Air Spade Investigation 2

To determine rooting activity at

Kings College Halls
Kidderpore Avenue
Hampstead
NW3 7ST

Dated
6th May 2016

CROWN Consultants
Tree consultants throughout England and Wales

Contents

1. Introduction

1.1. Instructions

1.1.1. We are instructed by James Thomas of Mount Anvil to undertake a site investigation to determine the extent of rooting activity at eight locations at Kings College Halls. The reason for investigating the extent of rooting activity is to inform an assessment of the potential impact of excavations to facilitate underground services within these areas upon adjacent trees.

1.1.2. The investigation took place from 26th April 2016 to 29th April 2016 and on the 4th May 2016. This report presents the findings.

1.2. Attendance

1.2.1. Present at the excavations were Ivan Button and Joe Taylor from Crown Consultants, as well as Darryn Reilly and his colleagues Chis and Lewis from Ringrose Tree Services. James Thomas of Mount Anvil and Tree Officer Gerry Oxford periodically visited the site to oversee the excavations.

1.3. Trial Pit Locations

1.3.1. The trial pits were located as indicated on the drawing CCL09166/TLP2 in Appendix 2. On this drawing significant roots have been accurately plotted within these trenches by measurements taken on site.

1.4. Excavation Methodology

1.4.1. Excavation was undertaken using an air-spade. This is a lance which directs a high pressure jet of air at the ground. This loosens the soil particles and blasts many of them away from the roots that are left intact. Surplus, loosened soil was then removed from the trench using a hand shovel.

1.4.2. Periodically the roots were logged and photographed.

2. Trail Trench Results

2.1. Trench 1 Root Catalogue

2.1.1. This trench measured 14.6m in length and its location is indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. This trench was excavated to determine the extent of rooting activity of the hornbeam, T50.

2.1.2. For the purpose of data recording, the trench was split into three sections as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2: Section A (3m in length), Section B (7.2m in length) and Section C (3.2m in length). Section A was excavated to a depth of 800mm, Section B to a depth of 800mm for the first 2m and 600mm for the remainder, and Section C to a depth of 700mm. Section A and part of Section B were excavated deeper due to their proximity to T50 as more roots were anticipated closer to this tree.

2.1.3. Between Section A and Section B an area of concrete measuring 1.2m in length and approximately 300mm deep prevented further excavation in this area.

2.1.4. The table below indicates the distribution frequency of roots:

Depth/Frequency	Root Diameter (mm)*						
	Fibrous	<5	5 – 15	16 – 25	26 – 50	>50	TOTAL (excl. fibrous)
0 – 300mm	Numerous	16	7	0	1	0	**24**
300mm – 600mm	Numerous	9	6	2	0	0	**17**
600mm – 700mm	Few	1	1	0	0	0	**2**
TOTAL (excl. fibrous)	**Numerous**	**26**	**14**	**2**	**1**	**0**	**43**

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.2. Comments

2.2.1. As can be seen in the above table and by viewing Photographs 1 to 14 which catalogue the excavation, very few roots were encountered taking into consideration the depth and length of this trench. The largest root was observed in Section A measuring 25mm in diameter at a depth of 350mm.

2.2.2. It is worth noting that the hawthorn (T49) is located approximately 1m away from the trench. It is therefore considered highly likely that several of the roots encountered within Section A emanate from T49.

2.2.3. The relative scarcity of large roots from T50 may be due to a row of shrubs that previously grew between the trench and the existing building to the southwest which has recently been removed. This competing vegetation may have discouraged the roots of T50 from growing in this area.

2.3. Implications

2.3.1. If the root system of the hornbeam (T50) extended into the red hatched area as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2, one would expect the excavations to have encountered significant rooting activity including some large roots.

2.3.2. Given that very little rooting activity was encountered, despite sampling a length of 14.6m, it is considered that excavation in this area may proceed with minimal impact on the hornbeam, T50.

2.4. Trench 2 Root Catalogue

2.4.1. This trench measured 11.8m in length and was located approximately 7.5m from the hornbeam (T50) as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. This trench was excavated to determine the extent of rooting activity of T50.

2.4.2. For the purpose of data recording, the trench was split into three sections as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2: Section A (4m in length), Section B (4m in length) and Section C (4.3m in length). Section A was excavated to a depth of 800mm, Section B to a depth of 600mm and Section C to a depth of 600mm. Section A was excavated deeper due to its proximity to T50 as more roots were anticipated closer to this tree.

2.4.3. The table below indicates the distribution frequency of roots:

Depth/Frequency	Root Diameter (mm)*						
	Fibrous	<5	5 – 15	16 – 25	26 – 50	>50	TOTAL (excl. fibrous)
0 – 300mm	Numerous	24	10	3	0	0	**37**
300mm – 600mm	Numerous	15	10	1	0	0	**26**
600mm – 800mm	0	4	3	0	0	0	**7**
TOTAL (excl. fibrous)	**Numerous**	**43**	**23**	**4**	**0**	**0**	**70**

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.5. Comments

2.5.1. As can be seen in the above table and by viewing Photographs 15 to 29 which catalogue the excavation, very few roots were encountered taking into consideration the depth and length of this trench. The largest root was observed in Section A measuring 25mm in diameter at a depth of 420mm.

2.5.2. It is worth noting that a row of shrubs that previously grew between the trench and the existing building to the east has recently been removed. As the roots of the removed shrubs were indistinguishable from the roots of T50, it is possible that some roots belonging to the shrubs were also recorded. Our investigation suggests that this competing vegetation has discouraged the roots of T50 from proliferating in this area.

2.6. Implications

2.6.1. If the root system of the hornbeam (T50) were prolific within the yellow hatched area (as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2), one would have expected the excavations to have encountered significant rooting activity including some large roots.

2.6.2. Given that very little rooting activity was encountered, it is clear that there is no significant rooting activity associated with the hornbeam that would impede further excavations to facilitate underground services in this area. We therefore recommend that this area is utilised for underground services. The roots in excess of 25mm that were unearthed in our investigation should be neatly pruned. Once this has been done, a mechanical excavator may be used to excavate in this area.

2.7. Trench 3 Root Catalogue

2.7.1. This trench measured 7m in length and was located as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. This trench was excavated to determine the extent of rooting activity of T52 in an area where excavation for underground services is being considered.

2.7.2. For the purpose of data recording, the trench was split into two sections as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2: Section A (3m in length) and Section B (4m in length). Section A was excavated to a depth of 600mm and Section B to a depth of 700mm. Section A and part of Section B were excavated deeper due to their proximity to T50 as more roots were anticipated closer to this tree.

2.7.3. Within Section A, an area of concrete measuring 1.5m in length and a small area of large stones prevented excavation further than 500mm deep.

2.7.4. The table below indicates the distribution frequency of roots:

Depth/Frequency	Root Diameter (mm) *						
	Fibrous	<5	5 – 15	16 – 25	26 – 50	>50	TOTAL (excl. fibrous)
0 – 300mm	Numerous	28	2	0	0	0	**30**
300mm – 600mm	Few	9	7	1	2	0	**19**
600mm – 700mm	0	0	0	0	0	0	**0**
TOTAL (excl. fibrous)	**Numerous**	**37**	**9**	**1**	**2**	**0**	**49**

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.8. Comments

2.8.1. As can be seen in the above table and by viewing Photographs 30 to 39 which catalogue the excavation, very few roots were encountered considering the close proximity of T52 to this trench. The largest root was observed in Section A measuring 35mm in diameter at a depth of 495mm.

2.9. Implications

2.9.1. If the root system of T52 extended into the green hatched area (as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2), one would expect the excavations to have encountered significant rooting activity including some large roots.

2.9.2. Given that very little rooting activity was encountered, it is considered that underground services may be carefully installed in his area.

2.10. Trench 4 Root Catalogue

2.10.1. This trench measured 6.5mm in length and was located approximately 0.5m from the stem of T54, as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. This trench was excavated to determine the extent of rooting activity of T54 in an area where installation of underground services is being considered.

2.10.2. For the purpose of data recording, the trench was split into three sections as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2: Section A (2m in length), Section B (2m in length) and Section C (2.5m in length). Section A was excavated to a depth of 500mm, Section B to a depth of 250mm and Section C to a depth of 200mm.

2.10.3. Section B and Section C could not be excavated deeper due to a relatively high abundance of roots encountered close to the stem of T54.

2.10.4. The table below indicates the distribution frequency of roots:

Depth/Frequency	Root Diameter (mm)*						
	Fibrous	<5	5 – 15	16 – 25	26 – 50	>50	TOTAL (excl. fibrous)
0 – 300mm	Numerous	51	9	3	5	1 @ 70mm 1 @ 75mm	**70**
300mm – 500mm	Few	13	2	1	0	0	**16**
TOTAL (excl. fibrous)	**Numerous**	**64**	**11**	**4**	**5**	**2**	**86**

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.11. Comments

2.11.1. As can be seen in the above table, and by viewing Photographs 39 to 52 which catalogue the excavation, a 70mm diameter root was found at a depth of 140mm (see Photographs 44 and 45) and a 75mm diameter root was found at a depth of 50mm (see Photographs 47 and 48).

2.12. Implications

2.12.1. This indicates that the installation of services in this area could have a significant detrimental impact on the health of T54. We recommend that excavation in this area is avoided as much as possible and that alternative routes for underground services are considered. The purple line marked on the accompanying drawing (CCL09166/TLP2 in Appendix 2) shows the approximate location for the services that have been diverted around T54 following the roots observed in Trench 4.

2.13. Trench 5 Root Catalogue

2.13.1. This trench was split into two small trenches due to the relatively high abundance of roots encountered, as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. One part of the trench included Section A and Section B measuring 4.7m in length combined. The second part of the trench included Section C which measured 1.5m in length. This trench was excavated to determine the extent of rooting activities of T51 and T53.

2.13.2. For the purpose of data recording, the trench was split into three sections: Section A, Section B and Section C as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. Section A was excavated to a depth of 300mm, Section B to a depth of 400mm and Section C to a depth of 300mm.

2.13.3. Section B could not be excavated deeper due to a relatively high abundance of roots encountered. Consequently, Section C was only excavated to a depth of 300mm, as this was deemed satisfactory due to the abundance of roots encountered within Section B.

2.13.4. The table below indicates the distribution frequency of roots:

Depth/Frequency	Root Diameter (mm)*						
	Fibrous	<5	5 – 15	16 – 25	26 – 50	>50	TOTAL (excl. fibrous & <5)
0 – 300mm	Numerous	Numerous	11	3	1	0	**15**
300mm – 400mm	Numerous	Numerous	6	2	0	0	**8**
TOTAL (excl. fibrous & <5)	**Numerous**	**Numerous**	**17**	**5**	**1**	**0**	**23**

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.14. Comments

2.14.1. As can be seen in the above table and by viewing Photographs 53 to 61 which catalogue the excavation, a relatively high frequency of roots were observed within a small area of Section B. The largest root was observed in Section C measuring 45mm in diameter at a depth of 250mm.

2.15. Implications

2.15.1. This indicates that the area where the underground services are proposed close to T51 and T53 is a primary rooting zone for these two trees. It is therefore considered that the installation of services in this area could have a significant detrimental impact on the health of T51 and T53. We recommend that excavation in this area is avoided as much as possible and that alternative routes for underground services are considered.

2.16. Trench 6 Root Catalogue

2.16.1. This trench was excavated in an L-shape with Section A measuring 4.5m and Section B measuring 3m. Section C extends from Section B at a length of 2m. This is indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. This trench was excavated to determine the extent of rooting activity of T35 where installation of a substation is proposed.

2.16.2. For the purpose of data recording, the trench was split into three sections as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2: Section A (4m in length), Section B (2m in length) and Section C (2m in length). All three sections were excavated to a depth of 600mm.

2.16.3. The table below indicates the distribution frequency of roots:

Depth/Frequency	Root Diameter (mm)*						
	Fibrous	<5	5 – 15	16 – 25	26 – 50	>50	TOTAL (excl. fibrous)
0 – 300mm	Numerous	18	0	0	0	0	**18**
300mm – 600mm	Few	10	7	2	0	0	**19**
TOTAL (excl. fibrous)	**Numerous**	**28**	**7**	**2**	**0**	**0**	**37**

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.17. Comments

2.17.1. As can be seen in the above table and by viewing Photographs 62 to 73 which catalogue the excavation, very few roots were encountered.

2.18. Implications

2.18.1. If the root system of T35 extended into the area where the substation is proposed, one would expect the excavations to have encountered significant rooting activity including some large roots.

2.18.2. Given that very little rooting activity was encountered, it is considered that the proposals in this area (to install the substation mat on a shallow raft foundation with deeper excavations for the cables) would not have a significant detrimental impact on T35.

2.19. Trench 7 Root Catalogue

2.19.1. This trench measured 12.5mm in length and was located as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2. This trench was excavated to determine the extent of rooting activity of T33 and T34 where the installation of underground services is being considered. This trench was also located approximately 1.5m from T33 and approximately 1m from T34.

2.19.2. For the purpose of data recording, the trench was split into four sections as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2: Section A (4m in length), Section B (3m in length), Section C (3m in length) and Section D (3.7m in length). Section A, Section B and Section C were excavated to a depth of 600mm. Section D was only excavated to a depth of 600mm where roots permitted.

2.19.3. The table below indicates the distribution frequency of roots:

Depth/Frequency	Root Diameter (mm)*						
	Fibrous	<5	5 – 15	16 – 25	26 – 50	>50	TOTAL (excl. fibrous & <5)
0 – 300mm	Numerous	Numerous	11	4	1	1 @ 80mm 1 @ 53mm	**18**
300mm – 600mm	Numerous	Numerous	19	5	3	1 @ 57mm 1 @ 65mm 1 @ 55mm 1 @ 90mm	**31**
TOTAL (excl. fibrous & <5)	**Numerous**	**Numerous**	**30**	**9**	**4**	**6**	**49**

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.20. Comments

2.20.1. As can be seen in the above table and by viewing Photographs 74 to 94 which catalogue the excavation, a relatively high incidence of roots was observed within this trench.

Within Section C, a 57mm diameter root was found at a depth of 420mm (see Photographs 83 and 86), a 65mm diameter root was found at a depth of 410mm (see Photographs 83 and 87) and a 80mm diameter root was found at a depth of 250mm (see Photographs 83 and 88). Within Section D, a 90mm diameter root was found at a depth of 330mm (see Photographs 91 and 92), a 55mm diameter root was found at a depth of 360mm (see Photographs 90 and 94) and a 53mm diameter root was found at a depth of 210mm (see Photographs 89 and 93).

2.21. Implications

2.21.1. This indicates that the area where the underground services are proposed close to T33 is a primary rooting zone for this tree. We therefore recommend that excavation in this area is avoided as much as possible and that an alternative route is utilised if possible.

2.22. Trench 8 Root Catalogue

2.22.1. This trench measured approximately 8m in length and was located adjacent to an existing footpath as indicated on the accompanying drawing CCL09166/TLP2 in Appendix 2.

2.22.2. In this trench, numerous fibrous roots were encountered. However the only roots in excess of 15mm that were encountered are listed in the table below:

Root Number	Diameter (mm)	Depth (mm)
1	35	730
2	32	750
3	34	500
4	38	900
5	22	700
6	20	850

*Note: The root dimensions recorded are based on an average of horizontal and vertical measurements (roots are rarely circular). This explains any minor discrepancy between photographs and recorded dimensions.

2.23. Comments

2.23.1. The abundance of fibrous roots, as indicated in the above table and in Photographs 95 to 99, suggest that the roots of T35 have colonised the area between the trench and the building front. However, the relative lack of large roots indicates that rooting activity is less than one might have expected.

2.24. Implications

2.24.1. The installation of services in this area would have some impact on T35 and therefore the relocation of services should be considered. However, if it is deemed necessary to excavate in this area, the impact on T35 shall be relatively minor and may be mitigated by undertaking light pruning of the canopy and improving rooting conditions (e.g. terraventing and mulching).

3. Photographs

Photo 1. Location of Trench 1 before excavation.

Photo 2. Start of excavation for Trench 1.

Photo 3. Overview of Trench 1.

Photo 4. Depth of Trench 1 at 700mm.

Photo 5. Trench 1 Section A.

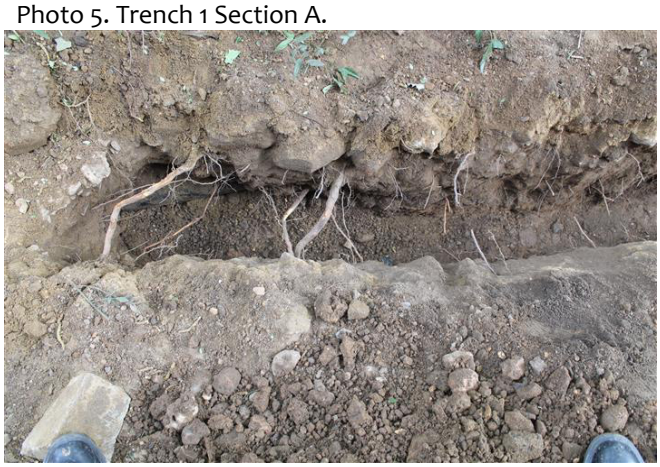

Photo 6. Trench 1 Section A.

Photo 7. Trench 1 Section A.

Photo 8. Trench 1, area of hard-core.

Photo 9. Trench 1 Section B.

Photo 10. Trench 1 Section B.

Photo 11. Trench 1 Section C.

Photo 12. Trench 1 Section C.

Photo 13. Trench 1 Section C.

Photo 14. Trench 1 Section C.

Photo 15. Start of excavation for Trench 2.

Photo 16. Overview of Trench 2.

Photo 17. Depth of Trench 2 at 800mm.

Photo 18. Trench 2 Section A.

Photo 19. Trench 2 Section A.

Photo 20. Trench 2 Section A.

Photo 21. Trench 2 Section A.

Photo 22. Trench 2 Section B.

Photo 23. Trench 2 Section B.

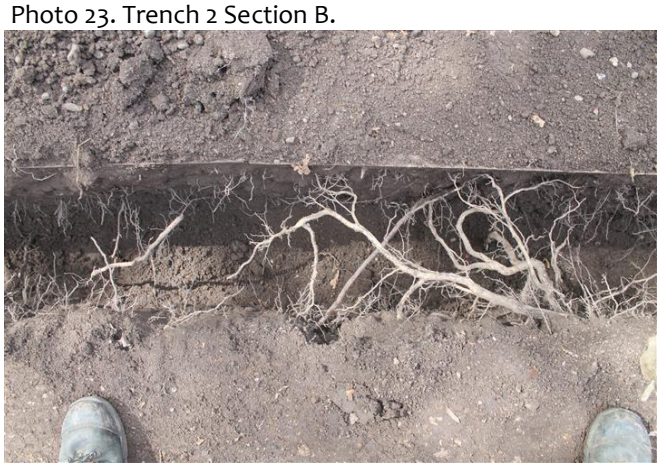

Photo 24. Trench 2 Section B.