



CONSERVATION MANAGEMENT PLAN FOR BRUSSELTON RESERVOIR

**Archaeo-Environment
for the Friends of the
Stockton & Darlington
Railway**

AE-0205 April 2020



Friends of the
Stockton &
Darlington Railway



Archaeo-Environment Ltd

Archaeo-Environment Ltd
Marian Cottage
Lartington
Barnard Castle
County Durham
DL12 9BP

Tel/Fax: (01833) 650573
Email: info@aenvironment.co.uk
Web: www.aenvironment.co.uk

Summary

Brusselton Reservoir in the hamlet of Brusselton in County Durham (NGR NZ 21484 25461) was constructed as part of Brusselton incline plane ready for the opening of the Stockton & Darlington Railway in September 1825. The reservoir was built and maintained by the Stockton & Darlington Railway Company and supplied the boilers for the stationary engine at the top of the incline. The stationary engine designed by Robert Stephenson pulled large numbers of heavy wagons from the foot of the plane near Broom Mill to the top of Brusselton and then down towards Shildon where they continued their journey eastwards.

Today it is a tranquil reservoir located immediately south of the village of Brusselton, behind what is left of the engine house and the adjacent engineman's house. It is used by the Shildon Angling Club who control the access to the site.

The reservoir sits within Brusselton Conservation Area. The incline, located north of and adjacent to the reservoir, is part of a Scheduled Monument (List Entry Number: 1002315) but this statutory protection does not currently extend to the reservoir. The engine house and adjacent engineman's house are listed buildings.

This Conservation Management Plan sets out the history of the reservoir and what is significant about it. It then sets out policies and actions designed to ensure that its future management protects that significance. Those actions have largely been derived from a Structural Condition Survey and a Tree Survey which are included as appendices.

This Conservation Management Plan was supported by the Brightwater Landscape Partnership using funds from the National Lottery Heritage Fund who also supported associated training in heritage skills in how to manage and care for heritage sites.

Report author

Caroline Hardie, Archaeo-Environment Ltd

Acknowledgements

Thanks to Tracey Bellas and Glen Gibson of Shildon Town Council for access to the site and their interest in the project. To the Friends of the Stockton & Darlington Railway for commissioning the work, and to the Brightwater Landscape Partnership and the National Lottery Heritage Fund for funding the work. Thanks to David Hicks the neighbouring landowner for access to view the site from the 'outside' and to Simon Nesti of RNJ and Stephen Keene of Olivers Tree Services for their respective technical reports and last, but not least, to Fred Wright of Brusselton and the members of the Shildon Angling Club.

CONTENTS

Summary and Acknowledgements	
Introduction	3
Understanding the History of Brusselton Reservoir	5
The reservoir today	15
Gaps in our understanding	16
The Significance of Brusselton Reservoir	17
Protection and Management	18
The condition of the reservoir	18
Issues and risks	19
Policies to protect and enhance the significance of the reservoir	20
Action Plan – Capital Works	20
Action Plan – Maintenance Plan	21
Conclusion	22
Bibliography	23
Appendix 1 Definitions of Significance	
Appendix 2 Condition Survey	
Appendix 3 Tree Survey	

BRUSSELTON RESERVOIR CONSERVATION MANAGEMENT PLAN

INTRODUCTION

Brusselton Reservoir in the hamlet of Brusselton in County Durham (NGR NZ 21484 25461) was constructed as part of Brusselton incline plane ready for the opening of the Stockton & Darlington Railway in September 1825. A stationary engine designed by Robert Stephenson¹ was designed to pull large numbers of heavy wagons from the foot of the plane near Broom Mill to the top of Brusselton and then down towards Shildon. The reservoir was designed to provide water for the steam powered engine.

The reservoir sits within Brusselton Conservation Area. The incline, located north of and adjacent to the reservoir, is part of a Scheduled Monument (List Entry Number: 1002315) but this statutory protection does not currently extend to the reservoir. The engine house and adjacent engineman's house are listed buildings. Today it is a tranquil reservoir located immediately south of the village of Brusselton, behind what is left of the engine house and the adjacent engineman's house. It is used by the Shildon Angling Club who control the access to the site and owned by Shildon Town Council.

This Conservation Management Plan sets out the history of the reservoir and what is significant about it. It then sets out policies and actions designed to ensure that its future management protects that significance.

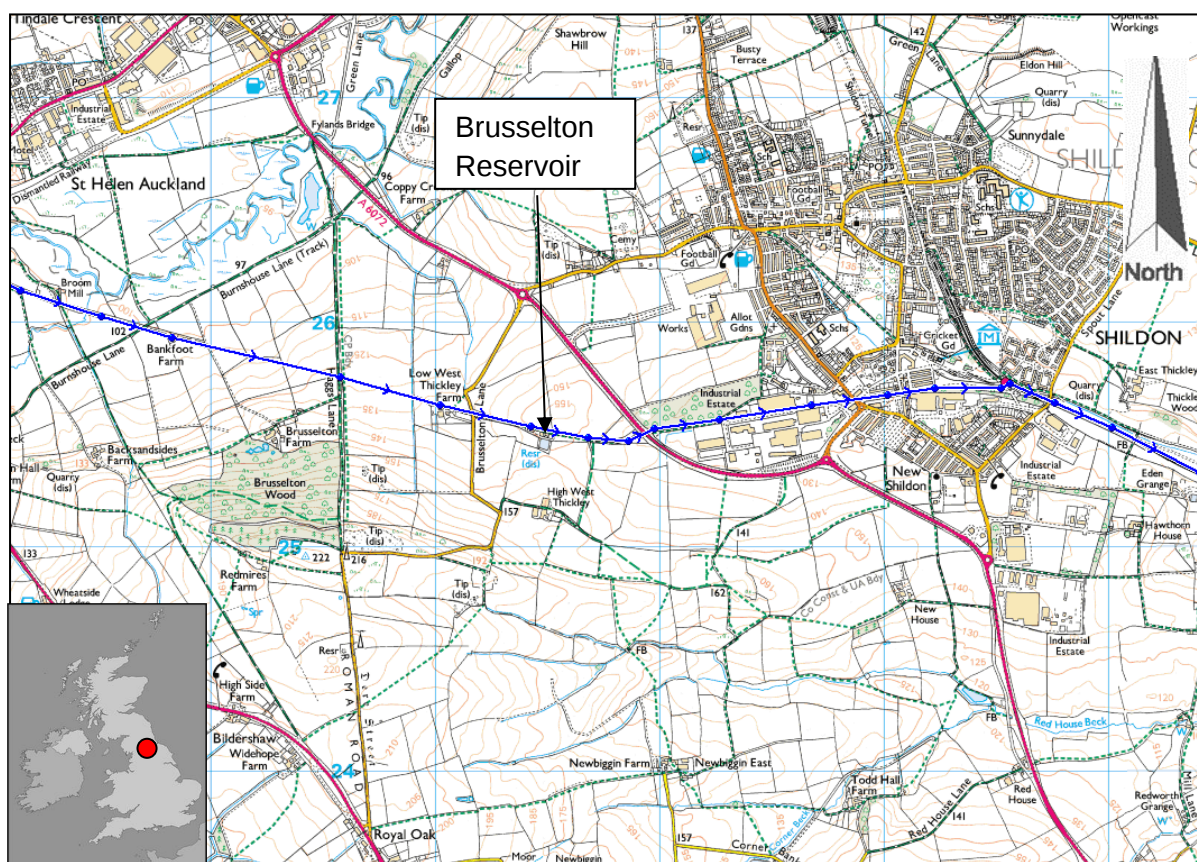


Figure 1. Location plan of Brusselton Reservoir. The blue line marks the route of the 1825 S&DR which includes the Brusselton Incline. © Crown copyright 2020. All rights reserved. Licence number 100042279

¹ Tomlinson 1914, 96

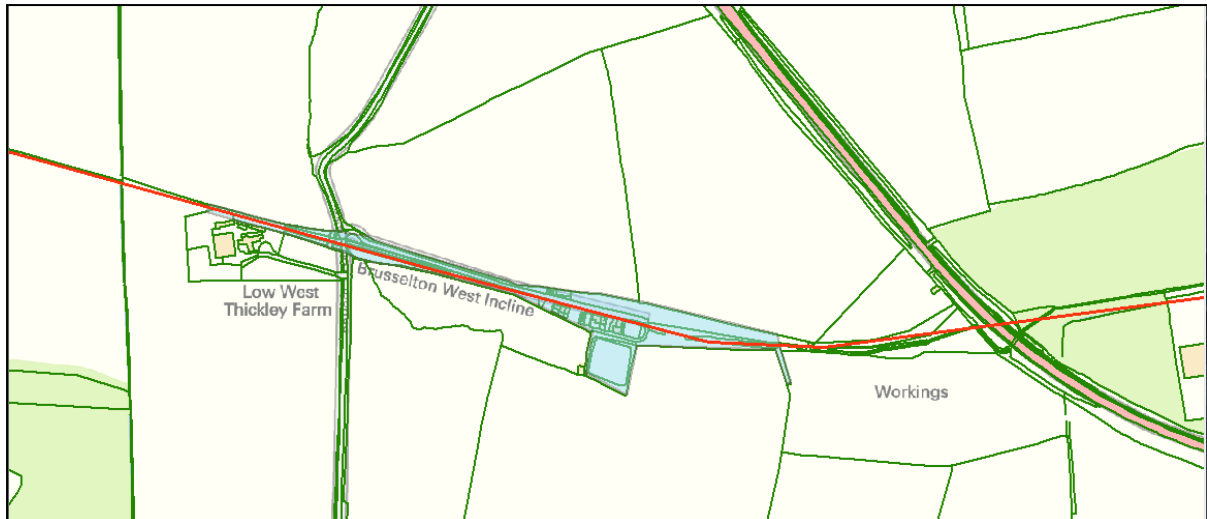


Figure 2. The extent of Brusselton Conservation Area (in blue). © Crown copyright 2020. All rights reserved. Licence number 100042279

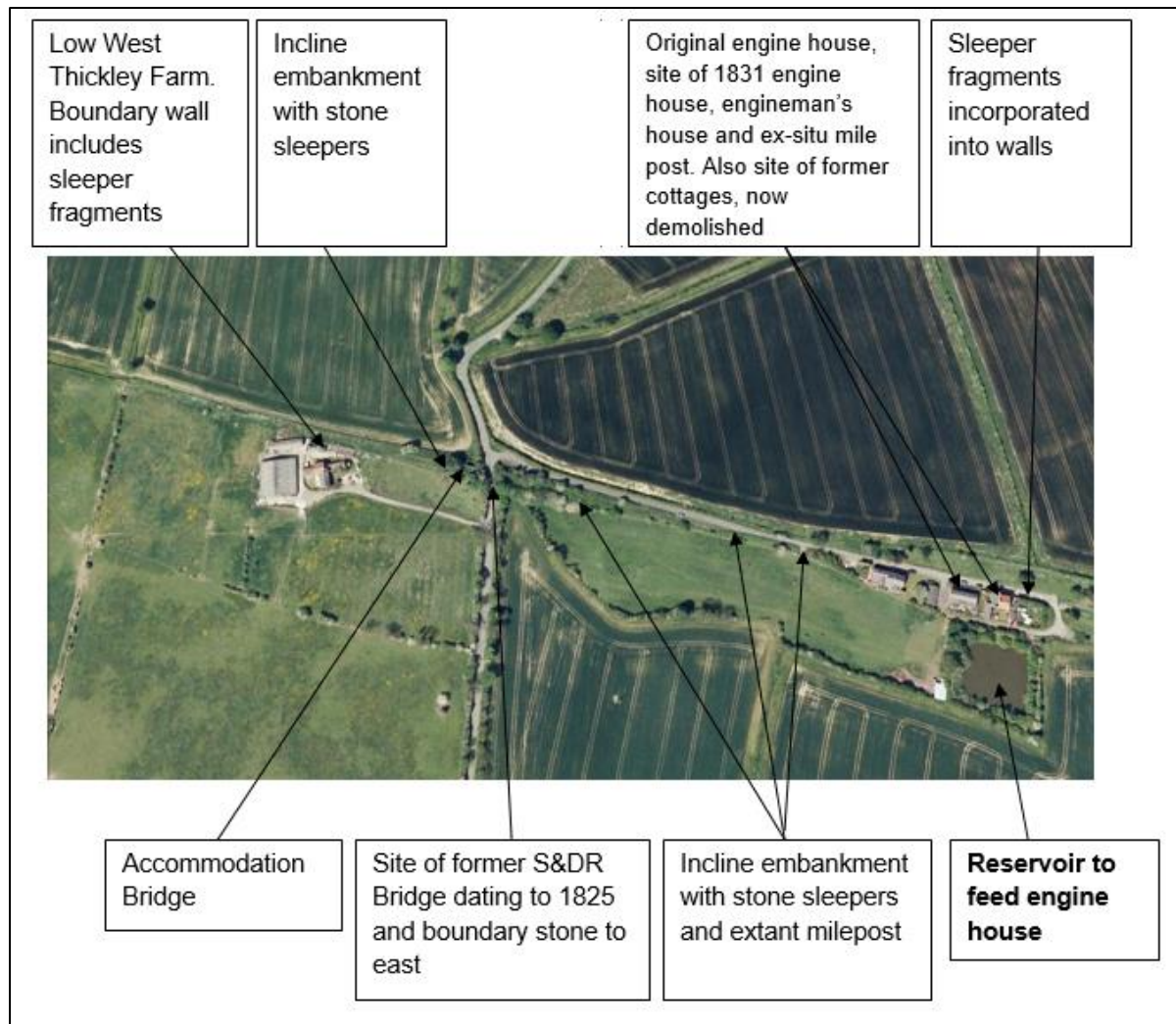


Figure 3. Aerial photograph (Google Earth) 2009 of the Brusselton Incline from Low West Thickley Farm to the engine house and reservoir showing features referred to in the text

UNDERSTANDING THE HISTORY OF BRUSSELTON RESERVOIR

When twelve wagons of coal left Phoenix Pit at Witton Park Colliery at seven in the morning on the 27th September 1825 to be hauled by horse and engine along the much awaited Stockton & Darlington Railway line, the thousands of people who attended to watch the show, knew that this was the start of something special. Horses drew the twelve wagons each carrying two tons of coal to Etherley where a combination of stationary engine and self-acting plane negotiated the Etherley ridge. At St. Helen's Auckland another wagon was added carrying bags of flour; horses then drew all thirteen wagons to the foot of Brusselton West Bank. Crowds gathered to watch the sixty horse power stationary engine haul the wagons up the incline and a few excited observers may have hitched a lift.² At the Brusselton Engine House itself (the 'permanent steam engine' according to publicity material of the time, see figure 5), the railway proprietors gathered at 8 o'clock in order to 'examine their extensive inclined planes'.³ More spectators clung on to the wagons as they rolled down the hill and headed towards Locomotion No.1 with her new coat of paint, her engine boiler fired to build up a head of steam ready to haul twenty one new wagons including the long passenger coach named Experiment. They were designed to carry 300 passengers that day, but somewhere between 450 to 600 travelled.⁴ The first overcrowded rail journey in the world set off at 9am and so the day that would change the world, was well underway.

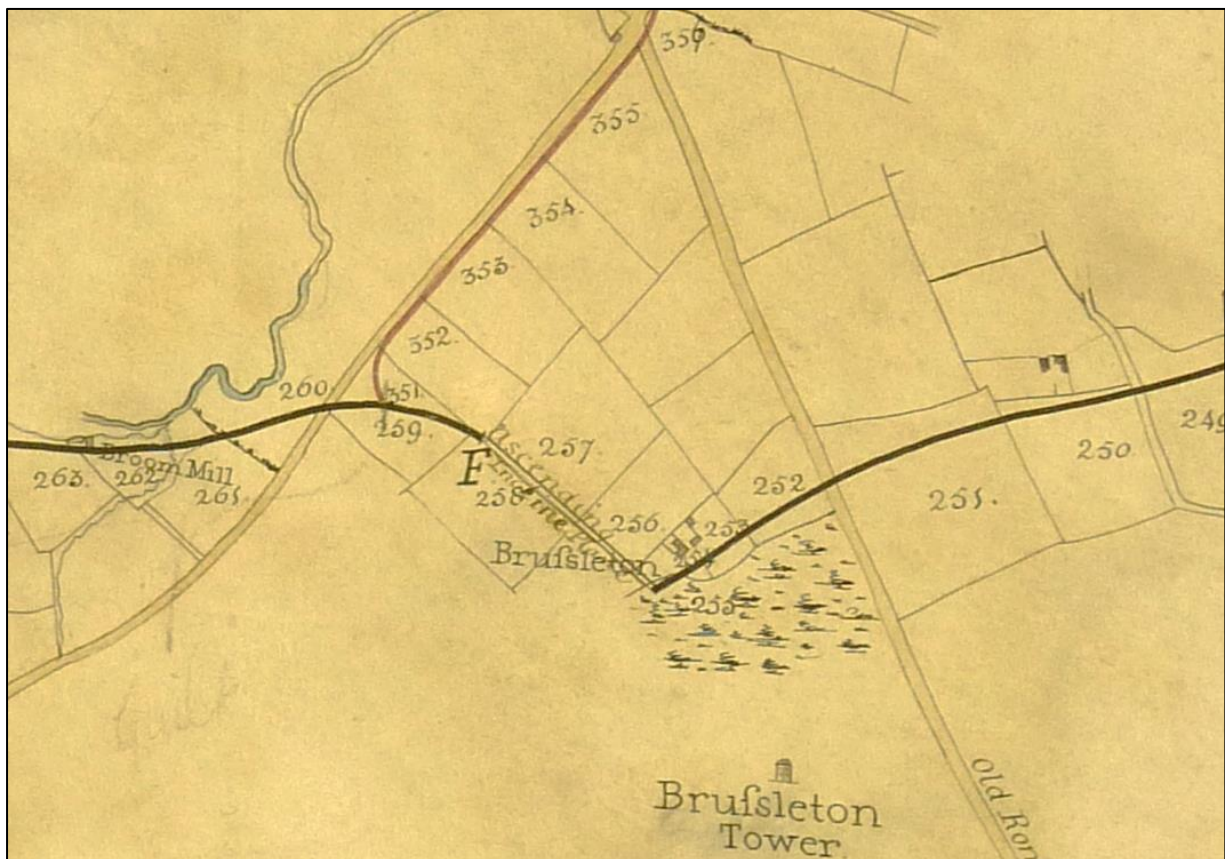


Figure 4. Overton's plan of 1820 showing the 'ascending incline' further west near Brusselton Farm and then crossing the Roman Road Dere Street (now Haggs Lane) towards Low West Thickley Farm. Stephenson was to alter this arrangement and place the incline further east as he believed that Overton's incline was too steep and would lead to accidents.

² Tomlinson 1914, 96

³ Taken from the publicity notice issued at the time (fig 5)

⁴ Ibid, 19 and Jeans 1974, 70

THE
STOCKTON & DARLINGTON
RAILWAY COMPANY

Whereby give Notice,

THAT the FORMAL OPENING of their RAILWAY will take place on the 27th instant, as announced in the public Papers.—The Proprietors will assemble at the Permanent Steam Engine, situated below BRUSSELTON TOWER, about nine Miles West of DARLINGTON, at 8 o'clock, and, after examining their extensive inclined Planes there, will start from the Foot of the BRUSSELTON descending Plane, at 9 o'clock, in the following Order:—*

1. THE COMPANY'S LOCOMOTIVE ENGINE.
2. The ENGINE'S TENDER, with Water and Coals.
3. SIX WAGGONS, laden with Coals, Merchandize, &c.
4. The COMMITTEE, and other PROPRIETORS, in the COACH belonging to the COMPANY.
5. SIX WAGGONS, with Seats reserved for STRANGERS.
6. FOURTEEN WAGGONS, for the Conveyance of Workmen and others.

At 9 o'clock The WHOLE of the above to proceed to STOCKTON.

7. SIX WAGGONS, laden with Coals, to leave the Procession at the DARLINGTON BRANCH.
8. SIX WAGGONS, drawn by Horses, for Workmen and others.
9. Ditto Ditto.
10. Ditto Ditto.
11. Ditto Ditto.

The COMPANY'S WORKMEN to leave the Procession at DARLINGTON, and DINE at that Place at ONE o'clock; excepting those to whom Tickets are specially given for YARM, and for whom Conveyances will be provided, on their Arrival at STOCKTON.

TICKETS will be given to the Workmen who are to dine at DARLINGTON, specifying the Houses of Entertainment.

The PROPRIETORS, and such of the NOBILITY and GENTRY as may honour them with their Company, will DINE precisely at THREE o'clock, at the TOWN-HALL, STOCKTON.—Such of the Party as may incline to return to DARLINGTON that Evening, will find Conveyances in waiting for their Accommodation, to start from the COMPANY'S WHARF there precisely at SEVEN o'clock.

The COMPANY take this Opportunity of enjoining on all their WORK-PEOPLE that Attention to *Sobriety* and *Decorum* which they have hitherto had the Pleasure of observing.

The COMMITTEE give this PUBLIC NOTICE, that all Persons who shall ride upon, or by the sides of, the RAILWAY, on Horseback, will incur the Penalties imposed by the Acts of Parliament passed relative to this RAILWAY.

* Any Individuals desirous of seeing the Train of Waggon descending the inclined Plane from EYBERRY, and in Progress to BRUSSELTON, may have an Opportunity of so doing, by being on the RAILWAY at ST. HELEN'S AUCLAND not later than Half-past Seven o'clock.

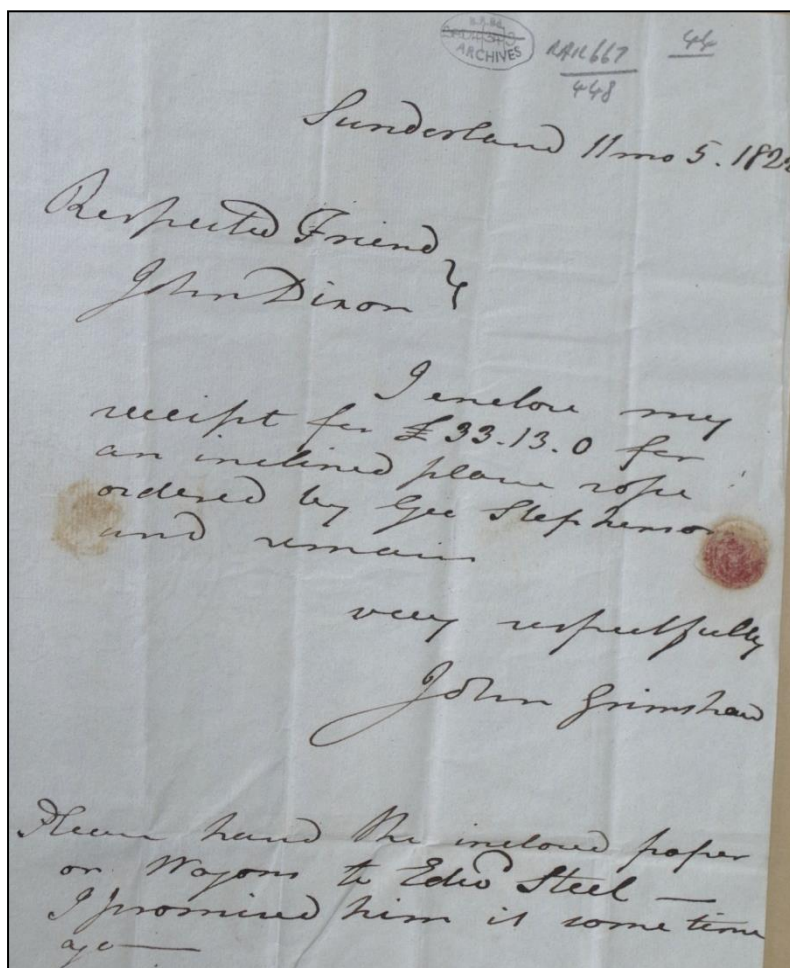
RAILWAY-OFFICE, *Sept. 19th, 1825.*

ATEINSON'S Office, High-Road, Darlington.

Figure 5. A poster promoting the formal opening of the railway on the 27th September 1825 referring to the Brusselton Incline.

The route of the S&DR line had been set out by the S&DR engineer, George Overton in 1818 which finally obtained assent from Parliament in 1821; earlier attempts being defeated because of disputes over rights of way and the death of King George III. This first section of the S&DR line was hilly with two ridges (Etherley and Brusselton) running across the landscape and would present major engineering challenges. Overton chose a route requiring a steep incline which George Stephenson thought would be dangerous. He therefore made the ascending plane three times longer to create a gentler climb. He also placed the line a little to the north at the top of the summit in order to have a greater descent from the engine which instead of requiring horses to return the empty wagons, could be hauled back by the engine.⁵ Once the wagons reached Shildon where the terrain was less challenging, they could be hitched to a locomotive and hauled the rest of the way to Stockton without further use of incline planes (although a later one was built at the Black Boy Branch in 1827).

Inclines had been negotiated innumerable times in the past, but what made this section of the S&DR unique at the time was the fact that the scale of the distance to be negotiated was five miles from Witton Park to Shildon. Robert Stephenson designed two stationary engines; one to be located on the Etherley summit and one at the Brusselton summit.



Horses pulled the wagons from the foot of the Etherley incline to the foot of the Brusselton Incline. While Etherley was designed to have an engine haul the wagons up and a self-acting incline to help them descend, Brusselton used a steam powered stationary engine to control both the incline and the decline, each with a gradient of 1 in 33 ½.

The engines were ordered from Stephenson's son's newly created company, Robert Stephenson & Co in November 1823 – its first big order. Robert was 22 years old at the time and he designed them and oversaw the works before leaving Newcastle to travel to Columbia.⁶

Figure 6. Receipt from John Grimshaw to John Dixon for incline plane rope ordered by George Stephenson (TNA RAIL 667/448)

⁵ Stephenson's justification to the S&DR Committee proposing an alternative route TNA RAIL 667/166

⁶ Tomlinson 1914, 96

The building of the engine house at Brusselton was put out to tender on the 1st May 1824 and also included the construction of Etherley Engine House. It was advertised in the local press referring prospective masons and joiners to contact either Thomas Storey at Saint Helen's Auckland or Robert Stephenson and Co Engine Builders in Newcastle where they could view the plans.⁷ The advert made no mention of the reservoirs, but Stephenson included a clause in the contract that the water supply for the engine house boilers would be provided and maintained at the railway's expense.⁸

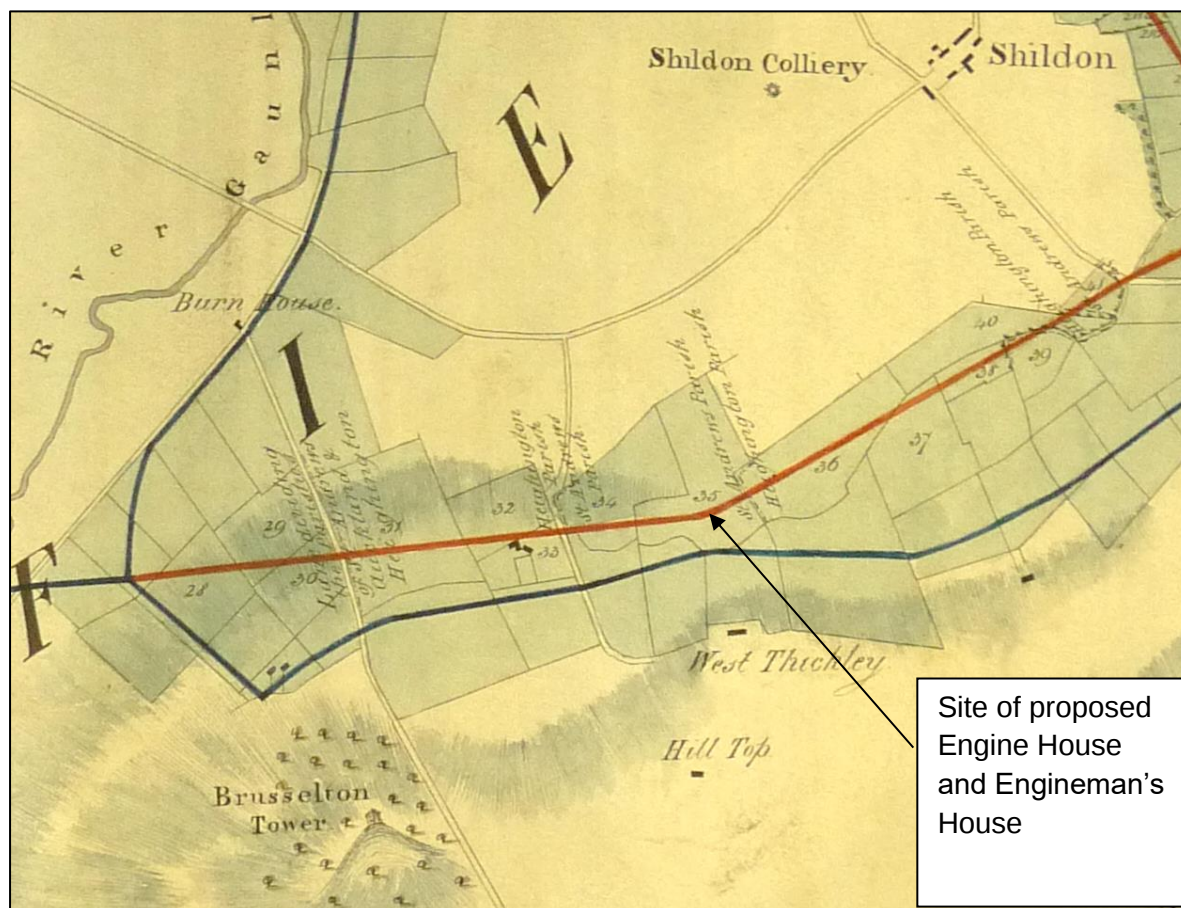


Figure 7. Stephenson's amended plan dated 1822 retained the incline but moved it so that it crossed north of Low West Thickley Farm following a gentler incline from Broom Mill (Stephenson's amendments in red, Overton's original route in blue. DRO Q/D/P 8)

The engine at Brusselton was to be two 30 horsepower two-cylinder low pressure engines costing £3,482-15s. The company were also commissioned to provide winding gear which spun the rope around drums sitting above the line within a stone built shelter and substantial boilers measuring 8 feet in diameter and 20ft long.⁹ It was a simple hemp rope 1850 yards long that hauled the engines up the incline at a steady 8mph and a shorter 825 yard length that lowered the wagons to New Shildon, both supplied by John Grimshaw of Bishop Wearmouth in 1822 at cost of £33.13.0.¹⁰ This rope was reported on the opening day as being a patented design, all of one piece for the length of the incline.¹¹

⁷ Durham County Advertiser 8.5.1824, & Newcastle Courant 8.5.1824

⁸ Smith 2019, 16

⁹ Tomlinson 1914, 96

¹⁰ TNA RAIL 667/448

¹¹ Durham County Advertiser 1 October 1825

The engine needed water for the boiler and coal to generate steam that would power the engine. Coal was brought along the line from the collieries to the west, but water also needed to be readily available on site. Consequently, reservoirs were constructed to hold the water necessary. The design of the reservoirs was similar at Brusselton and Etherley Inclines; both were furnished with two circular reservoirs each but at Etherley they were located to the side of the engine house. The arrangement at Brusselton can be seen on Thomas Dixon's plan of the S&DR line produced in 1839, however it does not show where the water was obtained to fill the reservoirs.¹² It was presumably piped in from higher ground to the south near (High) West Thickley Farm and Hill Top. Natural springs which could have fed the reservoir occur at Brusselton east and westwards.¹³

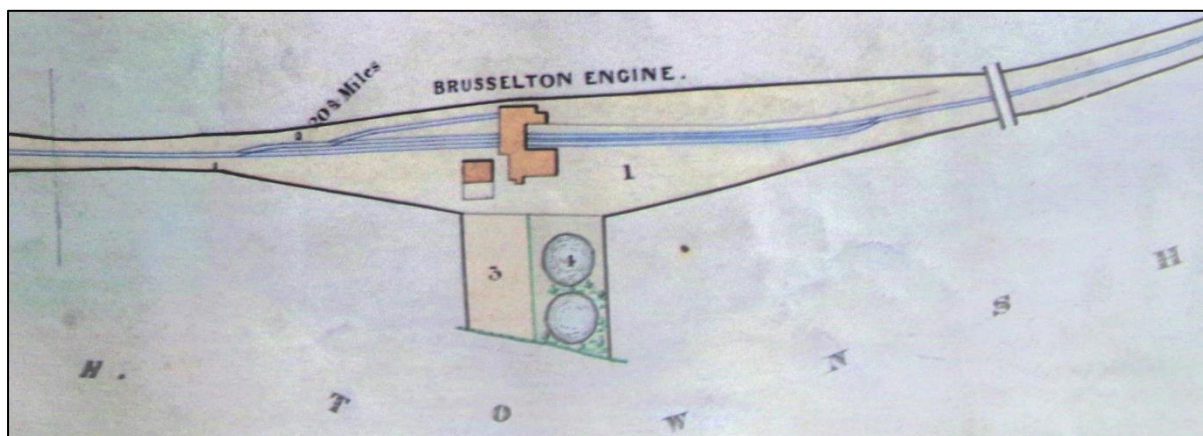


Figure 8. Dixon's Plan of 1839 showing the engine house with the winding gear crossing over the trackbed. Two circular reservoirs were located to the rear and the other building beside the engine house was the engineman's house and blacksmith's house. The plot of land left of the reservoirs was a garden (TNA 1037/453)

From 1824, the S&DR's newly appointed Resident Engineer, Timothy Hackworth spent many hours and probably some blood, sweat and tears ensuring that everything at the incline worked well in time for the opening day on the 27th September 1825. Indeed, his postal address for much of 1824 was Brusselton.¹⁴ On that day it took eight minutes for the thirteen wagons to travel up the Brusselton Incline to the engine house at the top.¹⁵

The engines 'drew forth expressions of admiration from everyone who inspected them, so beautiful is their construction, and so completely did they execute their work'.¹⁶ However on regular use, the engine, boilers and winding gear were to be a source of trouble and constantly needed repair. Hackworth carried out major modifications in 1826 creating double acting drums in sizes proportionate to the length of incline; one to haul wagons up the western gradient of over a mile and another to lower the wagons to Shildon, a distance of about ½ a mile. In doing so he tripled the amount of traffic using half the engine power. He replaced the engine in 1831 with a more powerful 80 horse power one made by R & W Hawthorn of Newcastle.¹⁷ Due to its large size, the new engine house and chimney had to be placed on the north side of the track and the drum house spanned the track linking the new engine house

¹² TNA RAIL 1037/453

¹³ OS 3rd ed 6 inch Durham XLII, Revised: 1914 to 1915, Published: 1924

¹⁴ Smith 2019, 20

¹⁵ Durham County Advertiser 1 October 1825 'Opening of the Stockton and Darlington Railway'

¹⁶ *ibid*

¹⁷ Young 1975 (first pub 1923), 133

and the original one, but no alterations were made to the reservoir at that time. It is this later arrangement that can be seen in surviving historic photos and on Dixon's plan (see fig 8 & 9). The new arrangement was a great success and increased the speed and capacity of the incline; on a good day the incline could take over six sets of wagons per hour.¹⁸

The incline was also used for passenger traffic. Coaches were hitched to the rope and pulled up the hill in the same way as wagons, however those passengers sitting on top of the coach were very close to the drum house which crossed over the track; in 1834 an unfortunate traveller gashed his head on the drum house which he hadn't spotted in the dark. The coach's guard received an official warning from the company for not providing any light during the hours of darkness.¹⁹

The running of the incline after the excitement of the 27th September fell to William Mowtrey who was paid as a sub-contractor 1 1/4d per ton to draw the loaded wagons and haul the empty ones and to maintain them.²⁰ He was also responsible for paying his assistant's wages, the fireman's wages and to source supplies. The Company reverted to a waged structure of 22s a week and 18s for the assistant, presumably because it cost less, but then reverted to subcontract terms at a reduced tonnage rate. Mowtrey subsequently became a locomotive driver and was replaced by Robert Young of whom it was said "He stood in his engine house for 20 years without taking a holiday".²¹

In 1826-7 James Garthwaite was paid 7s a day for drawing wagons with his horse to the bottom of the incline, coupling them, delivering the tickets that came with them and pumping water for the locomotive engines (it is not clear which engines and whether that included using the reservoir), but on the 29th May 1828, the directors contracted with him to do the work for a farthing per ton. This changing between salaried staff and contracts was common in the early days while the Company decided which method of employment was most efficient.²² Ralph Stephenson (brother of George) "rode the banks" and greased the sheaves at Brusselton in 1828. The job of bank rider was to attach the ropes to the coal wagons at the foot of the incline, ride up with them to the top, and let them down the other side. He later became a driver.²³

By 1839 when the area was surveyed to produce the tithe map,²⁴ the garden at the engine house cottages (field 255) was occupied by Thomas Lamb, but still owned by the S&DR.²⁵ This was probably the plot of land that was half reservoir (not tithe-able so not depicted) and half garden seen on the Dixon survey (fig 9). At this time the management of the incline was within Thomas Hackworth's remit. Thomas, brother of Timothy, was much criticized for an unfortunate series of accidents which took place on the incline between 1837-39.²⁶

¹⁸ *ibid*

¹⁹ Smith 2019, 28

²⁰ Tomlinson 1914, 132

²¹ Young 1975 (first published 1923), 310 quoting the Darlington and Richmond Herald Nov 13th 1875. Speech at Shildon Railway Institute by Thomas Greener (of Etherley)

²² Tomlinson 1914, 133-4

²³ Young 1975 (first pub 1923), 303

²⁴ DDR/EA/TTH/1/199

²⁵ Earlier, the Durham County Advertiser of Saturday 21st February 1824 reported the death of another Thomas Lamb in February 1824 during the construction of the railway cutting at Brusselton. He was aged 37 on his death and left a wife and a 'small family'. This Thomas Lamb could be a son 14 years later?

²⁶ Smith 2019, 82



Figure 9. Brusselton Engine House chimney and winding gear house, now demolished (photo courtesy of Jane Hackworth-Young, undated, but possibly c.1880). The large empty building of 1831 held the winding gear which consisted of large drums which sat above the line, powered by the steam engine in the adjacent engine house. This was a replacement of the first Engine House which still survives partially on site today.



Figure 10. A similar view in 2015 without the winding house and chimney which were demolished at the end of the 19th century but still with the other 1825 buildings in the picture intact but extended. The distant building at right angles to the road is the first engine house.

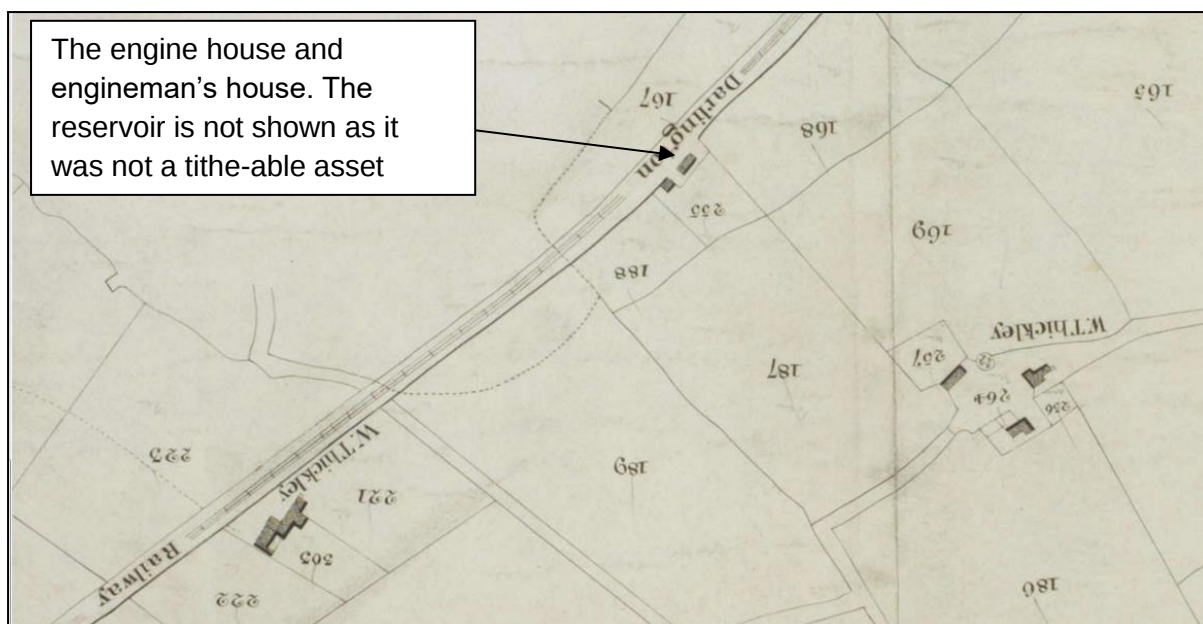


Figure 11. The tithe map of 1839 shows the incline from Low West Thickley Farm up to the cottages at Brusselton. Field 255 behind the cottages on the incline was occupied by Thomas Lamb and owned by the S&DR. Field 168 was fittingly named as Engine Field. Apart from the line itself and the cottages, most surrounding land was owned by Sir George Musgrave (DDR/EA/TTH/1/199 13 December 1839 (map rotated so north is top))

The engineman at the top of Brusselton Incline had to be told when wagons a mile-and-a-half away were ready to be pulled up. A tall pole was erected at the bottom with a disc on top of it. When the disc was spinning, it meant the wagons were ready. To see the disc, the engineman had a telescope permanently fixed near his chair; this may have been positioned at an engine house window.²⁷ However, when visibility was poor the disc couldn't be seen, so long wires attached to bells or rappers were installed. This is said to be the first recorded example of a railway signal system anywhere in the world,²⁸ but requires further research to confirm.

The smooth running of the whole railway line was very dependent on the inclines. If the export of coal was held up at the docks (only two staithes were provided by 1826 in Stockton and this caused delays in loading), trains would back up as there were initially very few sidings where fully loaded wagons could await processing. When backlogs did happen, the inclines often had to work through the night so that coal could continue to be transported from the collieries around West Auckland.²⁹

Between 1839 and 1855 the two circular reservoirs at Brusselton were remodelled to create one large square reservoir which encroached on to what had been garden space belonging to Thomas Lamb in 1839. This arrangement can be seen on the OS 1st edition map surveyed in 1855 (published 1856). The two contemporary reservoirs at Etherley Incline were never amalgamated; this might be because Etherley Incline went out of use after 1843 and so there was no need for further improvements. It is therefore likely that the amalgamation of the Brusselton reservoirs and their extension into Thomas Lamb's garden was sometime between 1843 and 1855. The Stockton & Darlington Railway Company were already looking into

²⁷ Smith 2019, 33

²⁸ Northern Echo 22.11.2014 but unsourced

²⁹ Tomlinson 1914, 381

abandoning the Brusselton Incline by 1853³⁰ by constructing a new branch line from St. Helen's Auckland to the north end of the Shildon Tunnel³¹ and so any improvements to the reservoir were unlikely from 1853.

The braking system on the early wagons required considerable modification. The brakes could only be applied from inside the vehicle, but if the rope on the incline snapped unmanned wagons would fly off smashing into anything that stood in their way. Young lads were employed to stand by the side of the incline ready to jump aboard a runaway train and apply the brake. Near the foot of the bank, the last braking device consisted of men with huge blocks of wood and tree trunks which they threw into the path of the rolling wagons to deliberately derail them.³² In 1832, a wagon carrying Joseph and Henry Pease, Timothy Hackworth and William Kitching (of Kitching's ironworks on North Road, Darlington) was descending down Brusselton incline when the rope snapped. All jumped to safety except Kitching who was a rather large man; he attempted to apply the brake. A gang of youths led by John Summerson jumped aboard and managed to slow the wagon down to 8mph by the time it reached the bottom of the incline. Mr Kitching was badly shaken and Summerson was given a shilling for his efforts.³³ Timothy Hackworth subsequently invented a system (called the cow) whereby if the rope snapped and the wagon lost control, it would be thrown off the tracks, thus limiting any subsequent damage – this may have been small comfort to Mr Kitching.³⁴ The ongoing issues with breaking, stretching and twisting ropes was to convince Hackworth and Stephenson that the way forward would be mobile locomotives and they took an important role in convincing the Liverpool and Manchester Railway line to adopt mobile locomotives rather than be 'strangled' with the ropes of the stationary engine.³⁵

The reservoir remains this shape today. The west embankment was formed with dressed sandstone walls varying in height from 1.3 to 1.6m high and with copes laid on edge. Some of the sandstone used was former stone sleeper blocks from the first few decades of incline use. The wall varies in thickness from 400mm at the top to 600mm at the base and was originally pointed in lime. The south and east sides are made of earth and stone embankments and the north side is simply terraced into the hillside. Presumably the basin was formed with puddled clay overlaid with rubble, but this cannot be confirmed.³⁶

Brusselton Incline ceased operations in 1856 when the Tunnel Branch was constructed to meet the growing traffic flows, although formal closure was not announced until 13th October 1858. In 1859 the engine was sold by private contract (advert in the Darlington & Stockton Times 23.7.1859), but the incline was maintained as a contingency route until the 1880s in case the Shildon Tunnel was blocked. From this date, the reservoir was unlikely to be used for steam power unless the occasional steam engine needed to take on water; it may however have been used for domestic purposes as the hamlet went on to grow in the second half of

³⁰ In fact, the construction at the Shildon Tunnel had already started in 1839 with the long term view to reduce reliance on the inclines

³¹ Tomlinson 1914, 524

³² Northern Echo 22.11.2014 but unsourced

³³ Slack and O'Neill 2015, 27

³⁴ Northern Echo 22.11.2014, but unsourced

³⁵ NRM HACK 1/1/122

³⁶ RNJ Construction Consultants November 2019 BS/19/75

the 19th century. Even when the hamlet only consisted of the engineman's house and the blacksmith's house, both would have required access to water from this hilltop position including water for their wash-houses to the rear.

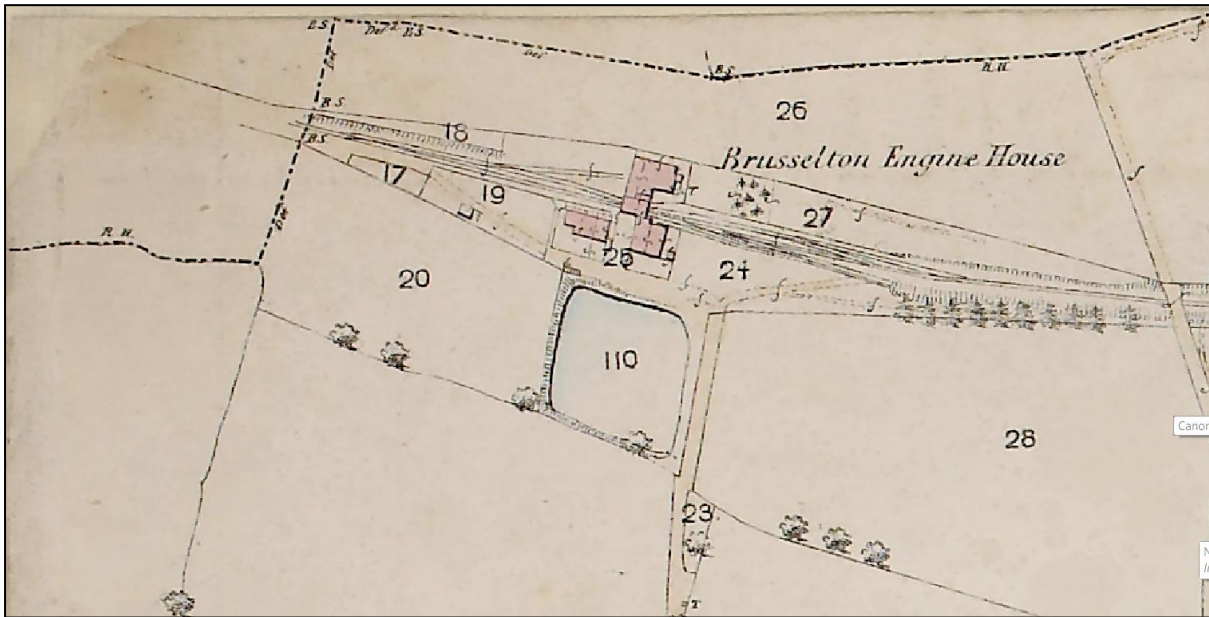


Figure 12. The Brusselton Engine reservoir as depicted on the 1st ed OS map of 1856 (DT 42.15 A) with the 1831 engine house with chimney and winding gear over the line; the cottages for the engineman, blacksmith and their families. This captures the moment when Brusselton Incline went out of use.

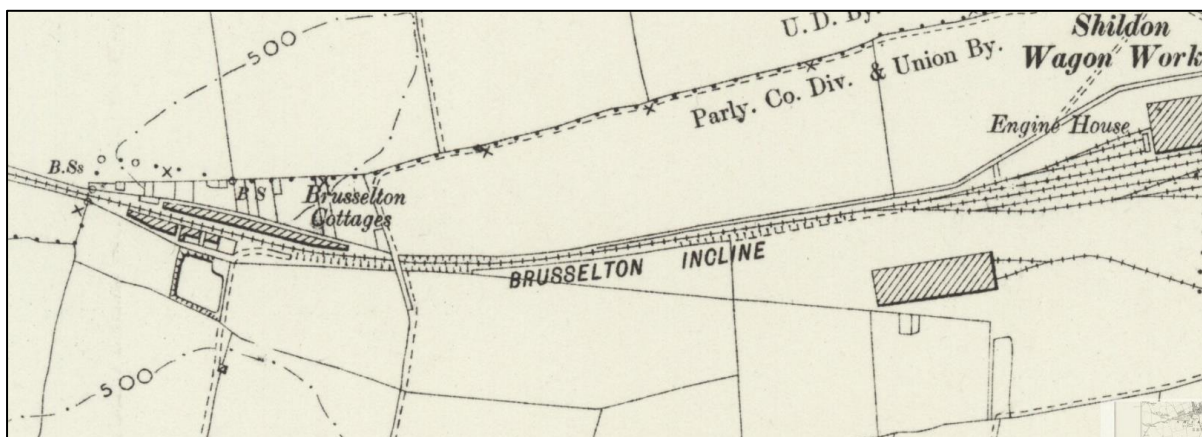


Figure 13. The reservoir with a small section taken out in the NE corner which may have been the exit point for water. A small building on a field boundary to the south might have housed a water pump feeding water into the reservoir. OS 6 inch Durham XLII.SE. Revised: 1896. Published: 1898

The line east of Brusselton and west of Shildon was used as part of a wagon repair line with an engine shed to house wagons awaiting repair. This section of line consequently remained in use sufficiently to be electrified between the Milk Bridge (to the east of the reservoir) and the Masons Arms in Shildon, probably around 1914. Although the line was reduced to a repair siding, steam engines could still be seen on occasion as far west at Brusselton village in the early 1950s, possibly to load coal to local residents, or simply to assist with shunting wagons around.³⁷

³⁷ Trevor Horner, Brusselton Incline Group pers comm.

In the early 1980s water from the reservoir was used as a coal washing facility by Golightly's for a nearby Opencast coal scheme (Fred Wright pers comm). An entry pump from this period is located at the SW corner of the reservoir and an exit pipe at the NE corner.



Figure 14. The engine house in 1968 (John Proud collection, courtesy of Win Proud)

The Reservoir Today

The reservoir is owned by Shildon Town Council and now used for angling by the Shildon Angling Club. It retains its stone boundary wall on the west side in reasonable condition and has a lean-to building built up against the wall on the south west corner. A pathway runs around the perimeter of the reservoir on top of the embankment and the site is fenced with thick tree/shrub growth around the boundary. The majority of trees are ash and there is also sycamore, goat willow and cherry along with various woody shrubs such as privet, hawthorn & elder. Some of these trees and bushes are growing out of the top of the embankment and wall. The stone wall has been repaired in the past using liberal quantities of cement over the original lime. This along with frost damage has resulted in damage to the stonework in some isolated areas. There is also some vertical cracking in the western boundary wall exacerbated by root action from the trees growing from the wall tops. However, in most places it is not severe enough to have caused outward displacement. Significant displacement is however taking place where the goat willow has caused bulging.

On the north, east and south sides the perimeter also has timber fencing with some additional, later wire mesh stock fences at various points and apparently put in place by the adjoining landowner or occupier. Some timber sleepers have been used as uprights for the fencing; these are set into brick and concrete foundations. The fencing is largely in poor condition.

Despite references to the site being a Site of Special Scientific Interest in the Tree Report (Appendices 1 and 2), the site does not appear to have any designation covering the natural environment. Nor is it listed as a Site of Nature Conservation Interest by Durham County Council.



Figure 15. The reservoir looking north towards the Engine House with the roof of the Engineman's house visible to the left.

Gaps in our understanding

While there are records and newspaper adverts relating to the construction and design of the buildings and engine at Brusselton, there are few references to the construction of the reservoir(s) in 1825 or the subsequent remodelling into one large reservoir prior to 1855. As a result the exact date of the reservoir in its current form is not known, nor do we have access to information about its construction method, although it is clear that it was made in part from reused sleeper stones and some timber. There may be additional records as part of the RAIL collection in The National Archive.

It is also not clear how water was collected and then moved to the boilers of the engine houses; information is largely anecdotal.

There is no information on the ecological value of the reservoir other than the tree cover.

THE SIGNIFICANCE OF THE BRUSSELTON RESERVOIR

The Brusselton Reservoir consists of a number of related features, many of which are associated with the pioneering phase of the railways and are therefore considered to be internationally and nationally important. This detailed statement of significance fleshes out this special interest. The nature of the heritage significance is divided into archaeological, architectural, historic and artistic interests as outlined in national planning policy.³⁸ The level of significance is divided into considerable, some, limited, unknown or none. Definitions of these terms are given in Appendix 1.

This section also assesses the significance of the tree cover and any later features added to the reservoir.

The present-day reservoir represents the second phase of reservoir construction; the original two circular reservoirs do not survive but were subsumed into the later square reservoir which covered an area at least double in size.

Archaeological interest

The archaeological interest is the evidence that survives within the structure that could lead to a better understanding of how the reservoir functioned. The surrounding fields are regularly ploughed therefore there are no visible remains of any aqueduct channels that may have once fed the reservoir either on the ground or on recent aerial photographs. It is possible that they survive in a truncated form below ground. Similarly, it is not clear how water was fed into the steam engine from the reservoir; this evidence may also be below ground between the reservoir and the engine house or in the external elevations to the engine house itself.

The structure itself is of archaeological interest. The embankment walls around the reservoir incorporate the remains of stone sleepers; split stone sleepers are used in other boundary walls in Brusselton and were clearly a ready supply of nicely dressed sandstone once they were no longer used on the incline. Two-hole sleepers were replaced with four-hole sleepers in the 1830s and on other parts of the line, all stone sleepers were replaced with timber sleepers by the 1840s. Otherwise the embankment is evidence of mid-19th century construction techniques and possibly also 20th century reinforcement carried out by Golightly's. The rest of the structure is underwater and inaccessible, but presumably has evidence of the construction method used to build and adapt the reservoir.

Collectively the reservoir and its surroundings are therefore of **some archaeological** interest.

Architectural interest

The architectural interest of the reservoir is limited to the boundary wall which is a typical mid-19th century structure pointed in lime. It is of **limited architectural interest**, although its role in containing the water is of course essential. The relationship between the reservoir and the engine house is of much more architectural interest because they are part of the same structure and process. Collectively they are of **some architectural interest**.

³⁸ NPPF 2018, 71

Historic interest

The reservoir is part of a wider grouping which form part of the pioneering phase not just of the S&DR, but of the world's railways. It is part of an innovative engineering solution to landscapes too hilly for locomotives of the 1820s and is closely linked to Robert Stephenson who designed the engine, Timothy Hackworth who kept it working and redesigned it and George Stephenson who designed the incline. Its historic interest is largely to do with its association with the rest of the incline group (engine house, engineman's house, incline) rather than in its own right, because it is the second phase of development probably dating to the 1840s. This still makes it between the pioneer phase (up to 1841) and heroic phase (up to 1850) of the railways as defined by Historic England in their Listing Selection Guide for Transport Infrastructure (2017, 2-3). It is therefore of **considerable historic interest**.

Artistic interest

The reservoir has not featured in any artistic works save for few historic photos, however it is an attractive setting to the village and a tranquil place to visit. It is therefore of **some artistic interest**.

Nature conservation interest

The reservoir is not designated as a SSSI. Great Crested Newts are known from the wider area. Other species which have been identified in the wider area include corn bunting and grey partridge (ref A06).³⁹ However no ecological survey has been undertaken to provide further evidence of ecological significance. The ecological interest in terms of wildlife habitat is therefore unknown.

The trees around the reservoir are relatively young with no medium or old mature or veteran trees on site suggesting that it was traditionally kept clear of trees. However as a whole it forms an ecologically valuable habitat and so can be considered to be of **some ecological interest**.

PROTECTION AND MANAGEMENT

The current condition of the reservoir (2019)

A condition survey of the reservoir was carried out by RNJ Construction Consultants in November 2019 and the report is included in full as Appendix 2. Access to part of the retaining wall was not possible because of a lean-to building on the south side, along with a pile of debris and manure. This will need to be accessed at some time in the future in order to check the maintenance requirements of this section of walling.

The retaining boundary features around the reservoir are in reasonable condition given their function and age. It was built in good quality stone some of which was recycled from the railway. Generally, there is nominal outward movement caused by tree root action (Goat Willow in particular), but rebuilding is not necessary with the exception of a small isolated area on the west elevation. There is some structural cracking, but this could be remediated without

³⁹ <https://magic.defra.gov.uk/MagicMap.aspx>

rebuilding. Other damage has been caused by the use of cementitious pointing which has led to cracking.

The timber fences are about 60 years old and largely decayed. They will need to be replaced.

The risks associated with managing the heritage are relatively low, but some urgent work has been identified and is listed below in the Action Plan. These urgent works are likely to cost in the region of £24,000 (ex VAT) and include repairs to the embankment wall and replacing the fencing so that the site remains stock proof.

There are also some maintenance issues which need to be considered in future. While trees have ecological value, it is largely the presence of self-seeded trees growing out of the embankment wall that has led to the above damage. Long term maintenance will need to ensure that trees are not permitted to seed into the wall.

The other source of damage is the use of cementitious material to repoint the stonework. This will need to be removed and replaced with a lime mortar which is what was used in the reservoir originally. When future pointing is required, it is important that cement is not used in order to avoid further future damage. Future planned maintenance is likely to cost in the region of £9,150 (ex VAT).

Further investigative and survey work to better understand the original pointing mix, the construction method of the reservoir, accessing currently inaccessible areas and monitoring site levels to check for movement will cost in the region of £3,100 (ex VAT). An ecological survey could cost in the region of £1,000 (ex VAT).

Issues and risks

-  The site is vulnerable to inappropriate or no management as this has led to damage in the past. The deterioration of the fabric of the retaining wall could be a safety risk to local residents and the public if not adequately repaired and maintained.
-  The boundary features are at risk from subsidence which could lead to damage beyond the reservoir.
-  It is potentially at risk from climate change resulting in increased water levels without any adequate knowledge of how those levels are managed and where excess water is drained to.
-  Future landscaping works including enhanced access or investigative works to the surrounding area, could damage below ground archaeological remains or wildlife habitats.
-  Creating new buildings or shelters on the site could have a negative impact on its appearance and impact on the ability to appreciate the relationship between the reservoir and the engine house/engineman's house.
-  The Angling Club and Town Council have no control over the quality of water entering the reservoir because it is drawn from farmland in the surrounding area.

- 🌳 There is currently no interpretation at the site so that residents, angling club members or passers-by understand the history and importance of the reservoir
- 🌳 The ecological interest of the site could be enhanced but should not include further tree growth on the boundary features which will lead to root damage.
- 🌳 The reservoir is included in the Conservation Area but is not designated in any other way for its heritage interest. It could be considered to be curtilage listed as it formed an essential part of the engine house which is listed.
- 🌳 In a Conservation Area, if a tree has a stem diameter greater than 75mm (3") measured 1.5m from the ground level, it is necessary to give Durham County Council six weeks' notice of any tree works proposed. This enables DCC to assess the proposed works and if necessary, serve a Tree Preservation Order. If no decision is received within six weeks, then consent is gained by default.

Policies to Protect and Enhance.

The following policies will help to ensure that the significance of the reservoir is adequately maintained and that works avoid conflict between the special interests of the site and its use by the Angling Club.

The reservoir should be managed in a way that recognises the world class importance of the site and its association with the Stockton & Darlington Railway.

Maintenance and use of the reservoir by the Angling Club should conserve and enhance its heritage and wildlife interest, while providing an excellent well-used resource for angling and visitors.

Action Plan – Capital Works

The following works are considered urgent (see Condition Survey Report in Appendix 2 for full specifications):

Boundary walls:

1. Stitch the vertical cracking using threaded stainless-steel rods inserted at a 45° angle, resin grouted and made good with the salvaged stone inserts. Alternatively use 'Helical' Bar reinforcement to an agreed design.
2. Allow for taking down and rebuilding the bulging section of stone walling reusing all stone units in NHL mortar including removal of tree and root bowl.
3. Allow for structural design calculations by a CARE Structural Engineer.
4. Survey in levels of embankment to use as a baseline for future monitoring

Boundary fencing:

5. Take down and replace all fences to 1.8m height with posts, rails and open pale pattern allowing for retention and reuse of railway sleepers.
6. Replace single picket gate to northern boundary fence.
7. West boundary: replace wire mesh stock fence with posts, cutting back vegetation as necessary

The following works are considered non urgent:

Boundary walls:

8. Remove, set aside and relay the stone copings over length of wall
9. Rake out by hand the cement mortar (initially using a conservation approved oscillator) and repoint in NHL mortar with coarse grit to match the original mortar. Mortar mix to be based on analysis of the original lime mix.
10. Check concealed areas of wall behind the rendered blockwork walling of the lean-to structure built up against the retaining wall.

Boundary fences:

11. Overhaul and redecorate the metal palisade style double gates.
12. Allow for investigative work to assess the construction of the embankment, petrological analysis of the rubble stone in the embankment

General:

13. Carry out an ecological survey of the reservoir (water and walls) to include recommendations for enhancing the wildlife interest of the site.
14. Historic England and Durham County Council to clarify the reservoir's protected status as part of the curtilage of the listed engine house and as part of or key to the setting of the scheduled Brusselton incline (List Entry Number: 1002315).

Maintenance Plan

-  Instigate a regular programme of surveying to take levels to monitor any further settlement of the embankment (start annually then if no movement, every 5 years and if stable, increase to every ten years unless circumstances change)
-  Check the boundary walls each late summer for self-seeded trees taking root and remove them.
-  Check the stability of any trees after storms and carry out remedial action where appropriate.

-  Regularly check the security of the fencing and gate.
-  If new structures are built adjacent to the reservoir by neighbouring occupiers, ensure that access for maintenance purposes is still possible along the boundary. Negotiate removal of any existing structures which prevent access or detract from the reservoir.
-  Consider enhancing the wildlife value of the reservoir by installing bat or bird boxes.
-  Monitor water quality to protect fish stocks and biodiversity.
-  Prepare a Conservation Area Appraisal (ideally as part of a larger Conservation Area covering much of the 1825 S&DR) to include the significance of the Area, a review of its boundary, designation status of the reservoir and considers the removal of permitted development rights on unlisted buildings if appropriate.

CONCLUSION

Brusselton reservoir was part of the design of the incline plane which hauled wagons up the steep slope from West Auckland to Brusselton and then lowered the wagons down to New Shildon where they could be hitched to locomotives before continuing their journey. At this early date in railway development no locomotives were powerful enough to negotiate hilly terrain. The reservoir was built by the Stockton & Darlington Railway Company and provided water for the substantial boiler built as part of the engine. The engine was designed by Robert Stephenson, but the incline itself was a design by his father George. Construction works to the reservoir were likely to have been from 1824 when the engine house was also built, and the works were overseen by Timothy Hackworth who lived at Brusselton before moving to New Shildon in 1825. The incline and the engine house played an important role in the opening day ceremony of the Stockton & Darlington Railway on the 27th September 1825.

The reservoir as built actually consisted of two circular ponds; a similar design to the layout on the Etherley Incline to the north. Some time between 1840 and 1855 these two ponds were replaced with a much larger square reservoir and it is this second phase reservoir that can be seen today.

The status of the incline in parts as a listed building and scheduled monument means that it is nationally important, but the reservoir has no such statutory protection. Their early date means that the structures as a whole are part of the internationally important pioneering and heroic phases of railway development and anything within the period merits careful consideration as part of the designation process. The reservoir is however within the Conservation Area. The Conservation Area does not have the benefit of a conservation area appraisal. This should be rectified so that the significance of the conservation area is better understood and can be protected.

Brusselton is strongly associated with the evolution of the incline plane and the use of stationary engines adequate for the job of pulling large numbers of heavy wagons over much longer areas than had previously been used in mining operations. Because of the challenging terrain, inclines were the focus of technological achievements resulting from an arduous process of trial and error that concentrated on the locomotive power and the stability of the

wagons. They consequently made a major contribution to the knowledge of how to construct an efficient railway system that would be adopted across the world. The combination of several different railway structures at Brusselton, including the reservoir, covering the first dynamic years of rail travel adds to that importance.

Brusselton is also strongly associated with George and Robert Stephenson, Timothy and Thomas Hackworth and other named enginemen and incline staff. The lessons that Stephenson and Timothy Hackworth learned here helped them to persuade the Liverpool and Manchester Railway, with some difficulty, to adopt the moveable locomotion engine, rather than be strangled by the ropes of a stationary engine.⁴⁰

There are some gaps in our knowledge regarding the construction date and methods of the two phases of the reservoir. There is also no information on the ecological interest of the site which could act as a baseline against which future monitoring could take place.

However, the condition and tree surveys, while acknowledging that the reservoir is in fair condition for its age, do still require some stabilisation works and costs have been obtained for them. Based on this information capital costs have been divided into urgent and non-urgent and a long-term maintenance plan devised.

BIBLIOGRAPHY

- Archaeo-Environment 2015 *Statement of Significance for the Brusselton Incline and Accommodation Bridge*, for Blackett Ord Conservation
- Archaeo-Environment 2016 *The 1825 Stockton & Darlington Railway: Historic Environment Audit*
- Historic England 2017 *Designation Listed Selection Guide. Transport Infrastructure.*
- Chapman, V 2005 *Around Shildon*
- Hall, R 1961 'Brusselton Incline' in *Railway World* July 1961
- Jeans, J. S 1974 *History of the Stockton and Darlington Railway*
- Rolt, L T C 2012 *George & Robert Stephenson: The Railway Revolution*
- Slack, G and O'Neill, M 2015 *The First Five Miles*
- Smith, G. T 2019 *A Railway History of New Shildon*
- S&D.150 Research and Preservation Sub-Committee 1975 *Rail Trail* (leaflet)
- Tomlinson W.W 1914 *The North Eastern Railway. Its Rise and Development*
- Young, R 1975 (first published 1923) *Timothy Hackworth and the Locomotive*

⁴⁰ NRM HACK 1/1/122

Appendix 1

This assessment of significance includes an assessment of the nature, extent and level of significance of the heritage asset and how this helps to understand its significance. The nature of the heritage assets is divided into archaeological, architectural, artistic or historic interest (NPPF (2019), annex 2).

Within this report the following terms are used to define the level of significance and are designed to aid informed conservation and the need to balance heritage significance with the wider public benefit of the proposal which is the spirit of PPS5:

Considerable: aspects of the site considered as seminal to the archaeological, architectural, artistic or historic significance of the site, the alteration or development of which would destroy or significantly compromise the integrity of the site.

Some: aspects that help to define the archaeological, architectural, artistic or historic significance of the site, without which the character and understanding of place would be diminished but not destroyed.

Limited: aspects which may contribute to, or complement, the archaeological, architectural, artistic or historic significance of the site but are not intrinsic to it or may only have a minor connection to it, and the removal or alteration of which may have a degree of impact on the understanding and interpretation of the place.

Unknown: aspects where the significance is not clearly understood possibly because it is masked or obscured and where further research may be required to clarify its significance.

None: aspects which may make a negative contribution or a neutral contribution where its loss would make no difference to our understanding and interpretation of the place.

APPENDIX 2 Structural Report by RNJ

APPENDIX 3 Tree Report by Oliver's tree Services

SHILDON TOWN COUNCIL

**BRUSSELTON RESERVOIR
SOUTH TERRACE
BRUSSELTON
SHILDON
COUNTY DURHAM
DL4 1PZ**

CONDITION SURVEY REPORT

NOVEMBER 2019

BS/19/75



Chartered Quantity Surveyors
Chartered Building Surveyors
Project Managers
Principal Designers
Asbestos Surveyors

RNJ Partnership LLP , 2 Diamond Court, Kenton,
Newcastle upon Tyne, NE3 2EN
Tel. 0191 286 0707 Fax. 0191 286 0865
email. rnj@rnjllp.com
website. www.rnjllp.com

SHILDON TOWN COUNCIL

BRUSSELTON RESERVOIR SHILDON, COUNTY DURHAM

CONTENTS

	Page Nr
1.0 INTRODUCTION	
1.1 Instructions	1
1.2 The Site	1
1.3 Construction	1
1.4 Tenure	1
1.5 Access	2
1.6 Weather Conditions and date of the Survey	2
1.7 Directions	2
2.0 BUILDING EXTERIOR	
2.1 Boundary Walls	3
2.2 Boundary Fences	5
2.3 Reservoir Embankment	5
3.0 SUMMARY AND CONCLUSION	
3.1 Urgent Repairs	8
3.2 Future Planned Maintenance	8
3.3 Further Investigation and Survey Work	9

APPENDICES

Appendix A	Photographs
Appendix B	Location Plan
Appendix C	Oliver's Tree Services Report

1.0 INTRODUCTION

1.1 Instructions

Instructions were received from Shildon Town Council on 11th October 2019 to carry out a survey of the Reservoir to include comments on the following

- Condition assessment of the reservoir by component part (suggested east, west, north, south internal and external elevations)
- Identified order of costs for all faults described
- Identification of any further survey work required to inform repairs
- Suggested outline maintenance and inspection plan following any capital repair works

1.2 The Site

Brusselton reservoir was originally two circular pools which provided water for a steam engine built to haul wagons up the Brusselton incline located on the Stockton and Darlington Railway of 1825. It became redundant following the re-routing of the line avoiding the incline due to the construction of a tunnel. It is understood that it was once used for a coal washing facility and subsequently and to date the Brusselton Reservoir Nature Reserve which opened in 1988.

The reservoir is located east of a group of residential buildings comprising of cottages and part of the original Engine House within which the Winding Engine was located

It is accessed from the A6072 via Brussleton Lane and a single lane of approximately 300 m in length.

1.3 Construction

It is understood the reservoir was originally fed from the ground water/mine reservoir of West Durham by a water pipe and then by pump and subsequently by a water mains in the adjoining field known as the Pump House Field. It is understood the water supply was via a wind pump in the south west corner and outfall in the north east corner, however this will require further research and investigation. It is understood its construction comprises of a puddle clay embankment overlaid with stone rubble, however this can only be determined by formation of trial pits. The embankment is supported on the south boundary by a stone retaining wall and bounded by timber fences on the remaining three elevations. The nature of the reservoir bed could not be determined due to the presence of the water.

1.4 Tenure

It is understood the reservoir is owned by Shildon Town Council and therefore all repairing and maintenance liabilities belong to the Freeholder. The survey comments on all elements of the reservoir which could be determined from a visual survey. It is currently used as a angling lake by the private Shildon Angling Club.

1.5 Access

Access was provided by Shildon Town Council and a briefing meeting was held prior to commencement of the survey with Niall Hammond, Vice Chair Friends of the Stockton and Darlington Railway CIO and Glenn Gibson, Direct Works Manager of Shildon Town Council,

1.6 Weather Conditions and date of the Survey

The survey was carried out during a period of rain showers between 9.30 am and 1.30 pm on the 5th November 2019 (Refer to Appendix B, Location Plan).

1.7 Directions

All directions for the purpose of this survey are orientated from a North, South, East and West directions (Refer to Appendix B, Location Plan).

2.0 BUILDING EXTERIOR

2.1 Boundary Walls

- 2.1.1 The West boundary of the reservoir is defined by a stone built retaining wall over its entire length. This adjoins a field with livestock and has a lean-to outhouse built up against it on the South Western corner.
- 2.1.2 The wall is constructed in squared coursed plain dressed sandstone blocks finished with copings laid on edge. The height of the wall varies from 1.3 m to 1.6 m over its length corresponding with the sloping gradient of the land towards the South and it is measured at 400 mm in width at the top increasing to 600 mm at the base (refer to Photographs P23 and P24).
- 2.1.3 It is evident the wall has been repointed in a cement based mortar which has been applied over the original lime mortar and extends onto the face of the stonework having been liberally applied. It is noted that there are holed stone blocks within the wall which were reclaimed sleeper stones re-used from the original railway in the 1820's.
- 2.1.4 It serves as a retaining wall supporting the built up embankment of the West side of the reservoir upon which there are extensive trees and vegetative growth (Refer to Appendix C Oliver's Tree Services Report).
- 2.1.5 The inspection revealed the following defects within the wall and these are identified in the photographs appended to this report:-
- 2.1.5.1 ➤ Isolated areas of eroded stonework resulting from increased frost action and erosion due to the use of cementitious mortar repointing exacerbated by its application upon the surface of the stone thereby creating ledges to trap surface water
 - 2.1.5.2 ➤ Vertical structural cracking and isolated displacement of the retaining wall resulting from the mechanical root action of the trees on top of the wall (Refer to Appendix C Tree Report indicating the extent of the tree growth on the West boundary). It is noted that to the majority of the areas the structural cracking has not resulted in outward displacement and could be remediated by the installation of stainless steel bars inserted and resin bonded across the cracking to provide restraint
 - 2.1.5.3 ➤ Alternatively the stone bed joints could be reinforced by a proprietary system i.e. 'Helical Bar' which would be subject to structural calculations

2.1.5.4 ➤ Diagonal, horizontal and vertical cracking and outward displacement of the retaining wall by up to 15 mm is evident (Refer to Photograph P15). This section of the wall has been subject to considerable lateral forces caused by root action of the tree (marked as 'Goat Willow' in the Tree Report at the top of the retaining wall). Given the extent of the bulging of the walling it is unlikely this section of the wall could not be stitched and restrained effectively whilst insitu. It should be taken down and carefully rebuilt which may necessitate the removal of the tree.

2.1.5.5 ➤ To arrest any further delamination and spalling of the stonework in the medium term it is recommended the wall is raked out and repointed in a NHL (Natural Hydraulic Lime) mortar based upon the original mortar mix which should be chemically analysed. The copings should also be removed and rebbed to the top of the wall and its full length.

2.1.6 In conclusion, the retaining wall is in reasonable condition given its function and age. It has been built with good quality stone some of which has been reused from the railway. Generally there is nominal outward movement and rebuilding is not necessary with the exception of the isolated area as before described. The majority of the structural cracking evident could be remediated with the wall remaining insitu.

Recommendations:

- Stitch the vertical cracking using threaded stainless steel rods inserted at 45 degree angle resin grouted and made good with the salvaged stone inserts alternatively use 'Helical' Bar reinforcement (4 Nr) to the Structural Engineers design
- Allow for taking down and rebuilding the bulging section of stone walling reusing all stone units in NHL mortar including removal of the tree and root bowl
- Allow for Structural Design calculations by a CARE Structural Engineer
- Remove, set aside and relay the stone copings over the length of the wall
- Rake out by hand, initially using a Conservation approved oscillator to break the cement mortar and repoint in NHL mortar with coarse grit to match the original mortar
- Allow for analysis of the existing mortar bedding/pointing of the wall
- Further investigation of the condition of the stonework concealed behind the manure heaped up against the boundary wall
- Further investigation of the concealed areas of stone walling behind the rendered and blockwork walling of the lean-to structure built up against the retaining wall

2.2 Boundary Fences

2.2.1 The North, East and South boundaries are defined by timber fences interspersed with later wire mesh stock fences, some of which have been clearly erected by the owner of the adjoining field. It is evident that railway sleepers have also been used to the South and East elevation fence. The fences are all in a dilapidated condition and requires to be replaced however the railway sleepers should be retained due to their historic significance. Our findings are as follows:-

- 2.2.1.1 ➤ East boundary: square top open pale fence, 2.1 m in height with four horizontal rails interspersed with railway sleepers laid vertically. The fence is in a severely dilapidated condition, has collapsed and is missing in areas (approximate length 60 m)
- 2.2.1.2 ➤ South boundary: square top pale fence with three mid rails approximate height 1.2 m changing to 2 m. Railway sleepers laid vertically into brickwork and concrete foundations are evident. A square wire mesh has been installed by the Farmer where the field adjoins the embankment (approximate length 57 m)
- 2.2.1.3 ➤ North boundary: timber post, three rail pale fence reduced in height to 1.3 m with single timber gate and metal palisade style gates. There are numerous decayed posts and this fence is beyond repair and should be replaced (approximate length 45 m)
- 2.2.1.4 ➤ West boundary: Wire mesh fence with timber posts approximately 0.6 m in height in dilapidated condition

Recommendation

- North, East, South boundaries: Take down and replace all fences to 1.8 m in height (subject to agreement) with posts, rails and open pale pattern allowing for retention of the railway sleepers
- Overhaul and redecorate the metal palisade style double gates
- Allow for replacing the single picket gate to the North boundary fence
- West boundary: replace wire mesh stock fence with posts, cutting back vegetation as necessary

2.3 Reservoir Embankment

- 2.3.1 It is not possible to determine the composition of the embankment forming the reservoir, however it is evident that the embankment is finished with stone rubble and extensive vegetation. It is noted that the embankment is lower than that to the South East and South West and there would appear to be some longstanding historic settlement.

It is recommended that the embankment to the South boundary is surveyed, levels taken for purposes of recording any further movement.

Recommendation

- Allow for trial pit of the embankment within the Reservoir
- Allow for petrographic analysis of the rubble stone to the Reservoir embankment
- Allow for surveying and taking levels of the Reservoir embankment to provide a record of any further settlement

3.0 SUMMARY AND CONCLUSION

The retaining wall to the South elevation is in reasonable condition given that it is approaching 200 years in age and its loadbearing function it has performed adequately for a sustained period of time. The damage has been largely caused by the effect of tree root action resulting from mechanical lateral forces upon the wall. This has resulted in structural cracking and with significant outward displacement in isolated areas. The later intervention of using hard cementitious mortar pointing roughly applied over the face of the wall has resulted in increased erosion of the stonework in isolated areas and replacement in a breathable lime mortar compatible with the stone would benefit the medium and long term maintenance of the stonework.

The timber fences to the boundaries are estimated to be in excess of 60 years in age and in a dilapidated condition and severely decayed and should be replaced in their entirety.

Consultation with the adjoining owner of the field to the South boundary should be initiated with a view to further inspection of the areas of the retaining wall currently concealed due to the lean-to structure and also the debris/manure piled up against the wall.

In terms of priority the repairs are categorised and set out below. This provides an outline for a maintenance plan following the urgent repair works:-

3.1 Urgent Repairs (Year 1)

These should not be delayed as postponing would have a significant impact on the Reservoir in respect of Health and Safety and further deterioration in the condition of the wall.

3.2 Future Planned Maintenance

These could be delayed without significantly affecting the structure in the immediate future but should be carried out as part of a planned maintenance plan as to delay would have an adverse effect on the condition of the Reservoir.

3.3 Further Investigation and Survey Work

This represents those items where an exact diagnosis of the defect cannot be readily ascertained from the visual inspection and further opening up is required.

3.1	Urgent Repairs	£
	Boundary Walls	
	Stitch the vertical cracking using threaded stainless steel rods inserted at 45 degree angle resin grouted and made good with the salvaged stone inserts alternatively use 'Helical' Bar reinforcement (4 Nr) to the Structural Engineers design	3,000.00
	Allow for taking down and rebuilding the bulging section of stone walling reusing all stone units in NHL mortar including removal of the tree and root bowl	5,000.00
	Allow for Structural Design calculations by a CARE Structural Engineer	1,500.00
	Boundary Fences	
	Take down and replace all fences to 1.8 m in height (subject to agreement) with posts, rails and open pale pattern allowing for retention of the railway sleepers	12,150.00
	Allow for replacing the single picket gate to the North boundary fence	250.00
	West boundary: replace wire mesh stock fence with posts, cutting back vegetation as necessary	2,000.00
	Total of Urgent Repairs	£ 23,900.00

3.2	Future Planned Maintenance	
	Boundary Walls	
	Remove, set aside and relay the stone copings over the length of the wall	3,000.00
	Rake out by hand, initially using a Conservation approved oscillator to break the cement mortar and repoint in NHL mortar with coarse grit to match the original mortar	6,000.00
	Boundary Fences	
	Overhaul and redecorate the metal palisade style double gates	150.00
	Total of Future Maintenance	£ 9,150.00

3.3 Further Investigation and Survey Work

Boundary Walls

- | | |
|--|--------|
| • Allow for analysis of the existing mortar bedding/pointing of the wall | 200.00 |
| • Further investigation of the condition of the stonework concealed behind the manure heaped up against the boundary wall | 150.00 |
| • Further investigation of the concealed areas of stone walling behind the rendered and blockwork walling of the lean-to structure built up against the retaining wall | 250.00 |

Boundary Fences

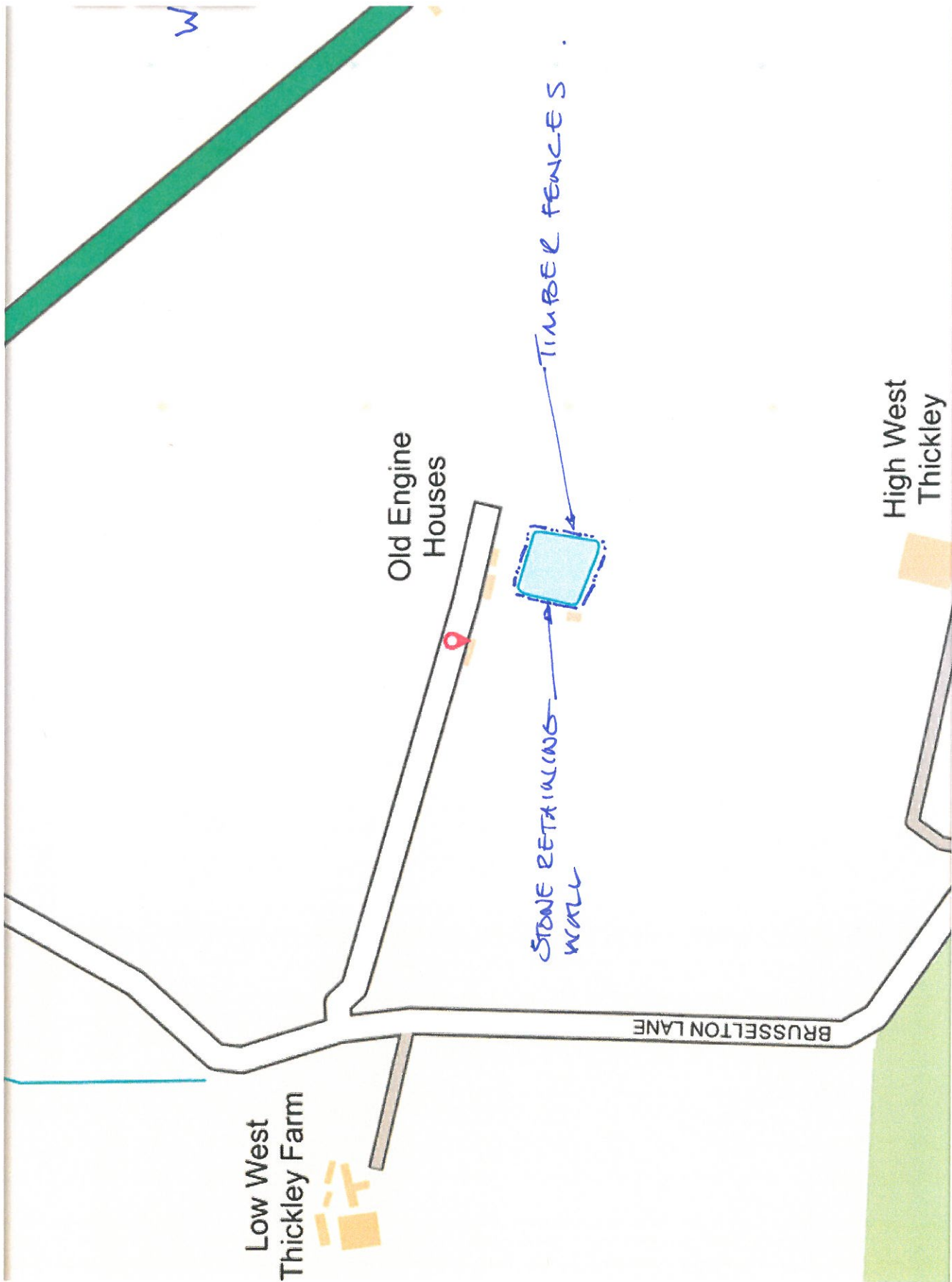
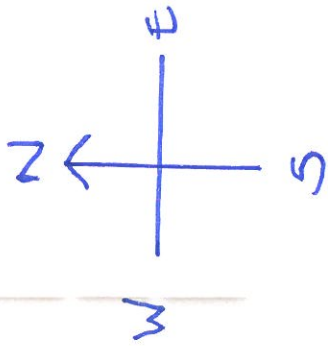
- | | |
|---|----------|
| • Allow for trial pit of the embankment within the Reservoir | 700.00 |
| • Allow for petrographic analysis of the rubble stone to the Reservoir embankment | 300.00 |
| • Allow for surveying and taking levels of the Reservoir embankment to provide a record of any further settlement | 1,500.00 |

Total of Further Investigation	£	3,100.00
---------------------------------------	----------	-----------------

APPENDIX A
PHOTOGRAPHS

APPENDIX B

Location Plan



APPENDIX C

Oliver's Tree Services Report



- Quality tree work
- Excellent customer service
- Fully qualified and experienced personnel
- Established in 1982

8th May 2019

Mr Glenn Gibson
Shildon Town Council
Council Offices
Civic Hall Square
Shildon
Co Durham
DL4 1AH

Dear Mr Gibson

Re: Brusselton Reservoir, South Terrace, Brusselton, Shildon, DL4 1PZ



Acting on your instructions I have now inspected the trees at the above property.

I have based this report on my site observations and the information that you have provided. All my observations were from ground level without any detailed investigation.

This report is concerned with recording the species, size and condition of the trees. Recommendations are made where appropriate to establish acceptable levels of safety for the site and a higher level of arboriculture management if required.

The information is recorded in the appraisal section of this report. Trees are living organisms whose health and condition may change rapidly and my observations are based on the status of the trees at the time of inspection.

Unit 3 Langley Park Industrial Estate North, Witton Gilbert, Co Durham, DH7 6TX

Tel: 0191 373 9771 Fax: 0191 373 9771

www.oliverstreeservices.co.uk – info@oliverstreeservices.co.uk



Site Visit

I carried out an unaccompanied site visit on Thursday 25th April 2019.
The weather that day was overcast but with no visibility restrictions.

Site Description

This reservoir was built by the Stockton and Darlington railway which finished at Shildon. Locomotives could not pull the laden coal trucks up the Brusselton incline so a large steam engine was used to winch them up and down into Shildon.
In 1988 the reservoir was developed by Shildon Town Council for angling.

The reservoir was classed as SSSI site (Site of Special Scientific Interest) in 1998 when great crested newts were found.

Brusselton Reservoir is a square plot of land (approximately 3000m²) located to the south of South Terrace at Brusselton which is less than 1.5 miles south west of Shildon.

Agricultural crop fields are beyond the eastern and southern site boundary, a smallholding field with paddocks forms the western boundary and gated access to the reservoir is from South Terrace to the north of the site.

A pathway runs around the perimeter of the reservoir and the site is fenced with thick tree/shrub growth around the boundary.

Appraisal

Age key: Y – young, **SM** – semi mature, **EM** – early mature, **M** – mature, **OM** – mature, **V** – veteran

Height: estimated to the nearest metre

Condition key: D – dead, **P** – poor, **M** – Moderate, **F** – Fair, **G** – good

Priority key: A – as soon as possible, **B** – as part of a management programme, **C** – desirable but not essential

No.	Species	Age	Height (m)	Condition	Comments	Recommendations	Priority
1.	Sycamore	Y	5	F	Grows adjacent to a stump from a previously felled tree, branches are clear of adjacent footpath	No work required	-
2.	Ash	EM	3.5	P	Pollarded at height of 3.5m as canopy failed in recent high winds – there is a stump from a Birch opposite which has to be removed as it was damaged when tree 2 failed. Grows on-top/upto retaining wall which is the boundary to adjacent field. Low risk tree as canopy has been removed, condition should be monitored as new growth forms crown	Monitor condition biennially	-
3.	Ash	SM	9	F	Grows on-top/upto field boundary retaining wall, consider reducing canopy to reduce forces on wall – advice from structural engineer would clarify if there is a need for this. Twin stemmed from base, wire fence fused to stem, low branches overhang paddock area of adjacent field	Option 1 Remove 2 low branches overhanging adjacent field Option 2 Remove 2 low branches overhanging adjacent field Crown reduce and reshape by 3m	B C

No.	Species	Age	Height (m)	Condition	Comments	Recommendations	Priority
4.	Ash	SM	11	F	Grows on-top/upto field boundary retaining wall, consider reducing canopy to reduce forces on wall – advice from structural engineer would clarify if there is a need for this. Split branches/deadwood in crown, some Ivy growth on stem	Option 1 Remove split branches and deadwood Option 2 Remove split branches and major deadwood Crown reduce and reshape by 3m	B C
5.	Ash	SM	12	F	Low branch over adjacent paddock, deadwood in crown. Grows on-top/upto field boundary retaining wall, consider reducing canopy to reduce forces on wall – advice from structural engineer would clarify if there is a need for this	Option 1 Remove major deadwood Option 2 Remove split branches and deadwood Crown reduce and reshape by 3m	B C
6.	Goat Willow	SM	5	F	Historically has been heavily reduced, branches encroach neighbouring barn and paddock, multi stemmed tree, grows on-top/upto field boundary retaining wall	Reduce to height of 2m and prune to clear adjacent barn	B
7.	Cherry	Y	4.5	F	Twin stemmed from 0.5m – the 2 stems cross and are rubbing against each other in wind – consider removing smaller stem to improve form and prevent future defect	Remove smaller crossing stem	C
8.	Ash	SM	11	F	Grows down bank from path but long low branch encroaches path	Remove low branch overhanging path	C
G1.	Woody Shrubs	SM	Upto 3.5	F	Mixed woody shrubs, species include Privet, Hawthorn & Elder forming boundary screen. Overgrown – consider reducing height and trimming back from path and neighbouring field	Reduce height to 2m, trim back from path and adjacent field	C

No.	Species	Age	Height (m)	Condition	Comments	Recommendations	Priority
G2.	Various spp.	Y – EM	Upto 10	P – G	Remainder of the site on land is made up of this fairly wild group which is ecologically valuable. Species include Ash, Willow, Hawthorn, Elder, historic pruning has occurred to maintain clearance from footpaths. Some trees have been coppiced, particularly the Ash trees – further coppicing work may be required in 3-5 years as part of an ongoing management of this area	No work required	-

Conclusion

Brusselton Reservoir has protection as a SSSI site (Site of Special Scientific Interest) due to the recorded presence of Great Crested Newts. To encourage other wildlife, areas away from pathways should be left 'wild' with only maintenance to keep pathways clear and safe being recommended.

Trees 2 – 6 grow upto/on top of retaining boundary wall at western site boundary, there are options to reduce the larger of these trees but advice about if this is necessary should be sought from a structural engineer or another relevant, competent professional.

The work recommended on site is medium (priority B) to low (priority C) in urgency, there is not any high priority work which would require work to be done as soon as possible.

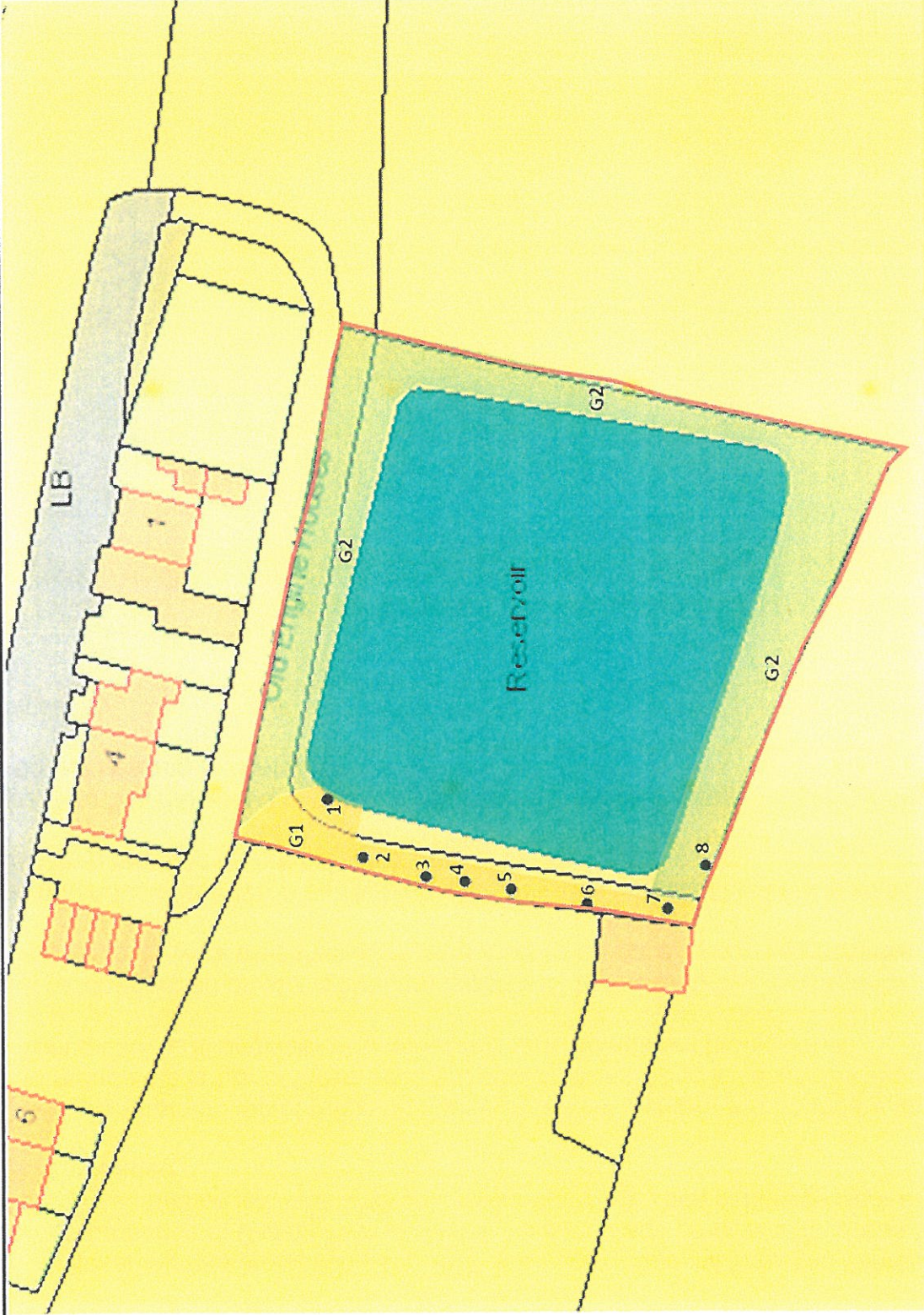
It is recommended that trees in public/high use area are inspected biannually so action can be taken when required and to fulfil your duty of care.

I trust that you find the above satisfactory, but should you require any further information please do not hesitate to contact me.

Yours sincerely



Stephen Keene HNC Arb.



Olivers Tree Services Ltd.

Title:	Brusseton Reservoir, South Terrace, Brusseton.
Date:	Shildon, DL4 1PZ
Drawn by:	29/04/2019
Scale:	S.K.
	H.T.S.



P1 – West Elevation view from the field



P2 - West Elevation retaining wall with reused railway sleeper blocks (holed)
(**Note:** structural cracking)



P3 - West Elevation retaining wall with reused railway sleeper blocks (holed)
(Note: structural cracking over the height of the wall)



P4 - West Elevation retaining wall with reused railway sleeper blocks (holed)
(Note: structural cracking)



P5 - West Elevation retaining wall with reused railway sleeper stones (holed)
(**Note:** structural cracking)



P6 – West Elevation structural cracking



P7 – West Elevation structural cracking and outwards displacement of the stone



P8 - West Elevation retaining wall structural cracking and displacement indicative of outer movement



P9 - West Elevation manure heap stacked up against the stone retaining wall



P10 - West Elevation debris stacked up against the stone retaining wall



P11 – West Elevation section of structural cracking and displaced stonework to the retaining wall



P12 – West Elevation structural cracking and displacement of the wall caused by tree root growth



P13 – West Elevation stonework outward displacement



P14 – West Elevation

(Note: in 'built in' bonding timber decayed and within the bulged section of the stone retaining wall



P15 – West Elevation structural cracking and displacement of the stonework adjacent to the lean-to offshot



P16 – Interior of the lean-to with inner skin of brickwork built up against the retaining wall



P17 - Interior of the lean-to with inner skin of brickwork built up against the retaining wall



P18 – Tree root growth at the top of the retaining wall



P19 – Lean-to shed/outhouse



P20 – West Elevation retaining wall thickness at the top i.e. coping 400 mm



P21 – West Elevation wall reasonably plumb



P22 – West Elevation retaining wall reasonably plumb



P23 – West Elevation end view taken from the South Elevation



P24 – West Elevation retaining wall



P25 – West Elevation retaining wall top thickness



P26 – Hard cement mortar applied to the face of the stone units resulting in increased erosion



P27 – Hard cement mortar applied to the face of the stone creating ledges, water entrapment and increased erosion of the stone



P28 – Reservoir West inner view



P29 – West Elevation – chain mesh timber post fence



P30 – South Elevation inner boundary



P31 – South Elevation inner boundary timber pale and rail fence



P32 – East elevation inner boundary fence



P33 – East elevation railway sleeper for post



P34 – East Elevation – timber pales 4 Nr rail fence with timber posts and railway sleepers used as posts; posts collapsed and outward lean of the fence



P35 – East Elevation – section missing and collapsed fence



P36 – East Elevation fence Inner View



P37 – East Elevation outer view



P38 – North Elevation entrance gates



P39 – North Elevation



P40 – North Elevation



P41 – North Elevation – reduced height post and rail fence



P42 – East Elevation Outer View



P43 – North Elevation timber gate



P44 – South Elevation outer view



P45 – Reservoir



P46 – Reservoir, rubble stone to create Embankment



P47 – Reservoir, rubble stone to create Embankment



P48 – Reservoir South Embankment



P49 – Reservoir North Embankment



P50 – Reservoir East Embankments