washed the construction (or other) debris down the slope;

(b) the construction (or other) debris that was washed into the Nomu sump and the Nomu deep sump undoubtedly came from the Nomu site;

(c) if not for the construction (and other) debris that flowed into and clogged the Nomu sump and the Nomu deep sump, the Luxe sump's capacity would have been able to cope with the volume of rain that fell on 10 August 2008;

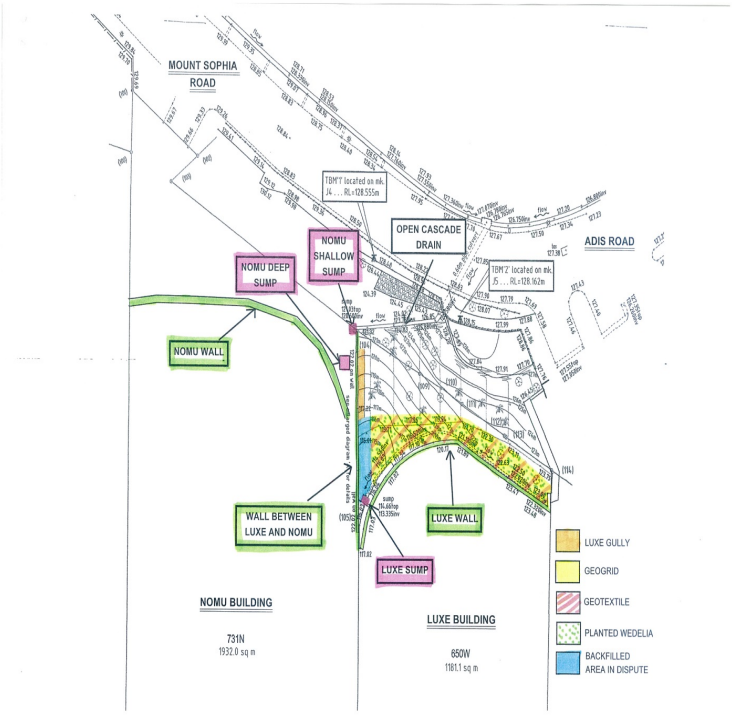
(d) the location of the Openings was not incorrect or too low at the material time; and

(e) the doctrine of *res ipsa loquitur* does not apply to hold the defendants liable. In any case this issue is academic in view of my finding in (b) above.

137 Concurrent with my findings, I am of the view that neither defendant has made out any of the pleaded defences including that of contributory negligence on the part of the first plaintiff. There were no construction activities on the Luxe site on 10 August 2008, there was no soil erosion on the Luxe side of the slope, and the location of the Openings and the Luxe sump did not cause or contribute to the flooding incident.

138 Consequently, I award interlocutory judgment to the plaintiffs on their claim with damages to be assessed by the Registrar, with interest (if any) on the damages and costs of the assessment reserved to the Registrar. The plaintiffs shall have their costs for the trial which are to be taxed unless otherwise agreed.

Annexure A



Annexure B