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To: The Court

**Re. Daniel Mullinger (Deceased) & Others v The
National Trust**

Location: Felbrigg Hall, Roughton, Norfolk

Incident date: 26 June 2007

**Report on matters raised in the supplementary
report of Mr Julian Forbes-Laird, dated 27 May 2011**

**by: David Lonsdale BSc, PhD, FArborA (Hon.),
as an Associate of
Treework Environmental Practice (TEP)**

Dated: 07 June 2011

Specialist Field: Tree risk assessment and
management

On the instructions of: Weightmans LLP

SUMMARY

- The present report concerns Quantified Tree Risk assessment (QTRA), in relation to the contents of Mr Forbes-Laird's supplementary report. It refers also to another method of assessment, known as THREATS.
- I explain that, in my main report, I used QTRA retrospectively in order to help in forming my opinion about the adequacy of the Defendant's inspection of the particular tree involved in the present case; not in order to appraise the Defendant's risk management system.
- I explain that QTRA is a soundly based method for tree risk assessment and that it enables the procedure to be conducted in a standardised manner without purporting to eliminate the subjectivity that is equally inherent in any method of risk assessment or management, including THREATS.
- I comment on the assertion that some aspects of QTRA are considered controversial in the arboricultural world, while pointing out that such an assertion could apply to any method of risk assessment. I also report that there are 634 currently licensed QTRA users in ten countries.
- I argue that the mere presence of children in the vicinity of trees, as distinct from the nature of their activities, does not automatically lead to an under-estimation of risk, as assessed using QTRA.
- I explain that QTRA is not designed to predict when a tree failure will occur. I further explain that any assessment of risk involving chance events can be made only with reference to a defined length of time (one year in the case of QTRA).
- I explain that the 'annualisation' of risk assessment in QTRA does not intrinsically lead to the under-estimation of risk at sites where there are peaks of visitor-occupancy, and that there was no such under-estimation in my use of QTRA in the present case.

DETAILED COMMENTS

1. The retrospective use of risk assessment methods

1.1 At para. 1.2, Mr. Forbes-Laird quotes para. 30 of the Experts' joint statement as follows¹:

"Since the NT's risk management at Felbrigg did not use either THREATS or QTRA, the Experts agree that the retrospective application of these methods cannot directly test the adequacy of that management. The Experts further agree that the NT's own risk management system and its implementation at Felbrigg should be appraised on its own merits".

1.2 At para. 1.3, Mr. Forbes-Laird reports that he invited me to resile from my reliance on QTRA and he cites the above-quoted paragraph as the basis of his invitation. Also, at para. 1.5, he states his view that "...an after-the-fact assessment of whether a tree was under responsible management by means of reverse-engineering inevitably subjective risk calculation methods (sic) has low credibility". He therefore appears to conclude that I used QTRA in an

¹ Note: In this quoted paragraph, "NT" refers to the National Trust.

inappropriate attempt to test the adequacy of the NT's risk management. My use of QTRA was, however, not for that purpose. In order to test the adequacy of the regime, I took account of the following:

- a) the written instructions for tree inspection
- b) records of the implementation of inspection
- c) evidence of the training and competence of the inspectors.

1.3 My retrospective use of QTRA was in order to help in forming my opinion as to whether a competent inspector could reasonably have concluded that, at the time of the inspection in January 2007, the incident tree did not give cause for concern. I thus used QTRA as a test of the inspection of this particular tree; not as a test of the risk management regime.

2. The use and acceptance QTRA in the arboriculture world

2.1 At para. 1.3, Mr Forbes-Laird states that "*it is fair to say*" that certain aspects of QTRA are "*considered to be controversial within the arboricultural world*". He does not state whether it is fair to say the same of THREATS, the system that he has devised. Of THREATS, he states only (at para. 1.4), that it is "*now in widespread national and international use*". These statements are therefore not truly comparative. On the basis that no method of tree risk assessment and/or management can be perfect, it would probably be more appropriate to state that all methods are to some extent controversial.

2.2 To the extent that I am aware of any controversy surrounding QTRA, this arises mainly from a concern about the wisdom of trusting any quantitative method that seems to detach the user from a more familiar descriptive process of risk assessment. In my experience, however, the quantification of risk enables QTRA users to adopt a structured and standardised approach to a familiar procedure whereby they have always taken proper account of relevant factors such as the probability of tree failure and the usage of the site concerned. There might also be some concern that risk assessment is onerous, but QTRA users are taught to apply the method in a simple manner in the first instance (Anon., 2010, Section 2), in order to identify the usually very small proportion of trees that might warrant individual risk assessment.

2.3 There is clearly also scope for controversy about certain details of QTRA that could usefully be improved or refined. This is evidently welcomed by Quantified Tree Risk Assessment Ltd., which runs an Internet forum for QTRA users. Constructive criticism submitted by users is taken into account in the further development of the method.

2.4 I am not aware of any Internet forum for users of THREATS, but there has been some debate on another Internet Forum (UK Tree Care Internet Forum, 2010), regarding the validity of the underlying numerical method. It was pointed out in the debate that the risk-components in QTRA are quantified according to principles that have been published in a professional journal (Ellison, 2005) and that are made known to users. In comparison, it was argued that the risk-

components in THREATS are quantified by means of an ‘algorithm’, the details of which are not explained to users.

- 2.5 Turning to Mr Forbes-Laird’s comment about the numbers of users of THREATS, I appreciate that it is not feasible to state an exact number, since he does not require users to be formally registered and thus to be countable. QTRA, like THREATS, is in the public domain to the extent that its basic method has been published (Ellison, 2005). Thus the total number of QTRA users, either individual or institutional, is unknown, but they include some who can be counted by virtue of being trained and currently licensed. More than 900 individuals or organisations have at some time been trained and licensed. At the time of writing, 634 current licensees are listed. They are based across the following countries in addition to the UK: Australia, Belgium, France, Germany, Hong Kong, Ireland (Republic), Singapore, Switzerland and the USA (QTRA, 2011). The total number of current licensees is slightly higher, since it includes others whose names are not publicly listed.

3. “The principle of relative danger”

- 3.1 At para. 2.2, Mr Forbes-Laird quotes and agrees with the QTRA user manual², where it states that an assessor should be mindful of children’s different perception of danger, but he does not mention that it also emphasises the need to take account of localities in which children congregate for reasons other than their perception of danger, such as school entrances and school bus stops (Anon, 2010: Section 7). Also, he criticises QTRA because it does not explain “*how the recommended mindfulness should be factored into the probability calculation*”. In my opinion, however, it is inappropriate to modify the calculation unless children’s behaviour is likely to contribute significantly to the risk of harm. I consider that, in such a situation, a QTRA user could adjust the estimate of target occupancy accordingly. I can envisage a need for such adjustment, for example, where substantial numbers of children are climbing trees without close supervision. Equally, where there are warning signs intended to discourage pedestrians from walking under certain trees, unsupervised children might fail to understand or to take heed of such signs.
- 3.2 According to Mr Daplyn’s witness statement (paras. 18 to 22), most of the children in the vicinity of the incident tree were taking part in the supervised activities of the Aylmerton Field Studies Centre. I am not aware of any evidence that unsupervised children formed a significant proportion of the visitors to the locality. I therefore conclude that there was no reason to believe that the risk of harm to visitors was significantly greater because some of them were children.
- 3.3 In the context of children’s activities, I refer to Mr Forbes-Laird’s main report (para. 4.2.2), where he describes a ‘den’ that children had created near the incident tree. I am, however, not aware of any evidence that the den (which is a very rudimentary structure, as pointed out in Mr Richard Daplyn’s witness

² Note: Mr. Forbes-Laird cites a somewhat earlier version of the manual (2007) than is cited in the present report.

statement, para. 17) was not being used to any significant extent with regard to site usage.

4. The timing of tree failure

- 4.1 At item. 2.2, Mr Forbes-Laird argues as follows: “*the assessment in QTRA is annualised; a core principle that confers two serious difficulties*”. His argument fails to recognise the fundamental principle that the risk from a chance event can be assessed only according to its probability of occurrence within a given length of time. It is in my view clearly incorrect to suppose that QTRA is intended to predict **when** failure will occur. QTRA involves a prediction of the probability of failure. One year is selected as the length of time over which this prediction is made, since it comprises one complete cycle of tree growth. In para. 5.3, below, I have addressed the question as to whether it would be reasonable to select a longer or shorter period.
- 4.2 THREATS does not involve an assessment of the probability of failure within a given period of time, but the user is required to estimate the “likelihood of failure” partly in relation to the question of how soon it will occur (Forbes-Laird, 2010). This method of estimation, although different to that of QTRA (Anon., 2010: Section 6), is in my opinion obviously probabilistic.
- 4.3 At para. 2.2.2, Mr Forbes-Laird asserts that there are “*three serious obstacles in the path of an accurate prediction of failure timing*”. I believe that this assertion is misplaced, since QTRA is not intended to predict **when** failure will occur, accurately or otherwise. The question of “when” arises only because of the need to assign a given period of time (one year in this instance) over which the probability of harm is assessed.
- 4.4 It is in the inappropriate context of alluding to a supposed intention to predict “when” tree failure will occur that Mr Forbes-Laird lists his “*three serious obstacles*” in his para. 2.2.2. In the same context he also cites (at para. 2.2.3) some unpublished research on the performance of surveyors.
- 4.5 Although QTRA is not intended to address the question of “when”, Mr. Forbes-Laird’s three obstacles are relevant to the accuracy and reliability of any method of assessment, including THREATS. I therefore identify the following three limitations, which bear some relationship to Mr. Forbes-Laird’s obstacles:
- 1) the current state of arboricultural knowledge;
 - 2) the competence of those who make the assessments;
 - 3) an inherent element of subjectivity.
- 4.6 With regard to the use of QTRA in my main report (Section 8.3), I have placed particular emphasis on the inherent subjectivity that is involved in assessing the probability of tree failure. The same subjectivity applies just as much, however, to the use of any method, including THREATS.
- 4.7 In both QTRA and THREATS, the user assigns each of three risk factors to one of a ranked series of categories (known as “scores” in THREATS and as

“ranges of probability” in QTRA). In QTRA, the user has an additional option to estimate the values for probability of failure and for target occupancy more exactly. If this option is exercised, the inherent subjectivity of estimating the probability of failure becomes more apparent. I take the view, however, that the option is helpful in borderline or complex cases, provided that account is taken of the subjective aspects of the assessment.

4.8 In my main report, I applied QTRA according to the ranges of probability, as shown in my para. 8.3.5.1. I also made use of the option to assign my own estimates of the three risk factors, since I recognised a need to explore the matter more thoroughly in the context of the Tolerability of Risk Framework (Anon., 2001), as explained in para. 8.3.5.3 of my main report.

4.9 At 2.2.5, Mr Forbes-Laird cites a passage from a publication of the Health and Safety Executive (his reference No. 5), which distinguishes between “*processes that are deterministic (where the cause assures the outcome) and those which are stochastic (where the outcome depends on chance)*”. He does so in order to argue (at para. 2.2.6) that, although QTRA deals with stochastic process such as the events that lead to tree failure, it appears to address the timing of failure as if this were a deterministic process. I do not agree with this argument, but I can identify certain deterministic conditions that must exist in order to create a possible need for risk assessment. With regard to a potentially harmful outcome, these include the following:

1. the presence of a tree, with potential to cause harm in the event of failure;
2. the existence of features of the site (e.g. a road, car park or other amenity) whereby people might be present in the locality concerned.

It is, however, equally obvious that the probability of a significantly harmful outcome occurring depends on chance events that might occur **within a stated period**. These include:

1. the probability of tree failure;
2. the probability that a person or persons will be in the locality at the time of a tree failure (or soon afterwards, in the case of an impact from a vehicle);
3. the probability that the impact will be great enough to cause severe harm.

4.10 There is room for debate about the division between deterministic and stochastic elements of tree-related risk. For example, the size of the tree or of the part that might fail is deterministic, but the manner of a potential impact is largely open to chance. Nevertheless, it is clear to me that, according to QTRA, risk is assessed on the basis that outcome depends largely on chance occurrence. In my opinion, Mr. Forbes-Laird is therefore incorrect to assert otherwise.

5. Target occupancy

5.1 As stated by Mr. Forbes-Laird at para. 2.3.2, risk assessment should be adapted in accordance with changing demands. In his cited example, (para. 2.1.3), a four-day festival was held in a field which was otherwise “*substantially*

unoccupied by people". To the best of my understanding of the QTRA method, its initial use at this field (Anon., 2010: Section 2) would almost certainly have shown that quantitative risk assessment was unnecessary, provided that the field was not to be used for a festival and that none of the trees had the potential to cause harm on neighbouring land. In anticipation of increased site usage during a planned festival, however, the initial use of QTRA might have indicated that such an assessment was warranted, depending on the other risk factors. It is therefore incorrect to assert that QTRA does not take account of changed circumstances.

- 5.2 Mr. Forbes-Laird correctly points out, at para. 2.3.4 that account should be taken of "*visitor densities within particular impact areas*". He is, however, incorrect to assert that the "*annualised approach*" ignores those densities. Annualisation involves an averaging of the estimated densities over a year but it does not affect the relative densities in particular impact areas, as compared with other areas. For example, if there is an intention to erect a marquee beneath a particular tree or group of trees, the consequently high visitor density in and around the marquee would be taken into account when assessing the risk according to QTRA (Anon., 2010: Section 7). Thus, QTRA takes account of peaks of occupancy by identifying particular localities where those peaks are predicted to occur. It also allows for the possibility that more than one person (or other target) could be harmed in a densely occupied locality (Anon., 2010: Section 8).
- 5.3 With regard to the annualisation of risk assessment, the same principles of calculation that are used in QTRA could be applied (albeit not according to the advised QTRA method) to a short period of peak visitor occupancy. The proportionate increase in occupancy would, however, be cancelled out by the proportionate decrease in the time available for tree failure to occur.
- 5.4 In his criticism of annualisation, Mr. Forbes-Laird asserts that it ignores "seasonal factors that frequently drive tree failure. Seasonal factors would not be subject to the same 'cancelling out' effect that would occur if the assessment were attempted for periods of peak occupancy. I can therefore see some justification in principle for risk to be assessed separately for different seasons. In practice, however, such an approach would require more knowledge than, in my opinion, currently exists regarding the influence of season on the incidence of the various kinds of tree failure. It is, however, evident that most tree failures occur during severe weather (which is obviously related to season). QTRA allows for adjustment in order to allowance for the effect of weather, either where wind-induced tree failure tends to coincide with a low frequency of visitor occupancy, or where the phenomenon of "summer branch drop" might coincide with relatively high occupancy (Anon., 2010, Section 8).
- 5.5 In the present case, the activities of the Aylmerton Field Studies Centre created peaks of site-usage, but I think that such peaks are comparable with those that occur in a very wide range of sites, where no question of conducting special assessments for peak periods would arise. In general, if there were enough information available to conduct such assessments under UK conditions, risk

would, in my opinion, usually be found to be relatively low at times of year when a relatively high incidence of tree failure coincides with relatively little outdoor recreational activity.

6. Target value

- 6.1 At para. 2.4.2, Mr. Forbes-Laird cites statements by Professor John Adams, with regard to the inherent problems of attempting to attach a pecuniary value to human life. Such problems clearly exist, but they do not affect the assessment of the probability of a fatal tree-related accident using QTRA. It is true that a notional value (of £1 million) is placed on a human life when risk is assessed using QTRA, but only as a numerical reference for calculating the risk of incurring the repair or replacement cost of **property** that could be damaged as a result of tree failure. Thus, if the potential cost is estimated as £100,000 (i.e. a tenth of £1 million), the risk index will be one tenth of that pertaining to a potential fatality.

David Lonsdale
7th June 2011

References

- Anon. (2001). *Framework for the tolerability of risk*. Health and Safety Executive, HSE Books, Sudbury, UK.
- Anon. (2010). *Quantified Tree Risk Assessment: User Manual*, Version 3.04_2010-081, Quantified Tree Risk Assessment Ltd., Cheshire, UK, 47 pp.
- Ellison, M.J. (2005). Quantified tree risk assessment, used in the management of amenity trees. *Journal of Arboriculture* **31**, 57-65.
- Forbes-Laird, J. (2010). *Tree Hazard: Risk Evaluation and Treatment System: guidance note for users*. Forbes-Laird Arboricultural Consultancy, Bedford, UK, 16 pp.
- QTRA (2011). QTRA website: <http://www.qtra.co.uk>
- UK Tree Care Internet Forum (2010). <http://www.tree-care.info/uktc/archive>

DECLARATION

I, David Lonsdale, declare that:

I understand that my duty is to help the Court on the matters within my expertise and that this duty overrides any obligation to the person from whom I have received instructions or by whom I am paid. In order to fulfil my duty I have complied with, and will continue to comply with, the following requirements: (1) to provide objective, unbiased opinion on matters within my expertise, (2) not to assume the role of an advocate, (3) to consider all material facts, including those which might detract from my opinion, (4) to make it clear when a question or issue falls outside my expertise or when I am not able to reach a definite opinion and (5) to communicate to all the parties without delay any change of view on any material matter that I might reach after producing a report.

Signed and dated

David Lonsdale

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David Lonsdale

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7th June 2011

STATEMENT OF TRUTH

I confirm that I have made clear which facts and matters in this report are within my own knowledge and which are not. Those that are within my own knowledge I confirm to be true. The opinions I have expressed represent my true and complete professional opinions on the matters to which they refer.

Signed and dated

David Lonsdale

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David Lonsdale

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7th June 2011

APPENDIX: QTRA User Manual, version 3.04_2010-081