Twickenham Riverside

Tree Establishment Failure

Investigation Report

For London Borough of Richmond upon Thames

Project No.: ALP001-008

October 2024

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001	10/10/2024	Tim Ranger	Andrew Poynter	Andrew Poynter

Contents

1. Summary

1.1.1 London Borough of Richmond upon Thames commissioned Thomson Environmental Consultants to conduct a ground investigation of the rooting environment for three out of seven remaining pin oaks (*Quercus palustris*) at Twickenham Riverside, to determine why the trees have not thrived. The trees are currently located in areas of soft landscaping between The Embankment and the River Thames. This report follows the Arboricultural Impact Assessment and Method Statement submitted by Thomson Environmental Consultants (document number: 220705 ALP001-008-002 Twickenham Riverside AIA AMS 003 AP merged).

1.1.2 Planning consent for the development of 1-1C King Street, 2-4 Water Lane, The Embankment And River Wall, Water Lane, Wharf Lane And The Diamond Jubilee Gardens, Twickenham has been granted under application 21/2758/FUL. This ground investigation report has been prepared to satisfy the tree related condition NS49.

1.1.3 The development proposals directly require the removal of 46 individual trees and four groups (containing in total, 20 individual trees). The three Pin oaks, subject to this report, are proposed to be removed as part of the consented development. The reason for the investigation is to determine the cause of decline to prevent it happening to newly planted trees as part of the redevelopment. Of the three subject trees, two of the trees (T58 and T60) were dead with no live growth visible in the crown and the third tree (T63) exhibited live growth and appeared healthier in general but still had a sparse and not thriving like it should be.

1.1.4 It was confirmed using the London Borough of Richmond Upon Thames online mapping system on 19th April 2024 that the site is located within the Twickenham Riverside Conservation Area.

1.1.5 Ground investigation was undertaken by a third-party contractor, Down to Earth, who excavated trenches in each of the three planting pits to expose the root growth on both sides of the stem.

1.1.6 Soil Analysis was also completed using two separate soil samples taken from each tree. One sample was taken from the soil arisings during the air spade investigation, and a second sample was taken using a handheld auger driven to a depth of c.1m below the surface of the ground.

2. Introduction

2.1 Brief and Objectives

2.1.1 London Borough of Richmond upon Thames commissioned Thomson Environmental Consultants to conduct a ground investigation of the rooting environment for three out of seven remaining pin oaks at Twickenham Riverside (hereafter referred to as 'the site') to determine why the trees have not thrived. The trees are currently located in areas of soft landscaping between The Embankment and the River Thames. This report follows the Arboricultural Impact Assessment and Method Statement submitted by Thomson Environmental Consultants (document number: 220705 ALP001-008-002 Twickenham Riverside AIA AMS 003 AP merged).

2.1.2 The brief was to complete:

- Ground investigation into the rooting and soil environment for three individual pin oaks; and
- A Ground Investigation Report detailing the results of the investigation

2.2 Development Background

2.2.1 The regeneration of Twickenham Riverside has been ongoing for several years. Prior to 2011 the horse chestnut (*Aesculus hippocastanum*) trees which were planted at the site were showing signs of stunted growth and thin foliage. The assumption at the time was that the health of the trees was impacted by daily tidal flooding, inadequate soli volumes and poor drainage which had resulted in the roots becoming waterlogged and therefore starved of nutrients.

2.2.2 The horse chestnut trees were removed and replaced by the Pin oak species (*Quercus palustris*) of which 18 were planted, firstly in 2011 and a second batch in 2014. Tree pits were re-designed to increase soil volume within the inclusion of Greenleaf (now GreenBlue Urban) in the design which led to Strata Cells being installed under the hard standing to the south of the trees, see Appendix 5. Prior to the trees being planted in their pits, Strata Cells were installed beneath the ground, to the south of and between the planting pits. This was to allow the trees to grow within the soil volume within the planting pit and utilise further available soil to the south as hard standing, with deep foundations, existed to the north.

2.2.3 After planting, the trees did not thrive and continued as the horse chestnuts did, by declining. A study was undertaken in 2015 by Tim O'Hare Associates when the trees started to show signs of stress study was undertaken in 2015 by Tim O'Hare Associates when the trees started to show signs of stress. Within the Soil Investigation report (ref: TOHA/15/5195/LHJ 17/08/2015) it was stated that:

'*This investigation has provided a 'snap shot' of soil conditions at this point in time, and there does not appear to be one obvious soil-related factor which is causing the poor health of the trees. However, there appears to have been a historical decline and subsequent partial recovery of some of the Phase 1 trees as shown by the initial die-back and loss of crown shape, and regrowth around the trunk and inner branches.'*

2.2.4 Since the investigation the trees have still not thrived, with the majority declining to a state of being in poor condition or even dead.

2.2.5 The development proposals for the whole site continue to progress and involve the demolition of existing buildings and structures and redevelopment of the site comprising 45 residential units (Use Class C3), ground floor commercial/retail/cafe (Use Class E), public house (Sui Generis), boathouse locker storage, floating pontoon and floating ecosystems with associated landscaping, reprovision of Diamond Jubilee Gardens, alterations to highway layout and parking provision and other relevant works. These proposals are hereafter referred to as 'the development'.

2.2.6 Planning consent for the development has been granted under application 21/2758/FUL. This ground investigation report has been prepared to satisfy the tree related condition NS49.

2.2.7 Condition NS49 reads:

'*1. Prior to the felling of the Pin Oaks along The Embankment (T58, T59, T60, T61, T62, T63, T64), details of an investigation scheme into their failure, including below ground rooting and soil environment, shall be submitted to and approved in writing.*

2. The development shall not be implemented other than in accordance with the approved scheme.

3. The results of the investigation shall be submitted to and approved in writing prior to details of the soft landscaping scheme (condition titled 'Soft Landscaping Required) being submitted, and should inform the final landscaping scheme along the Embankment.

REASON: To ensure a robust planting scheme.'

2.3 Pin Oak Species

2.3.1 The pin oak was introduced to the UK around the 1800's. This riparian[1] species, also known as swamp oak or water oak, is relatively short lived, with an approximate lifespan of c.120 years. The Pin Oak develops a shallow, fibrous root system, which allows it to tolerate flooded soil conditions, though to survive the wet conditions roots must be established. It can withstand a range of soil conditions, though it can tolerate heavy clay soil. It thrives in free draining, slightly acidic soil and will struggle on soils with a high pH value, i.e. more alkaline. If the soil has a higher alkalinity, then a common problem is chlorosis which results in yellowing or browning between the leaf veins and the eventual decline of the tree. This problem may be corrected by treating the soil.

2.3.2 Pin oaks can tolerate dormant-season flooding but do not cope well with growing-season flooding. Soils which are saturated for more than a few weeks during the growing season may be detrimental to tree growth, and if rooting areas are flooded over several successive years the tree may die prematurely. Additionally, if the tree has not yet established then the root system may not have adapted to this type of environment, which can take several years.

[1] relating to or living or located on the bank of a natural watercourse (such as a river) or sometimes of a lake or a tidewater. riparian trees.

2.3.3 The River Thames is known to flood and specifically the area of The Embankment has a high probability of being flooded, as it is in Flood Zone 3. According to the Environment Agency's flood map for planning, there is a flood defence system in place, but this does not include the areas of soft landscaping where the pin oaks have been planted.

3. Methodology

3.1 Non-Invasive Root Investigation

3.1.1 Ground investigation was undertaken to establish the actual root morphology of the trees and take soil samples from each of the tree's rooting environment. A third-party contractor, Down to Earth, performed the ground investigation using an Air Spade, consisting of a handheld lance connected to a compressor. The Air spade uses a high-speed jet of air to loosen and displace soil and is able to excavate around tree roots without causing them harm. All rooting material remained in situ and the trenches were all backfilled and made good upon completion.

3.1.2 The works comprised three manually excavated trenches positioned to the north and south of each stem with a connecting trench in between. The exposed trenches for each tree have been illustrated at Appendices 2, 3 and 4.

3.2 Soil Samples

3.2.1 Soil samples were taken from each tree. One sample was taken from the top 100mm of the soil arisings, excavated during the air spade investigation, and a second sample was taken using a handheld auger driven into the ground on the periphery of the rooting area, down to a depth of c.1m below ground level.

4. Results

4.1 Root Growth for T58

4.1.1 No structural roots were found outside the Burlap. Fibrous roots had grown out of the hessian wrapping on the north side of T58 but hit the car park edge wall and grown back towards the root ball but during the excavation roots were brittle so broke off when soil was being removed from the trench. On the southern side of the stem there is a mass of fibrous roots which are largely contained around the edge of the root ball and have not extended south to the strata cells. Roots also appear to have girdled around the base of the stem. Roots had not fully grown out of root ball and had not even made it to the strata cells, to the south. The soil was bone dry around the base, and that was after very recent flooding in the area, so it's expected the soil in the planting pit would be extremely dry in the summer.

4.1.2 During the investigation measurements were taken within the depth of the excavation along the edge of the car park. The top 0.4m contained soil and the next c.0.2m contained sand before reaching a concrete block.

4.2 Root Growth for T60

4.2.1 The root growth for T60 is very similar to T58, with larger structural root establishment around the base but not outside the burlap, and slightly more girdling around the base. A mass of fibrous roots was found around the burlap but not extending out past the sack. The soil was also bone dry around the base.

4.2.2 Within the ground, the top c.0.3m was soil and the next c.0.3m was sand. No concrete block was discovered during the excavation.

4.3 Root Growth for T63

4.3.1 T63 is a lot healthier than the previous two trees investigated and coming into leaf at the time of the investigation. There were more dense fibrous roots growing towards the car park to the north, with less sand, and the roots have grown out of the Burlap sack on the south side underneath the hedge towards the strata cells. There were two slightly larger roots, at a diameter of c.0.2m and 0.15m below the surface on the southwest side. The soil was wetter and denser in the planting pit compared to being bone dry in first two.

4.3.2 Similarly to T60, within the ground, the top c.0.3m was soil and the next c.0.3m was sand. No concrete block was discovered during the excavation.

4.4 Soil Samples

4.4.1 A previous soil investigation was undertaken by Tim O'Hare Associates LLP, in 2015, which determined that the composition of the topsoil and subsoil was strongly alkaline to alkaline and in the leaf tissue analysis there was a deficiency in Iron content. During the most recent investigation, two of the subject trees had no leaves on with the third in the beginning stages of coming into leaf so a direct comparison will not be possible.

4.4.2 The first two trees investigated, T8 and T60 both had a dry topsoil and subsoil with a low moisture content. Considering the time of year and the amount of rainfall recently occurring this was a surprise, the third tree, T63, had a greater dampness to the soil.

4.5 Conclusion

4.5.1 The common threads between the 2015 study by Tim O'Hare Associates and Thomson Environmental Consultants are that the moisture content of the soil in all the tree pits is low, and alkalinity levels are high. There was a low iron content in the soil samples taken in 2015, and this was apparent in the foliage samples which showed signs of iron chlorosis. By contrast, iron levels in the foliar samples taken in 2021 were normal and some of the other nutrients, such as phosphorous, zinc and magnesium met or exceeded soil Environmental Quality Standards.

4.5.2 The site is located next to the River Thames, which is tidal, and it is known that periodically the area adjacent to the river becomes flooded with water from the Thames which is 'brackish', meaning a mixture of fresh and saltwater. There may be some influence from brackish water influx here which may affect the pH of the soil, as brackish water often has a higher pH, typically between 6.0 and 9.0, and a higher alkalinity. If a soils pH is between 7.5-8 this negatively affects the trees uptake of Phosphate, Potassium, Iron, Boron and, to a lesser extent, Copper and Zinc. With regards to Iron specifically, if the soil has a higher alkalinity, then it can mean a lower iron content because iron is less soluble in alkaline soils, making it less available for plants to absorb. This is evident in the problem of chlorosis in the leaves.

4.5.3 The results of the soil investigation also showed that the three trees, and likely all others in the area, are in sediments categorised as 'Sandy Loam with Gravel & Roots' with a clay underlying layer. This sediment type is expected to be free-draining, and this was confirmed with the moisture content in all tree pits being fairly low, which was also evident on site. Though the soil within the planting pits of T58 and T60 was noticeably drier than for T63.

4.5.4 Pin oaks prefer free draining, slightly acidic soil and will struggle on soils with a higher alkalinity, flooding is tolerated but if excessive and long lasting then it could be damaging. On the opposite end of the scale, if the soil is too dry then this can also be detrimental.

4.5.5 Recent years of high drought in the summer may have affected the health of the trees, and repeated flooding from the River Thames will likely have affected the pH levels of the soil, also impacting on their health. It is thought that a combination of these factors has caused the decline in the trees, resulting in their poor form and ultimately death.

5. Bibliography

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5.1.5 HM Government. The Town and Country Planning (Tree Preservation) (England) Regulations 2012. London: Office of Public Sector Information (OPSI).

5.1.6 Lonsdale, D. (1990) *Principles of Tree Hazard Assessment and Management*. The Stationery Office, London.

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5.1.10 National Joint Utilities Group (NJUG) (2007) *Guidelines for the planning, installation and maintenance of utility services in proximity to trees*. NJUG, London.

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5.1.12 Robertson, J, Jackson, N & Smith, M (2006) *Tree Roots in the Built Environment.* The Stationery Office, London.

5.1.13 Rose, B. (2020) Guidance Note 12*: The use of cellular confinement systems near trees. A guide to good practice*. The Arboricultural Association.

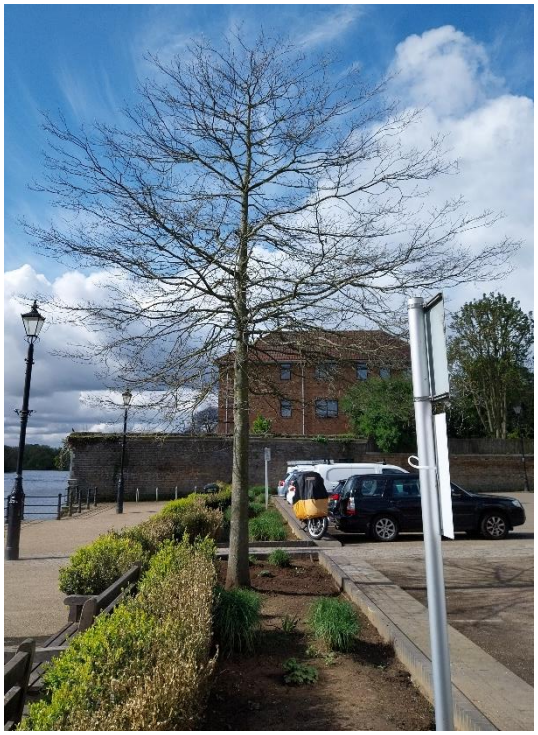
5.1.14 Santamour, F.S. (2002) *Trees for urban planting: diversity uniformity, and common sense*. U.S. Department of Agriculture. Washington D.C.

5.1.15 Edward F. Gilman and Dennis G. Watson, Quercus palustris, United States Forestry Service, Fact Sheet ST-555, October 1994.

Appendix 1 - Tree Schedule

Tree/ Group No.	Species	Height (m)	Stem Diameter (mm)	Canopy Spread (m)				Height of Lowest Limb and Direction (m)	Crown Clearance (m)	Age Class	Estimated Remaining Contribution (years)	Condition		Comments	Preliminary Management Recommendations	BS Category	RPA (m^2)	RPA Radius (m)
				N	E	S	W					Physiology	Structure					
T58	Pin oak; *Quercus palustris*	9	200	3.5	3.5	3.5	3.5	2SW	1.5	Middle-aged	10+	Fair	Fair	Strong excurrent shape. Low vigour.	Raise over road and footpath.	B1 2	18.1	2.4
T60	Pin oak; *Quercus palustris*	8.5	220	3.5	3.5	3.5	3.5	2.5S	1.5	Middle-aged	10+	Fair	Fair	Strong excurrent shape. Low vigour. Dieback at top.	Clear stem of regrowth.	B1 2	21.9	2.7
T63	Pin oak; *Quercus palustris*	8	220	3.5	3.5	3.5	3.5	2.5S	1.5	Middle-aged	10+	Fair	Fair	Excurrent shape. Dieback at top.	-	B1 2	21.9	2.7

Appendix 2 – Locations of trenches for T58

	T58 located at the western end of the car park
	Location of trial pits

	View of south side of rooting area
	View mainly of north side of rooting area

	View of the north site of the rooting area showing roots growing towards the wall within the sand but not dense and dry and brittle
	Image of the amount of sand mixed in with the soil within the planting pit

Appendix 3 – Locations of trenches for T60

	T60 located towards the western end of the car park
	View of trenches either side of the stem excavated using the air spade

	View of the root ball on the south side where it has not grown out towards the hedge
	View of the root ball on the north side where it has not grown out towards the hard standing
	View of the root ball on the west side where it has girdled

Appendix 4 – Locations of trenches for T63

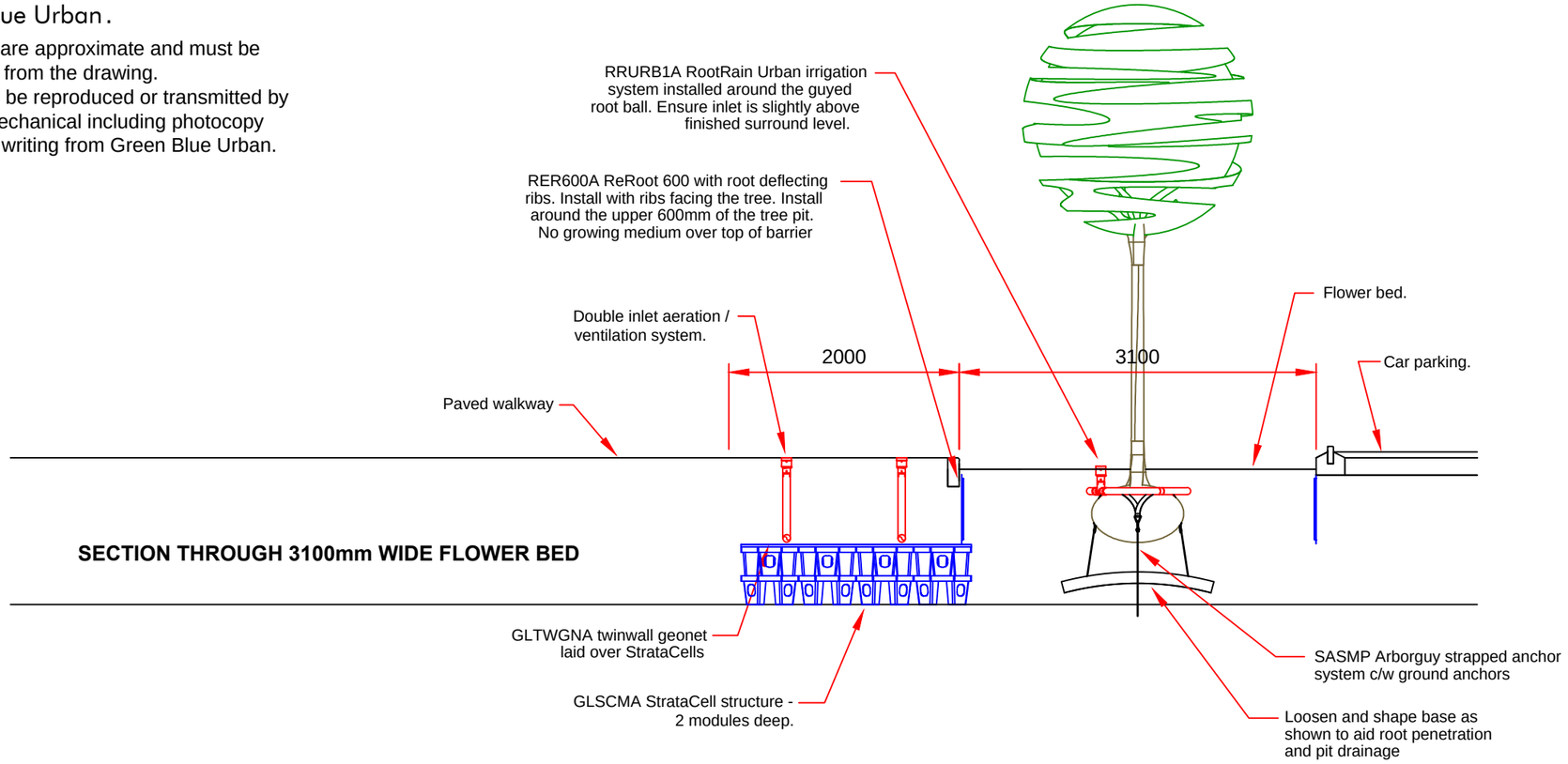
	T63 located at the central section of the car park, near to the footbridge and looking healthier than the previous two trees

	View of trial pits on the north and south side of the stem

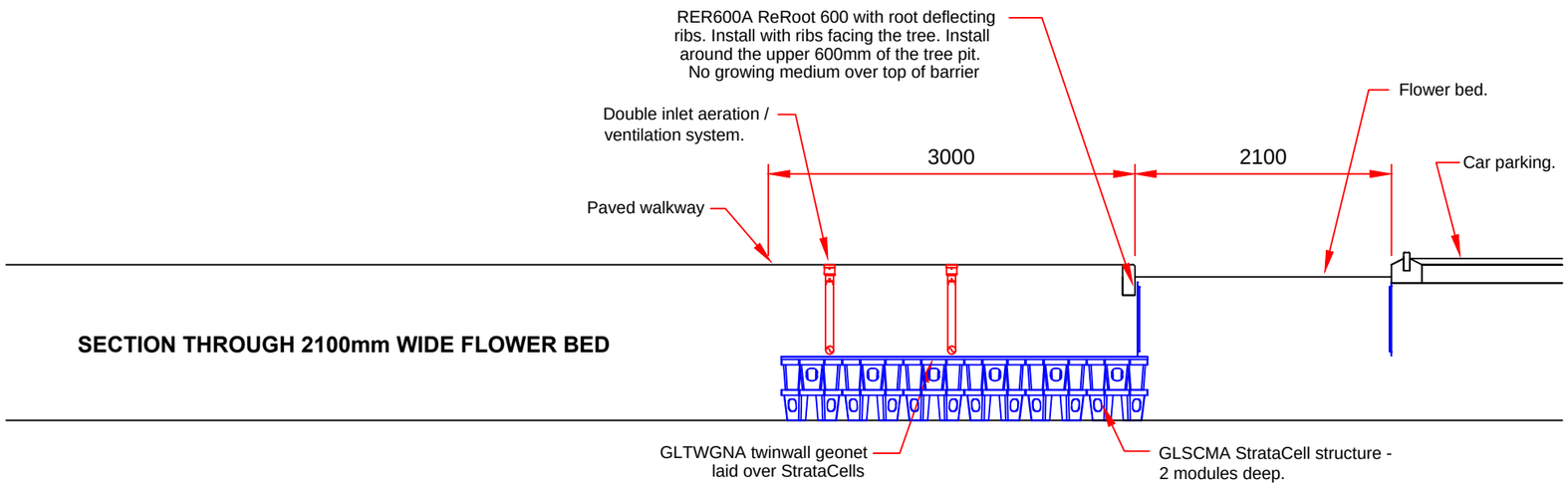
	View of trial pits on the south side of the stem with visibly more roots and a dense mass close to the hedge and one of the larger roots found on the southwest side

	View of trial pits on the north side of the stem with visibly more roots but still no roots close to the hard standing

Appendix 5 – GreenBlue Urban (formerly Greenleaf) Strata Cell design



SECTION THROUGH 3100mm WIDE FLOWER BED



SECTION THROUGH 2100mm WIDE FLOWER BED

CLIENT

London Borough of Richmond Upon Thames

PROJECT

Twickenham Embankment Phase 2

DRAWING TITLE

Embankment Sections

SCALE	JOB NO	DRAWN BY
1:50@A3	.	SPH

DRAWING NUMBER

01

DATE

Sept '13

Greenleaf

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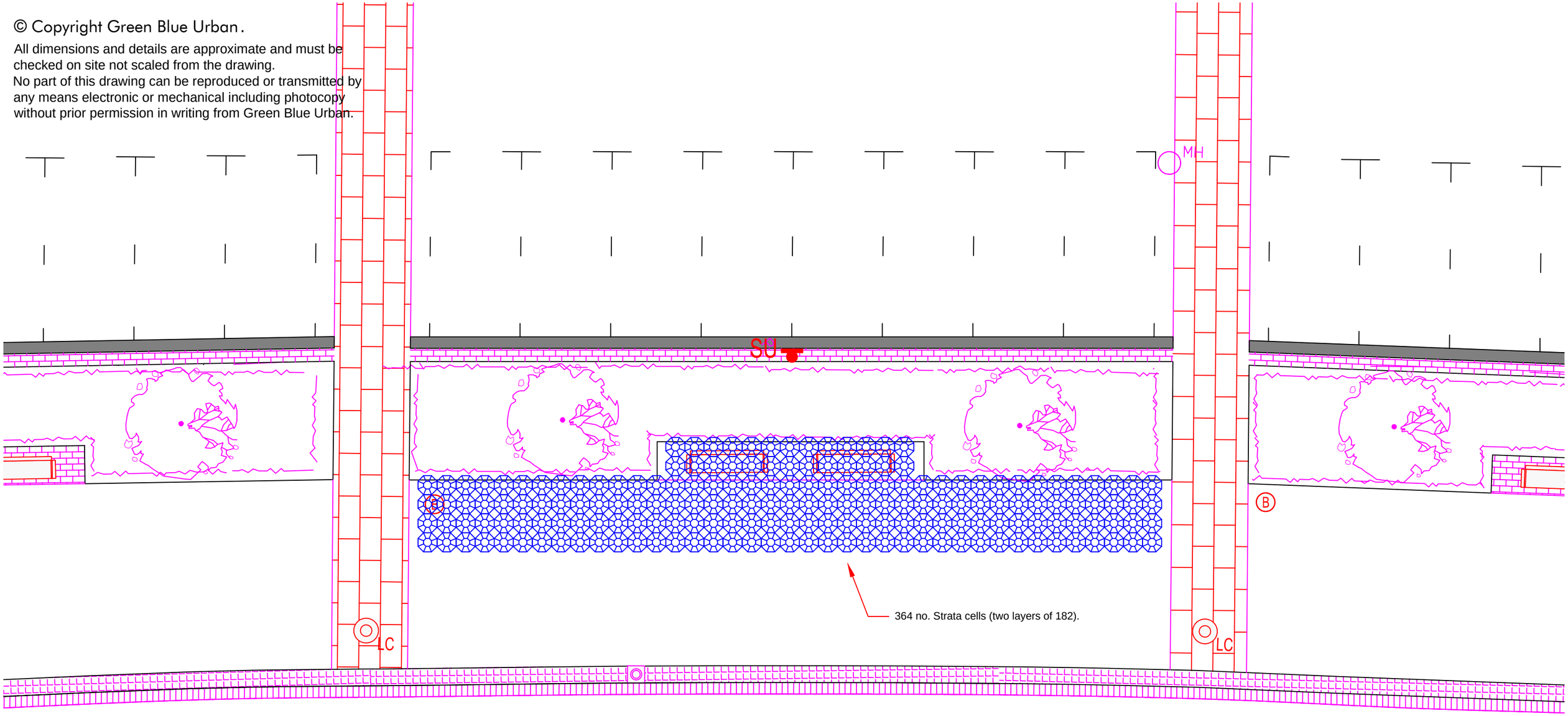

CLIENT

London Borough of
Richmond Upon Thames

PROJECT

Twickenham Embankment Phase 2

DRAWING TITLE

Typical Embankment Plan

SCALE	JOB NO	DRAWN BY
1:100@A3	CAE1306	SPH

DRAWING NUMBER

02

DATE

Sept '13

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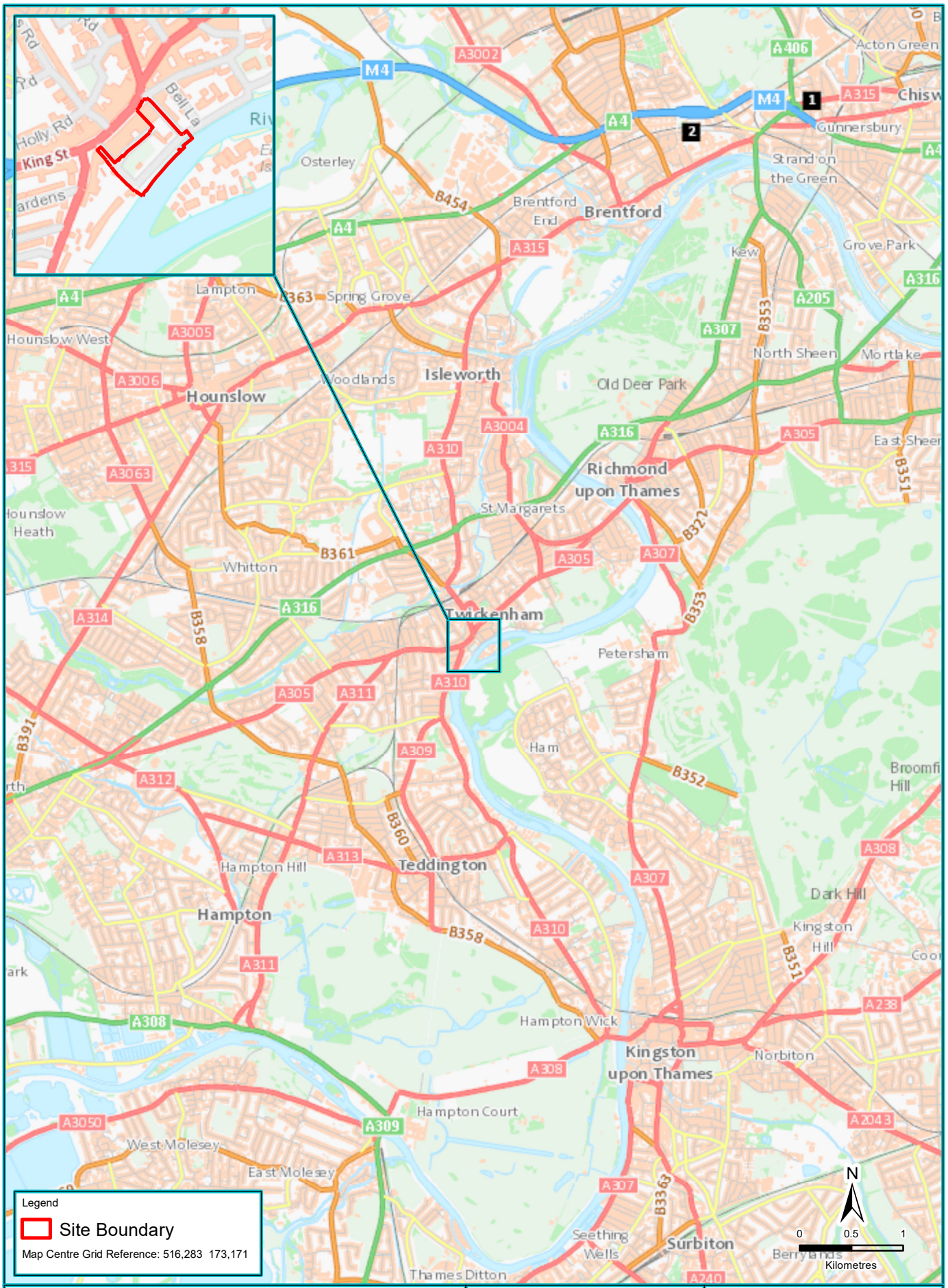

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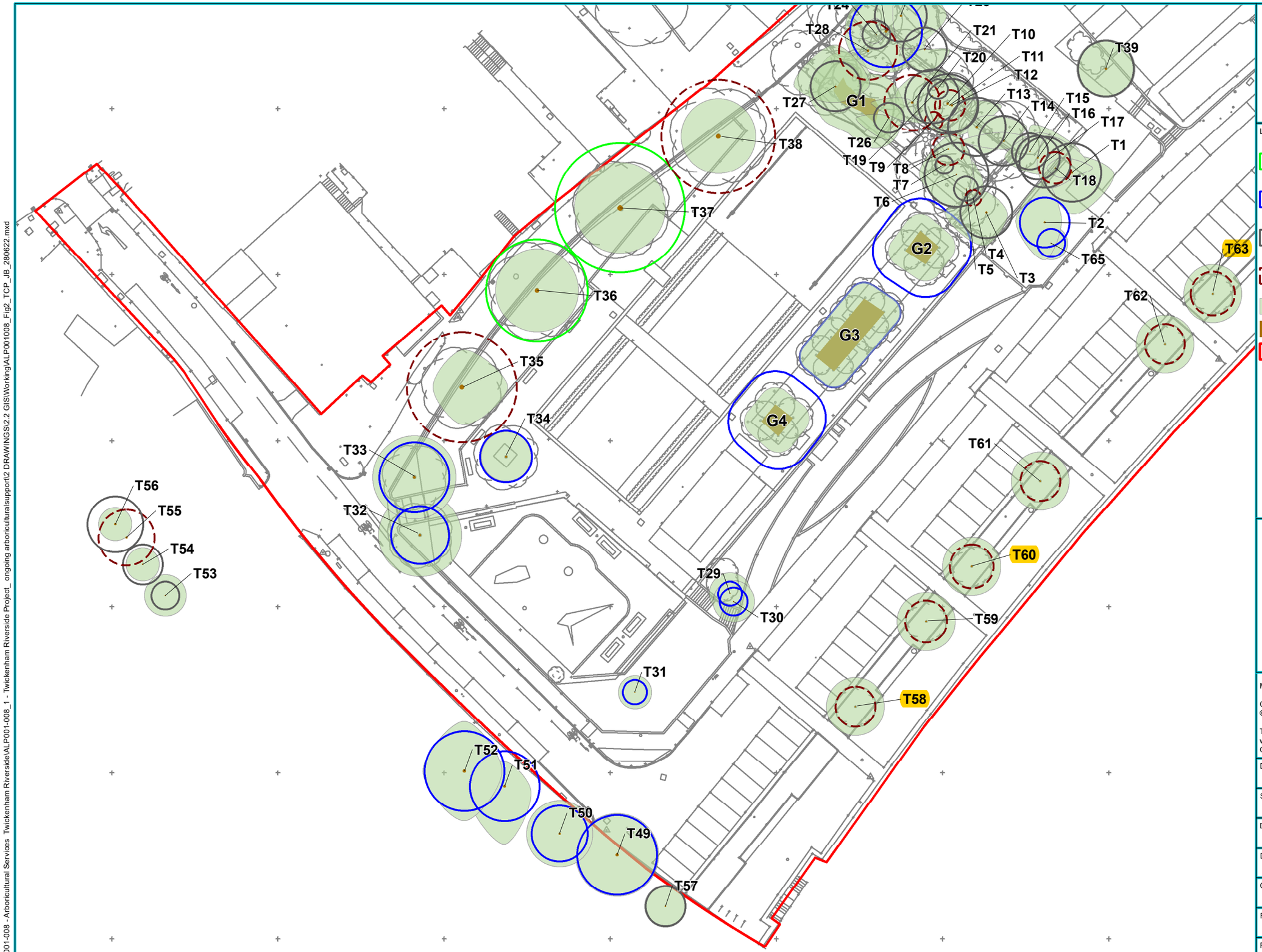

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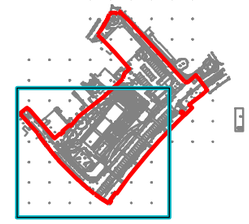
Legend

- Root Protection Area of Category 'A' Tree
- Root Protection Area of Category 'B' Tree
- Root Protection Area of Category 'C' Tree
- Root Protection Area of Category 'U' Tree
- Tree Canopy Extents
- Tree Stem Location
- Site Boundary



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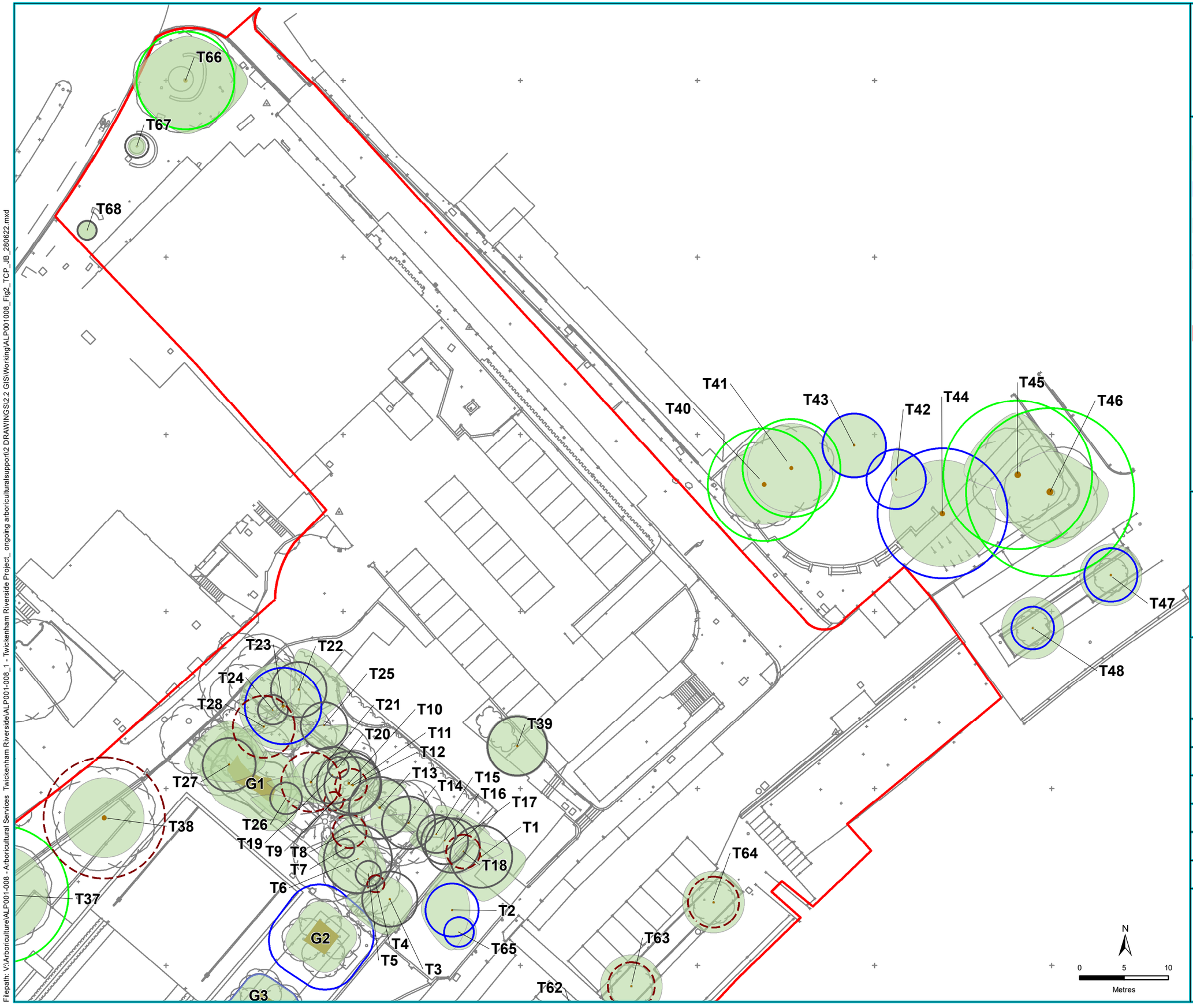

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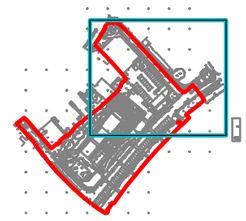
Legend

- Root Protection Area of Category 'A' Tree
- Root Protection Area of Category 'B' Tree
- Root Protection Area of Category 'C' Tree
- Root Protection Area of Category 'U' Tree
- Tree Canopy Extents
- Tree Stem Location
- Site Boundary



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