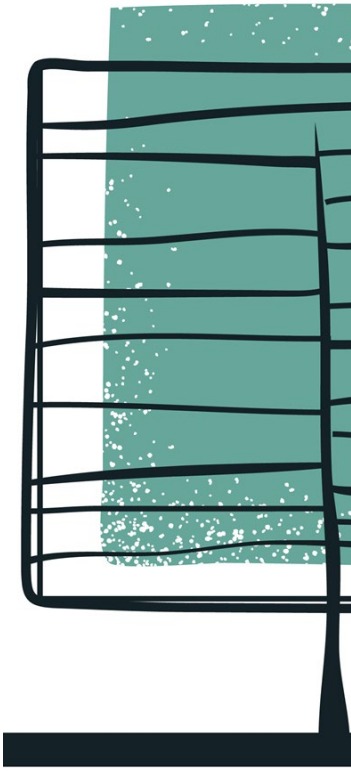

Lally TREE MANAGEMENT

Report No: LTM0645.VTA.Claytonbrook.01

Date: 21/10/2022

Project: GMP Claytonbrook, Openshaw, Manchester, M11 1PP

Tree Health & Risk Assessment

Inspection Record

Date of Inspection	Surveyor
17/10/2022	Matthew Lally. FdSc MArborA

Lally Tree Management
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Revision	Date	Prepared by	Status
Final	21/10/2022	M. Lally	Complete

1.0 INTRODUCTION

1.1 Professional Details

1.1.1 My name is Matthew Lally and I have been working and studying in the Arboricultural Industry for over 16 years. I have many years practical experience as an arborist and professional experience as a consulting arboriculturalist.

1.1.2 I so far hold the following Arboricultural qualifications and technical memberships:

- FdSc Arboriculture
- LANTRA Profession Tree Inspection Certificate
- VALID – Validator
- QTRA Registered User
- Professional Member of the Consulting Arborist Society
- Professional member of the Arboricultural Association

1.2 1.2 Tree Risk Assessment (QTRA Approach)

1.2.1 *What is Quantified Tree Risk Assessment (QTRA)?*

Tree safety management is a matter of balancing the Risk of Harm from falling trees with the benefits from trees. Although it may seem counter intuitive, the condition of trees should not be the first consideration. Instead, tree managers should first consider the usage of the land on which the trees stand, which in turn will inform the process of assessing the trees.

Quantified Tree Risk Assessment (QTRA) applies established and accepted risk management principles to tree safety management in accordance with ISO 31000:2009, Risk management – Principles and guidelines, which is published by national standards agencies. By quantifying the Risk of Harm as a probability, QTRA enables the tree manager to manage the risk from tree failure to widely accepted risk thresholds.

Using the QTRA approach, the land-use (people and property) upon which trees could fail is assessed and quantified first. This enables tree managers to determine whether or not and to what degree of rigour a survey or inspection of the trees is required. Where necessary, the tree or branch is then considered in terms of both size (potential impact) and probability of failure. Values derived from the assessment of these three components are combined to calculate the risk of harm as a probability, which can then be compared to advisory levels of risk acceptability.

The method moves the management of tree safety away from labelling trees as either ‘safe’ or ‘unsafe’, thereby requiring definitive statements of tree safety from either tree surveyors or tree managers. Instead, QTRA quantifies the risk of significant harm from tree failure in a way that enables tree managers to balance safety with tree value and operate to predetermined risk thresholds.

By taking a QTRA approach to tree risk, tree managers commonly find they spend less resources on assessing and managing tree risk, whilst maximising the benefits

their tree populations provide. Furthermore, in the event of a 'tolerable' or 'acceptable' tree risk being realised, they are in a robust position to demonstrate that they have acted reasonably and proportionately.

1.2.2 This report was commissioned by Greater Manchester Police and its purpose was to carry out a site visit and to make a visual assessment of all the trees standing within the grounds of GMP Claytonbrook as shown on the site plan in Appendix Two.

1.2.3 This document has been completed using the QTRA approach to risk management and should be read in conjunction with the data tables of Appendix One and site plan of Appendix Two. The QTRA Practice Note explaining the principles and methodology of QTRA can be found in Appendix Three.

1.2.4 The survey on which the findings of this report are based was undertaken on 17/10/2022.

1.2.5 All comments and recommendations have taken into account the location of each tree, their surroundings and their likely impact on persons or property.

1.2.6 The limitations of this report are restricted to the persons, time, information made available, and purpose for which this report has been prepared.

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2.0 FINDINGS

2.1 The trees were visually assessed and given an identification number which is marked clearly on the site plan. The results are clearly described in the data tables of Appendix One and site plan of Appendix Two.

2.2 To give assistance in reading the findings the following glossary has been produced.

Arboricultural Glossary of Terms

The following terms are concurrent with best Arboricultural practice and within the guidelines set by the International Society of Arboriculture (ISA), the Arboricultural Association (AA) and the British Standards Institute (BSI).

Age Range: Age is site specific and categorised:

Young (Y)	Newly Planted trees that have not yet established
Semi-Mature (SM)	Established trees up to 1/3 of expected height, stem girth and crown spread
Early Mature (EM)	Between 1/3 and 2/3 of expected height, stem girth and crown spread
Mature (M)	Between 2/3 and full expected height, stem girth and crown spread
Fully Mature (FM)	Full expected height, stem girth and crown spread
Over Mature (OM)	Exceeding life expectancy & Evidence of die back in crown.
Senescent (S)	In advanced stages of decline

Height: Height was estimated and recorded in five metre intervals such as: 0-5, 6-10, 11-15, 16-20, 21-25 and 26+

T/G/W/H - T = Tree. G = Group. W= Woodland. H = Hedge

Condition: Assessment of current physiological and structural condition incorporating vigour and vitality. Condition is to be categorised as follows:

A – Tree needing little, if any attention
B – Tree with some risk features, or in the early stages of physiological stress
C – Tree with significant risk features and/or extremely stressed
D – Tree that is dead, biologically/physically moribund or dangerous

Priority Rating:

Priority Rating		
1	Immediate	Action should be taken immediately. No delay
2	High	Works should be undertaken as soon as possible
3	Moderate	Work should be implemented in a programme of works
4	Low	Work that would benefit the trees or other issues. Work not considered essential but should be implemented if funding becomes available.

RISK RATING KEY

Target Type: P= Property V= Vehicles H = Humans

Mx Targets: If there are multiple targets or a target well above the top value then this can be multiplied using this field to give a more accurate output. See Appendix 3.

Target: Rated from 1 to 6. 1 being the highest value and 6 being the lowest value. (See appendix 3)

Size: This is the size of the part that could fail. These are given values 1 to 4 and a P represents property. (See appendix 3)

Probability of Failure: Likelihood of failure given a value of 1 to 7. 1 being certain of failure and 7 being certain of no failure. (See appendix 3)

Mass%: Percentage of mass lost from part.

ROH: Risk of Harm calculated from the above inputs. (See appendix 3)

Definition of Physiological & Morphological Terms

Adaptive Growth - The process whereby wood formation is influenced both in quantity and in quality by the action of gravitational force and mechanical stresses on the cambial zone.

Cankers - A localised area of dead bark and cambium on a stem or branch which can be caused by bacterial or fugal agents.

Cavity - An open area within the stem or branches of the tree. The cavity forms by the presence of fugal decay.

Chlorotic Leaf - Lacking in chlorophyll, typically yellow in colour.

Compartmentalisation - The physiological process that creates the chemical and mechanical boundaries that act to limit the spread of disease and decay organisms.

Coppicing - An ancient form of woodland management that involves repetitive felling and re-growth on the same stool, near to ground level.

Compression wood – A type of wood found in Gymnosperms (Coniferous Trees) that is created as a rection to compressive forces. This type of wood is more resistant to compressive forces than normal wood.

Crack - A split in the stem or branch, involving bark and/or underlying wood. These may be vertically and horizontally orientated.

Decay - Process of degradation of woody tissues by fungi and bacteria through decomposition of cellulose and lignin.

Deadwood - Deadwood is often present within the crown or on the stems of trees. In some instances, is may be an indication of ill health, however, it may also indicate natural growth processes.

Design Wind Load- The maximum static load to which a tree is expected to be exposed during a chosen extreme wind event. It is the interaction between the wind force and the size and shape of the crown of the tree. Design Wind Load is expressed as a moment.

Girdling Root - Root which circles and constricts the stem or roots causing death of phloem and/or cambial tissue.

Hazard Beam - An upwardly curved branch in which strong internal stresses may occur without the compensatory formation of extra wood (longitudinal splitting may occur in some cases).

Included Union - Pattern of development at branch junctions where bark is turned inward rather than pushed out. Potential weakness due to a lack of a woody union.

Ivy Growth - Ivy growth may ascend into the tree's crown, increasing wind resistance, concealing potential defects and reducing the tree's photosynthetic capacity. Ivy growth is often acceptable in woodland areas as a conservation benefit.

Live Crown Ratio - The relative proportion of photosynthetic mass (leaf area) to overall tree height.

Root Plate Lift - The physical movement of the rooting plate causing soils to shift and crack. May occur during adverse weather conditions. Trees may become unstable.

Suppressed - Trees which are dominated by surrounding vegetation and whose crown development is restricted from above.

Topping - A highly disfiguring practise, likely to cause severe xylem dysfunction and decay in major structural parts of the wood.

Wound - Any injury, which induces a compartmentalisation response.

Wound wood - Wood with atypical anatomical features, formed in the vicinity of a wound and a term to describe the occluding tissues around a wound as opposed to the ambiguous term "callus."

Woodland Structure - The vertical and horizontal arrangement of trees within a group or woodland i.e. Dominant - trees with a crown above the upper layer of the canopy, Co-dominant - trees that define the general upper edge of the canopy, Intermediate - trees that have been largely overgrown by others, Suppressed - trees that have been overgrown and occupy an under storey position and grow slowly, often severely asymmetrical.

Note: The definitions described above, may not necessarily be included within the Arboricultural Survey Data.

3.0 RECOMMENDATIONS

3.1 It is recommended that all works to the trees be carried out in accordance with the data tables of Appendix One in order to bring them into good management and continue long-term tree cover in this area. The works can be summarised as follows:

Priority	Other	Prune	Fell
1	-	-	-
2	-	-	-
3	2251, 2252, 2253, 2254, 2256, G1,	2230, 2231, 2232, 2233, 2234, 2236, 2257, 2258, 2260, 2263, 2264, 2266, 2273, 2279, 2287, 2295, 2305, 2310,	2269, 2281, 2288,
4	-	-	2237, 2244,

Priority Rating:

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3.2 Standard of work

All tree work undertaken should be done in accordance with British Standard 3998:2010 and by competent contractors who are insured with public liability cover of at least two million pounds.

3.3 Statutory controls

If the trees on site are subject to any Tree Preservation Orders (TPO's) or are encompassed within a Conservation Area, then statutory permission from the Local Planning Authority (LPA) will be required before any tree works take place.

3.4 Wildlife

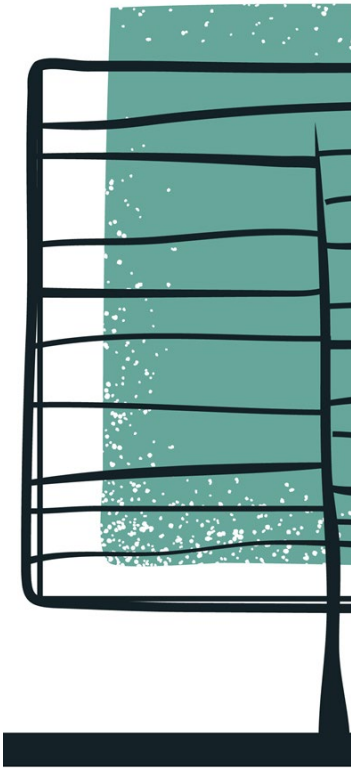
All operations should take account of wildlife needs and be planned to take advantage of weather conditions and time of year for minimum damage and disturbance. If any protected species or nesting birds are present or discovered while the works are taking place all work should cease until contact has been made with Natural England for further advice. Natural England can be contacted on 0845 600 3078 or by e-mail to: enquiries@naturalengland.org.uk. Specific consideration should be given to the possible presence of roosting bats, which are protected by the Wildlife and Countryside Act 1981 (schedule 5) and included in schedule 2 of the Conservation Regulations 1994. Ideally, a survey should be carried out to identify any potential roost sites and if bats are found to be present advice should be sought form a person qualified and experienced in handling such matters and fully conversant with the implications of the Act.

3.5 **Repeat survey's**

The frequency of the repeat surveys can be found in the tree schedule in Appendix One titled "next survey (months)".

Appendix One

Tree Survey Data



TREE RISK ASSESSMENT SCHEDULE

QTRA Quantified Tree Risk Assessment

Lally TREE MANAGEMENT

SURVEYOR: Matthew Lally
DATE: 17/10/2022
PROJECT ADDRESS: GMP Claytonbrook
PROJECT REF: LTM0645.VTA.Claytonbrook.01

Tree No.	T/G/W/H	Species	Height (m)	Age Class	Condition	Comments	Recommendations	Priority	Next Survey (months)	RISK ASSESSMENT OF	TARGET TYPE	Mx TARGETS	TARGET	SIZE	POF	MASS %	ROH
2230	T	Cherry	6 to 10	SM	A	Good form and vitality. No hazards noted. Low branches.	**Crown lift to 3m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2231	T	Lime	11 to 15	SM	A	Good form and vitality. No hazards noted. Low branches over road.	**Crown lift to 4m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2232	T	Cherry	6 to 10	SM	A	Good form and vitality. No hazards noted. Low branches over road.	**Crown lift to 3m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2233	T	Cherry	6 to 10	SM	A	Good form and vitality. No hazards noted. Low branches over road.	**Crown lift to 4m over road**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2234	T	Field Maple	6 to 10	SM	A	Good form and vitality. No hazards noted. Branches obstructing lighting.	**Prune back 0.5m from lighting for clearance**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2235	T	Field Maple	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2236	T	Cherry	6 to 10	EM	A	Good form and vitality. No hazards noted. Branches obstructing lighting. Mechanical damage to exposed roots - not significant at present.	**Prune back from lighting to allow correct light splay**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2237	G	Goat willow x 1 Rowan x 1 Birch x 1	6 to 10	EM	B	Good form and vitality. Multistemmed at base with acute unions. Rowan is located in grassed area and is in decline. Birch is growing in between fencing which limited the inspection. Trees appear stable.	**Remove Rowan**	4	36	RISK <1/1M, CALCULATION NOT REQUIRED							

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2238	T	Ash	6 to 10	SM	A	Good form and vitality. No hazards noted. Balanced open crown.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2239	T	Birch	11 to 15	SM	A	Good form and vitality. No hazards noted. Balanced open crown.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2240	G	Goat willow x 6	11 to 15	SM	B	Good form and vitality. No hazards noted. x6 trees with no defects. x2 growing through and damaging boundary fence.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2241	T	Ash	11 to 15	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2242	T	Rowan	6 to 10	SM	A	Good form and vitality. No hazards noted. Acute unions and crossing branches.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2243	T	Cherry	11 to 15	SM	A	Good form and vitality. No hazards noted. Previously pruned back from building.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2244	T	Maple	11 to 15	SM	A	Good form and vitality. No hazards noted. Suppressed specimen. Stem growing into boundary fencing.	**Remove to prevent future damage to fence**	4	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2245	T	Maple	11 to 15	SM	A	Good form and vitality. No hazards noted. Suppressed specimen. Limited access to stem - dense vegetation.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2246	T	Maple	6 to 10	SM	A	Good form and vitality. No hazards noted. Suppressed specimen. Limited access to stem - dense vegetation.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							

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2247	G	Western red cedar	11 to 15	SM	A	Good form and vitality. No hazards noted. Suppressed specimen. Limited access to stem - dense vegetation. x2 trees. x1 twin stemmed at base.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2248	G	Western red cedar	11 to 15	SM	A	Good form and vitality. No hazards noted. Suppressed specimen. Limited access to stem - dense vegetation. x2 trees both twin stemmed at base.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2249	G	Western red cedar	11 to 15	SM	A	Good form and vitality. No hazards noted. Suppressed specimen. Limited access to stem - dense vegetation. x2 trees x1 twin stemmed at base.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2250	G	Western red cedar	11 to 15	SM	A	Good form and vitality. No hazards noted. Suppressed specimen. Limited access to stem - dense vegetation. x2 trees both multistemmed at base.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2251	T	Ash	11 to 15	SM	B	Good form and vitality. No hazards noted. Dense ivy covering stem and branch framework. Limited inspection.	**Clear ivy from ground level to 2m on main stem. Reinspect**	3	6	RISK <1/1M, CALCULATION NOT REQUIRED							
2252	T	Ash	11 to 15	SM	B	Good form and vitality. No hazards noted. Dense ivy covering stem and branch framework. Limited inspection.	**Clear ivy from ground level to 2m on main stem. Reinspect**	3	6	RISK <1/1M, CALCULATION NOT REQUIRED							

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2253	T	Sycamore	11 to 15	SM	B	Good form and vitality. No hazard noted. Dense ivy covering stem and branch framework. Limited inspection due to dense vegetation.	**Clear ivy from ground level to 3m on main stem. Reinspect**	**3**	6	RISK <1/1M, CALCULATION NOT REQUIRED							
2254	T	Birch	11 to 15	SM	B	Good form and vitality. No hazard noted. Dense ivy covering stem and branch framework. Limited inspection due to dense ivy.	**Clear ivy from ground level to 2m on main stem. Reinspect**	**3**	6	RISK <1/1M, CALCULATION NOT REQUIRED							
2255	T	Goat willow	11 to 15	SM	B	Good form and vitality. No hazard noted. Dense ivy covering stem and branch framework. Multistemmed at base.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2256	T	Rowan	0 to 5	Y	A	Good form and vitality. No hazard noted. Tie restricting cambium.	**Remove tie**	**3**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2257	T	London plane	6 to 10	SM	A	Good form and vitality. No hazards noted. Balanced open crown. Dense vegetation at base. Low branches.	**Crown lift to 3m**	**3**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2258	T	Lime	11 to 15	EM	A	Good form and vitality. No hazard noted. Balanced open crown. Dense vegetation at base. Low branches.	**Crown lift to 3m**	**3**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2259	T	Hornbeam	6 to 10	SM	A	Good form and vitality. No hazard noted. Balanced open crown. Multiple acute unions at crown break. Dense vegetation at base.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							

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2260	T	Ash	6 to 10	SM	A	Good form and vitality. No significant risk features observed. Balanced open crown. Low branches.	**Crown lift to 3m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2261	T	Hornbeam	6 to 10	SM	A	Good form and vitality. No significant risk features observed.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2262	T	Field maple	6 to 10	SM	A	Good form and vitality. No hazards noted. Multiple partially occluded pruning wounds from previous crown lift.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2263	T	Rowan	0 to 5	SM	A	Good form and vitality. No hazards noted. Low branches over footpath.	**Crown lift to 2.25m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2264	T	Silver birch	11 to 15	EM	A	Good form and vitality. No hazards noted. Low branches. Low branches over seating area.	**Crown lift to 2.5m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2265	T	Alder	0 to 5	Y	A	Good form and vitality. No hazards noted. Branches encroaching in to parking space.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2266	T	Cherry	0 to 5	SM	A	Good form and vitality. No hazards noted. Low branches over car park.	**Crown lift to 2.5m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2267	T	Ash	0 to 5	Y	A	Good form and vitality. No hazards noted. Bulge where tie used to be.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2268	T	Hornbeam	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	24	RISK <1/1M, CALCULATION NOT REQUIRED							

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2269	T	Ash	0 to 5	SM	C	Large bulge where tie used to be. 60% crown dieback on account of Ash dieback disease.	**Remove**	**3**	n/a	Deadwood	P	1	4	P	3	100%	1/300K
2270	T	Ash	0 to 5	SM	B	Good form, moderate vitality. No hazards noted. Early stage Ash dieback disease affecting 40% of crown.	**No action required**	**-**	24	RISK <1/1M, CALCULATION NOT REQUIRED							
2271	T	Hornbeam.	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2272	T	Field maple	0 to 5	SM	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2273	G	Alder x 4 Rowan x 1	0 to 5	SM	B	x4 trees. Good form and vitality. Multistemmed at base. No hazards noted. x1 young rowan within group. Low branches.	**Crown lift to 3m over car park**	**3**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2274	G	Alder x 2 Hawthorn x 1	0 to 5	Y	A	Good form and vitality. Multistemmed at base. No hazards noted. x1 young hawthorn within group.	**No action required**	**-**	24	RISK <1/1M, CALCULATION NOT REQUIRED							
2275	T	Norway maple	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2276	T	Norway maple	0 to 5	Y	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2277	T	Norway maple	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2278	T	Norway maple	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							

1- Immediate - Action should be taken immediately. No Delay

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3- Moderate - Work should be implemented in a programme of works

4- Low - Work that would benefit the trees or other issues. Work not considered essential but should be implemented if funding becomes available.

TREE RISK ASSESSMENT SCHEDULE

QTRA Quantified Tree Risk Assessment

Lally TREE MANAGEMENT

SURVEYOR: Matthew Lally
DATE: 17/10/2022
PROJECT ADDRESS: GMP Claytonbrook
PROJECT REF: LTM0645.VTA.Claytonbrook.01

Tree No.	T/G/W/H	Species	Height (m)	Age Class	Condition	Comments	Recommendations	Priority	Next Survey (months)	RISK ASSESSMENT OF	TARGET TYPE	Mx TARGETS	TARGET	SIZE	POF	MASS %	ROH
2279	T	Cherry	0 to 5	SM	A	Good form and vitality. No hazards noted. Low branches.	**Crown lift to 3m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2280	T	Ash	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	24	RISK <1/1M, CALCULATION NOT REQUIRED							
2281	T	Hawthorn	0 to 5	SM	D	Dead standing tree.	**Remove**	3	n/a	Total tree failure	P	1	4	P	2	100%	1/30K
2282	T	Rowan	0 to 5	Y	B	Good form with low vitality. No hazards noted.	**Monitor for decline**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2283	T	Field maple	0 to 5	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2284	T	Laburnum	0 to 5	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2285	T	Rowan	0 to 5	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2286	T	Silver birch	11 to 15	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2287	T	Alder	11 to 15	EM	A	Good form and vitality. No hazards noted. x1 large overextending hazard beam.to west, good reaction wood present. Stem.is abutting and deflecting boundary fence. Low branches over path	**Crown lift to 3m**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							

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2288	T	Alder	0 to 5	Y	C	Heavily pruned back previously. Primary union is included with large split.	**Remove**	**3**	(n/a)	Branch failure on to car	P	1	4	P	3	100%	1/300K
2289	T	Cherry	0 to 5	SM	A	Poor form. Good vitality. Heavily imbalanced crown - tree appears stable.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2290	T	Cherry	0 to 5	SM	A	Poor form due to poor past husbandry - large pruning wounds in centre of crown. Good vitality. Imbalanced crown - no targets.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2291	T	Norway maple	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2292	T	Norway maple	6 to 10	SM	A	Good form and vitality. No hazards noted. Previously pruned back from building.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2293	T	Cherry	6 to 10	SM	B	Previously partially failed root plate. Stabilised and lean self corrected.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2294	T	Cherry	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2295	T	Cherry	6 to 10	SM	A	Good form and vitality. Large target canker at 2m, partially occluded, not significant at present. Low branches over public footpath. No hazards noted.	**Crown lift to 2.5m**	**3**	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2296	T	Cherry	6 to 10	Y	B	Good form and vitality. Target canker on stem adjacent to crown break - not significant at present.	**No action required**	**-**	36	RISK <1/1M, CALCULATION NOT REQUIRED							

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2297	T	Cherry	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2298	T	Cherry	6 to 10	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2299	T	Birch	16 to 20	EM	A	Good form and vitality. No hazards noted. Previously topped at 10m with healthy regrowth. Minor deadwood in crown. Multiple historic pruning wounds to stem from previous crown lifts.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2300	T	Birch	0 to 5	Y	A	Good form and vitality. No hazards noted. Kink in stem at 1m.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2301	T	Sycamore	16 to 20	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2302	T	Sycamore	16 to 20	M	B	Good form and vitality. Codominant twin stemmed at base. x1 stem with large open cavity from base to 4m. Good reaction growth. Tree appears stable. Seating area beneath crown.	**Inspect annually**	-	12	Stem failure	H	1	2	1	6	100%	<1/1M
2303	T	Birch	16 to 20	SM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2304	T	Laburnum	6 to 10	SM	A	Good vitality. Multistemmed at base, acute unions and crossing limbs. Acceptable condition	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2305	T	Rowan	6 to 10	SM	B	Good vitality. Multistemmed at base, acute unions. Deadwood present.	**Remove significant deadwood**	3	36	Deadwood	P	1	3	P	3	100%	1/30K

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Tree No.	T/G/W/H	Species	Height (m)	Age Class	Condition	Comments	Recommendations	Priority	Next Survey (months)	RISK ASSESSMENT OF	TARGET TYPE	Mx TARGETS	TARGET	SIZE	POF	MASS %	ROH
2306	T	Birch	6 to 10	SM	A	Good form and vitality. No hazards noted. Minor suppression by adjacent trees.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2307	T	Sycamore x 1. Alder x 1	11 to 15	EM	A	Good form and vitality. No hazards noted.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2308	T	Alder	11 to 15	SM	A	Good form and vitality. No hazards noted. Twin-stemmed at base.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2309	T	Sycamore	11 to 15	EM	A	Good form and vitality. No hazards noted. Multiple pruning wounds from previous crown lifts.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
2310	T	Alder x 2	0 to 5	SM	A	Good form and vitality. No significant risk features observed. Low branches over car park.	**Crown lift to 3m over car park**	3	36	RISK <1/1M, CALCULATION NOT REQUIRED							
G1	G	Leyland cypress	16 to 20	SM to EM	A	Good form and vitality. No access to stems due to dense vegetation. Many trees have acute primary unions. Limited inspection due to dense vegetation.	**Clear vegetation and reinspect**	3	6	RISK <1/1M, CALCULATION NOT REQUIRED							
G2	G	Hawthorn	0 to 5	SM	A	Good form and vitality. No hazards noted. x3 trees.	**No action required**	-	36	RISK <1/1M, CALCULATION NOT REQUIRED							
G3	G	Mixed	11 to 15	Y to SM	A	x10 trees - Ash, goat willow, birch and hawthorn. Woodland edge group at perimeter of site. No targets. All good form and vitality. Limited inspection due to dense bramble. Low use area.	**No action required**	-	24	RISK <1/1M, CALCULATION NOT REQUIRED							

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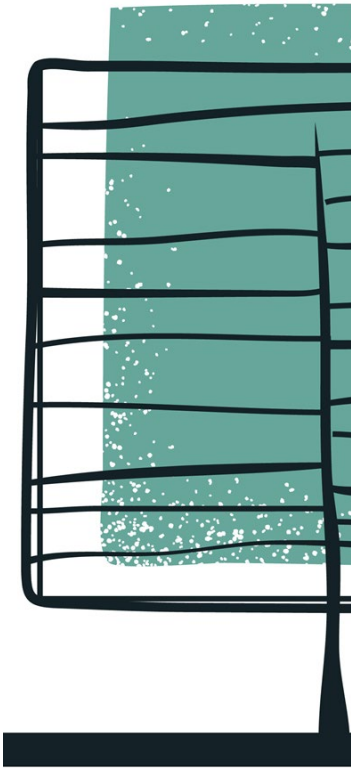
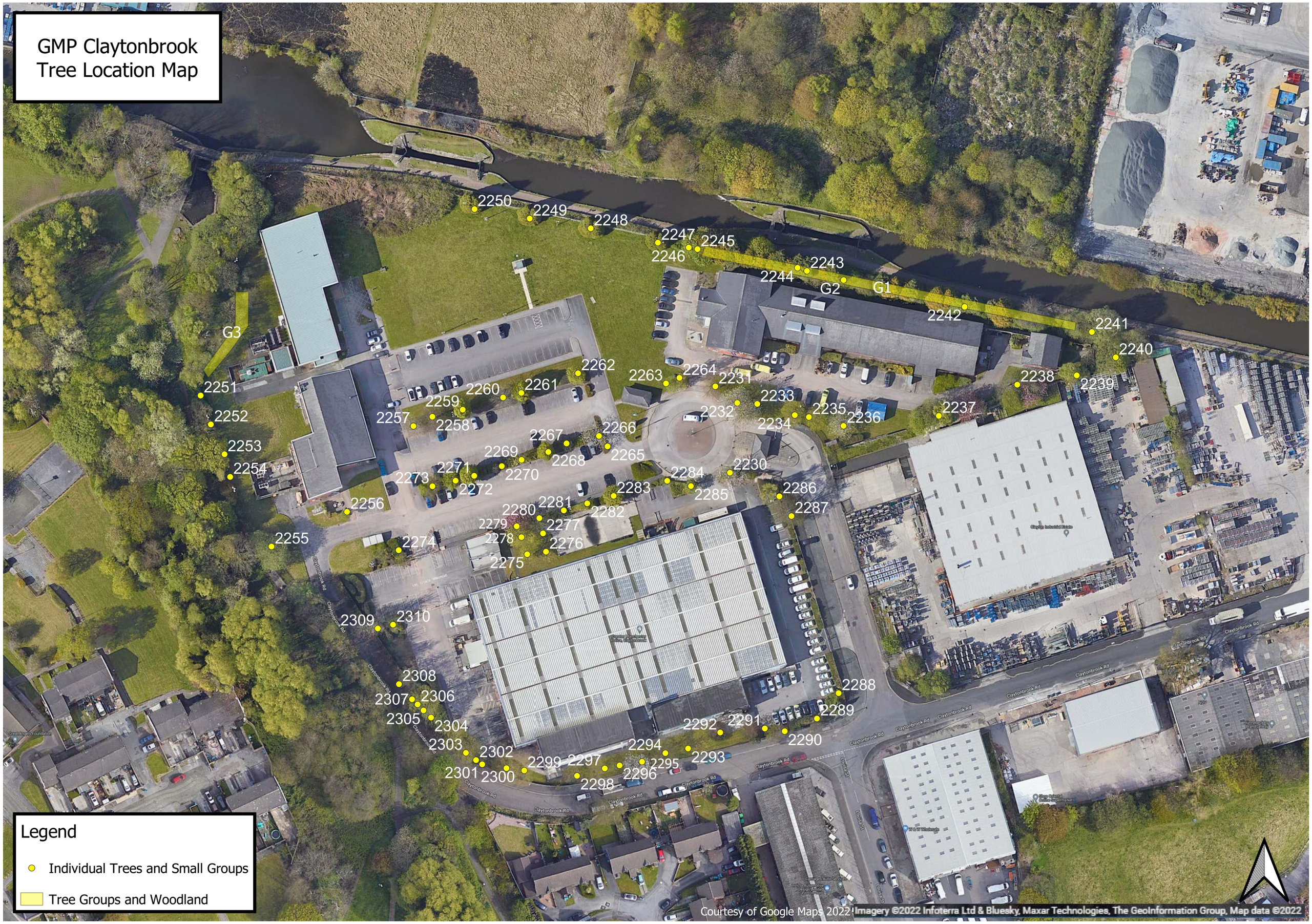
Appendix Two

Site Plan



GMP Claytonbrook Tree Location Map



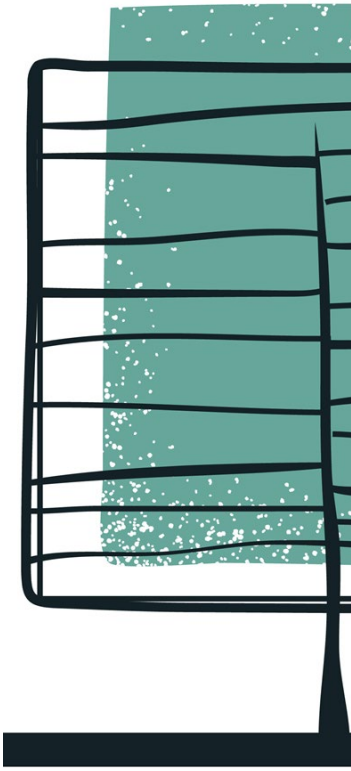
Legend

- Individual Trees and Small Groups
- Tree Groups and Woodland

Courtesy of Google Maps 2022 | Imagery ©2022 Infoterra Ltd & Bluesky, Maxar Technologies, The GeoInformation Group, Map data ©2022

Appendix Three

QTRA Practice Note



QTRA Quantified Tree Risk Assessment

Simply Balancing Risks With Benefits

Quantified Tree Risk Assessment

PRACTICE NOTE

VERSION 5

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Quantified Tree Risk Assessment Practice Note

"When you can measure what you are speaking about, and express it in numbers, you know something about it; but when you cannot measure it, when you cannot express it in numbers, your knowledge is of a meagre and unsatisfactory kind"

William Thomson, Lord Kelvin, Popular Lectures and Addresses [1891-1894]

1. INTRODUCTION

Every day we encounter risks in all of our activities, and the way we manage those risks is to make choices. We weigh up the costs and benefits of the risk to determine whether it is acceptable, unacceptable, or tolerable. For example, if you want to travel by car you must accept that even with all the extensive risk control measures, such as seat-belts, speed limits, airbags, and crash barriers, there is still a significant risk of death. This is an everyday risk that is taken for granted and tolerated by millions of people in return for the benefits of convenient travel. Managing trees should take a similarly balanced approach.

A risk from falling trees exists only if there is both potential for tree failure and potential for harm to result. The job of the risk assessor is to consider the likelihood and consequences of tree failure. The outcome of this assessment can then inform consideration of the risk by the tree manager, who may also be the owner.

Using a comprehensive range of values[1], Quantified Tree Risk Assessment (QTRA) enables the tree assessor to identify and analyse the risk from tree failure in three key stages. 1) to consider land-use in terms of vulnerability to impact and likelihood of occupation, 2) to consider the consequences of an impact, taking account of the size of the tree or branch concerned, and 3) to estimate the probability that the tree or branch will fail onto the land-use in question. Estimating the values of these components, the assessor can use the QTRA manual calculator or software application to calculate an annual Risk of Harm from a particular tree. To inform management decisions, the risks from different hazards can then be both ranked and compared, and considered against broadly acceptable and tolerable levels of risk.

A Proportionate Approach to Risks from Trees

The risks from falling trees are usually very low and high risks will usually be encountered only in areas with either high levels of human occupation or with valuable property. Where levels of human occupation and value of property are sufficiently low, the assessment of trees for structural weakness will not usually be necessary. Even when land-use indicates that the assessment of trees is appropriate, it is seldom proportionate to assess and evaluate the risk for each individual tree in a population. Often, all that is required is a brief consideration of the trees to identify gross signs of structural weakness or declining health. Doing all that is reasonably practicable does not mean that all trees have to be individually examined on a regular basis (HSE 2013).

The QTRA method enables a range of approaches from the broad assessment of large collections of trees to, where necessary, the detailed assessment of an individual tree.

Risk of Harm

The QTRA output is termed the Risk of Harm and is a combined measure of the likelihood and consequences of tree failure, considered against the baseline of a lost human life within the coming year.

ALARP (As Low As Reasonably Practicable)

Determining that risks have been reduced to As Low As Reasonably Practicable (HSE 2001) involves an evaluation of both the risk and the sacrifice or cost involved in reducing that risk. If it can be demonstrated that there is gross disproportion between them, the risk being insignificant in relation to the sacrifice or cost, then to reduce the risk further is not 'reasonably practicable'.

Costs and Benefits of Risk Control

Trees confer many benefits to people and the wider environment. When managing any risk, it is essential to maintain a balance between the costs and benefits of risk reduction, which should be considered in the determination of ALARP. It is not only the financial cost of controlling the risk that should be considered, but also the loss of tree-related benefits, and the risk to workers and the public from the risk control measure itself.

When considering risks from falling trees, the cost of risk control will usually be too high when it is clearly 'disproportionate' to the reduction in risk. In the

[1] See Tables 1, 2 & 3.

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context of QTRA, the issue of 'gross disproportion'[2], where decisions are heavily biased in favour of safety, is only likely to be considered where there are risks of 1/10 000 or greater.

Acceptable and Tolerable Risks

The Tolerability of Risk framework (ToR) (HSE 2001) is a widely accepted approach to reaching decisions on whether risks are broadly acceptable, unacceptable, or tolerable. Graphically represented in Figure 1, ToR can be summarised as having a Broadly Acceptable Region where the upper limit is an annual risk of death 1/1 000 000, an Unacceptable Region for which the lower limit is 1/1 000, and between these a Tolerable Region within which the tolerability of a risk will be dependent upon the costs and benefits of risk reduction. In the Tolerable Region, we must ask whether the benefits of risk control are sufficient to justify their cost.

In respect of trees, some risks cross the Broadly Acceptable 1/1 000 000 boundary, but remain tolerable. This is because any further reduction would involve a disproportionate cost in terms of the lost environmental, visual, and other benefits, in addition to the financial cost of controlling the risk.

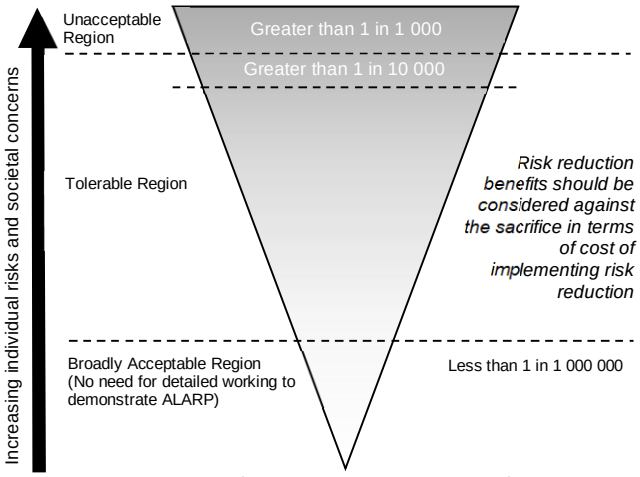

Figure 1. Adapted from the Tolerability of Risk framework (HSE 2001).

Value of Statistical Life

The Value of Statistical Life (VOSL), is a widely applied risk management device, which uses the value of a hypothetical life to guide the proportionate allocation of resources to risk reduction. In the UK, this value is currently in the region of £2 000 000, and this is the value adopted in the QTRA method.

In QTRA, placing a statistical value on a human life has two particular uses. Firstly, QTRA uses VOSL to enable damage to property to be compared with the loss of life, allowing the comparison of risks to people and property. Secondly, the proportionate allocation of financial resources to risk reduction can be informed by VOSL. "***A value of statistical life of £1 000 000 is just another way of saying that a reduction in risk of death of 1/100 000 per year has a value of £10 per year***" (HSE 1996).

Internationally, there is variation in VOSL, but to provide consistency in QTRA outputs, it is suggested that VOSL of £2 000 000 should be applied internationally. This is ultimately a decision for the tree manager.

2. OWNERSHIP OF RISK

Where many people are exposed to a risk, it is shared between them. Where only one person is exposed, that individual is the recipient of all of the risk and if they have control over it, they are also the owner of the risk. An individual may choose to accept or reject any particular risk to themselves, when that risk is under their control. When risks that are imposed upon others become elevated, societal concern will usually require risk controls, which ultimately are imposed by the courts or government regulators.

Although QTRA outputs might occasionally relate to an individual recipient, this is seldom the case. More often, calculation of the Risk of Harm is based on a cumulative occupation – i.e. the number of people per hour or vehicles per day, without attempting to identify the individuals who share the risk.

Where the risk of harm relates to a specific individual or a known group of people, the risk manager might consider the views of those who are exposed to the risk when making management decisions. Where a risk is imposed on the wider community, the principles set out in the ToR framework can be used as a reasonable approach to determine whether the risk is ALARP.

3. THE QTRA METHOD - VERSION 5

The input values for the three components of the QTRA calculation are set out in broad ranges[3] of Target, Size, and Probability of Failure. The assessor estimates values for these three components and inputs them on either the manual calculator or software application to calculate the Risk of Harm.

[2] Discussed further on page 5.

[3] See Tables 1, 2 & 3.

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Assessing Land-use (Targets)

The nature of the land-use beneath or adjacent to a tree will usually inform the level and extent of risk assessment to be carried out. In the assessment of Targets, six ranges of value are available. Table 2 sets out these ranges for vehicular frequency, human occupation and the monetary value of damage to property.

Human Occupation

The probability of pedestrian occupation at a particular location is calculated on the basis that an average pedestrian will spend five seconds walking beneath an average tree. For example, an average occupation of ten pedestrians per day, each occupying the Target for five seconds is a daily occupation of fifty seconds, giving a likelihood of occupation 1/1,728. Where a longer occupation is likely, as with a habitable building, outdoor café, or park bench, the period of occupation can be measured, or estimated as a proportion of a given unit of time, e.g. six hours per day (1/4). The Target is recorded as a range (Table 2).

Weather Affected Targets

Often the nature of a structural weakness in a tree is such that the probability of failure is greatest during windy weather, while the probability of the site being occupied by people during such weather is often low. This applies particularly to outdoor recreational areas. When estimating human Targets, the risk assessor must answer the question 'in the weather conditions that I expect the likelihood of failure of the tree to be initiated, what is my estimate of human occupation?' Taking this approach, rather than using the average occupation, ensures that the assessor considers the relationship between weather, people, and trees, along with the nature of the average person with their ability to recognise and avoid unnecessary risks.

Vehicles on the Highway

In the case of vehicles, likelihood of occupation may relate to either the falling tree or branch striking the vehicle or the vehicle striking the fallen tree. Both types of impact are influenced by vehicle speed; the faster the vehicle travels the less likely it is to be struck by the falling tree, but the more likely it is to strike a fallen tree. The probability of a vehicle occupying any particular point in the road is the ratio of the time it is occupied - including a safe stopping distance - to the total time. The average vehicle on a UK road is occupied by 1.6 people (DfT 2010). To account for the substantial protection that the average vehicle provides against most tree impacts and in particular, frontal collisions, QTRA values the substantially protected 1.6 occupants in addition to the value of the vehicle as equivalent to one exposed human life.

Property

Table 1. Size

Size Range	Size of tree or branch	Range of Probability
1	> 450mm (>18") dia.	1/1 - >1/2
2	260mm (10½") dia. - 450mm (18") dia.	1/2 - >1/8.6
3	110mm (4½") dia. - 250mm (10") dia.	1/8.6 - >1/82
4	25mm (1") dia. - 100mm (4") dia.	1/82 - 1/2 500

* Range 1 is based on a diameter of 600mm.

Property can be anything that could be damaged by a falling tree, from a dwelling, to livestock, parked car, or fence. When evaluating the exposure of property to tree failure, the QTRA assessment considers the cost of repair or replacement that might result from failure of the tree. Ranges of value are presented in Table 2 and the assessor's estimate need only be sufficient to determine which of the six ranges the cost to select.

In Table 2, the ranges of property value are based on a VOSL of £2 000 000, e.g. where a building with a replacement cost of £20 000 would be valued at 0.01 (1/100) of a life (Target Range 2).

When assessing risks in relation to buildings, the Target to be considered might be the building, the occupants, or both. Occupants of a building could be protected from harm by the structure or substantially exposed to the impact from a falling tree if the structure is not sufficiently robust, and this will determine how the assessor categorises the Target.

Multiple Targets

A Target might be constantly occupied by more than one person and QTRA can account for this. For example, if it is projected that the average occupation will be constant by 10 people, the Risk of Harm is calculated in relation to one person constantly occupying the Target before going on to identify that the average occupation is 10 people. This is expressed as Target 1(10T)/1, where 10T represents the Multiple Targets. In respect of property, a Risk of Harm 1(10T)/1 would be equivalent to a risk of losing £20 000 000 as opposed to £2 000 000.

Tree or Branch Size

A small dead branch of less than 25mm diameter is not likely to cause significant harm even in the case of direct contact with a Target, while a falling branch with a diameter greater than 450mm is likely to cause some harm in the event of contact with all but the most robust Target. The QTRA method categorises

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Size by the diameter of tree stems and branches (measured beyond any basal taper). An equation derived from weight measurements of trees of different stem diameters is used to produce a data set of comparative weights of trees and branches ranging from 25mm to 600mm diameter, from which Table 1 is compiled. The size of dead branches might be discounted where they have undergone a significant reduction in weight because of degradation and shedding of subordinate branches. This discounting, referred to as 'Reduced Mass', reflects an estimated reduction in the mass of a dead branch.

Table 2. Targets

Target Range	Property (repair or replacement cost)	Human (not in vehicles)		Vehicle Traffic (number per day)	Ranges of Value (probability of occupation or fraction of £2 000 000)
1	£2 000 000 – >£200 000	Occupation:	Constant – 2.5 hours/day	26 000 – 2 700 @ 110kph (68mph) 32 000 – 3 300 @ 80kph (50mph) 47 000 – 4 800 @ 50kph (32mph)	1/1 – >1/10
		Pedestrians & cyclists:	720/hour – 73/hour		
2	£200 000 – >£20 000	Occupation:	2.4 hours/day – 15 min/day	2 600 – 270 @ 110kph (68mph) 3 200 – 330 @ 80kph (50mph) 4 700 – 480 @ 50kph (32mph)	1/10 – >1/100
		Pedestrians & cyclists:	72/hour – 8/hour		
3	£20 000 – >£2 000	Occupation:	14 min/day – 2 min/day	260 – 27 @ 110kph (68mph) 320 – 33 @ 80kph (50mph) 470 – 48 @ 50kph (32mph)	1/100 – >1/1 000
		Pedestrians & cyclists:	7/hour – 2/hour		
4	£2 000 – >£200	Occupation:	1 min/day – 2 min/week	26 – 4 @ 110kph (68mph) 32 – 4 @ 80kph (50mph) 47 – 6 @ 50kph (32mph)	1/1 000 – >1/10 000
		Pedestrians & cyclists:	1/hour – 3/day		
5	£200 – >£20	Occupation:	1 min/week – 1 min/month	3 – 1 @ 110kph (68mph) 3 – 1 @ 80kph (50mph) 5 – 1 @ 50kph (32mph)	1/10 000 – >1/100 000
		Pedestrians & cyclists:	2/day – 2/week		
6	£20 – £2	Occupation:	<1 min/month – 0.5 min/year	None	1/100 000 – 1/1 000 000
		Pedestrians & cyclists:	1/week – 6/year		

Vehicle, pedestrian and property Targets are categorised by their frequency of use or their monetary value. The probability of a vehicle or pedestrian occupying a Target area in Target Range 4 is between the upper and lower limits of 1/1 000 and >1/10 000 (column 5). Using the VOSL £2 000 000, the property repair or replacement value for Target Range 4 is £2 000 - >200.

Probability of Failure

In the QTRA assessment, the probability of tree or branch failure within the coming year is estimated and recorded as a range of value (Ranges 1 – 7, Table 3).

Selecting a Probability of Failure (PoF) Range requires the assessor to compare their assessment of the tree or branch against a benchmark of either a non-compromised tree at Probability of Failure Range 7, or a tree or branch that we expect to fail within the year, which can be described as having a 1/1 probability of failure.

During QTRA training, Registered Users go through a number of field exercises in order to calibrate their estimates of Probability of Failure.

Table 3. Probability of Failure

Probability of Failure Range	Probability
1	1/1 - >1/10
2	1/10 - >1/100
3	1/100 - >1/1 000
4	1/1 000 - >1/10 000
5	1/10 000 – >1/100 000
6	1/100 000 – >1/1 000 000
7	1/1 000 000 – 1/10 000 000

The probability that the tree or branch will fail within the coming year.

The QTRA Calculation

The assessor selects a Range of values for each of the three input components of Target, Size and Probability of Failure. The Ranges are entered on either the manual calculator or software application to calculate a Risk of Harm.

The Risk of Harm is expressed as a probability and is rounded, to one significant figure. Any Risk of Harm

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that is lower than 1/1 000 000 is represented as <1/1 000 000. As a visual aid, the Risk of Harm is colour coded using the traffic light system illustrated in Table 4 (page 7).

> Risk of Harm - Monte Carlo Simulations
>
> The Risk of Harm for all combinations of Target, Size and Probability of Failure Ranges has been calculated using Monte Carlo simulations[4]. The QTRA Risk of Harm is the mean value from each set of Monte Carlo results.
>
> In QTRA Version 5, the Risk of Harm should not be calculated without the manual calculator or software application.

Assessing Groups and Populations of Trees

When assessing populations or groups of trees, the highest risk in the group is quantified and if that risk is tolerable, it follows that risks from the remaining trees will also be tolerable, and further calculations are unnecessary. Where the risk is intolerable, the next highest risk will be quantified, and so on until a tolerable risk is established. This process requires prior knowledge of the tree manager's risk tolerance.

Accuracy of Outputs

The purpose of QTRA is not necessarily to provide high degrees of accuracy, but to provide for the quantification of risks from falling trees in a way that risks are categorised within broad ranges (Table 4).

4. INFORMING MANAGEMENT DECISIONS

Balancing Costs and Benefits of Risk Control

When controlling risks from falling trees, the benefit of reduced risk is obvious, but the costs of risk control are all too often neglected. For every risk reduced there will be costs, and the most obvious of these is the financial cost of implementing the control measure. Frequently overlooked is the transfer of risks to workers and the public who might be directly affected by the removal or pruning of trees. Perhaps more importantly, most trees confer benefits, the loss of which should be considered as a cost when balancing the costs and benefits of risk control.

When balancing risk management decisions using QTRA, consideration of the benefits from trees will usually be of a very general nature and not require detailed consideration. The tree manager can consider, in simple terms, whether the overall cost of risk control is a proportionate one. Where risks are approaching 1/10 000, this may be a straightforward balancing of cost and benefits. Where risks are 1/10 000 or greater, it will usually be appropriate to implement risk controls unless the costs are grossly disproportionate to the benefits rather than simply disproportionate. In other words, the balance being weighted more on the side of risk control with higher associated costs.

Considering the Value of Trees

It is necessary to consider the benefits provided by trees, but they cannot easily be monetised and it is often difficult to place a value on those attributes such as habitat, shading and visual amenity that might be lost to risk control.

A simple approach to considering the value of a tree asset is suggested here, using the concept of 'average benefits'. When considered against other similar trees, a tree providing 'average benefits' will usually present a range of benefits that are typical for the species, age and situation. Viewed in this way, a tree providing 'average benefits' might appear to be low when compared with particularly important trees – such as in Figure 2, but should nonetheless be sufficient to offset a Risk of Harm of less than 1/10 000. Without having to consider the benefits of risk controls, we might reasonably assume that below 1/10 000, the risk from a tree that provides 'average benefits' is ALARP.

In contrast, if it can be said that the tree provides lower than average benefits because, for example, it is declining and in poor physiological condition, it may be necessary to consider two further elements. Firstly, is the Risk of Harm in the upper part of the Tolerable Region, and secondly, is the Risk of Harm likely to increase before the next review because of an increased Probability of Failure. If both these conditions apply then it might be appropriate to consider the balance of costs and benefits of risk reduction in order to determine whether the risk is ALARP. This balance requires the tree manager to take a view of both the reduction in risk and the costs of that reduction.

[4] For further information on the Monte Carlo simulation method, refer to http://en.wikipedia.org/wiki/Monte_Carlo_method

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Fig. 2

Lower Than Average Benefits from Trees

Usually, the benefits provided by a tree will only be significantly reduced below the 'average benefits' that are typical for the species, age and situation, if the life of the benefits is likely to be shortened, perhaps because the tree is declining or dead. That is not to say that a disbenefit, such as undesirable shading, lifting of a footpath, or restricting the growth of other trees, should not also be considered in the balance of costs and benefits.

The horse chestnut tree in Figure 3 has recently died, and over the next few years, may provide valuable habitats. However, for this tree species and the relatively fast rate at which its wood decays, the lifetime of these benefits is likely to be limited to only a few years. This tree has an already reduced value that will continue to reduce rapidly over the coming five to ten years at the same time as the Risk of Harm is expected to increase. There will be changes in the benefits provided by the tree as it degrades. Visual qualities are likely to reduce while the decaying wood provides habitats for a range of species, for a short while at least. There are no hard and fast measures of these benefits and it is for the tree manager to decide what is locally important and how it might be balanced with the risks.

Where a risk is within the Tolerable Region and the tree confers lower than average benefits, it might be appropriate to consider implementing risk control while taking account of the financial cost. Here, VOSL can be used to inform a decision on whether the cost of risk control is proportionate. Example 3 below puts this evaluation into a tree management context.

There will be occasions when a tree is of such minimal value and the monetary cost of risk reduction so low that it might be reasonable to further reduce an already relatively low risk. Conversely, a tree might be of such considerable value that an annual risk of death greater than 1/10 000 would be deemed tolerable.

Occasionally, decisions will be made to retain elevated risks because the benefits from the tree are particularly high or important to stakeholders, and in these situations, it might be appropriate to assess and document the benefits in some detail. If detailed assessment of benefits is required, there are several methodologies and sources of information (Forest Research 2010).

Delegating Risk Management Decisions

Fig. 3

Understanding of the costs with which risk reduction is balanced can be informed by the risk assessor's knowledge, experience and on-site observations, but the risk management decisions should be made by the tree manager. That is not to say that the tree manager should review and agree every risk control measure, but when delegating decisions to surveyors and other staff or advisors, tree managers should set out in a policy, statement or contract, the principles and perhaps thresholds to which trees and their associated risks will ordinarily be managed.

Based on the tree manager accepting the principles set out in the QTRA Practice Note and or any other specific instructions, the risk assessor can take account of the cost/benefit balance and for most situations will

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be able to determine whether the risk is ALARP when providing management recommendations.

Table 4. QTRA Advisory Risk Thresholds

Thresholds	Description	Action
	Unacceptable Risks will not ordinarily be tolerated	• Control the risk
1/1,000	Unacceptable (where imposed on others) Risks will not ordinarily be tolerated	• Control the risk • Review the risk
	Tolerable (by agreement) Risks may be tolerated if those exposed to the risk accept it, or the tree has exceptional value	• Control the risk unless there is broad stakeholder agreement to tolerate it, or the tree has exceptional value • Review the risk
1/10 000	Tolerable (where imposed on others) Risks are tolerable if ALARP	• Assess costs and benefits of risk control • Control the risk only where a significant benefit might be achieved at reasonable cost • Review the risk
1/1 000 000	Broadly Acceptable Risk is already ALARP	• No action currently required • Review the risk

QTRA Informative Risk Thresholds

The QTRA advisory thresholds in Table 4 are proposed as a reasonable approach to balancing safety from falling trees with the costs of risk reduction. This approach takes account of the widely applied principles of ALARP and ToR, but does not dictate how these principles should be applied. While the thresholds can be the foundation of a robust policy for tree risk management, tree managers should make decisions based on their own situation, values and resources. Importantly, to enable tree assessors to provide appropriate management guidance, it is helpful for them to have some understanding of the tree owner's management preferences prior to assessing the trees.

A Risk of Harm that is less than 1/1 000 000 is Broadly Acceptable and is already ALARP. A Risk of Harm 1/1 000 or greater is unacceptable and will not ordinarily be tolerated. Between these two values, the Risk of Harm is in the Tolerable Region of ToR and will be tolerable if it is ALARP. In the Tolerable Region, management decisions are informed by consideration of the costs and benefits of risk control, including the nature and extent of those benefits provided by trees, which would be lost to risk control measures.

For the purpose of managing risks from falling trees, the Tolerable Region can be further broken down into two sections. From 1/1 000 000 to less than 1/10 000, the Risk of Harm will usually be tolerable providing that the tree confers 'average benefits' as discussed above. As the Risk of Harm approaches 1/10 000 it will be necessary for the tree manager to consider in more detail the benefits provided by the tree and the overall cost of mitigating the risk.

A Risk of Harm in the Tolerable Region but 1/10 000 or greater will not usually be tolerable where it is imposed on others, such as the public, and if retained, will require a more detailed consideration of ALARP. In exceptional circumstances a tree owner might choose to retain a Risk of Harm that is 1/10 000 or greater. Such a decision might be based on the agreement of those who are exposed to the risk, or perhaps that the tree is of great importance. In these circumstances, the prudent tree manager will consult with the appropriate stakeholders whenever possible.

5. EXAMPLE QTRA CALCULATIONS AND RISK MANAGEMENT DECISIONS

Below are three examples of QTRA calculations and application of the QTRA Advisory Thresholds.

Example 1.

	Target		Size		Probability of Failure		Risk of Harm
Range	6	x	1	x	3	=	<1/1 000 000

Example 1 is the assessment of a large (Size 1), unstable tree with a probability of failure of between 1/100 and >1/1 000 (PoF 3). The Target is a footpath with less than one pedestrian passing the tree each week (Target 6). The Risk of Harm is calculated as less than 1/1 000 000 (green). This is an example of where the Target is so low consideration of the structural condition of even a large tree would not usually be necessary.

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Example 2.

	Target		Size		Probability of Failure		Risk of Harm
Range	1	x	4	x	3	=	1(2T)/50 000

In Example 2, a recently dead branch (Size 4) overhangs a busy urban high street that is on average occupied constantly by two people, and here Multiple Target occupation is considered.

Having an average occupancy of two people, the Risk of Harm 1(2T)/50 000 (yellow) represents a twofold increase in the magnitude of the consequence and is therefore equivalent to a Risk of Harm 1/20 000 (yellow). This risk does not exceed 1/10 000, but being a dead branch at the upper end of the Tolerable Region it is appropriate to consider the balance of costs and benefits of risk control. Dead branches can be expected to degrade over time with the probability of failure increasing as a result. Because it is dead, some of the usual benefits from the branch have been lost and it will be appropriate to consider whether the financial cost of risk control would be proportionate.

Example 3.

	Target		Size		Probability of Failure		Risk of Harm
Range	3	x	3	x	3	=	1/500 000

In Example 3, a 200mm diameter defective branch overhangs a country road along which travel between 470 and 48 vehicles each day at an average speed of 50kph (32mph) (Target Range 3). The branch is split and is assessed as having a probability of failure for the coming year of between 1/100 and 1/1 000 (PoF Range 3). The Risk of Harm is calculated as 1/500 000 (yellow) and it needs to be considered whether the risk is ALARP. The cost of removing the branch and reducing the risk to Broadly Acceptable (1/1 000 000) is estimated at £350. To establish whether this is a proportionate cost of risk control, the following equation is applied. £2 000 000 (VOSL) x 1/500 000 = £4 indicating that the projected cost of £350 would be disproportionate to the benefit. Taking account of the financial cost, risk transfer to arborists and passers-by, the cost could be described as being grossly disproportionate, even if accrued benefits over say ten years were taken into account.

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