VikingCCS

Viking CCS pipeline

Preliminary Environmental Information Report Volume IV

Technical Appendices

Applicant: Chrysoar Production (U.K.) Limited,
a Harbour Energy Company

PINS Reference: EN070008

November 2022

Harbour Energy | AECOM

Appendix 11.2

Site Visit Technical Note

Table of Contents

11. Introduction 11-1
11.2 Initial site visit watercourses 11-1
11.3 Harborough Marsh Drain 11-4
11.4 North Beck Drain (Site 2) 11-14
11.5 Laceby Beck 11-17
11.6 Waithe Beck (Site 4b) 11-22
11.7 Black Leg Drain (Site 6a) 11-24
11.8 Poulton Drain (Site 7a) 11-26
11.9 Yarburgh Beck (Site 8b) 11-28
11.10 Louth Canal 11-30
11.11 River Ludd 11-34
11.12 Green Dike 11-39
11.13 Harrowsea Drain (Site 12b) 11-43
11.14 Grayfleet Drain (Site 13b) 11-45
11.15 Sykes Drain (Site 14b) 11-47
11.16 Head Dike Drain (Site 15) 11-49
11.17 Long Eau (Site 16b) 11-51
11.18 The Cut Drain (Site 17a) 11-53
11.19 Two Mile Drain (Site 18) 11-55
11.20 Old Engine Drain (Site 21b) 11-57
11.21 Great Eau (Site 22b) 11-59
11.22 The Cut (Site 23b) 11-61

Figures

Figure 11-1: Plan of northern survey locations 11-1
Figure 11-2: Plan of southern survey locations 11-2
Figure 11-3: Location of Site 1a 11-4
Figure 11-4: Location of Site 1c 11-6
Figure 11-5: Location of Site 1d 11-8
Figure 11-6: Location of Site 1f 11-10
Figure 11-7: Location of Site 1g 11-12
Figure 11-8: Location of Site 2 11-14
Figure 11-9: Location of Site 3a 11-17
Figure 11-10: Location of Site 3c 11-19
Figure 11-11: Location of Site 4b 11-22
Figure 11-12: Location of Site 6a 11-24
Figure 11-13: Location of Site 7a 11-26
Figure 11-14: Location of Site 8b 11-28
Figure 11-15: Location of Site 9a 11-30
Figure 11-16: Location of Site 9b 11-32
Figure 11-17: Location of Site 10a 11-34
Figure 11-18: Location of Site 10b 11-36
Figure 11-19: Location of Site 11a 11-39
Figure 11-20: Location of Site 11b 11-41
Figure 11-21: Location of Site 12b 11-43
Figure 11-22: Location of Site 13b 11-45

Figure 11-23: Location if Site 14b 11-47
Figure 11-24: Location of Site 15 11-49
Figure 11-25: Location of Site 16b 11-51
Figure 11-26: Location of Site 17a 11-53
Figure 11-27: Location of Site 18 11-55
Figure 11-28: Location of Site 21b 11-57
Figure 11-29: Location of Site 22b 11-59
Figure 11-30: Location of Site 23b 11-61

Tables

Table 11-1: Watercourses Surveyed 11-2

Photographs

Photograph 11-1: Harborough Marsh Drain (Site 1a) View Upstream 11-5
Photograph 11-2: Harborough Marsh Drain (Site 1a) View Downstream 11-5
Photograph 11-3: Harborough Marsh Drain (Site 1c) View Upstream 11-7
Photograph 11-4: Harborough Marsh Drain (Site 1c) View Downstream 11-7
Photograph 11-5: Harborough Marsh Drain Tributary (Site 1d) View Upstream 11-9
Photograph 11-6: Harborough Marsh Drain tributary (Site 1f) View Downstream 11-11
Photograph 11-7: Harborough Marsh Drain tributary (Site 1f) View Upstream 11-11
Photograph 11-8: Harborough Marsh Drain (Site 1g) View Downstream 11-13
Photograph 11-9: Harborough Marsh Drain Tributary (Site 1g) View Upstream .. 11-13
Photograph 11-10: North Beck Drain (Site 2) View Upstream 11-15
Photograph 11-11: North Beck Drain (Site 2) View Upstream 11-15
Photograph 11-12: North Beck Drain (Site 2) View Downstream 11-16
Photograph 11-13: Drain to Laceby Beck (Site 3a) View Downstream..... 11-18
Photograph 11-14: Laceby Beck (Site 3c) View Downstream 11-20
Photograph 11-15: Laceby Beck (Site 3c) View Upstream 11-20
Photograph 11-16: Laceby Beck (Site 3c) View Downstream 11-21
Photograph 11-17: Waithe Beck (Site 4b) View Upstream 11-23
Photograph 11-18: Waithe Beck (Site 4b) View Downstream..... 11-23
Photograph 11-19: Black Leg Drain (Site 6a) View Downstream 11-25
Photograph 11-20: Black Leg Drain (Site 6a) View Upstream 11-25
Photograph 11-21: Poulton Drain (Site 7a) View Downstream 11-27
Photograph 11-22: Yarburgh Beck (Site 8b) View Upstream 11-29
Photograph 11-23: Louth Canal (Site 9a) View Upstream 11-31
Photograph 11-24: Louth Canal (Site 9a) View Downstream 11-31
Photograph 11-25: Louth Canal (Site 9b) View Upstream 11-33
Photograph 11-26: Louth Canal (Site 9b) View Downstream 11-33
Photograph 11-27: River Ludd (Site 10a) View of Channel 11-35
Photograph 11-28: River Ludd (Site 10b) Sluice Structure 11-37
Photograph 11-29: River Ludd (Site 10b) View Upstream 11-37
Photograph 11-30: River Ludd (Site 10b) View Downstream 11-38
Photograph 11-31: Green Dike (Site 11a) View Upstream 11-40
Photograph 11-32: Green Dike (Site 11a) View Downstream..... 11-40
Photograph 11-33: Green Dike (Site 11b) View Upstream 11-42
Photograph 11-34: Green Dike (Site 11b) View Downstream..... 11-42
Photograph 11-35: Harrowsea Drain (Site 12b) View Downstream..... 11-44
Photograph 11-36: Grayfleet Drain (Site 13b) View Downstream..... 11-46
Photograph 11-37: Sykes Drain (Site 14b) View Upstream 11-48
Photograph 11-38: Harrowsea Drain (Site 12b) View Downstream..... 11-48

Photograph 11-39: Head Dike Drain (Site 15) View Upstream 11-50
Photograph 11-40: Head Dike Drain (Site 15) View Downstream 11-50
Photograph 11-41: Long Eau (Site 16b) View Upstream 11-52
Photograph 11-42: Long Eau (Site 16b) View Downstream 11-52
Photograph 11-43: The Cut (Site 17a) View Upstream 11-54
Photograph 11-44: The Cut (Site 17a) View Downstream 11-54
Photograph 11-45: Two Mile Drain (Site 18) View Upstream 11-56
Photograph 11-46: Two Mile Drain (Site 18) View Downstream 11-56
Photograph 11-47: Old Engine Drain (Site 21b) View Upstream 11-58
Photograph 11-48: Old Engine Drain (Site 21b) View Downstream 11-58
Photograph 11-49: Great Eau (Site 22b) View Upstream 11-60
Photograph 11-50: Great Eau (Site 22b) View Downstream 11-60
Photograph 11-51: The Cut (Site 23b) View Downstream 11-62
Photograph 11-52: The Cut (Site 23b) View Upstream 11-62

11. Introduction

11.1.1 An initial site visit was undertaken by an AECOM water scientist and a hydromorphologist to observe major watercourses that are likely to be crossed by the proposed pipeline. This was to classify the hydromorphological attributes of each waterbody, to understand the general characteristics of the waterbodies, and to provide a basis of the baseline and Preliminary Environment Information Report (PEIR) assessment. The initial site visit took place on the 25 and 26 of May 2022.

11.1.2 A more detailed site visit will be undertaken prior to the Environmental Statement, once there is further clarity on the alignment and available access.

11.2 Initial site visit watercourses

Figure 11-1: Plan of Northern Survey Locations

Figure 11-2: Plan of Southern Survey Locations

Table 11-1: Watercourses Surveyed

Watercourse Name	Watercourse ID	Survey ID	Survey NGR
Haborough Marsh Drain - Branch 1	LD_A4	1a	TA1770716210
	LD_A4	1c	TA1685815626
Haborough Marsh Drain - Branch 2	LD_A5	1d	TA1640014949
Haborough Marsh Drain - Branch 3	LD_A6	1f	TA1690214956
	LD_A6	1g	TA1718714227
North Beck Drain	R_A1	2	TA1861611486
Drain - leads to Laceby Beck	LD_B3	3a	TA2164204706
Laceby Beck	S_B1	3c	TA2226205028
Waithe Beck	S_B3	4b	TA2522801680
Black Leg Drain	LD_C4	6a	TF2872697492
Poulton Drain	LD_E1	7a	TF3354693885
Yarburgh Beck	S_E4	8b	TF3476192626
Louth Canal	CNL_E1	9a	TF3606590404

Watercourse Name	Watercourse ID	Survey ID	Survey NGR
Louth Canal	CNL_E1	9b	TF3635890678
River Ludd	R_E1	10a	TF3611190233
	R_E1	10b	TF3659790670
Green Dike	LD_E4	11a	TF3671789934
	LD_E4	11b	TF3700790266
Harrowsea Drain	LD_E6	12b	TF3813189286
Grayfleet Drain	LD_E9	13b	TF3863788841
Sykes Drain	LD_E21	14b	TF4146587746
Head Dike Drain	LD_E17	15	TF4207387476
Long Eau	LD_E28	16b	TF4254287775
The Cut Drain	LD_E16	17a	TF4232386544
	LD_E10	23b	TF4778487867
Two Mile Bank Drain	LD_E31	18	TF4318586239
Old Engine Drain	LD_E16	21b	TF4559988000
Great Eau	R_E2	22b	TF4576888103

11.3 Harborough Marsh Drain

11.3.1 Harborough Marsh Drain was viewed at three locations on the main channel and two tributaries/feeder drains.

11.3.2 Harborough Marsh Drain and its tributaries are a network of modified and artificial drainage channels located around Immingham. The planform of these watercourses upstream of the existing A1173 road crossing has remained mostly unchanged since 1910 according to historic Ordnance Survey (OS) mapping, indicating that any modification occurred prior to this date. There have been significant modifications since 1910 within the area now occupied by Immingham Dock, including the diversion of Harborough Marsh Drain and the network of connected drains through one channel around the docks to the south east.

11.3.3 Specific details of each viewing locations are shown in the following subsections.

Harborough Marsh Drain (Site 1a)

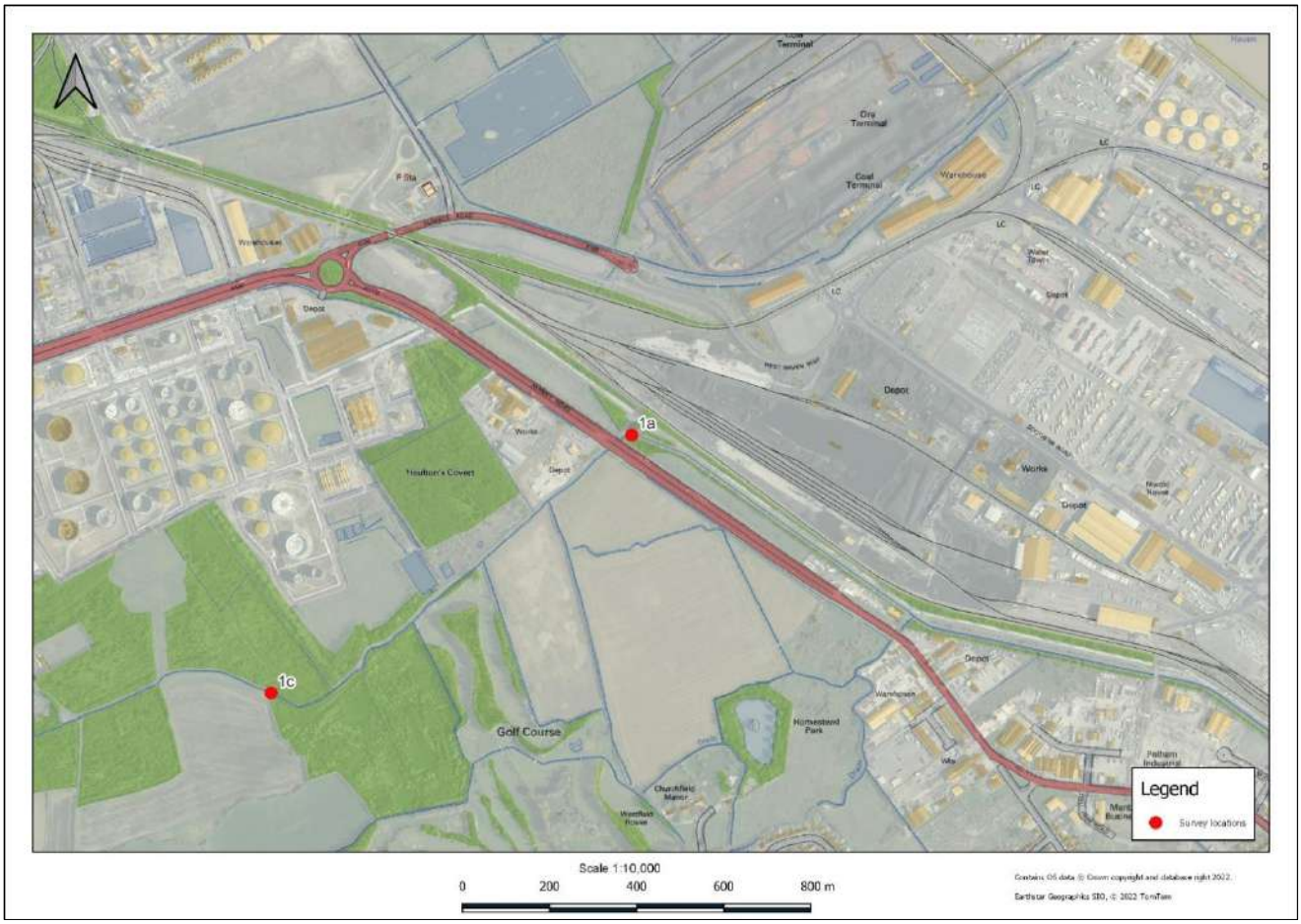


Figure 11-3: Location of Site 1a

11.3.4 The watercourse was surveyed at the existing Manby Road crossing to the north of Immingham. The watercourse flowed through an area of flat land and was bordered by agricultural fields and industrial units. The watercourse has been significantly modified for drainage, having been straightened, deepened and widened. As a result, the watercourse displays no morphological diversity, and the straight trapezoidal channel provides little opportunity to provide quality habitat. The steep banks were

approximately 2 m high and vegetated with grasses, with some scattered trees present. The bed was primarily comprised of silt.

Photograph 11-1: Harborough Marsh Drain (Site 1a) View Upstream

Photograph 11-2: Harborough Marsh Drain (Site 1a) View Downstream

Harborough Marsh Drain (Site 1c)

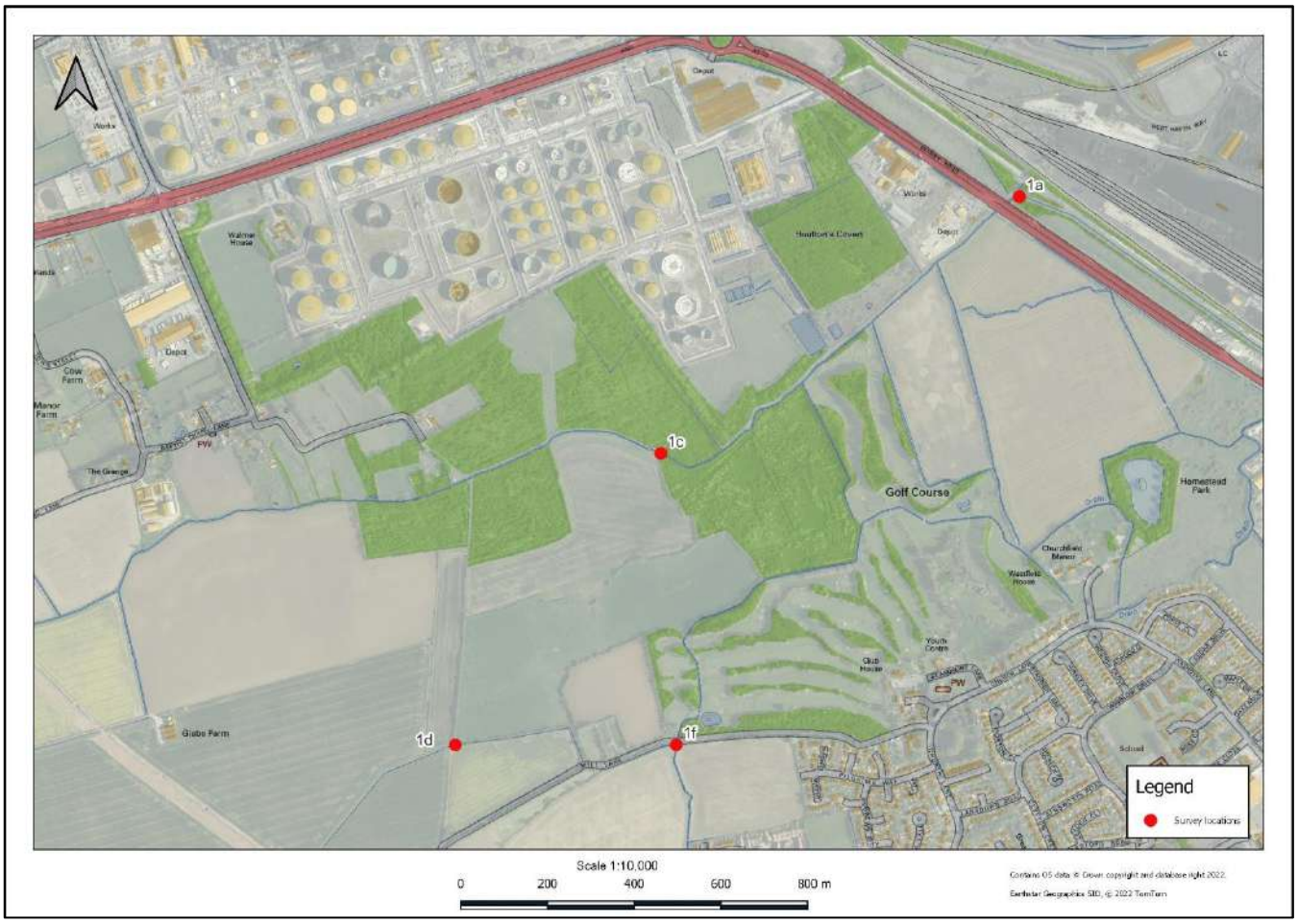


Figure 11-4: Location of Site 1c

11.3.5 At Site 1c Harborough Marsh Drain displays a similar straight planform and trapezoidal cross section as it does at Site 1a. The banks were a similar height to Site 1a, and largely comprised grasses, although there was a length of the right bank that was vegetated with dense tree cover. As with Site 1a, the drain displayed no morphological diversity. The bed was comprised of silt and had considerable macrophyte growth. Adjacent land use is predominantly agricultural, with a former golf course on land on the right.

Photograph 11-3: Harborough Marsh Drain (Site 1c) View Upstream

Photograph 11-4: Harborough Marsh Drain (Site 1c) View Downstream

Harborough Marsh Drain tributary (Site 1d)

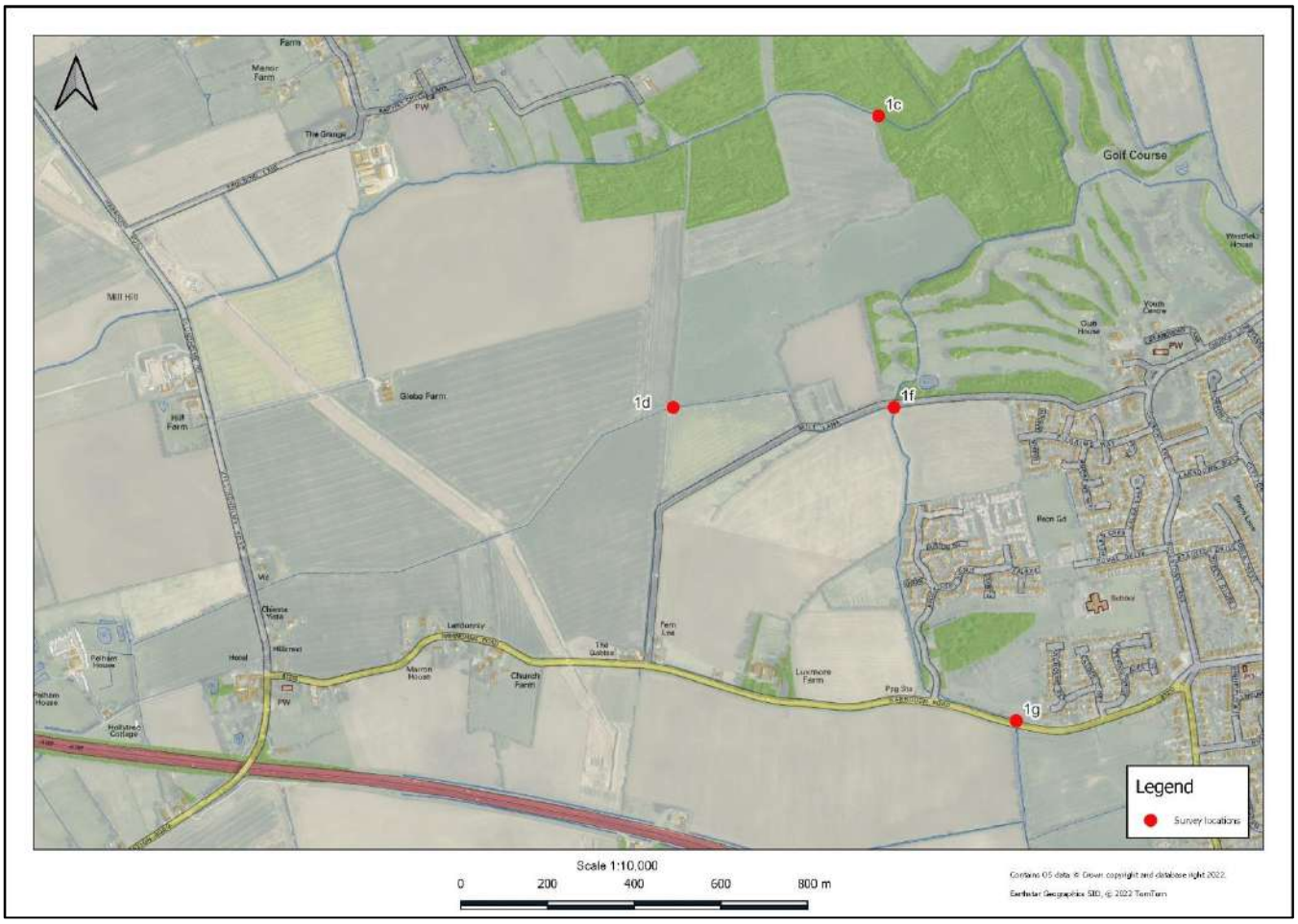


Figure 11-5: Location of Site 1d

11.3.6 Site 1d is located on a drain connected to that on which the previously detailed sites lie. The drain at this location displayed a highly modified planform and cross section, having been straightened, deepened and widened for agricultural drainage. The banks were approximately 2 m high and vegetated with grasses and trees. Surrounding land use is predominantly agricultural fields.

Photograph 11-5: Harborough Marsh Drain Tributary (Site 1d) View Upstream

Harborough Marsh Drain tributary (Site 1f)

Figure 11-6: Location of Site 1f

11.3.7 The watercourse at Site 1f was again a different watercourse connected to the drains detailed previously. The site is located at the existing Mill Lane crossing. The watercourse was heavily modified as was seen at the previous sites, with a similar cross section. Some coarser material on the bed did, however, provide some minor flow variation, although the channel was largely devoid of morphological features.

Photograph 11-6: Harborough Marsh Drain tributary (Site 1f) View Downstream

Photograph 11-7: Harborough Marsh Drain tributary (Site 1f) View Upstream

Harborough Marsh Drain (Site 1g)

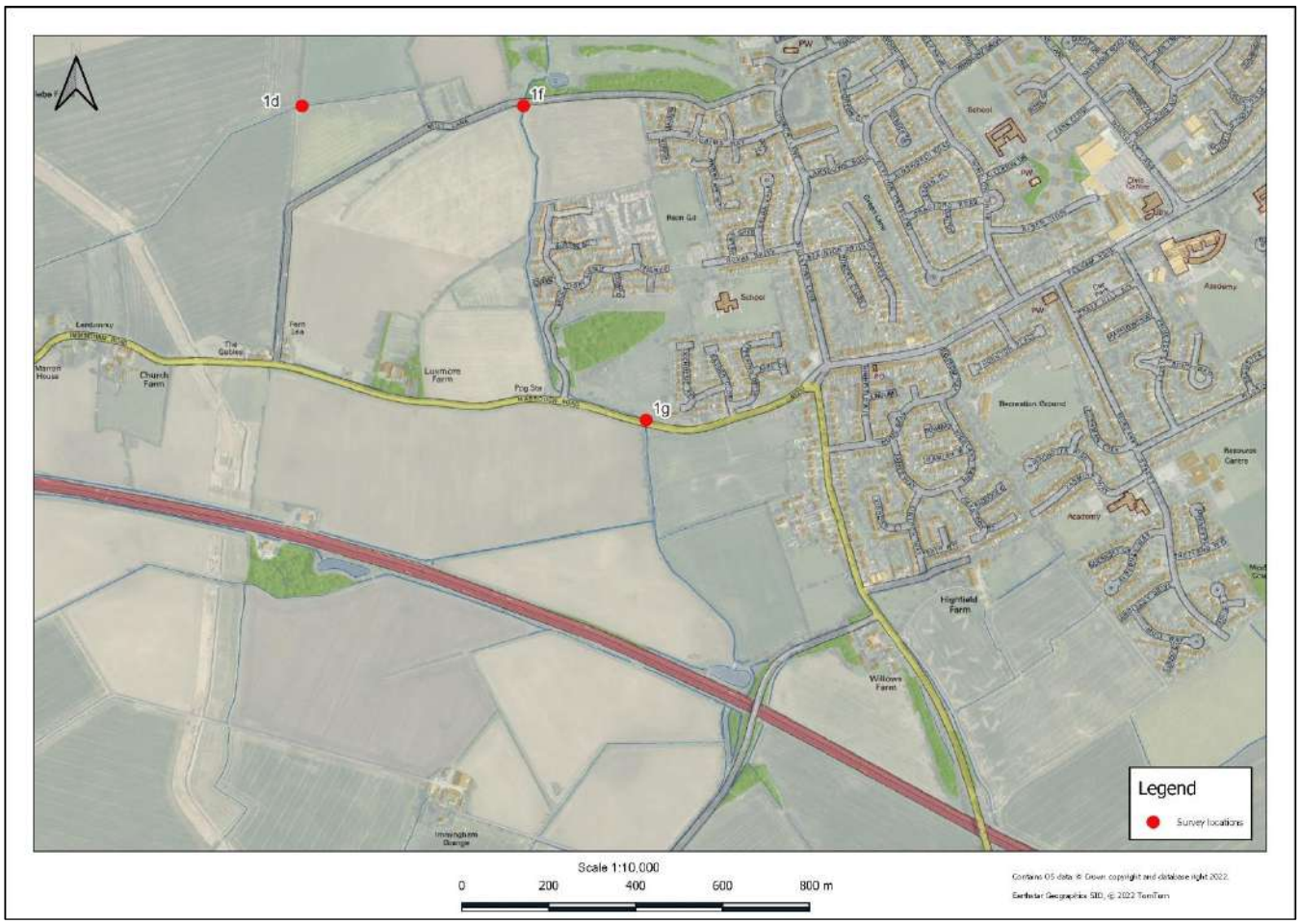


Figure 11-7: Location of Site 1g

11.3.8 Site 1g is located where the watercourse is crossed by Harborough Road. The watercourse has been straightened along the road and upstream of the crossing. There was no perceptible flow at the time of survey and the water was very turbid, indicating the presence of fine sediment which likely enters the watercourse from the road and surrounding agricultural land via runoff. The banks were heavily vegetated with grasses and herbs and were both quite steep. The left bank was higher at the downstream end, at around 2 m, due to it bordering the road which is raised above the surrounding land. The left bank was approximately 1.5 m high. Emergent, linear leaved macrophytes were present on the bed, indicating the presence of finer bed substrate.

Photograph 11-8: Harborough Marsh Drain (Site 1g) View Downstream

Photograph 11-9: Harborough Marsh Drain Tributary (Site 1g) View Upstream

11.4 North Beck Drain (Site 2)

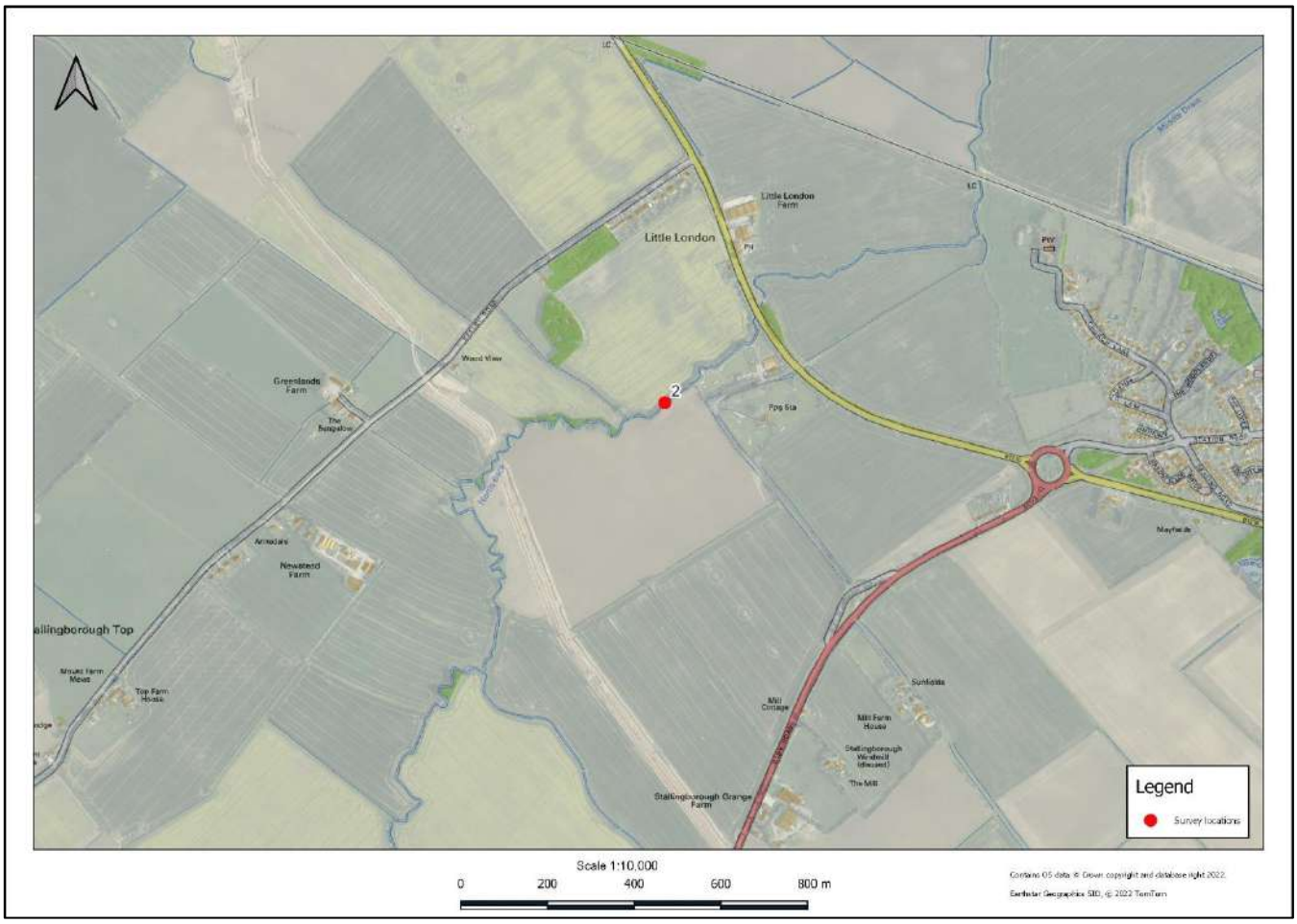


Figure 11-8: Location of Site 2

11.4.1 Site 2 is located on a straightened length of North Beck Drain, within an area of flat agricultural land. The watercourse planform has remained largely unchanged since 1908 according to historic OS mapping, although some straightening has occurred a short distance upstream of Site 2. The straightening of the length at Site 2 evidently occurred prior to 1908.

11.4.2 The channel was incised, disconnecting it from the surrounding land, with banks of approximately 2 m height. The channel was devoid of morphological diversity through this straightened length, and was characterised by laminar gliding flow. Bed substrate was predominantly silt and turbidity was quite high. A short distance upstream of Site 2 the watercourse displays a more natural sinuous planform. Morphological and flow diversity are much greater through this sinuous length, with embryonic riffles and bars present along with a variety of flow types. Both banks were predominantly vegetated with long grasses and herbs, with some scrub present in parts. The riparian zone on the left was wooded with a narrow strip of dense tree cover.

Photograph 11-10: North Beck Drain (Site 2) View Upstream

Photograph 11-11: North Beck Drain (Site 2) View Upstream

Photograph 11-12: North Beck Drain (Site 2) View Downstream

11.5 Laceby Beck

11.5.1 Laceby Beck was viewed at the proposed crossing locations on the main channel and at one feeder drain at the potential crossing point.

11.5.2 The drains connected to Laceby Beck are generally straight, artificial or modified field drains. Historic OS mapping from 1908 indicates that there have been no significant modifications to the field boundaries which these drains are located along.

11.5.3 Laceby Beck itself displays a more natural sinuous planform in parts, particularly downstream of the existing golf course. There are straightened lengths with and upstream of the golf course, upstream of the confluence with Team Gate Drain. The planform of Laceby Beck appears to have remained largely the same as that shown on historic OS mapping dating from 1908.

11.5.4 Specific details of each viewing locations are shown in the following subsections.

Drain to Laceby Beck (Site 3a)

Figure 11-9: Location of Site 3a

11.5.5 This linear drain is an artificial feature used for agricultural land drainage. The drain was heavily vegetated on the bed and banks during the survey which made observation of the bed difficult. There was no indication of water being present at the time of survey. A thin strip of trees was present in the riparian zone on the left bank.

Photograph 11-13: Drain to Laceby Beck (Site 3a) View Downstream

Laceby Beck (Site 3c)

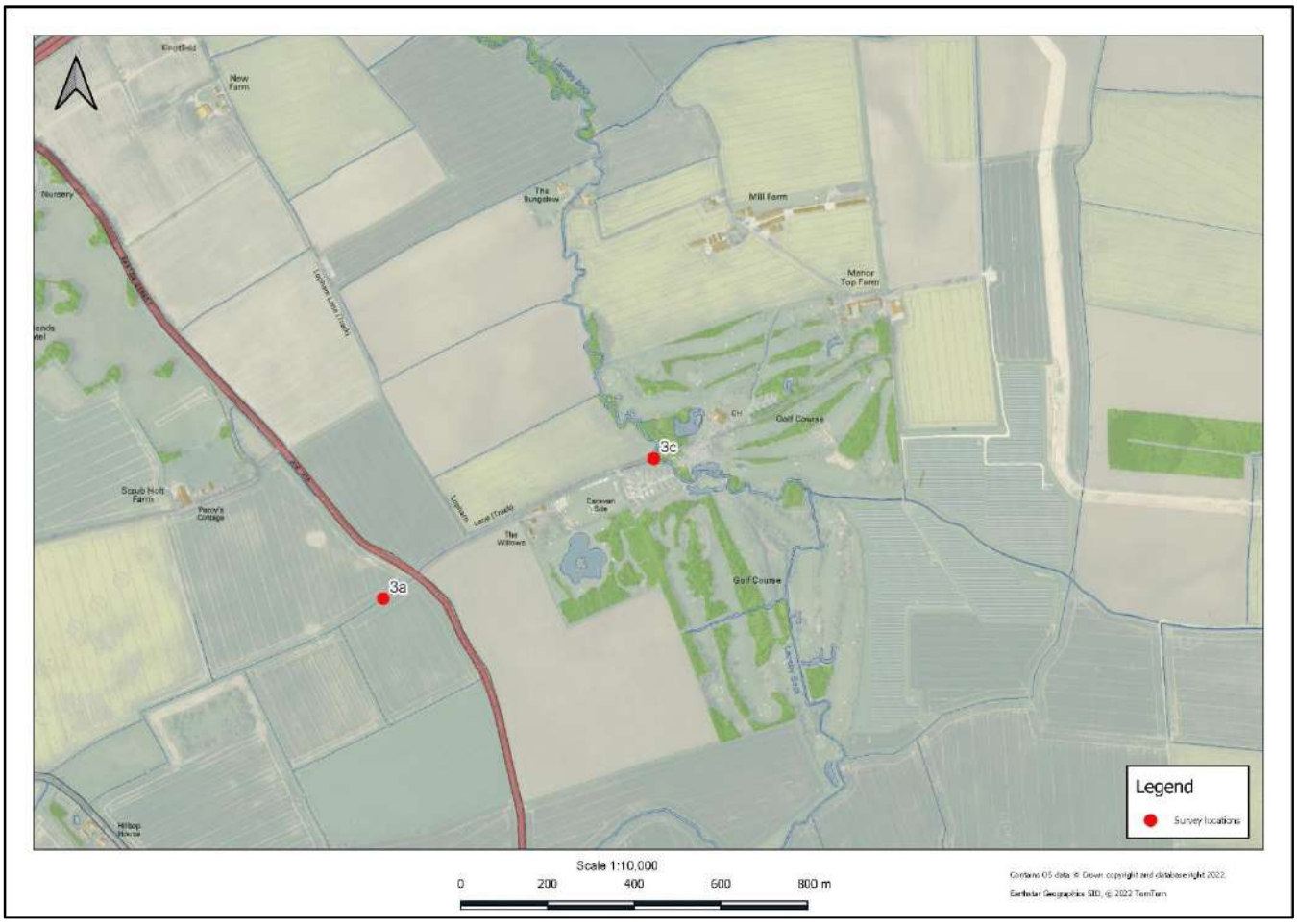


Figure 11-10: Location of Site 3c

11.5.6 This length of Laceby Beck surveyed was located within the landscaped grounds of a holiday park and golf club, with the car park adjacent to the watercourse. The bank profile appeared to have been modified and natural bank vegetation had been cleared. The bed was heavily vegetated with reeds through the length that flows adjacent to the holiday park, and there was no perceptible flow. A large gravel bar was located on the right side of the channel downstream of the holiday park.

Photograph 11-14: Laceby Beck (Site 3c) View Downstream

Photograph 11-15: Laceby Beck (Site 3c) View Upstream

Photograph 11-16: Laceby Beck (Site 3c) View Downstream

11.6 Waithe Beck (Site 4b)

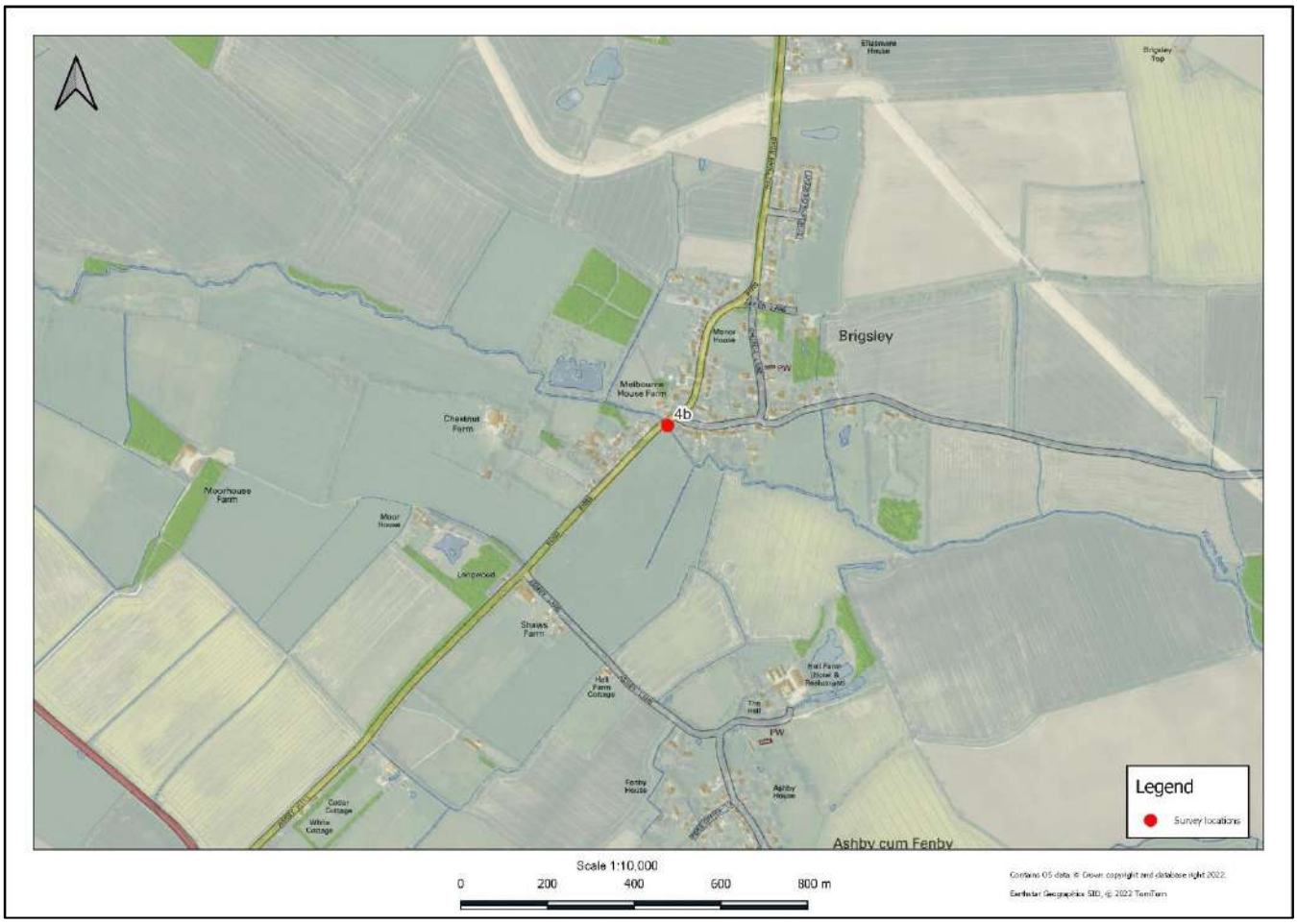


Figure 11-11: Location of Site 4b

11.6.1 Waithe Beck has been straightened through the length on which Site 4b is located. Historic OS mapping dating from 1907 indicates that the straightening at Site 4b occurred prior to this date. There has been significant straightening downstream of Brigsley since 1907, along with the straightening of the length immediately upstream of Site 4b.

11.6.2 Turbidity was high during the survey indicating the presence of fine sediment, with likely input from adjacent agricultural land use and the local road network. Although this length was of watercourse had been modified, it still displayed pool riffle sequences. The bed was comprised of cobbles and larger gravels overlain by silty deposits in many parts. Artificial bank reinforcement was present upstream of the B1203 road crossing. Downstream of the road crossing, the banks were approximately 1.2 m high, with the right bank forming a raised embankment disconnecting the watercourse from the floodplain. The banks were vegetated with grasses and herbs, with some trees on the left bank.

Photograph 11-17: Waithe Beck (Site 4b) View Upstream

Photograph 11-18: Waithe Beck (Site 4b) View Downstream

11.7 Black Leg Drain (Site 6a)

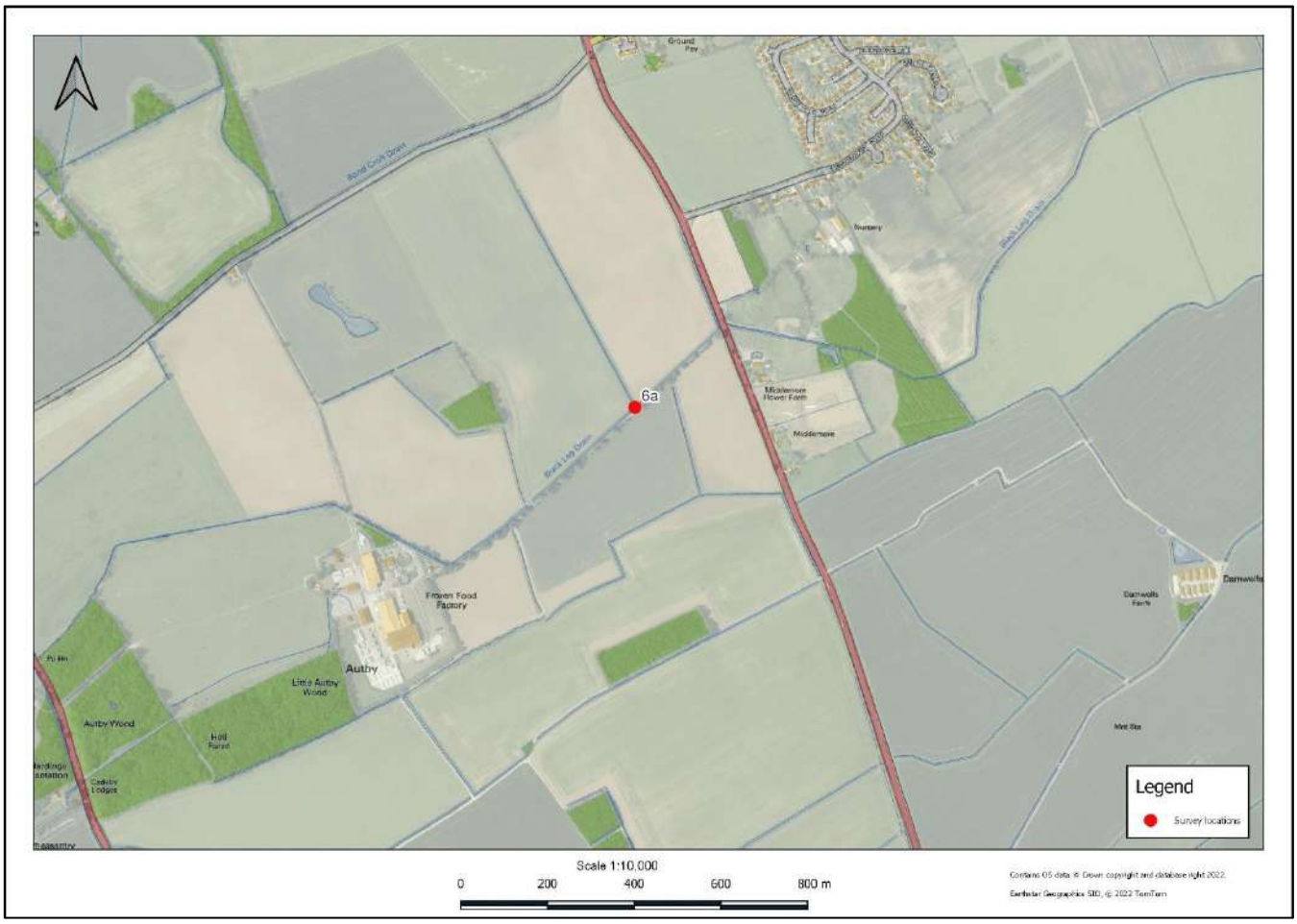


Figure 11-12: Location of Site 6a

11.7.1 Black Leg Drain follows the same course as was indicated on the 1907 OS mapping, suggesting any modifications occurred prior to this date.

11.7.2 Black Leg Drain through this length comprised a straightened channel bordered by a narrow access road set within flat, open, agricultural land. The bed was silty and occasionally vegetated with willowherb, with heavier willowherb growth at the channel margins. The steep banks were approximately 1.8 m high and vegetated with grasses. Minor localised sinuosity driven by vegetation growth had developed, with vegetation providing minor variation in flow types. The bank tops were primarily comprised of grasses, with the access road also being present on the right. Some planted trees were present on the right bank top, spaced at approximately 10 m intervals.

Photograph 11-19: Black Leg Drain (Site 6a) View Downstream

Photograph 11-20: Black Leg Drain (Site 6a) View Upstream

11.8 Poulton Drain (Site 7a)

Figure 11-13: Location of Site 7a

11.8.1 According to historic OS mapping dating from 1907, there have been no significant modifications to the planform of Poulton Drain since this date, apart from the creation of a pond upstream of Site 7a near Ings Lane which appears to be formed from a small impounding structure on the watercourse. A review of aerial imagery indicated that this pond may not always be fully wetted. There also appears to be another small impounding structure further upstream.

11.8.2 Poulton Drain was set within an area of flat agricultural land. The watercourse had steep banks of approximately 2 m height, disconnecting it from the floodplain. The bed was heavily vegetated in parts, with reeds and herbs occupying much of the width and having a direct impact on flow. The banks were vegetated with herbs and grasses, with lone trees present in parts. The bed appeared to be silty and flow was pooled.

Photograph 11-21: Poulton Drain (Site 7a) View Downstream

11.9 Yarburgh Beck (Site 8b)

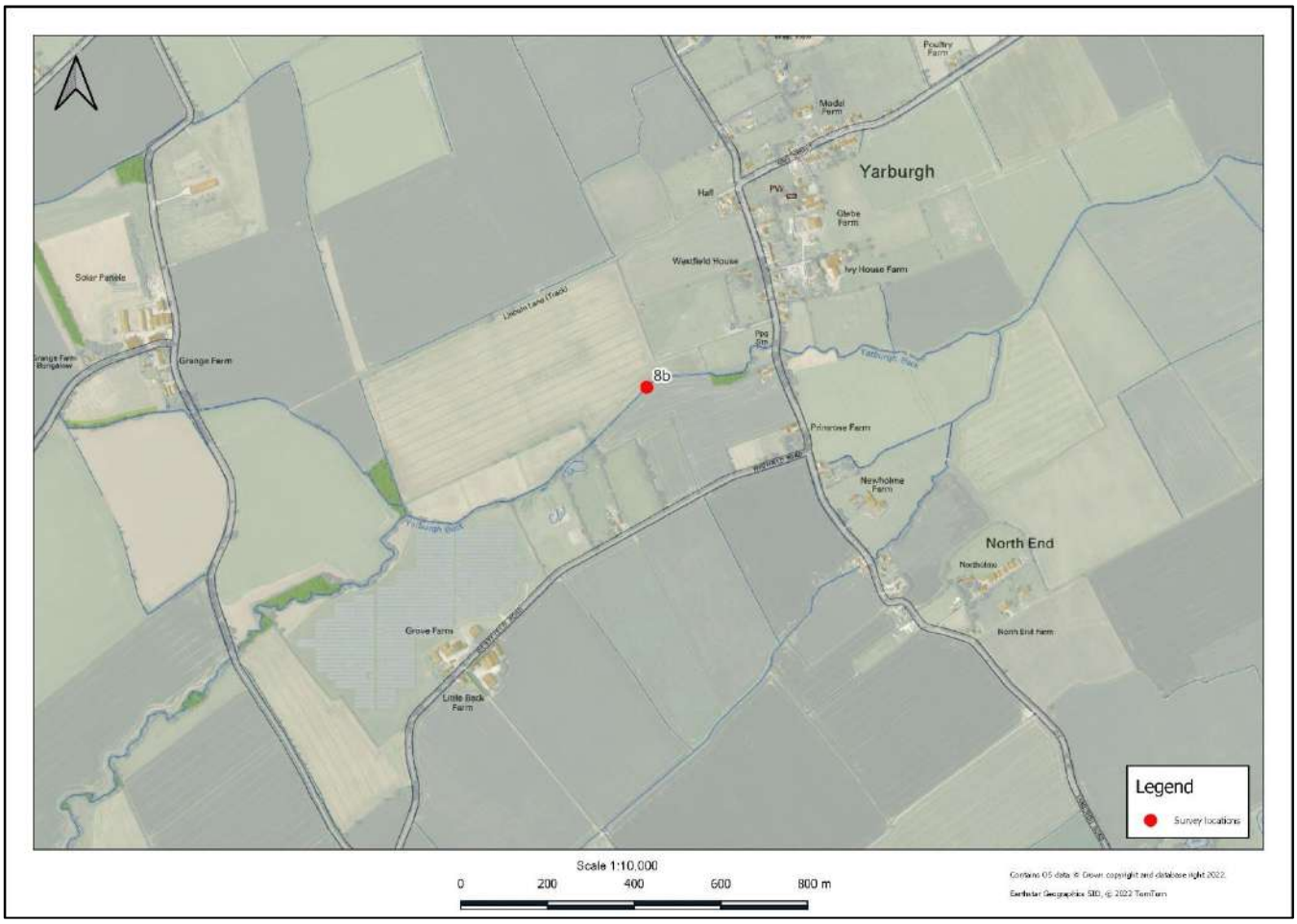


Figure 11-14: Location of Site 8b

11.9.1 Yarburgh Beck has been straightened near to Site 8b, including straightening immediately downstream of the site which has occurred after the 1907 OS mapping was published.

11.9.2 Through this length Yarborough Beck displayed a similar character as many of the watercourses in this area. Adjacent land was flat and was comprised of agricultural fields. The watercourse had steep banks of approximately 1.5-2 m height, disconnecting it from the floodplain. The banks were vegetated with herbs and grasses with occasional trees. Some herb growth was present on the channel bed and margins. The bed appeared to be silty.

Photograph 11-22: Yarburgh Beck (Site 8b) View Upstream

11.10 Louth Canal

11.10.1 Louth Canal was viewed at two proposed crossing locations on the main channel.

11.10.2 The Louth Canal, formerly known as the Louth Navigation, is a straight, artificial water body which follows the course of the River Ludd. It is connected to the River Ludd in Louth and receives much of its water from the river. The canal was completed in 1770 but ceased to be used as a navigation in the 1920s.

11.10.3 Specific details of each viewing locations are shown in the following subsections.

Louth Canal (Site 9a)

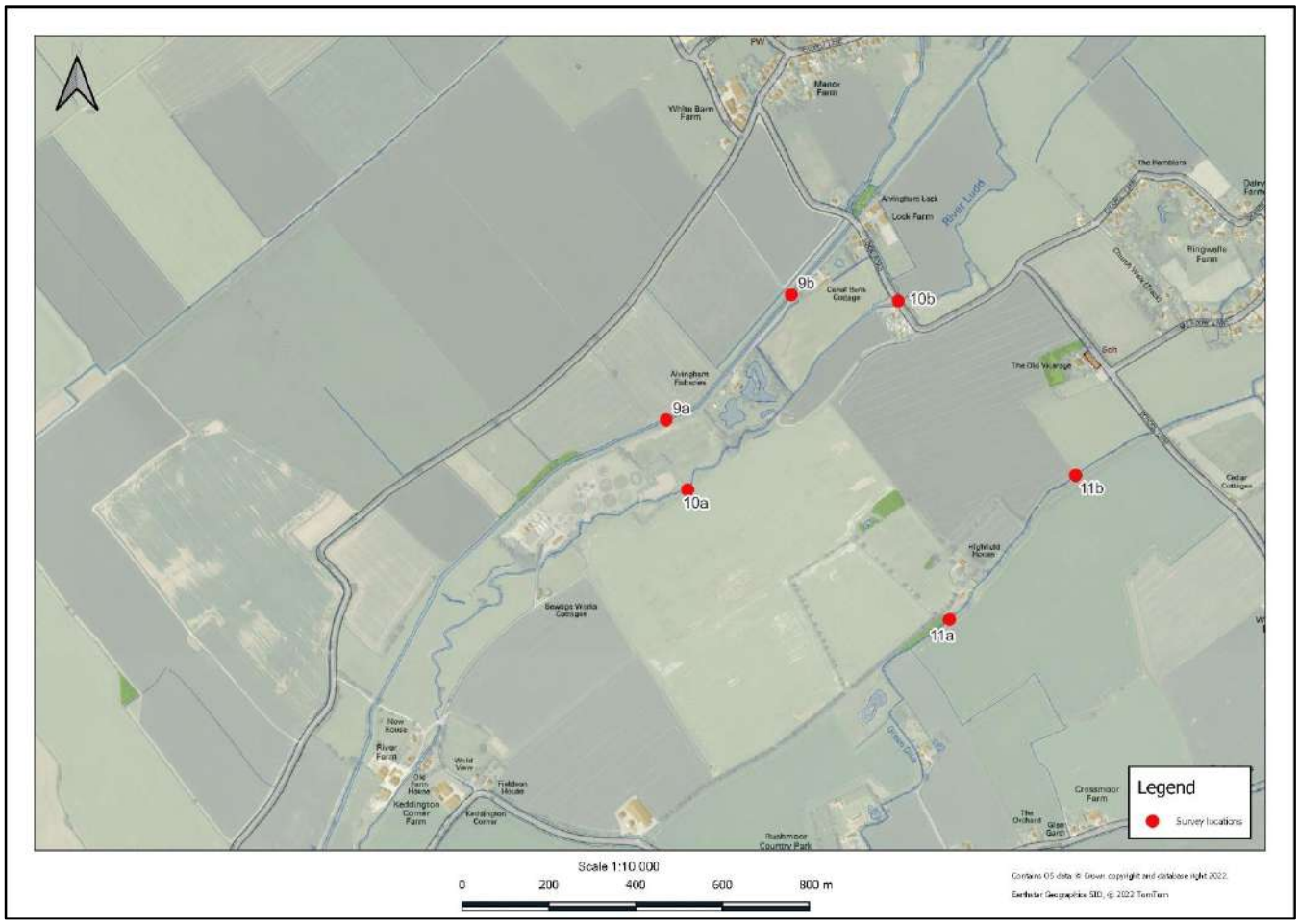


Figure 11-15: Location of Site 9a

11.10.4 The Louth Canal appears to be an artificial water body which generally follows the course of the River Ludd through this area. The canal was straight with a uniform cross section. The bed was heavily vegetated with submerged broadleaved macrophytes, with some reed growth at the channel margins. Flow was generally smooth and laminar or there was no perceptible flow. Since the canal is artificial and low energy, it is assumed that the bed would likely be silty. The banks were steep and approximately 1.5-2 m high, and were vegetated with grasses and herbs. A narrow tree line was also present on the left bank and bank top.

Photograph 11-23: Louth Canal (Site 9a) View Upstream

Photograph 11-24: Louth Canal (Site 9a) View Downstream

Louth Canal (Site 9b)

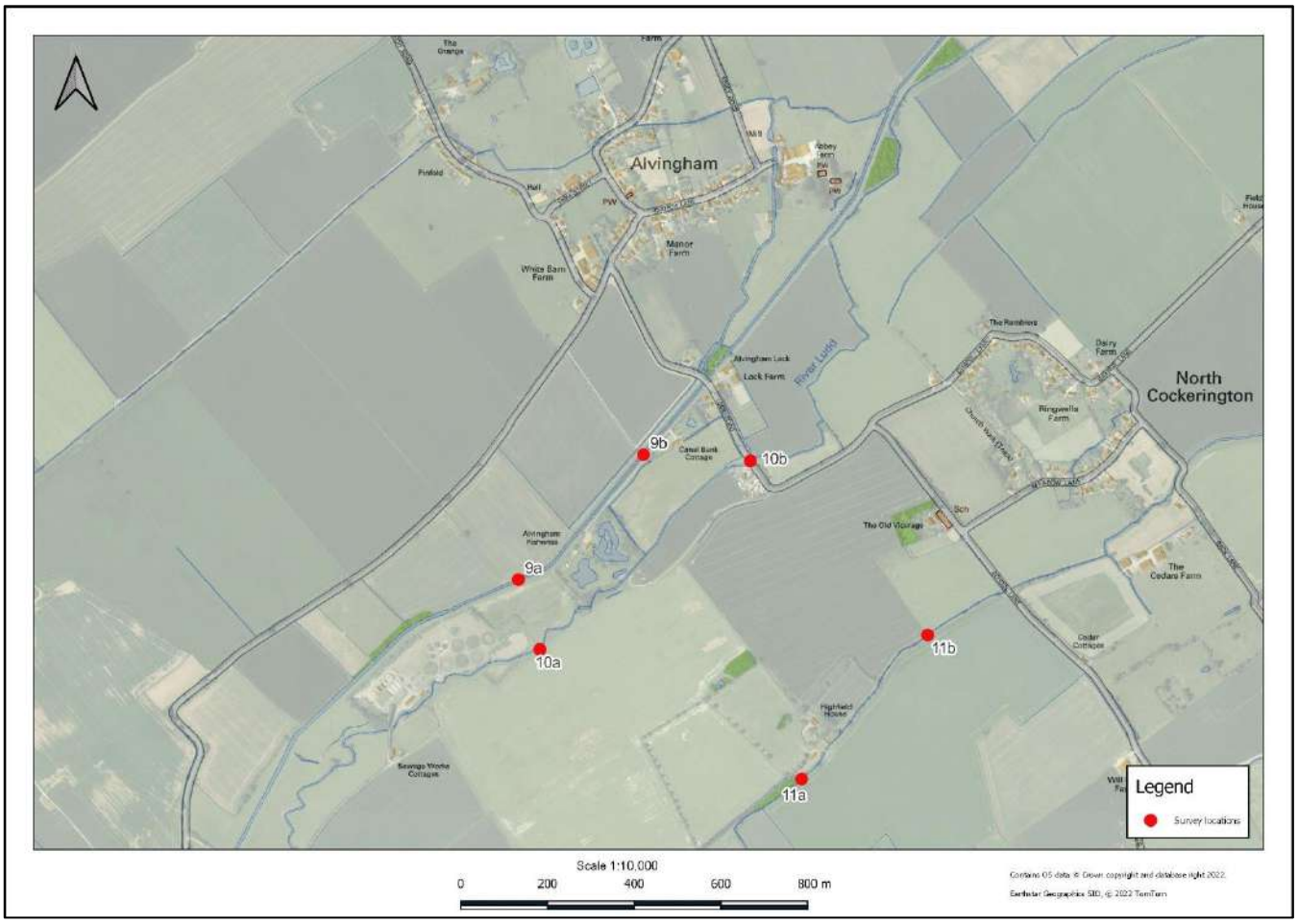


Figure 11-16: Location of Site 9b

11.10.5 Site 9b is of the same character as Site 9a, although the presence of trees on the left bank was now gone.

Photograph 11-25: Louth Canal (Site 9b) View Upstream

Photograph 11-26: Louth Canal (Site 9b) View Downstream

11.11 River Ludd

11.11.1 The River Ludd could not be viewed at the proposed crossing location, and therefore an additional location was added on the main channel.

11.11.2 The River Ludd has been modified and straightened in numerous locations within the study area, with some planform modifications occurring after the 1907 OS mapping was published. However, the most significant modifications are likely to have occurred as part of the construction of the Louth Canal/Navigation in the 18th century. Most of the flow from the River Ludd enters the canal in Louth.

11.11.3 Specific details of each viewing locations are shown in the following subsections.

River Ludd (Site 10a)

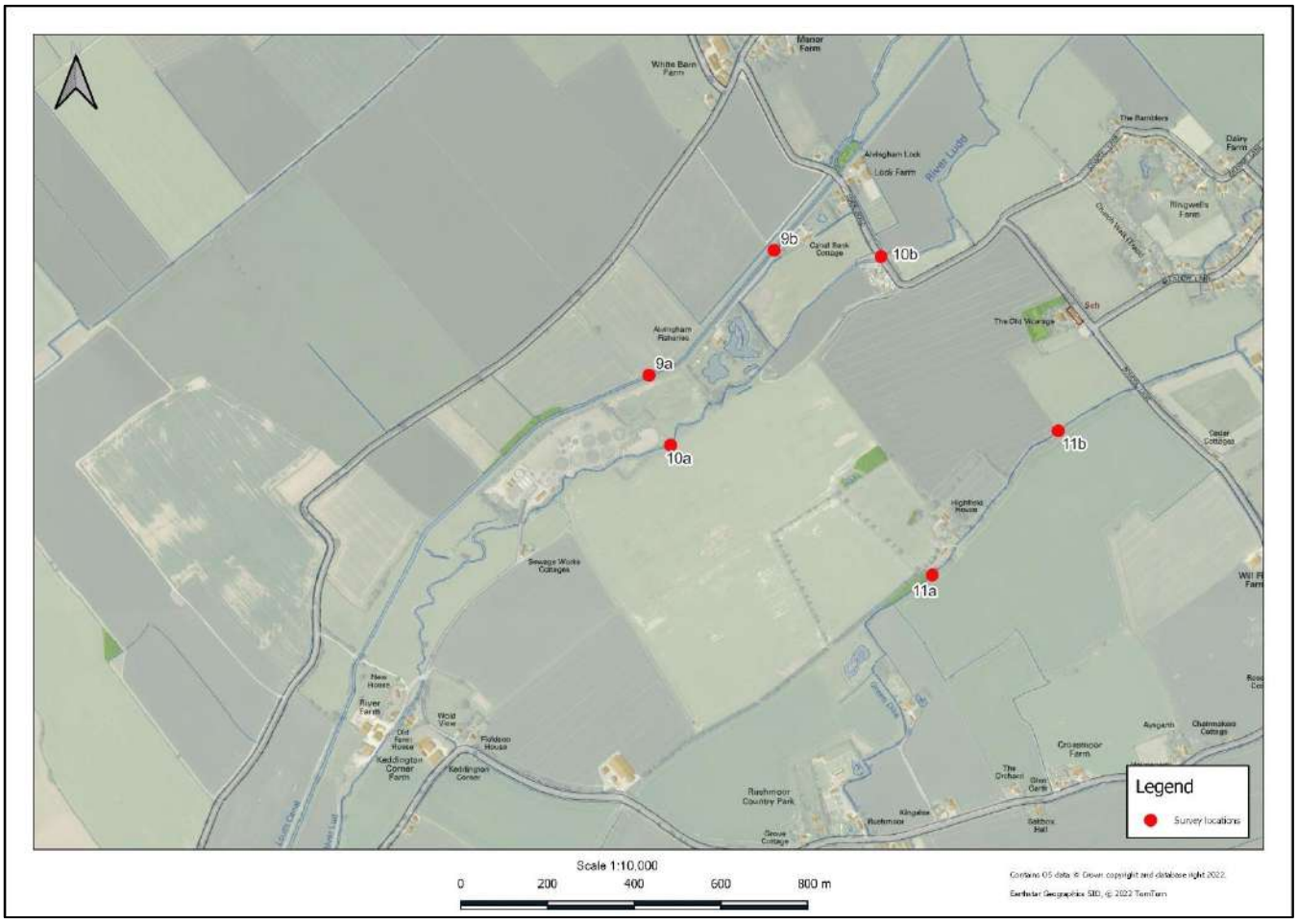


Figure 11-17: Location of Site 10a

11.11.4 Vegetation prevented access directly to the watercourse to observe the bed. A large embankment of approximately 3 m height was present on the right bank. Bank vegetation was mostly comprised of grasses and herbs. Bank vegetation was overhanging and shading the channel.

Photograph 11-27: River Ludd (Site 10a) View of Channel

River Ludd (Site 10b)

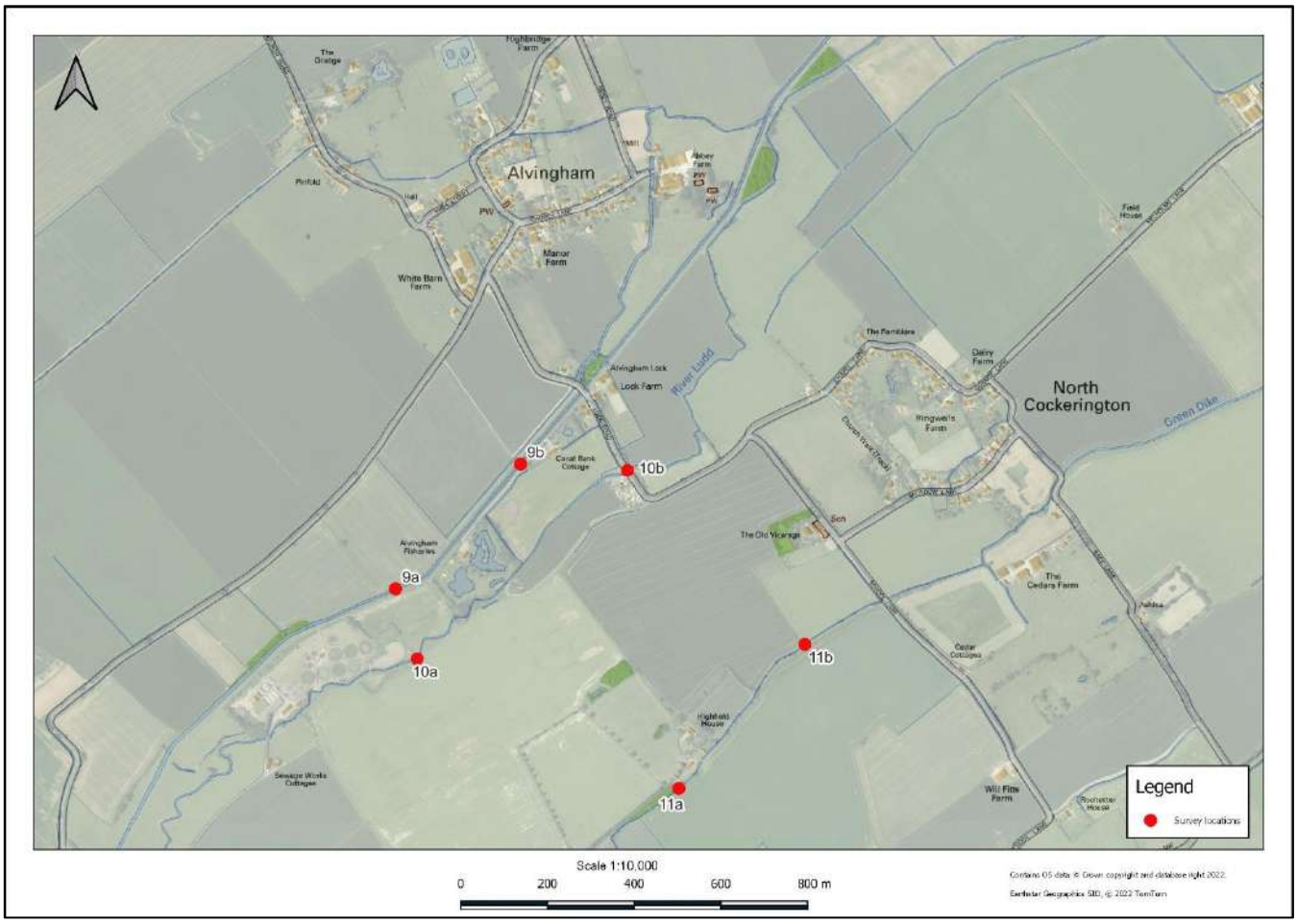


Figure 11-18: Location of Site 10b

11.11.5 Access to Site 10b was not possible so the watercourse was viewed further downstream at the crossing of Lock Road. A sluice weir was present at this location impounding flow upstream of it. The watercourse had been straightened in this location, with palaeomeanders visible on aerial imagery on the left floodplain upstream of the road crossing. A linear channel is connected on the left bank at the sluice weir which appears to be connected to the Louth Canal, and likely takes water from the River Ludd to the canal. This sluice weir and offtake channel resulted in little water being present in the channel downstream. The banks were approximately 1.5-2 m high and vegetated with grasses and herbs. Linear reeds were growing at the channel margins and shading the channel. Surrounding land use was agricultural fields.

Photograph 11-28: River Ludd (Site 10b) Sluice Structure

Photograph 11-29: River Ludd (Site 10b) View Upstream

Photograph 11-30: River Ludd (Site 10b) View Downstream

11.12 Green Dike

11.12.1 Green Dike was viewed at two locations.

11.12.2 Green Dike appears to have been straightened historically, although historic OS mapping from 1907 indicates that the watercourse followed the same alignment then as it does at present, so any straightening occurred prior to this date.

Green Dike (Site 11a)

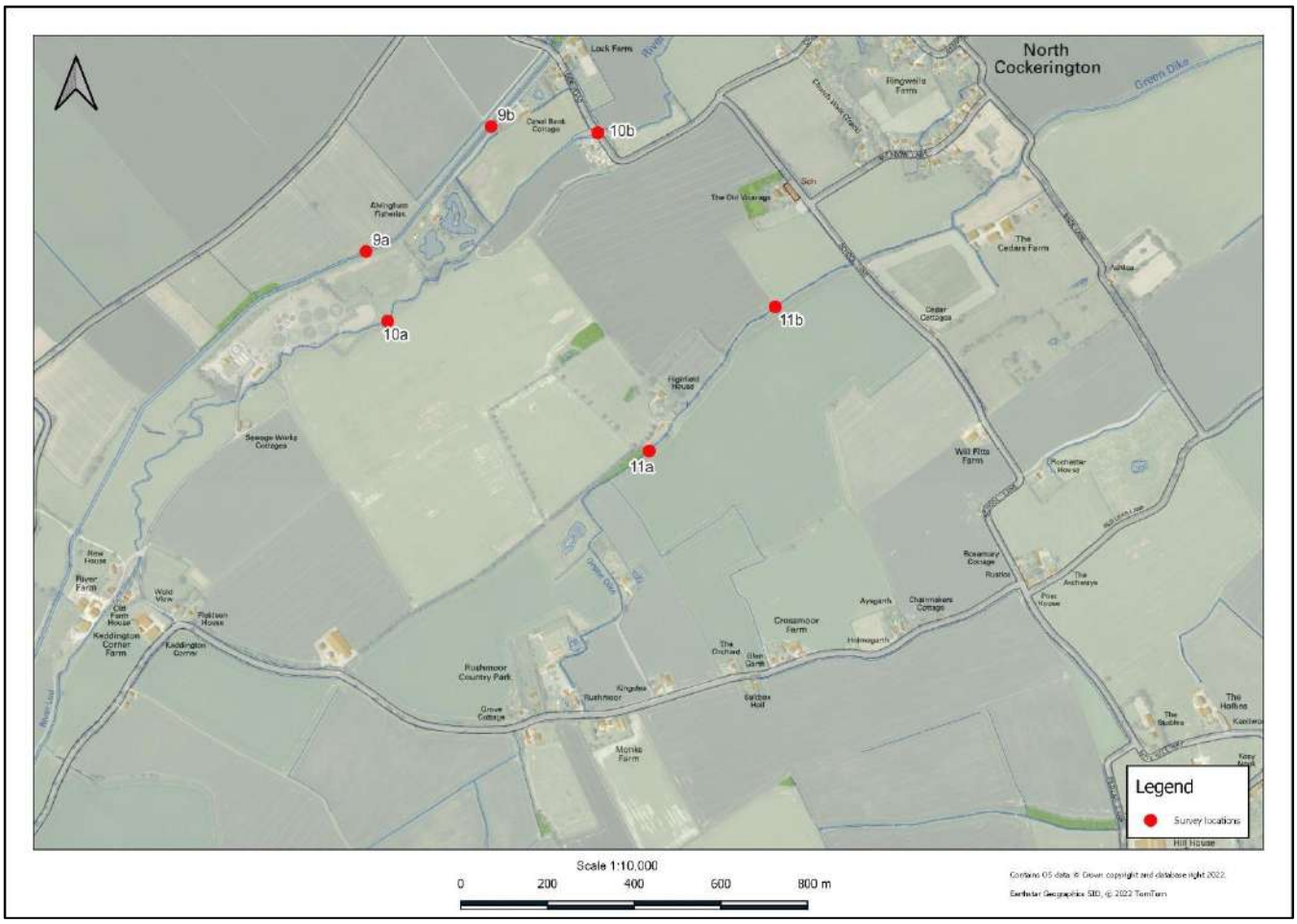
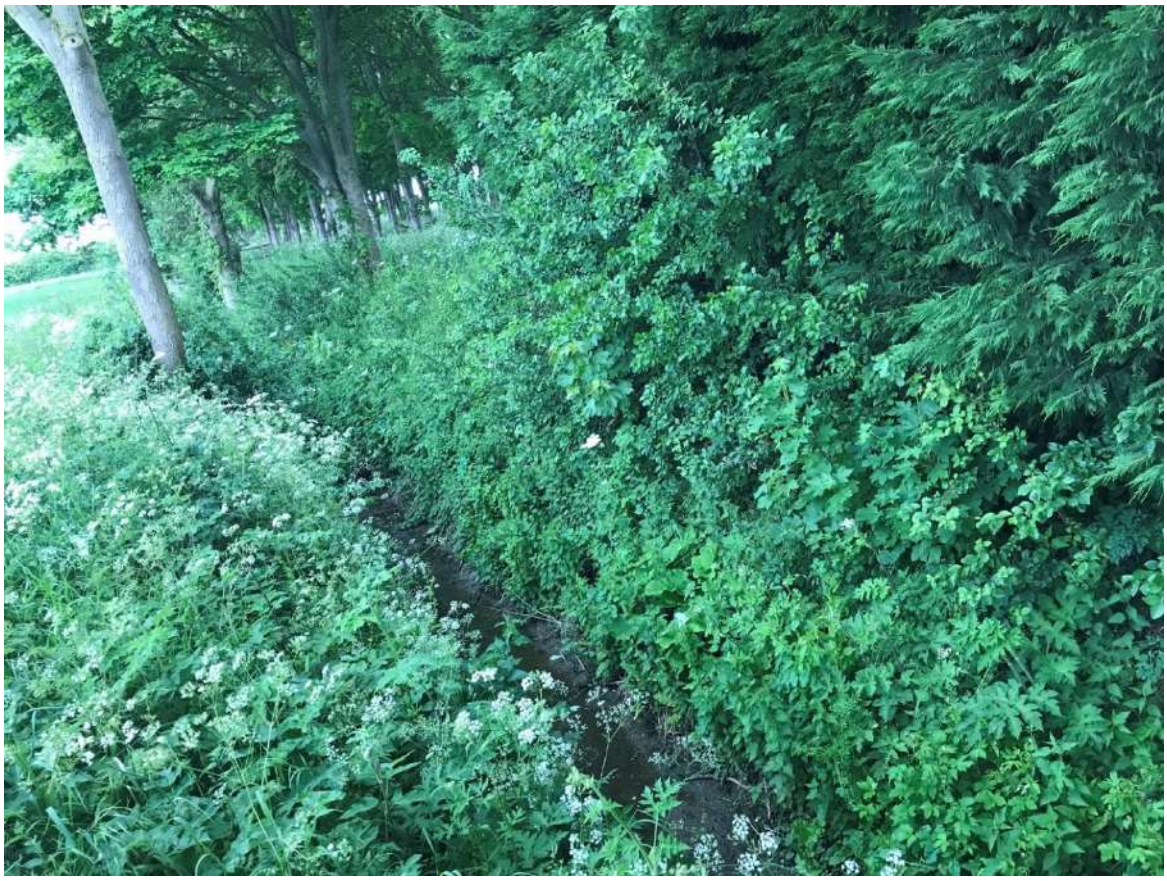


Figure 11-19: Location of Site 11a

11.12.3 Green Dike through this length was formed of a small linear drain set within flat agricultural fields and bordered by a narrow strip of woodland. There was very little flow at the time of survey, with some parts being dry and shallow standing water being present elsewhere. The bed was silty. The banks were shallow, approximately 0.3-0.5 m high, and vegetated with herbs, grasses, shrubs, and trees.



Photograph 11-31: Green Dike (Site 11a) View Upstream

Photograph 11-32: Green Dike (Site 11a) View Downstream

Green Dike (Site 11b)

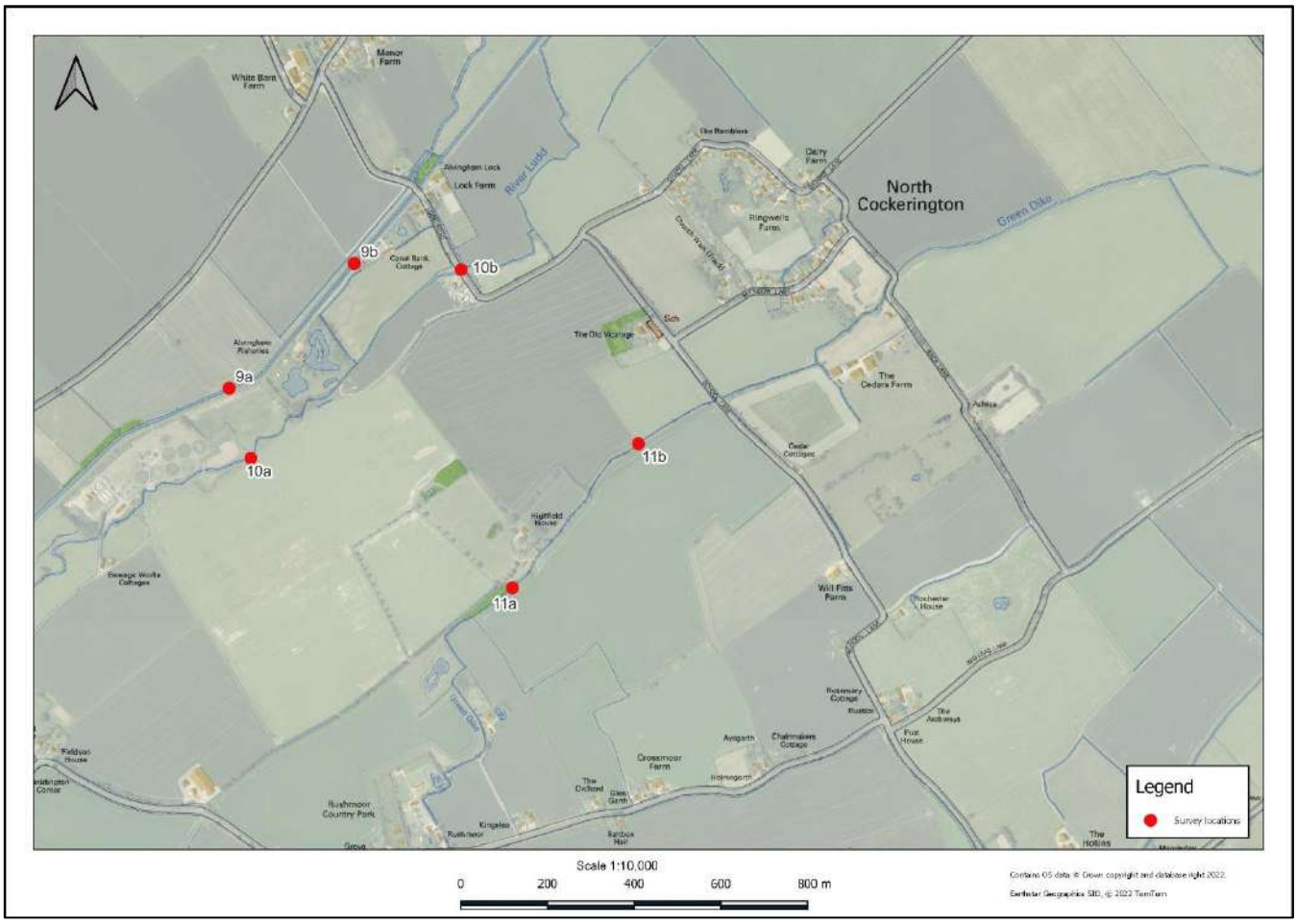


Figure 11-20: Location of Site 11b

11.12.4 Green Dike at this site displayed a similar character to Site 11a, although it was no longer bordered by woodland and the channel bed was vegetated with reeds and some other herbs and grasses. The banks were also steeper and higher through this length, being up to approximately 1 m in height.

Photograph 11-33: Green Dike (Site 11b) View Upstream

Photograph 11-34: Green Dike (Site 11b) View Downstream

11.13 Harrowsea Drain (Site 12b)

Figure 11-21: Location of Site 12b

11.13.1 Harrowsea Drain has been historically straightened along field boundaries prior to the publication of the 1907 OS mapping. Numerous artificial field drains join Harrowsea Drain along its course.

11.13.2 Harrowsea Drain comprised a small agricultural drain. It was mostly dry at the time of survey, with a small trickle of water and some standing water in parts. Bed substrate was comprised of silt. The banks were approximately 0.5-1.5 m high, With the left bank generally being higher. The left bank was vegetated with grasses and herbs while the right bank vegetation comprised grasses, herbs, shrubs and trees.

Photograph 11-35: Harrowsea Drain (Site 12b) View Downstream

11.14 Grayfleet Drain (Site 13b)

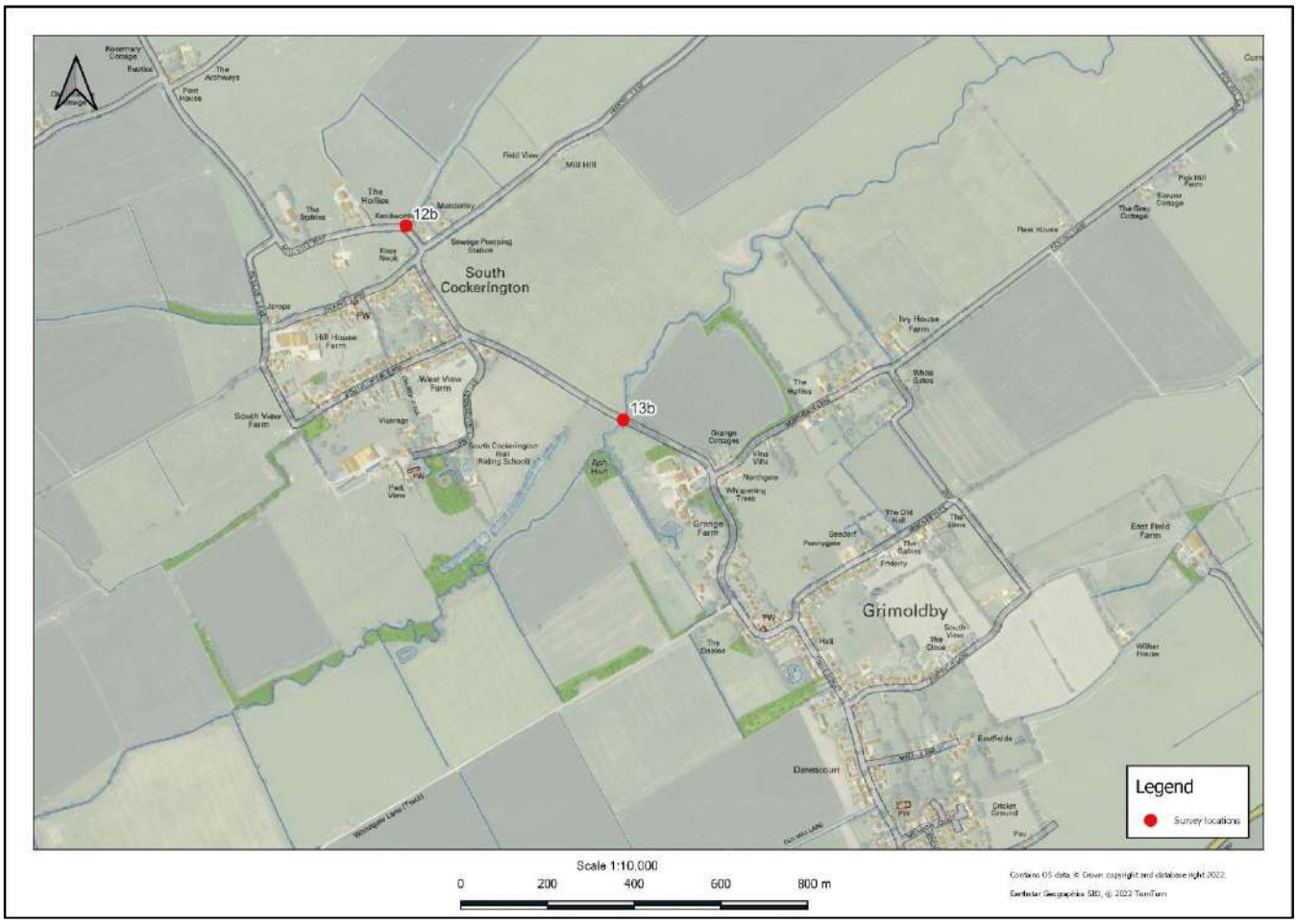


Figure 11-22: Location of Site 13b

11.14.1 Grayfleet Drain has been straightened in several places since the publication of the 1907 OS map. This is particularly noticeable immediately downstream of the road crossing at Site 13b.

11.14.2 The watercourse was heavily incised, with banks of approximately 4-5 m height completely disconnecting the watercourse from the surrounding land. Although the bed appeared to be silty and the water quite turbid, a small mid-channel gravel deposit was visible suggesting that there may be gravels underlying the silt. Bank vegetation was comprised of grasses and herbs, with trees present on the right bank. Surrounding land use comprised agricultural fields. An existing pipe crossing was present at this site.

Photograph 11-36: Grayfleet Drain (Site 13b) View Downstream

11.15 Sykes Drain (Site 14b)

Figure 11-23: Location of Site 14b

11.15.1 Sykes Drain has evidently been straightened, however this occurred prior to the publication of the 1907 OS map. Palaeochannels are visible on aerial imagery in the adjacent fields upstream of the confluence with Grayfleet Drain.

11.15.2 Sykes Drain appeared to have been heavily modified for agricultural drainage with banks being steep and approximately 2 m high upstream of the Willow Row Bank road crossing. The banks were steep downstream of the road crossing but were only approximately 1.5 m high. Water was present within the channel but there was no perceptible flow. The bed was quite heavily vegetated with reeds and appeared to be silty. Approximately 20 m downstream of the site work had taken place on the channel, with both the bed and banks being stripped of vegetation.

Photograph 11-37: Sykes Drain (Site 14b) View Upstream

Photograph 11-38: Harrowsea Drain (Site 12b) View Downstream

11.16 Head Dike Drain (Site 15)

Figure 11-24: Location of Site 15

11.16.1 Head Dike Drain follows the same straight alignment on the 1907 OS map as it does at present, indicating that any planform modification occurred prior to this date.

11.16.2 Head Dike Drain was a linear field drain. The channel itself could not be observed fully due to dense vegetation. Reeds, grasses and herbs, and some trees were growing within and adjacent to the channel. Surrounding land was flat agricultural fields.

Photograph 11-39: Head Dike Drain (Site 15) View Upstream

Photograph 11-40: Head Dike Drain (Site 15) View Downstream

11.17 Long Eau (Site 16b)

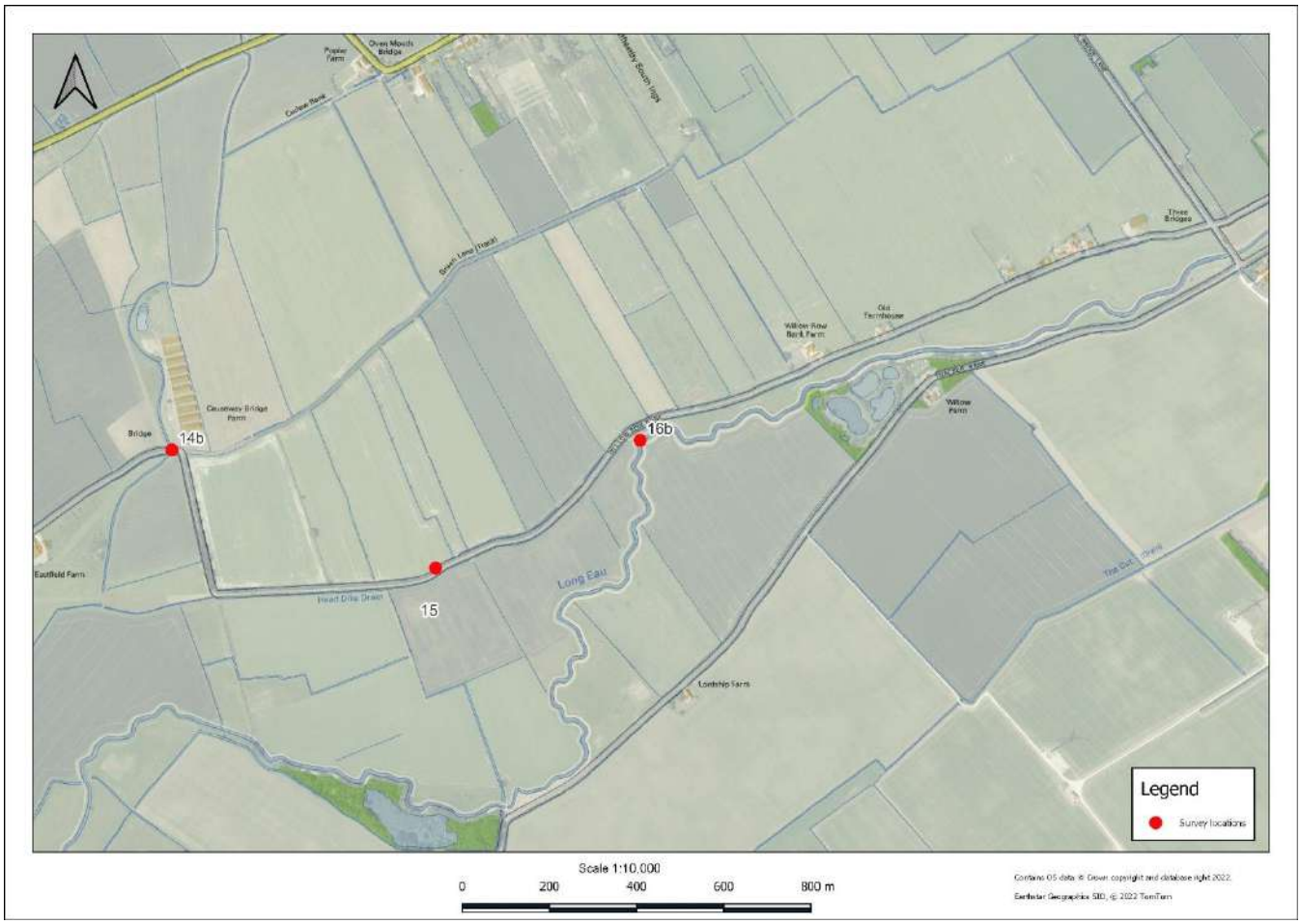


Figure 11-25: Location of Site 16b

11.17.1 Long Eau follows the same sinuous course as it did in 1907 according to historic OS mapping. There are some areas of straightening that evidently occurred prior to 1907.

11.17.2 The watercourse was observed where it flows adjacent to Willow Row Bank. Although it displays a more natural sinuous planform, the watercourse has still been modified with embankments on either side disconnecting it from its floodplain. The low energy nature of the watercourse coupled with embankments mean that the watercourse cannot remeander itself through the lengths that have been straightened. There was abundant reed growth at the channel margins. Bed substrate could not be observed. Surrounding land was flat agricultural fields.

Photograph 11-41: Long Eau (Site 16b) View Upstream

Photograph 11-42: Long Eau (Site 16b) View Downstream

11.18 The Cut Drain (Site 17a)

Figure 11-26: Location of Site 17a

11.18.1 The Cut Drain has been artificially straightened, displaying a linear planform. However, this modification evidently occurred prior to the publication of the 1907 OS map.

11.18.2 The drain was quite large at approximately 4 m bankfull width. The banks were steep and high (approximately 2 m) and vegetated with grasses and herbs. There was some marginal reed growth, and other submerged macrophytes appeared to be growing on the channel bed. Turbidity was quite high indicating the presence of fine sediment. The bed was not visible so substrate could not be observed, although it is assumed that it would likely be silty due to the high turbidity, slow flow and general low gradient, low energy conditions. A small road bordered the drain on one side, with agricultural fields on the other.

Photograph 11-43: The Cut (Site 17a) View Upstream

Photograph 11-44: The Cut (Site 17a) View Downstream

11.19 Two Mile Drain (Site 18)

Figure 11-27: Location of Site 18

11.19.1 Two Mile Drain has followed the same linear course since the publication of the 1907 OS map, indicating that any straightening occurred prior to this date.

11.19.2 Two Mile Drain comprised a linear channel set within flat agricultural land. It was connected to the same network of drainage channels as The Cut Drain. It had steep high banks of approximately 2-3 m. Algae was present in the channel indicating the input of nutrients. There was some marginal growth of grasses and other submerged broadleaved macrophytes were present on the bed. The bed appeared to be silty and sandy.

Photograph 11-45: Two Mile Drain (Site 18) View Upstream

Photograph 11-46: Two Mile Drain (Site 18) View Downstream

11.20 Old Engine Drain (Site 21b)

Figure 11-28: Location of Site 21b

11.20.1 Old Engine Drain has been historically straightened prior to the publication of the 1907 OS map, likely to connect it to the Gayton Pumping Engine.

11.20.2 Old Engine Drain is also part of the same linear network of drainage channels as the previous two sites. The drain displayed a similar character to The Cut Drain, with a similar bank profile and height. As with The Cut Drain, reeds were abundant at the channel margins, and submerged macrophytes were present on the bed. Turbidity was quite high, and as with the previous site, the bed was likely to be silty.

Photograph 11-47: Old Engine Drain (Site 21b) View Upstream

Photograph 11-48: Old Engine Drain (Site 21b) View Downstream

11.21 Great Eau (Site 22b)

Figure 11-29: Location of Site 22b

11.21.1 The Great Eau has been historically straightened prior to the publication of the 1907 OS map. It has been connected to the artificial drainage network, receiving flow from several field drains and potentially providing flow to Old Engine Drain.

11.21.2 The Great Eau comprised a channel of approximately 6-8 m bankfull width, with banks of approximately 2 m height. The bed was silty and sandy, and heavily vegetated with submerged linear leaved macrophytes. Flow was smooth and the water very clear. Channel margin vegetation consisted of reeds, while the banks were vegetated with grasses and herbs. Some reed growth was also observed on the channel bed. Surrounding land use was flat agricultural fields.

Photograph 11-49: Great Eau (Site 22b) View Upstream

Photograph 11-50: Great Eau (Site 22b) View Downstream

11.22 The Cut (Site 23b)

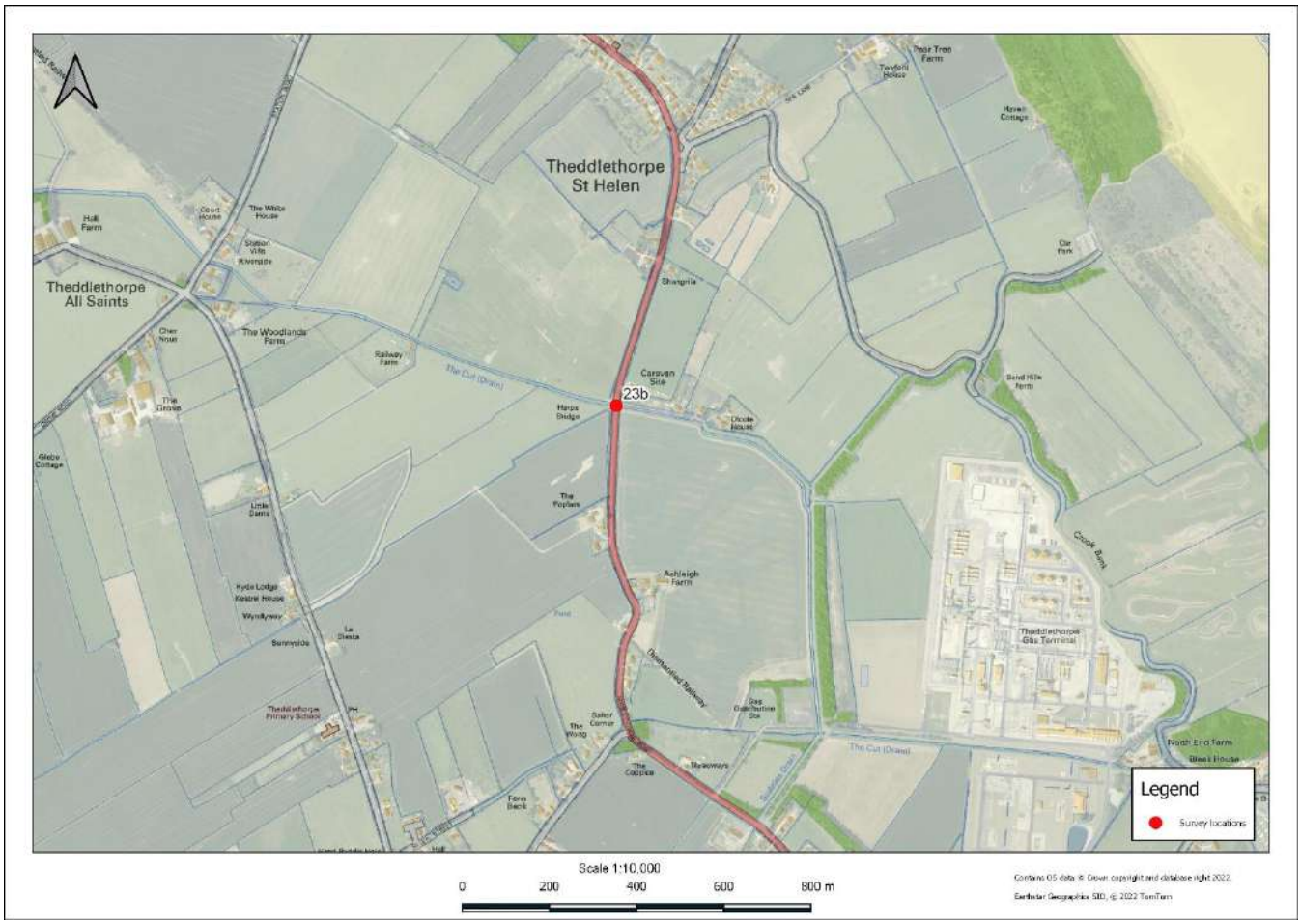


Figure 11-30: Location of Site 23b

11.22.1 The Cut follows the same linear course as indicated on the historic 1907 OS map. It has likely been straightened or artificially cut to provide space and drainage for agricultural land.

11.22.2 The Cut has been significantly modified, with a straightened and over deep channel devoid of morphological features as a result. The over deep channel was disconnected from the surrounding land, with steep, high banks of approximately 2 m height. There was no perceptible flow and the water was turbid, so it is likely that substrate was predominantly formed of silt. Water quality is likely to be an issue on the watercourse with very high algal growth which almost covered the entirety of the waters surface. Bank vegetation comprised taller grasses, while riparian vegetation was primarily agricultural farmland. A farm road was located on the left bank.

Photograph 11-51: The Cut (Site 23b) View Downstream

Photograph 11-52: The Cut (Site 23b) View Upstream