

Determination 2006/112

Stability of a house on a riverside site at 177 Fitzherbert East Road, RD 1, Palmerston North



1 The matter to be determined

- 1.1 This is a determination under section 17 of the Building Act 1991 (“the former Act”) as amended by section 424 of the Building Act 2004 (“the Act”), made under due authorisation by me, John Gardiner, Determinations Manager, Department of Building and Housing (“the Department”), for and on behalf of the Chief Executive of that Department. In this determination, references to sections are to sections of the Act unless otherwise stated.
- 1.2 I take the view that the matter for determination is a dispute about a building consent for the construction of a house on a riverside site (“the house”), and specifically whether the house will comply with clauses B1 Structure and B2 Durability of the Building Code (the First Schedule to the Building Regulations 1992) in respect of possible removal of support, including removal due to erosion by the river. In this determination, references to clauses are to clauses of the Building Code unless otherwise stated.
- 1.3 In making this determination, I have not considered any other requirements of the Building Code.
- 1.4 This determination does not purport to do more than indicate the nature of the technical points at issue and cannot do justice to the carefully presented submissions and evidence both written and oral. Various matters that were mentioned in the submissions and evidence are not discussed below because I concluded, after full consideration of all the circumstances, that those matters did not affect my decision.

2 The parties

- 2.1 The applicant is the Palmerston North City Council (“the territorial authority”) acting through a firm of solicitors. The other party is C M Davidson (“the owner”) acting through another firm of solicitors.

3 Background

3.1 The building and the sequence of events

- 3.1.1 The proposed two-storey house is approximately 400 m² in floor area. It has a conventional timber frame supported by a concrete slab with perimeter footings plus specifically designed concrete pads under columns supporting roofs. It is proposed to be erected on the left bank (looking downstream) above the outside of a bend in the Manawatu River. The bank is about 14 m high to a terrace (“the top terrace”), and includes a stepped intermediate platform (“the lower terrace”) about 8 m above the base. The house is shown as being sited 2 m back from the edge of the top terrace and about 25 m horizontally from the base of the river bank.

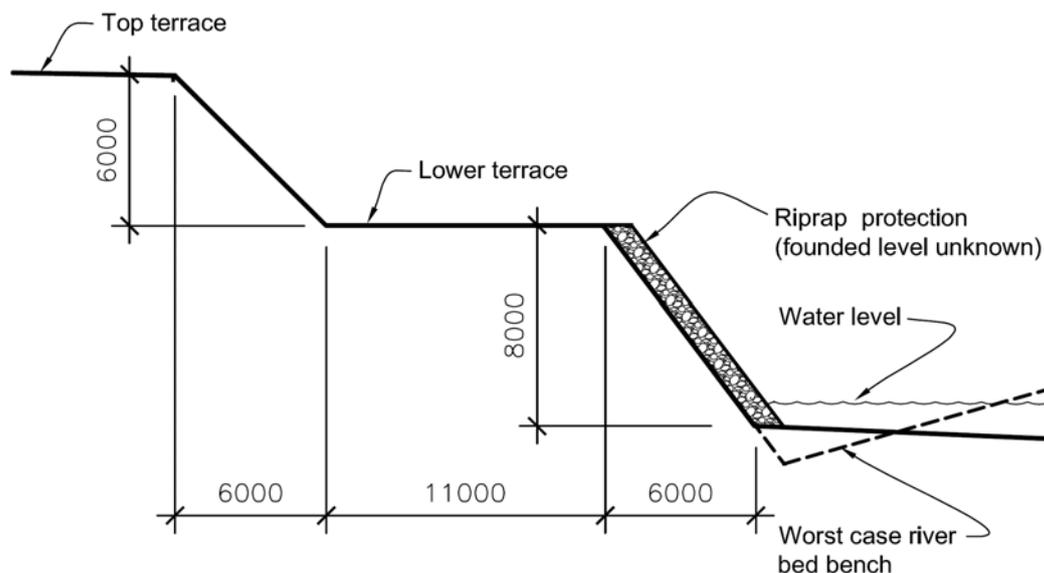


Figure 1: Schematic cross section through the river

- 3.1.2 The owner applied to the territorial authority for a building consent for the construction of the house. The territorial authority, concerned about erosion from the river and the stability of the top terrace, requested geotechnical information about bank stability. The territorial authority also sought advice from the regional council, which considered that the house in its intended location was “likely to be impacted upon by the river in its lifetime”.
- 3.1.3 The regional council recommended that the house should be set back 25 m from the edge of the top terrace. The owner disputed that advice, but did not provide the requested geotechnical information. After correspondence and discussions, the territorial authority refused the application for building consent, saying:

"I believe . . . Resource Management Act matters, are becoming confused with those requirements Council has to consider when undertaking the processing of a building consent.

"In particular section 36 of the Building Act 1991 where Council must give due consideration to whether the building work in itself will accelerate, worsen or result in [the natural hazards listed in section 36(1)(a)].

"The stability of the bank is also important in terms of the performance criteria of clause B1.2 of [the building code].

"Without the appropriate geotechnical report the Council is unable to make such an assessment. . .

"Therefore, pursuant to section 34 of the Building Act 1991 the Council is refusing to grant the building consent on the grounds that it is unable to determine from the information provided [whether or not the house] would comply with the requirements of the building code."

- 3.1.4 After further discussions, the owner made a second application for building consent, this time accompanied by a report on erosion at the site ("the erosion report") by J Philpott of John Philpott & Associates ("the owner's erosion consultant") and a report on the general stability of the site ("the stability report") by D G Napier of David Napier & Associates ("the owner's stability consultant"). The territorial authority referred those reports to G S Doull, Senior Design Engineer for Horizons Regional Council ("the regional council's erosion engineer") and P J Millar of Tonkin & Taylor ("the territorial authority's stability consultant") for review. Their reviews concluded that the reports did not adequately address the territorial authority's concerns. (When the matter came to Court (see 3.1.6 below), those reviews were recorded in the form of affidavits by Mr Doull and Mr Millar, which I refer to as "the erosion review" and "the stability review" respectively.)
- 3.1.5 Acting on that advice, the territorial authority refused the second application for building consent and, aware that the owner did not accept that decision, applied to the then Building Industry Authority ("the Authority") for this determination.
- 3.1.6 After some correspondence between the owner's solicitors and solicitors employed by the Authority, the owner did not accept that the Authority had jurisdiction to determine the dispute, and commenced judicial review proceedings in the High Court. The owner was granted interim orders and directions¹ restraining the territorial authority from pursuing its application to the Authority pending substantive hearing and prohibiting the Authority from dealing with the territorial authority's application. At the substantive hearing, those orders were discharged, and accordingly the Authority was free to consider the matter.
- 3.1.7 The High Court judgment discharging the orders² was delivered on 10 December 2004. On 30 November 2004, section 434 of the Building Act 2004 had come into force, the Building Industry Authority had been dissolved, and

¹ *Davidson v Palmerston North City Council* 15/10/04, Wild J, HC Palmerston North CIV 2004 454 670.

² *Davidson v Palmerston North City Council* 8/12/04, Ronald Young J, HC Palmerston North CIV 2004 454 670.

all references to the Authority in the Act were to be read as references to the Chief Executive of the Department of Building and Housing.

3.2 The Building Code

3.2.1 The relevant provisions of the Building Code are (defined terms shown in *italics*):

B1.3.1 *Buildings, building elements* and *sitework* shall have a low probability of rupturing, becoming unstable, losing equilibrium, or collapsing during construction or alteration and throughout their lives.

B1.3.3 Account shall be taken of all physical conditions likely to affect the stability of *buildings, building elements* and *sitework*, including:

- (a) Self-weight,
- (b) Imposed gravity loads arising from use,
- (e) Water and other liquids,
- (f) Earthquake,
- (h) Wind,
- (r) Removal of support

B1.3.4 Due allowance shall be made for:

- (a) The consequences of failure,
- (d) Variation in the properties of materials and the characteristics of the site, and
- (e) Accuracy limitations inherent in the methods used to predict the stability of buildings.

B1.3.7 Any *sitework* and associated supports shall take account of the effects of:

- (a) Changes in ground water level,
- (b) Water, weather and vegetation, and
- (c) Ground loss and slumping.

B2.3.1 *Building elements* must, with only normal maintenance, continue to satisfy the performance requirements of this code for the lesser of the *specified intended life* of the building, if stated, or:

- (a) The life of the *building*, being not less than 50 years, if:
 - (i) Those *building elements* (including floors, walls, and fixings) provide structural stability to the *building* . . .
- (b) 15 years if:
 - (i) Those *building elements* . . . are moderately difficult to access or replace, or
 - (ii) Failure of those *building elements* to comply with the *building code* would go undetected during normal use of the *building*, but would be easily detected during normal maintenance.
- (c) 5 years if:
 - (i) The *building elements* . . . are easy to access and replace, and
 - (ii) Failure of those *building elements* to comply with the *building code* would be easily detected during normal use of the *building*.

4 The written submissions

4.1 General

- 4.1.1 The territorial authority submitted aerial photographs of the site, the plans and specifications submitted for building consent, the erosion report, the stability report, and correspondence between the parties.
- 4.1.2 In the statement “Matter of Doubt or Dispute” accompanying its application for a determination, the territorial authority outlined the sequence of events and said:
- “The Council seeks this determination in respect of the refusal to grant the Building Consent on the grounds that insufficient information was supplied with the application to enable the Council to conclude that the proposed structure would comply with the New Zealand Building Code.”
- 4.1.3 The owner submitted various documents that had accompanied the application for judicial review including or in addition to correspondence between the owner and the territorial authority, the plans and specifications, the erosion report, and the stability report.
- 4.1.4 The owner’s solicitor’s correspondence with the Authority amounted to legal submissions on the question of the Authority’s (now the Chief Executive’s) jurisdiction. Those submissions are outlined and discussed in 5.4 and 6.9 below.
- 4.1.5 I have carefully considered the evidence called at the hearing, see 5 below, together with all of the submitted documents, and have concluded that the technical matter of compliance with the Building Code turns on that evidence, the erosion report, the stability report, and the corresponding reviews which are discussed below.

4.2 The erosion report

- 4.2.1 The erosion report consisted largely of an analysis of aerial photographs of the site over the period 1942 to 2000. They showed that over those years the edge of the river had been within a range of 6 m from a horizontal datum. In 2000, a protective surfacing in the form of concrete riprap was placed along the bank, so that the edge was about 10 m further from the datum than it had been during the period 1942 to 1999.
- 4.2.2 The erosion report went on to say:
- “Taking these figures into account and being conservative, I believe that it would be more than reasonable to assume that no more than 5 m of erosion would occur over the next 50 years.
- “The . . . riprap . . . will further restrict any erosion of the bend. If a failure was to occur owing to undermining of the riprap, which is the common failure mode for riprap, the riprap would slump into the scour hole and further protect the toe of the riverbank. If this was to occur however, the upper bank would then become vulnerable to erosion until the riprap is topped up.
- “During the flood before the big flood in February 2004, when the channel was full to just below the top of the lower terrace, it could be seen that the velocity along the top edge of the riverbank at the location in question was low and erosion would not be significant if it did occur.
- “The . . . site currently pays [certain rates to the regional council that] would entitle [the owner] to quite a bit of work to control erosion. However other priorities would

control what and when this would be done. Once a house was on site it would rise up the list if the house was under a threat I would think.”

4.3 The stability report

- 4.3.1 The stability report also referred to the owner’s “right to receive [from the regional council] ongoing protection from erosion”.
- 4.3.2 The stability consultant prepared a stability model incorporating subsoil profiles and soil parameters that had been developed for previous assessments of nearby slopes, and which were “consistent with observations made on the exposed surfaces of the adjacent lot”. A factor of safety of 1.5 was adopted.
- 4.3.3 The stability consultant used that model to make a series of analyses to assess how far from the edge of the top terrace the house should be sited in order to avoid the likelihood that the loads imposed by the house would result in soil slippage leading to loss of support for the house.
- 4.3.4 Those assessments indicated that the house should be set back 3.4 m from the edge of the top terrace assuming that the river bank “had degraded by 5 m as recommended by [the erosion consultant]”.
- 4.3.5 The stability report accordingly concluded that:
- “ . . . the main part of the dwelling’s concrete floor needs to be at a distance of not less than 3.4m from the edge of the top terrace. The proposed pillars to support the front edge of the roof can be constructed closer to the edge . . . but will need to be founded below the potential failure plane. . . .
- “ . . . the construction process [will not affect the stability of the site provided it is] appropriately managed with respect to excavation, deposition of spoil materials, and control of surface runoff. . . .”
- 4.3.6 I note that the plans submitted with the application for building consent pre-date the stability report and show the concrete slab as being set back 2 m from the edge of the top terrace. For the purposes of this determination, I have assumed that is now to be read as showing the slab as being set back 5 m as accepted by the owner, see 5.3.2 below.

4.4 The erosion review

- 4.4.1 The erosion review referred to aerial photographs (which I take to be essentially the same as those analysed in the erosion report), and also to a series of cross-section surveys of the river about 300 m upstream of the subject site. The review referred to the lowest point of the river bed on that cross-section as meandering over time from one side of the river to the other.
- 4.4.2 The review said:
- “11. The effect of meander variation is that sometimes the main flow of the river is hard against the left river bank at the subject site, sometimes it is against the right bank. When the main flow is against the right bank, the water velocity against the left bank is relatively slow, and the erosion potential is minimal. When the main flow is against the left bank, the water velocity against the left bank is much faster, and the erosion potential is greater. . . .
- “28. Rivers typically erode most actively on the outside of bends. The downstream end of a bend usually experiences the worst erosion, but anywhere on a bend can be eroded. The forces involved are huge. The terrace has to change the direction of the river’s momentum, when upwards of a thousand tonnes of

water per second are flowing past at a velocity of 3 to 4 metres per second. . .

- “32. . . . My assessment is that there was an episode of erosion [at the subject site], possibly between 1949 and 1963, but definitely before 1979. There was then another episode in 1992 to 1993. Retreat of the riverbank did not progress very far because the concrete rubble was placed, and was successful, due in part to the change in river alignment. The beach currently protecting the site is in the process of being removed by the river, and once the beach has gone, the lower terrace will once more experience attack by the river. . . .
- “37. . . . The return period of the [February 2004 flood] is currently . . . taken as being 70 years. . . . smaller than the floods of 1880, 1902, and possibly 1897 [and] only slightly larger than the flood of 1907. . . . these larger historical floods . . . occurred in a cluster. . . . there is a real prospect of more of these major floods occurring during the lifetime of the house.
- “38. Despite the large size of the flood, it was not the worst case of an erosion causing event at the site, because of the location of the gravel beaches at the time. The main flow, and hence the fastest water, was close to the right bank. Flows by the left bank, adjacent to the subject site, were therefore slower, and much less erosive. This fortunate state of affairs may not pertain during future major floods. . . .
- “44. This is not to say that erosion will definitely occur during the lifetime of the house. It might not even be likely. However, the Building Code requires that during the lifetime of the building, the probability of its becoming unstable or collapsing must be low. I believe that the risk is more than ‘a low probability’.”

4.5 The stability review

4.5.1 The stability review also discussed the erosion report, saying:

- “13. [the erosion report] was based on a study of aerial photographs of the river for the period 1942 – 1993. . . .
- “14 . . . while the photos indicated a relatively low rate of regression of the river bank over the 50 year period, my experience was that erosion did not occur at a uniform rate but was often episodic. . . .
- “17. [The protective surfacing on the bank] comprised concrete rubble rather than specifically designed and placed riprap. . . .
- “21 I therefore concluded that there was insufficient technical information to support the conclusion that erosion would be limited to less than 5 m over the next 50 years. There remained a risk of increased levels of erosion of the riverbank”

4.5.2 The stability review then discussed the stability report, saying:

- “26. Observations of exposed surfaces were referenced on the adjacent site but there was no detailed geotechnical description of the soils to allow a technical review of the engineering properties used for design. There was no description of the site geology [and] no explanation provided for the selection of strength parameters used in the stability analysis. The parameters were not included in the original report but were later provided
- “27 . . . The analyses were carried out assuming the water table was deep, close to the river level. There was no analysis under seismic conditions. . . .
- “31 I expect the stability of the river banks would be highly sensitive to the strength parameters applied. The strength values used for the gravels are

high and require the material to be very dense and to not include any significant zones of weaker soils. . .

“32 The assumption of no groundwater was not supported by any evidence and is not consistent with my experience of nearby sites where perched water tables are present. . . . I would have expected the stability analysis to have included design conditions with elevated groundwater levels unless there was site specific test information, including monitored groundwater profiles, to demonstrate rapid drawdown and perched groundwater conditions were unlikely to occur. . . .

“38 I consider that the absence of a site specific investigation to determine the soils conditions on the site, the making of assumptions on strength of materials which are critical to the analyses without supporting data for their selection, and the failure to consider groundwater or seismic loading conditions were fundamental issues where the test of adequacy was not met”

4.6 Replies for the owner

4.6.1 The owner’s erosion consultant replied to the erosion review, saying:

“. . . I have concluded that the probability of there being any measurable erosion at the site over the next 50 years is very low (much less than a ‘low probability’, if that is thought to be a probability below 10%). . . .

“Generally significant erosion will occur only during large flood events at which time the bed forms which control the location of the low flow channel will be submerged beneath many metres of floodwater and their impact on flood flows and velocities as they affect the subject site will be very much reduced. In the 2004 flood event the river was some 10 metres deep at the subject site. . . .

“[Responding to paragraph 32 of the erosion review], I have not dwelt at length . . . on the episodic nature of the erosion at the site because my measurements do not show that there has been any significant erosion. The notion of episodic erosion is, therefore, redundant. I assume that there has been some minor erosion at the site given the placement [of] the old rock riprap protection adjacent to the subject site, and the 1992 erosion, but measurements show that these erosion events must be very minor. . . .

“[Responding to comments on the protective surfacing of the bank.] The concrete riprap is very large, some of it was one piece per truck load, and has not shown any sign of failure since it was placed in 1992 even with the large flood event of 2004. . . .

“[In conclusion and referring to paragraph 44 of the erosion review] Prior to any protection being placed along the river upstream of the subject site there was no evidence of any significant erosion over the years. The very existence of the heavy riprap makes the riverbank even more stable to the point that I believe that there is, without doubt, a very low probability of failure of the river bank and a very low probability of the proposed building becoming unstable or collapsing during its lifetime due to river erosion or slumping.”

4.6.2 The owner’s stability consultant replied to the stability review, saying:

“27. . . .

“a. I do not believe an elevated water table is ever likely to exist at this site. I consider the loess material on the surface would limit significant vertical flow of water, and that the gravels are permeable enough to make it impossible for a high water table to exist. . . .

- “32 . . .
- “b. . . . Rapid drawdown . . . is not generally a problem in gravels and sands, especially when the gravels and sands are of medium density, as the ones presently in question . . .
- “c. . . . the (very low) risks evident in the site did not require or rationally justify the huge cost of [monitoring groundwater profiles]. . . .
- “34
- “a. Regression of the upper terrace is not a risk which warrants consideration The upper terrace was tested in the 2004, 70 year flood event. It was untouched.”

5 The hearing

5.1 The first draft

- 5.1.1 Because a formal hearing had been requested, I sent the parties a draft determination (“the first draft”) with a request that they either accept it or identify points that they wished to raise at a hearing. The first draft confirmed the territorial authority’s decision to refuse to grant a building consent.
- 5.1.2 In response to the first draft:
- (a) The owner’s erosion consultant clarified the process he had used in arriving at the recommendations in the erosion report and commenting on specific passages in the first draft.
 - (b) The owner’s stability consultant described discussions he had had with the territorial authority’s stability consultant but which had not been mentioned in the stability review.
 - (c) Solicitors for each of the parties wrote to me and to each other, mainly on procedural matters.
- 5.1.3 The hearing was held before me on 15 December 2005. The territorial authority was represented by its solicitor J Maasen of Cooper Rapley, who was accompanied by the territorial authority’s Development Services Manager S Harris, its stability consultant, and the regional council’s erosion engineer. The owner was represented by her solicitor, A Isac of Fitzherbert Rowe, who was accompanied by the owner’s partner L Fugle, the owner’s erosion consultant, and the owner’s stability consultant. In attendance were B Brown, appointed to assist me under due delegation by the Chief Executive, and officers of the Department.
- 5.1.4 After the parties had presented their written and oral submissions and evidence as outlined in 5.2 to 5.7 below, I adjourned the hearing and invited the parties to make final submissions in writing.

5.2 The territorial authority’s written submissions and evidence

- 5.2.1 For the territorial authority it was submitted that a decision under section 34(3) of the former Act (now section 49) as to whether or not to issue a building consent required a territorial authority to be “satisfied” on reasonable grounds as to compliance with the Building Code. The word “satisfied” had recently

been considered by the Supreme Court in the context of sections 93(1) and 94(2) of the Resource Management Act 1991, and it had been held³

“Significant in the basic requirements stated in ss 93(1) and 94(2) are the double emphasis on ‘satisfied’, the strongest decisional word used in the [Resource Management] Act, the etymology of ‘satisfy’ (to do enough), and a standard meaning relevant in this context – to furnish with sufficient proof or information; to assure or set free from doubt or uncertainty; and to convince; or to solve a doubt, difficulty.”

5.2.2 Therefore, the question that I had to answer, it was submitted, was “does the application for building consent assure you or convince you so that you are free from uncertainty on reasonable grounds that clauses B1 and B2 of the Building Code can be met?”

5.2.3 The phrase “low probability” as used in Clause B1.3.1 had been held⁴ to mean:

“. . . that the risk of such events is no more than an appreciable risk (as distinct from a slight risk) or is at most a low risk (as distinct from a very low risk).”

The territorial authority did not accept that “low probability as [the owner’s erosion consultant] defines it, means less than 10%.”

5.2.4 The regional council’s erosion engineer and the territorial authority’s stability consultant gave oral evidence in which they essentially highlighted points they had made in the erosion review and the stability review respectively, and responded to the replies by the owner’s erosion consultant and the owner’s stability consultant.

5.2.5 The territorial authority also presented affidavits from officers of the regional council in respect of the rubble or riprap placed in 1992 and in respect of a conversation with the owner’s erosion consultant about erosion risks at the subject site.

5.3 The owner’s written submissions and evidence

5.3.1 For the owner it was submitted that:

“12 The [first draft] raises the following issues for consideration . . .

“12.1 Firstly, an assessment of the likelihood of erosion occurring at the subject site; and

“12.2 Only if [the Chief Executive] finds that there is more than a low probability of erosion in the next 50 years, an assessment of the extent of such erosion over the life of the building; and

“12.3 Once the extent of such erosion has been quantified, an assessment of the stability of the bank forming the upper terrace, and the proposed building site;

“12.4 Further, whether this is a case where it would be appropriate to grant a waiver or modification under s 34(4) of the [former] Act;

“12.5 Whether consent should issue because of the requirements of s 36(1)(c) are met; and alternatively

“12.6 Whether consent should issue under s 36(2) of the [former] Act notwithstanding the risk of erosion. . . .

³ *Westfield (New Zealand) Limited v North Shore City Council* [2005] NZSC 17, per Keith J at paragraph 52.

⁴ *Auckland City Council v Selwyn Mews Limited* 18/6/03, Judge McElrea, DC Auckland CRN 2004 067301-19.

- “15 A ‘low probability’ of instability or collapse has been said [in the *Selwyn Mews* case, see footnote 4] to involve an *appreciable* risk, rather than a perceptible but slight risk. It has been said to be a risk which is ‘*well below 50% but probably above 5%*’. . . .
- “18 When issuing subdivision consent in 2003 . . . [the territorial authority] was obviously satisfied that the likelihood of erosion and/or bank stability negatively impacting on the site was low given that a building restriction line was promulgated requiring a set-back of some 20 metres from the river’s edge (following the line of the edge of the upper terrace). It was for that reason that [the owner] purchased the land and proposed to build *outside* the current building restriction line. . . .
- “19 Thereafter, [the territorial authority] has, it appears on the advice of the Regional Council, variously accepted building restriction lines as little as approximately 20 metres from the bank of [the river], to as far away as 50 metres.
- “20 Nowhere in the assessments, objections or evidence of [the territorial authority] has any indication been given to an alternative set-back distance (other than 20 or 30 metres from the upper terrace edge). No indication has been given as to how the set-back distance is related to the need for a low probability of site failure.

5.3.2 It was indicated that the owner would accept a maximum set-back of 5 m from the edge of the upper terrace.

5.3.3 The owner’s partner, the owner’s erosion consultant, and the owner’s stability consultant gave oral evidence in which they essentially highlighted points they had made in their replies to the erosion and stability reviews and in their responses to the first draft.

5.4 Oral submissions as to jurisdiction

5.4.1 In a letter dated 20 July 2004, before the matter went to the High Court, the owner queried the Authority’s (now the Chief Executive’s) jurisdiction, saying:

“Our view is that the matters Council are averting to are all matters which properly fall within the scope of Section 36 of the [former] Act. In light of the Court of Appeal’s dicta in *Logan v Auckland City Council* (CA 243/99 9 March 2000, Richardson P), we do not consider the Authority would have jurisdiction over this matter to make a determination. In brief the reason for declinature advanced by Council is whether or not the building site is protected from river erosion, that is, the question of land stability.”

5.4.2 The territorial authority had responded:

“The owner is the registered proprietor of the land and accordingly, applying the principles in *Logan v Auckland City Council* a s.36 certificate should be placed on the title. The applicant has raised the issue of the [Chief Executive’s] jurisdiction to require a s.36 certificate. That argument is untenable and is inconsistent with the Act, *Logan* and previous BIA determinations, (see BIA determination 2004/08).”

5.4.3 Those views were reiterated at the hearing. See 6.9 below for my conclusions as to jurisdiction.

5.5 Oral evidence and submissions as to the building line

5.5.1 A building restriction line had been imposed under the Resource Management Act. The line was variously described, orally or in writing, as representing a 20 or 25 m set-back from the bank of the river or from the edge of the top terrace. I had in fact been previously given a consent notice with attached

survey plan identifying the building line, but it was illegible and neither party referred to it at the hearing.

- 5.5.2 The regional council's erosion engineer did not commit himself to a particular extent of erosion for design purposes, but observed that a building line 25 m from the edge of the top terrace "got it about right".
- 5.5.3 See 6.5 below for my conclusions as to the building line.

5.6 Oral evidence as to erosion

- 5.6.1 There were apparently irreconcilable differences between the owner's erosion consultant and the regional council's erosion engineer in respect of erosion. Each maintained the positions described in 4.2 and 4.4 above.
- 5.6.2 In essence, the owner's erosion consultant considered that there had been no significant erosion at the subject site since at least 1942, but that "being conservative . . . it would be more reasonable to assume that no more than 5 m of erosion would occur over the next 50 years". Furthermore, if erosion did occur the owner was entitled to call on the regional council to stabilise the bank under a scheme instituted by the council.
- 5.6.3 In essence, the regional council's erosion engineer considered the 5 m to be an unsafe assumption that did not take account of the episodic nature of erosion and the movement of the main flow of the river from one bank to the other over time (which he estimated at about every 30 years). If erosion did occur, it was not certain that the regional council would in fact ensure stabilisation of the bank.
- 5.6.4 The owner's erosion consultant and the regional council's erosion engineer also differed on the effect of the concrete rubble protection placed in 1992. The consultant considered that if the river bed became lower at the site then the rubble would slide down onto the bed and prevent erosion. The erosion engineer considered that the dumped rubble could not be relied on in an erosion episode, and in particular would not offer the protection to be expected from a properly designed and carefully placed graded riprap.
- 5.6.5 See 6.6 below for my conclusions as to erosion.

5.7 Oral evidence as to stability

- 5.7.1 The territorial authority's stability consultant said that he had now visited the site and has seen indications of perched water tables. The owner's stability consultant did not accept those indications.
- 5.7.2 The owner's stability consultant and the territorial authority's stability consultant maintained the positions described in 4.3 and 4.5 above.
- 5.7.3 In essence, the owner's stability consultant considered that the cost of the tests necessary to obtain site-specific parameters was not justified in this case. Accordingly, he used what he believed to be typical soil parameters for the region to make a series of analyses, taking account of the 5 m erosion recommended by the owner's erosion consultant. Those analyses indicated that if the house was sited 3.4 m from the edge of the top terrace it would comply with the Building Code in respect of soil stability.

5.7.4 In essence, the territorial authority's stability consultant considered that site-specific parameters should have been used and that in any case the analyses did not adequately take account of certain possible failure scenarios.

5.7.5 See 6.7 below for my conclusion as to stability.

5.8 Final submissions

5.8.1 I adjourned the hearing and invited the solicitors for the territorial authority and for the owner to make final submissions in writing, see 5.1.4 above.

5.8.2 The only further submission for the territorial authority consisted of information, including photographs, about protective works, referred to as "a rock groyne", which had been constructed in 2005 and had subsequently failed. The groyne's location in relation to the house concerned was not clear, except that it was on the opposite bank. On the view I take of the matter, see 6 below, I did not consider the failure of the groyne to be of any particular relevance except to illustrate that erosion had occurred recently at some point on the riverbank.

5.8.3 Further submissions for the owner included adverse comments on the processes adopted by the territorial authority for processing the building consent. I consider that such matters are not relevant to this determination.

5.8.4 Those submissions also said:

" . . . the real issue [is] whether, on all the evidence . . . , [the Chief Executive] is satisfied there is a low probability of building failure during the building's statutory lifetime."

I agree with that submission.

5.8.5 The submissions for the owner also included legal arguments as to the burden and standard of proof, the relevance and application of the *Westfield* case (see 5.2.1 above), and of another Resource Management Act case⁵, and as to my jurisdiction in respect of section 36 of the former Act (now sections 71 to 74). They also included rebuttals of comments made at the hearing about the evidence of the owner's erosion consultant, and comments on the evidence of the territorial authority's stability consultant and the regional council's erosion engineer. The submissions were accompanied by correspondence between the parties. On the view I take of the matter, see 6 below, I do not consider it necessary to discuss those submissions.

5.8.6 The owner's erosion consultant responded to the territorial authority's submissions about the "rock groyne", see 5.8.2 above, but on the view I take of those submissions there is no need to describe that response.

5.9 The second draft and the resumed hearing

5.9.1 After receiving those further submissions, I prepared another draft determination ("the second draft"), which was essentially the first draft amended to take account of the hearing, and which also confirmed the territorial authority's decision to refuse to grant the building consent. Because the hearing had been adjourned but not concluded, I copied the second draft to

⁵ *McIntyre v Christchurch City Council* [1996] NZRMA 289 (PT).

the parties under cover of a letter to the effect that if the second draft was not accepted then the hearing would be reconvened.

5.9.2 In that letter I also suggested amending the second draft by the addition of guidance as to steps that the parties could take after the determination so that a building consent could be issued in respect of revised plans and specifications for the house. Neither of the parties considered that such guidance was needed, and accordingly it is not discussed below.

5.9.3 The owner did not accept the second draft and made submissions as to:

- (a) the appropriate standard of proof,
- (b) the meaning of “low probability”,
- (c) the life of a building,
- (d) the building restriction line, and
- (e) the rate of erosion.

Those submissions have been taken into account in the discussion below.

5.9.4 The territorial authority did accept the second draft, and responded accordingly to the owner’s submissions. Those responses have been taken into account in the discussion below.

5.9.5 The hearing was reconvened on 20 October 2006 with the same participants as on 15 December 2005 except for the territorial authority’s stability consultant, the regional council’s erosion engineer, the owner’s erosion consultant, and the owner’s stability consultant (in other words, none of the expert witnesses were present).

5.9.6 The reconvened hearing included a visit to the site of the proposed building. As none of the experts were present, the visit did not provide any specific evidence but it did afford me an opportunity to better appreciate the background to the evidence.

5.9.7 After the owner’s submissions had been presented and discussed, with a brief response by the territorial authority, the hearing concluded.

5.9.8 I received further written comments from the owner after the hearing, which have been taken into account in the discussion below.

6 Discussion

6.1 General

6.1.1 I take the view that I must decide whether the evidence and submissions by the parties amount to reasonable grounds that satisfy me that the house, sited 5 m from the edge of the top terrace (see 4.3.6), would comply with clause B1 in

respect of having a low probability of instability caused by slumping or slipping failure of the soil on which it is erected.

- 6.1.2 As I understand it, the relevant mode of failure is that the loads imposed by the land itself, plus the load imposed by the house, particularly if there was significant erosion, could result in soil slippage, ground loss and slumping in terms of clause B1.3.7(c), leading to removal of support for the house.
- 6.1.3 In assessing the likelihood of that mode of failure occurring, it is necessary to consider:
- (a) imposed loads,
 - (b) the proximity of the house to the top of the bank,
 - (c) the soil properties and the effects of groundwater, and
 - (d) the characteristics of the site, including the likely effects of erosion on the terraces.

6.2 “Satisfied on reasonable grounds”

- 6.2.1 As to the phrase, “satisfied on reasonable grounds”, I take the view that the word “satisfied” in section 71(2) is to be taken to have the same meaning as was held to have in the Resource Management Act in *Westfield (New Zealand) Limited v North Shore City Council*, see 5.2.1 above.
- 6.2.2 It was submitted for the owner that the proper test when resolving a conflict of expert opinion on a future risk was laid down in *McIntyre v CCC* [1996] NZRMA 289 (PT), which meant:
- “. . . an applicant is not required to establish the probability of a future risk to a mathematical certainty, or ‘beyond reasonable doubt’. As a matter of policy the bar would be placed too high. The [former] Act itself tolerates risk; but the risk must be a ‘low’ one.”
- 6.2.3 I note that in *Auckland CC v NZ Fire Service*, partially reported at [1996] 1 NZLR 330, the High Court held, in respect of a determination made under the former Act:
- “[The Building Industry Authority] must have evidence to support its conclusions, but it is not helpful in matters of the kind contemplated by [the former Act] to consider the provision of evidence in the traditional sense of an onus or burden of proof”
- 6.2.4 I take the view that those cases decided under the former Act are good law in respect of the Act.
- 6.2.5 On the evidence outlined above, I am not satisfied that the proposed building will comply with clause B1 of the Building Code. I do not attempt to identify whether that decision is reached on the balance of probabilities or on some more stringent test.

6.3 “Low probability”

- 6.3.1 Specific engineering design necessitates the use of numerical values for design parameters, such as a loading or an event having a specific numerical probability of occurrence (or of being exceeded). The more frequently an event occurs the higher that numerical probability.

- 6.3.2 A numerical probability of occurrence must always be expressed in terms of a specific time period; for example, clause E13.1 of the Building Code refers to “an event having a 10 percent probability of occurring annually”, frequently called “a 10 year flood” or “an event having a 10% annual exceedance probability” (“10% AEP event”).
- 6.3.3 In the second draft, when discussing the term “low probability” in the Building Code, I said that I accepted, of course, the interpretation given in *Auckland City Council v Selwyn Mews Limited*, see 5.2.3 above, but took the view that where a compliance document specified a specific numerical probability for use in design, then that was to be preferred to the qualitative descriptions given in *Selwyn Mews* and other decided cases.
- 6.3.4 It was submitted for the owner that:
- “ . . . it is an error to find that compliance with an indicated standard is the appropriate threshold for determining a ‘low probability’ in terms of the . . . Code. The overriding statutory test cannot be redefined by altering its inherently qualitative and general nature by reference to a prescribed (and set) building industry standard. . . . [Such] standards are no more than a pre-approved mode of compliance with the Code . . . They are not the only means of compliance. They do not define what a ‘low probability’ of failure entails. Indeed, the standards may (and in my submission do) go beyond the level of probability tolerated by the Code. . . .
- “In any case, there are no compliance documents which relate to the issue of erosion and stability on which the draft determination turns.”
- 6.3.5 I accept that submission to the extent that a statutory requirement cannot be overridden by a compliance document. However, I repeat that for specific engineering design purposes it is necessary to adopt numerical values for all design parameters. Accordingly, I take the view that:
- (a) Where a numerical probability is specified in the Building Code itself (as in, for example, clauses E1.3.1 and E1.3.2) then that probability must be used for design purposes.
 - (b) When the Building Code does not specify a numerical probability for any particular design parameter then the corresponding numerical probability specified in a compliance document must be accepted as being a “low probability” in terms of the Building Code.
 - (c) Such a numerical probability may be used as a guideline or benchmark when considering proposals that are not in accordance with the compliance document, *Auckland CC v NZ Fire Service Auckland CC v NZ Fire Service 19/10/95*, Gallen J, HC Wellington AP336/93, [1996] 1 NZLR 330.
 - (d) Where, as in this case, there is no relevant numerical probability specified in a compliance document then for engineering design purposes the term “low probability” in the Building Code must be given an appropriate numerical value for each relevant design parameter. In the absence of any reasons to the contrary, such numerical probabilities should correspond to those generally used by professional engineers for engineering design.
- 6.3.6 Different numerical probabilities are appropriate for design in respect of different eventualities because each such probability will depend on

considerations that include the nature and the consequences of the occurrence concerned. For example, clause E1.3.1 provides in effect that the rain falling on a building in a 10% AEP event must be disposed of without damage or nuisance to neighbouring property. On the other hand, clause E1.3.2 provides in effect that water must not enter a house in a 2% AEP event. The higher AEP for rainwater flowing over a boundary and affecting other property reflects the fact that the consequences are generally less serious than the consequences of flood water entering a house.

- 6.3.7 It is possible, with varying degrees of accuracy, to calculate the numerical probabilities of various eventualities occurring during any given period of time. However, it is not possible to calculate the probability of an event occurring during the life of the building unless that life is known to be a certain number of years. The Act does not specify any such number (other than in respect of 'temporary' buildings having specified intended lives not exceeding 50 years in terms of section 113), see 6.4 below.
- 6.3.8 Nevertheless, for design purposes it is necessary to select particular design loadings as representing acceptability low probabilities. One example is the approximately 450 year "design earthquake" referred in NZS 4203. That design earthquake has a 10% probability of occurring in any 50 year period, 20% in any 100 year period, and so on.
- 6.3.9 As for flooding, if a building were required to have a life of 100 years, for example, then there would clearly be a very high probability that it would experience the 100 year (1% AEP) flood during its life (approximately 63% in fact, much more likely than not), and there would also be a high probability (approximately 40%) that it would experience the 200 year (0.5% AEP) flood. Of course, there could well be an asymptotic effect such that at some point the difference between floods with increasingly large return periods becomes insignificant. I recognise that it is not yet possible to assign precise numerical probabilities to some of the events that might cause building failure, but those examples indicate that one must be cautious about describing any particular event as having "a low probability".
- 6.3.10 Taking that approach, I do not consider that evidence to the effect that there has been no significant erosion over the 64 year period 1942 to 2006 amounts to reasonable grounds on which I can be satisfied that there is a low probability that the house will become unstable or collapse because of erosion occurring during its life. Furthermore, many other factors also come into considerations, such as changes in the contours of the riverbed and so on. The most unfavourable likely scenario must be taken into account.
- 6.3.11 I take it that the "below 10%" mentioned by the owner's erosion consultant, see 4.6.1 above, and the "5%" mentioned in submissions for the owner, see 5.3.1 above, were intended to refer to annual exceedance probabilities. If so, they correspond to a 10 year and a 20 year return period flood respectively. By way of comparison, I note that the erosion review said that the February 2004 flood had a 70 year return period, approximately 1.4% AEP, see 4.4.2 above. Accordingly, I take the view that for the purposes of this determination neither 10% AEP nor 5% AEP can be accepted as being "a low probability" for the purposes of the Building Code.

6.3.12 After the hearing, the locality experienced heavy rainfalls and the owner commented:

“as a result of the weekend storm [the Motua flood gates were opened and] the site rip-rap & embankment experienced a . . . 3-day attack from high plus fast flowing water . . .

“ . . . a site inspection . . . revealed that no loss of bank protection or any other natural hazard having occurred; further . . . this latest gate opening amounts to eighteen times since 1992 . . . [which shows that] the site stability has been the subject of numerous physical tests and yet there is no evidence of failure . . . ”

6.3.13 In my view, flood levels experienced 18 times since 1992, which averages more than once a year, do not have a low probability for the purposes of the Building Code.

6.4 The life of a building

6.4.1 As regards the life of a building, the owner said:

“While it may be desirable . . . for a building to have a life which is indefinite, and exceeds 50 years, the functional requirements of the Code themselves confirm that the period of performance must be for at least 50 years (unless a shorter period via s 39 [of the former Act, now section 113] exists) [so that the owner submits that] an applicant is not required to establish such performance for any period in excess of 51 years.”

6.4.2 I recognise that clause B2 refers to “the life of the building, being not less than 50 years”. I take “life” to mean the period for which a building, with only normal maintenance, including timely replacements of the “15 year” and “5 year” elements specified in clause B2.3.1(b) and (c), will continue to comply with the Building Code (subject to any approved waivers or modifications).

6.4.3 I take the view that the phrase “being not less than 50 years” is to be interpreted as excluding buildings having a specified intended life, which cannot be more than 50 years, see section 113. I disagree with the submission that the phrase is to be interpreted as meaning “being 51 years or more” because:

- (a) A great many buildings in New Zealand are significantly older than 51 years, and are generally expected to remain in use for the foreseeable future. I can find nothing in the legislation to indicate that Parliament intended to allow for a lower standard of durability under the Act or the former Act.
- (b) If buildings erected in New Zealand under the Act or the former Act, being effectively all buildings erected since 1993, were expected to last for only 51 years, then there would be significant effects on the long-term values of such buildings, particularly in relation to mortgages and insurance. In fact, as far as I am aware, there have been no such effects, and I cannot believe that Parliament intended that there should have been.

6.4.4 I do not mean to imply that a building complying with the Building Code is expected to last forever, but I do take the view that, within the limits of current technical knowledge, a building complying with the Building Code is expected to protect people and achieve the other objectives of the Act and the Building Code, to the extent required by the Code, for an indefinite period.

6.5 The building line

- 6.5.1 The evidence did not enable me to identify the actual location of the building line set under the Resource Management Act, but I consider that line to be irrelevant. It was clearly not based on specific information about future erosion or about soil parameters. The fact that the house will comply with the Resource Management Act if it is behind that line does not mean that it will comply with the Act.
- 6.5.2 Submissions for the owner on the preceding paragraph in the second draft said in effect that insufficient weight had been given to the building line as evidence that, in 2002, both the territorial authority and the regional council had turned their minds to whether the land concerned, or any structure on the land, was “likely to be subject to material damage by erosion” in terms of section 106 of the Resource Management Act, where the term “likely” was to be understood as having the meaning discussed in *Auckland CC v Selwyn Mews* see footnote 4. In particular, the owner quoted that decision to the effect that the Building Code did not seek to eliminate all risk, and that the “degree of acceptable risk” was “a real and substantial risk that stated consequences will happen”.
- 6.5.3 My responses to that submission are:
- (a) Whatever the territorial authority might have considered in 2002, in 2006 it did not accept that siting the building behind the building line would establish compliance with the Building Code in respect of the risks of slippage and erosion.
 - (b) In any case, I have been given insufficient evidence to identify the precise location of the line.
 - (c) The submission does not persuade me to change my mind as to the degree of acceptable risk, see 6.3 above.
- 6.5.4 After the hearing, the owner commented:
- “I am unsure why [the Chief Executive] would take the lead from the Resource Management Act as to the meaning of ‘satisfied’ [see 5.2.1 and 6.2 above] and yet find the agreed building line promulgated under the RMA is ‘irrelevant’.”
- 6.5.5 My response to that comment is that, even if the word “satisfied” has the same meaning in the Act as it does in the Resource Management Act, what I need to be satisfied about is compliance with the Building Code. The building line relates to compliance with the Resource Management Act, which is not the same as compliance with the Building Code.

6.6 Erosion

- 6.6.1 The owner’s erosion consultant and the regional council’s erosion engineer have comparable professional qualifications and experience. If they were in agreement as to a particular extent of erosion being appropriate for design purposes, then all other things being equal that would carry significant weight. However, they are far from agreeing.
- 6.6.2 I recognise that future events must frequently be estimated on the basis of experience with past events, but in this case I consider that experience since

1942 is not sufficient to support the consultant's estimate that there is a low probability of more than 5 m of erosion during the life of the house.

- 6.6.3 In such situations it is frequently possible for those with the appropriate qualifications and experience to agree on a consensus view. I am not aware of any attempt to reach such agreement amongst the technical community concerned with the behaviour of the Manawatu River. I suggest that the territorial authority and the regional council could well take the initiative in developing such agreement. Unless and until that is done, then the most restrictive reasonable opinion will generally prevail in any particular case.

6.7 Stability

- 6.7.1 I recognise that it is not always necessary to make test bores or trenches and test soil samples on a particular site. Frequently, soil stability analyses can be based on information obtained from tests on other sites of similar types in the same general area. That is largely a matter of qualified and experienced engineers applying their local knowledge.
- 6.7.2 In this case, I consider that both the owner's and the territorial authority's stability consultants have the necessary qualifications and experience. However, only the owner's consultant has had the opportunity to develop the necessary local knowledge. Nevertheless, I do not consider that I can be satisfied in respect of the soil design parameters and the effects of ground water based on that local knowledge because:
- (a) Both consultants visited the site but they came to different conclusions as to the presence of perched water tables and the associated groundwater effects. Bore holes or the like would be necessary to resolve that matter.
 - (b) The regional council's erosion engineer, who also has extensive local knowledge, referred to the variability of soil properties along the relevant length of the river.
- 6.7.3 Furthermore, stability analyses must take account of likely erosion during the life of the building, and as mentioned above I do not have reasonable grounds on which I can be satisfied as to that matter.

6.8 Waiver or modification of Clause B1

- 6.8.1 For the reasons set out above, I do not have reasonable grounds on which to be satisfied as to compliance with Clause B1. Nor have I been given any reasons to consider granting a waiver or modification of that clause under section 20 of the Act.
- 6.8.2 After the hearing, the owner commented:

"... objective B1 of the Code provides that building should safeguard people from injury caused by structural failure and clause B1.3.4 says that due allowance shall be made for '(a) consequence of failure'. The determination ... might well impose ... a requirement to carry out more work than that required under s 18 of the 1991 Act. ... this is not a situation where erosion or failure will be immediate and cause injury [but] will be gradual and permit rectification works over time if they were ever required (which according to our evidence they will not be). ..."

6.8.3 My responses to those comments are:

- (a) Another of the objectives set out in clause B1.1 is to safeguard people from loss of amenity caused by structural failure. The relevant performance criterion is specified in clause B1.3.2 in terms of “a low probability”, see 6.3 above.
- (b) Section 18 of the former Act used the words “whether or not, or to what extent, particular building work . . . complies with the Building Code”, whereas section 177(a) now uses the words “whether particular matters comply with the building code”. I take the owner’s point to be that a requirement to comply with the Building Code is more onerous than a requirement to comply with it to some extent. That is correct as far as it goes, but it overlooks section 188(3), which provides that a determination may include waivers or modifications of the Building Code.
- (c) As to whether erosion will “be gradual and permit rectification works over time”, that may well be so depending on the design and location of the building, but is not always the case as has been demonstrated by recent instances where houses have literally fallen from eroded cliff tops. In this case, there is no indication that the building has been designed to ensure gradual rather than immediate failure. The owner has not applied for any waiver or modification of the Building Code under section 67, nor for the building to have a specified intended life in terms of section 113.

6.9 Conclusion

- 6.9.1 For the reasons set out above, I conclude that I do not have reasonable grounds on which to be satisfied as to compliance with Clause B1 of the Building Code. That being so, I must confirm the territorial authority’s decision to refuse the application for building consent.

6.10 Jurisdiction in respect of section 73

- 6.10.1 The question of an entry on the certificate of title under section 36(2) of the former Act, now section 73, arises only when a building consent is issued. Accordingly, at this stage I do not have to consider whether I have the jurisdiction to require such an entry in this case. However, I observe that the term “the land on which the building work is to take place” has been interpreted as including such land as is “intimately connected to” the building, *Auckland CC v Logan* 1/10/99, Hammond J, HC Auckland AP77/99.

7 What is to be done?

- 7.1 It is not for me to decide how it is to be established whether the house can be sited in any particular location without being likely to suffer loss of support. Whether that is to be done by further and more detailed investigation and analysis, or by the adoption of suitably conservative assumptions, or a combination of both, or perhaps by some other approach, is for the owner to propose and for the territorial authority to accept or reject, with any of the parties entitled to submit doubts or disputes for another determination. As

discussed in paragraph 5.9.2 I have provided my view as to a process the parties could use.

8 Decision

- 8.1 In accordance with section 20 of the former Act, I hereby confirm the territorial authority's decision to refuse the application for building consent.

Signed for and on behalf of the Chief Executive of the Department of Building and Housing on 22 November 2006.

John Gardiner
Determinations Manager