
SCIENCE AND INDUSTRY MUSEUM

Landscape and ecological management plan

Document Control

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Contents

Introduction	4
1 Softworks	5
Softworks General Arrangement	6
Landscape and Ecological Management Plan	7
Tree Work	9
Shrubs	13
Herbaceous Planting and Bulbs	15
2 Hardworks	17
Hardworks General Arrangement	18
Hardworks - Maintenance Operations	19
Hardworks - Maintenance	21
3 Drainage	26
Drainage - Maintenance Operations	27
4 Furniture	28
Furniture General Arrangement	29
Street Furniture - Maintenance Operations	30
5 Appendix	32

For any further information regarding the landscape and ecological management of the site including material suppliers and specifications please refer to the Health and Safety Manual.

Introduction

This document has been prepared in relation to the landscape proposals for the Science and Industry Museum Upper Yard, Station Approach and associated landscape works.

To ensure the site continues to positively contribute to the surrounding landscape, it's vital that there is a long term commitment to management and maintenance.

The landscape and ecological management plan will covers an initial time period of 5 years, during which the planted material will become fully established. Anticipated management operations post 5 years, and up to a minimum of 30 years, are shown with the caveat that this plan should be thoroughly reviewed following Year 5, and every subsequent 5 year period, to ensure that it meets the future management needs of the site post establishment, and delivers the long-term aims stated within this document.

The landscape and ecological management plan must give prime consideration to existing ecological and habitat features within the site. The long term management of the site must ensure that the Biodiversity Net Gain(BNG) target should be achieved as a minimum.

The biodiversity net gain assessment carried out by Rachel Hacking Ecology on behalf of the museum states that the proposed development is predicted to result in a net gain of 0.06 habitat units (+47.99%).

For further information regarding the BNG assessments and reports see document appendix.

1 SOFTWORKS

Softworks General Arrangement

Planting Design Vision

The softworks proposals aim to keep main routes clear for easy pedestrian movement and legibility whilst providing green pocket spaces that compliment the historic setting of the museum.

Tree planting will be limited to the Upper Yard to keep historic views clear within the Station Approach.

The planting palette will provide a varied and interesting display of plants that will become part of a story telling narrative within the museum. Whilst, enhancing biodiversity and providing stimulation to various senses such as the eye and nose of the Museum visitors.

Planting will include:

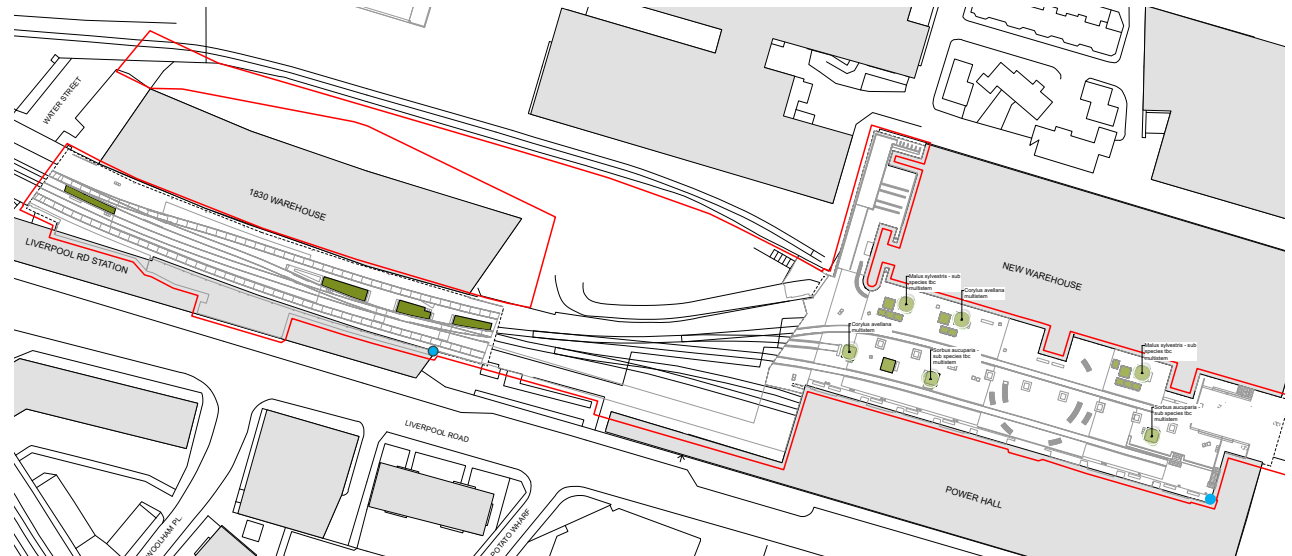
- Ornamental planting
- Bulb planting
- Multi-stem feature trees (Upper Yard)

The maintenance schedules on the following pages should be read in conjunction with the landscape design proposals.

The drawings relating to the Station Approach softworks are:

2913-PLA-XX-XX-DR-L-2002

2913-PLA-XX-XX-DR-L-6100



BOUNDARIES



SOFTWORKS



- **Irrigation connection points.** Existing to be retained and improved.

- **Irrigation connection points.** Proposed

The drawings relating to the Upper Yard softworks are:

2913-PLA-XX-XX-DR-L-2001

2913-PLA-XX-XX-DR-L-2003

2913-PLA-XX-XX-DR-L-6000

2913-PLA-XX-XX-DR-L-6001

Landscape and Ecological Management Plan

Objectives

Consideration has been given to the future management requirements of the softworks elements within the public realm associated with the Station Approach and Upper Yard. As a result, the following objectives have been identified:

- To ensure the successful establishment and continuity of the overall design concept.
- To prescribe all necessary management and maintenance principles and management tasks to ensure satisfactory establishment and maintain plants in a continuing healthy and attractive condition.
- To establish appropriate amenity and biodiversity value.
- To provide a mechanism for the ongoing monitoring and reviewing of the landscape and ecological management plan and the specific maintenance operations contained therein.
- To establish a mechanism for the replacement of any failing plant or one which has reached maturity.
- Encourage engagement and learning of the natural environment.

Duration

Once the initial construction defects and maintenance period is complete, all of the general activities highlighted below will need to be addressed by the maintenance team as part of the standard maintenance procedures.

The landscape and ecological management plan will cover a time period of 30 years. After this time a full review of the site should be undertaken and a new landscape and ecological management plan produced.

Monitoring

Monitoring is of fundamental importance, since this is the means by which the success of the plan will be measured. It is therefore important to establish standardised survey and monitoring methods, which enable valid year on year comparisons to be made. There will be a need for flexibility during its implementation. The landscape and ecological management plan must be an evolving one, able to adapt to the specific needs of the site.

This maintenance provider should undertake an annual review of the site, providing written documentation as to the ongoing establishment of

the planting.

This report should include a condition review of all new /existing plant material, success rates of newly planted material, and recommendations for future management regimes and immediate management requirements.

Health and Safety

A Health & Safety plan is an important consideration for any area of public realm. The landscape maintenance team are expected to produce a risk assessment and method statement for the maintenance of the planting.

Chemicals

Chemicals generally should be restricted in use. All chemicals, herbicides, pesticides and fertilisers, should be approved by English Nature and should be used, stored and disposed of in accordance with EN guidelines and COSHH Regulations 2002.

Maintenance Operations

Set out in the tables overleaf are the maintenance operations that should be carried out over the next 5 years, and then after 5yrs up to the 30yr time period outlined previously, in order to achieve the design objectives.

They have been set out in a format that can be easily followed by all parties, ensuring that the landscape and ecological management plan exists and a working document and not an archived report. The management prescriptions are flexible such that each section can be changed and updated on an annual basis, allowing targets to be set, progress monitored and accurate reporting made.

Future Training and Volunteering Operations

The Science and Industry Museum will monitor the maintenance regime during the 12 months defects period under the contractor. Reviewing requirements including tasks, training needed, hours required and number of volunteers/operatives needed. A plan will then be formulated following this.

Tree Work

Trees

Projected Maintenance

The tree species have been carefully chosen for their suitability to the location. Formative pruning has already been carried out at the nursery and this will produce suitable growth and canopy shape for the space provided.

In the event of any structural damage to the trees by unknown circumstances such as an extreme weather event the following guidelines should be observed:

The tree should be inspected by a qualified arboriculturist and any necessary works undertaken in accordance with recognised standards. If too damaged to retain then it should be replaced with a tree of the same species and size.

Where possible, pruning should be carried out in the dormant season to avoid excessive sap loss. Some deciduous trees and shrubs will bleed if pruned in late winter.

Irrigation

Irrigation of the trees and shrubs particularly during the frost growing season will be fundamental to their long term successful establishment.

Nutrition

The tree pits have been backfilled with a suitable growing medium containing nutrition sufficient for the initial period of establishment.

It would be advisable to apply an application of fertiliser in the Spring as a top dressing. A broad spectrum fertiliser such as HortiTop Complete (available from Hortifeeds) would be suitable.

Tree Planting					
Code	Species - Latin	Common Name	Size: girth (cm)	Size: height (cm)	Rootball
Ca	<i>Corylus avellana</i>	Common Hazel	20-25, 300-450cm high	Multi-stem specimen, 300-450cm high, 3 x transplanted	RB or Containerised if outside tree planting season
ME	<i>Malus 'Evereste'</i>	Crab Apple 'Everest'	20-25, 300-450cm high	Multi-stem specimen, 300-450cm high, 3 x transplanted	RB or Containerised if outside tree planting season
Sa	<i>Sorbus aucuparia</i>	Mountain Ash/Rowan	20-25, 300-450cm high	Multi-stem specimen, 300-450cm high, 3 x transplanted	RB or Containerised if outside tree planting season

Maintenance Operation Overview

- Identification: Before starting work agree which trees are to be removed or pruned
- Protection: Avoid damage to neighbouring trees, plants and buildings
- Standards: To BS 3998 and Health & Safety Executive (HSE) 'Forestry and arboriculture safety leaflets'
- Removing branches: Cut as shown in Arboricultural Association Leaflet No 8 'Mature tree maintenance'. Cut vertical branches similarly, with no more slope on the cut surface than is necessary to shed rainwater
- Appearance: Leave trees with a well balanced natural appearance
- Chain saw work: Operatives must hold a Certificate of Competence
- Tree work: To be carried out by an approved member of the Arboricultural Association

Additional Work

Defective, diseased, unsafe or weak parts of trees additional to those scheduled for attention: Give notice if detected.

Prevention of Wound Bleeding

Standard: To BS 3998, clause 8.

Prevention Of Disease Transmission

Standard: To BS 3998, clause 9 and Appendix B.

Water Restrictions

General: If water supply is, or is likely to be, restricted by emergency legislation, submit proposals for an alternative suitable source of water. Obtain instructions before proceeding.

Task	Year	Season	Frequency
New Native Tree Planting			
1 Maintenance during defects liability period of 5 years after planting whichever is the greater	1-5	As required	2 March - September
2 To establish new planting, maintain a 800m diameter weed free area around all trees	1-5	Spring - Autumn	Each Visit
3 Inspection / maintenance times: quarterly and after strong winds - Operations: replace or re-secure loose or missing guy wires - Adjust to suit stem growth and to provide correct and uniform tension	1-5	Throughout year	4
4 Apply granular organic fertiliser according to manufacturer's recommendations. Give Notice	1 – 5	Spring - Autumn	Bi-annual
5 Ensure trees remain firmly bedded after disturbance and re-firm as necessary	1 – 5	As required	Each Visit
6 Control all pests and diseases as necessary	1 – 5	As required	To be determined
7 Prune in accordance with good horticultural practice, thin, trim and shape as appropriate. Eg. Removing branches: do not damage or tear the stem. Wounds: keep as small as possible and cut cleanly back to sound wood. Cutting: make cuts above and sloping away from an outward facing healthy, angled so that water will not collect on cut area. Larger branches: prune neither flush nor leaving a stub, but using the branch bark ridge or branch collar as a pruning guide. Tools: use clean sharp secateurs, handsaws or other approved tools. Disease of infection: give notice if detected. Growth retardants, fungicide or pruning sealant: do not use unless instructed. Assess and Prune all trees annually as needed to maintain a minimum 2.2m clear stem and desired form. Prune <i>Corylus avellana</i> and <i>Malus 'Evereste'</i> Prune <i>Sorbus aucuparia</i>	1 – 5	Late Winter - early Spring Late Winter - Early Spring (Feb-Mar) Late Winter - Early Spring (Jan-Mar)	As required 1 1
8 Watering – regular checks using a moisture probe testing during the first two years after planting on a monthly cycle. During dry weather, increase frequency as necessary to ensure continued thriving and establishment of all trees. Ensure any compacted topsoil is loosened to ensure water reaches rootzone, being careful not to loosen or damage surrounding plants	1 – 2	Monthly	12 minimum
9 Water as necessary to full depth of topsoil to ensure healthy growth and continued thriving of all planting.	3-5	As required	As required
10 Replace dead or damaged trees to original specification. Give notice and remove within 1 month or as soon as possible and replace within the next available planting season. Cut down and grub up roots being careful not to disturb surrounding planting. Remove replaced plant material off site to licensed recycling facility.	1 - 5,	As required	As required
11 Top up mulching to original specification annually	1 - 5	Spring/Autumn	1
12 Autumn leaf removal	1-5	Autumn	
13 Collect accumulations of drifted leaves from the vicinity and from paved area by hand raking. Leave the works in a clean and tidy condition after completion. Arisings: Remove from site to licensed recycling facility.	1 - 5	Autumn/Winter	As required

Post 5 year maintenance in addition to the above

14	Replace any dead/ under performing trees planted. Where planting continually fails to establish, undertake investigations to ascertain any underlying cause	6+	Autumn - Winter providing ground conditions are suitable	Annually
15	Carry out an annual inspection of all trees and carry out remedial work as necessary	6+	Summer/Autumn	Annually
16	Maintain tree forms and manage branching to prevent limbs from overhanging balustrades or edge restraints to prevent being used for climbing/access	6+	All year	As required

Shrubs

Task		Year	Season	Frequency
1	Re-spacing/thinning of natural regeneration should be undertaken to promote diversity of the ground cover layer Leave any cut material in place to create cover.	1-5	October -February	1
2	Prune shrubs to encourage healthy and bushy growth and desirable ornamental features, e.g. flowers, fruit, autumn colour, stem colour. Suckers: Remove by cutting back level with the source stem or root. Remove dead/dying wood and damaged stems. Remove all arrisings to a liscenced recycling facility off site. Time of year: Winter flowering shrubs: Spring. Shrubs flowering between March and July: Immediately after the flowering period. Shrubs flowering between July and October: Back to woody stems in winter.	1-5	See Below Spring Late Summer Winter	As required 1 1 1
3	Maintain in a weed free and debris free condition(less than 5%) by hand weeding	1-5	All year	As required
4	Watering – Regular checks using a moisture probe testing on a monthly cycle during the first two years after planting on a monthly cycle during all seasons as required. During dry weather, increase frequency as necessary to ensure continued thriving and establishment of all planting. Ensure any compacted topsoil is loosened to ensure water reaches rootzone, being careful not to loosen or damage plants. Wet full depth of topsoil. If water supply is, or is likely to be, restricted by emergency legislation, submit proposals for an alternative suitable source of water. Obtain instructions before proceeding.	1-2	All year	12 minimum
5	Ensure plants remain firmly bedded after disturbance and high winds and re-firm as necessary. Completion: Rake area to a neat, clean condition. Re-firm plant supports and replace as needed.	1-5	As required	Each maintenance visit
6	Control all pests and diseases as necessary.	1-5	All year	As required
7	Between 3-5 years progressively remove all stakes and guards.	3-5	-	1
8	Remove any dead plants within one week of notification. Replace any dead/ under performing plants in the next suitable planting season. Where planting continually fails to establish, undertake investigations to ascertain any underlying cause. Contact landscape architect for suitable alternative species.	1-5	As Required	Each visit

9	Remove any non-native, self seeded material.	1-5	Autumn	As required
10	Gaps in planting: Refill by replanting allow 5 % replacement planting. Any replacement species to be agreed with landscape architect.	1-5	As required	As required
11	Maintenance of mulch and gravel - Allowance should be made (2.5% of total quantities of mulch) for settlement of the growing medium This may require filling in small riverlets or reducing build ups of soils from specific areas.	1-5	May-September	5
12	Apply granular organic fertiliser according to manufacturer's recommendations. Give notice	1-5	Spring	1
13	Snowfall: Remove snow from shrubs and planted areas within 24 hours of snowfall	1-5	As required	As required

Operations Post Year 5 (In Addition to Year 1-5 Operations)

14	In year 5 commence thinning regime of any shrub planting implemented in year 1. Extent of thinning to be determined at the time	5	Autumn	3 years
15	Replace any dead/under performing shrubs. Where planting continually fails to establish, undertake investigations to ascertain any underlying cause	6+	Spring	Annually

Herbaceous Planting and Bulbs

Task		Year	Season	Frequency
Ornamental Planting				
1	Maintain weed and debris (less than 5%) free area to the surface of all planting areas by hand weeding	1-5	March-October	12-16
2	Apply granular organic fertiliser according to manufacturer's recommendations. Give notice	1-5	Spring	1
3	Ensure plants remain firmly bedded after disturbance and high winds and re-firm as necessary. Completion: Rake area to a neat, clean condition.	1-5	As required	Each visit
4	Re-firm plant supports and replace as needed.	1-5	As required	Each visit
5	Prune woody species as necessary to encourage healthy growth	1-5	Spring-Autumn	x2
6	Prune early flowering species after flowering. Remove dead flower heads to early flowering varieties to encourage second flourish.	1-5	Early Summer	1
7	Prune late flowering species before new growth	1-5	Early Spring	1
8	Prune evergreen species	1-5	Mid Spring	1
9	Cut back all herbaceous perennials in February to approx 50mm above soil/mulch level before spring growth appears. Remove accumulations from site to a licenced recycling facility. Take care to avoid early emerging bulb planting.	1-5	February	1
10	Cut back early flowering perennials near to ground level after flowering to encourage fresh foliage and later summer flowering.	1-5	Spring & Summer	2
11	Retain feature flower heads or seed heads to provide interest through the winter months .	1-5	Autumn/Winter	1
12	Control all pests and diseases	1	As required	As required
13	Watering – Regular checks using a moisture probe testing on a monthly cycle during the first two years after planting on a monthly cycle during all seasons as required. During dry weather, increase frequency as necessary to ensure continued thriving and establishment of all planting. Ensure any compacted topsoil is loosened to ensure water reaches rootzone, being careful not to loosen or damage plants.	1-2	All	12 minimum
	Water as necessary to ensure healthy growth. If water supply is, or is likely to be, restricted by emergency legislation, submit proposals for an alternative suitable source of water. Obtain instructions before proceeding.	1-5	As required	As required

14	Replace dead or damaged material to original specification	1-5	March/October	1
15	Top up mulch planting to original specification at the start of each year after the cutting back of tender perennials.	1-5	Spring	1
16	Divide large groups of perennials every 3 years if planting density becomes too crowded and impacts health of surrounding plants. Re-fill holes and maintain composted bark mulch level. Divide summer flowering plants in spring or autumn providing that the ground is dry enough to work. Divide spring flowering plants in summer after flowering.	3	Spring Spring/Autumn Summer	1 1 1
17	Gaps in planting: Refill by replanting allow 5 % replacement planting. Any replacement species to be agreed with landscape architect.	1-5	As required	As required
18	Litter removal from planted areas	1-5	Year Around	As required
19	Snowfall: Remove snow from shrubs and planted areas within 24 hours of snowfall.	1-5	As required	As required
Bulb Planting				
20	Allow foliage to die back naturally once flowering has ended. Do not remove foliage when green.	1-5	Note	Note
21	Should any species fail, replace in the next bulb planting season, following the initial planting design. Any substitutes should be agreed with the landscape architect.	1-5	Autumn	As required
22	Ensure underground bulbs are protected when carrying out maintenance in areas with bulb planting. Post flowering, allow a minimum of 6 weeks before cutting back foliage of bulb planting.	1-5	As required	As required

Operations Post Year 5 (In Addition to Year 1-5 Operations)

23	In year 5 commence thinning regime of any herbaceous planting implemented in year 1. Extent of thinning to be determined at the time	5	Autumn	3 years
24	Replace any dead/under performing species. Where planting continually fails to establish, undertake investigations to ascertain any underlying cause. Contact landscape architect for suitable alternative species.	6+	March/October	As required

2 HARDWORKS

Hardworks General Arrangement

BOUNDARIES

 Planning Boundary

 Existing to be retained

 Existing Railway Tracks

 ST15 - Existing Timber surface to station building, retained

 ST19 - Existing Yorkstone Paving

 Proposed

 ST19 - Existing Yorkstone Paving

 ST19 - Existing Yorkstone Paving

 ST19 - Existing Yorkstone Paving

 ST19 - Existing Yorkstone Paving

 ST19 - Existing Yorkstone Paving

 ST19 - Existing Yorkstone Paving

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 ST19 - Existing Yorkstone Paving

 ST19 - Existing Yorkstone Paving

 ST19 - Existing Yorkstone Paving

 MC - Existing/Proposed Manhole Cover

 ST7 - Large Format Precast Concrete Slabs

 ST7B - Size (L) 1000mm (W) 600mm (D) 70mm

 ST7D - Size (L) 400 / 600mm (W) 600mm (D) 70mm

 ST12A - New Natural Stone Setts

 ST12B - New Granite/Sandstone Setts

 ST18A - Reclaimed Loafed Cobbles

 ST18B - Reclaimed Loafed Cobbles

 ST13 - Angular Grit

 Temporary Surface

 ER - Existing Railway Tracks

 RW1 - Retaining Wall

 RW1b - Retaining Wall

 RW2 - Retaining Wall

 ET10 - Flush Steel Edge

 ET11 - Steel Edge

 ET12 - Proposed Gully

 ET13 - Granite Dished Sett Paving

 ET14 - Granite Sett Paving

 ET15 - Natural Stone Sett Paving

 ET16 - Reclaimed Loafed Cobbles

 ET17 - Corduroy Tactile Paving

 ET18 - Insitu Concrete

 ET19 - Proposed Gully

 ET20 - Borehole Recessed Cover

 ET21 - Corduroy Tactile Paving

 ET22 - Insitu Concrete

 ET23 - Proposed Gully

 ET24 - Borehole Recessed Cover

 ET25 - Corduroy Tactile Paving

 ET26 - Insitu Concrete

 ET27 - Proposed Gully

 ET28 - Borehole Recessed Cover

 ET29 - Corduroy Tactile Paving

 ET30 - Insitu Concrete

 ET31 - Proposed Gully

 ET32 - Borehole Recessed Cover

 ET33 - Corduroy Tactile Paving

 ET34 - Insitu Concrete

 ET35 - Proposed Gully

 ET36 - Borehole Recessed Cover

 ET37 - Corduroy Tactile Paving

 ET38 - Insitu Concrete

 ET39 - Proposed Gully

 ET40 - Borehole Recessed Cover

 ET41 - Corduroy Tactile Paving

 ET42 - Insitu Concrete

 ET43 - Proposed Gully

 ET44 - Borehole Recessed Cover

 ET45 - Corduroy Tactile Paving

 ET46 - Insitu Concrete

 ET47 - Proposed Gully

 ET48 - Borehole Recessed Cover

 ET49 - Corduroy Tactile Paving

 ET50 - Insitu Concrete

 ET51 - Proposed Gully

 ET52 - Borehole Recessed Cover

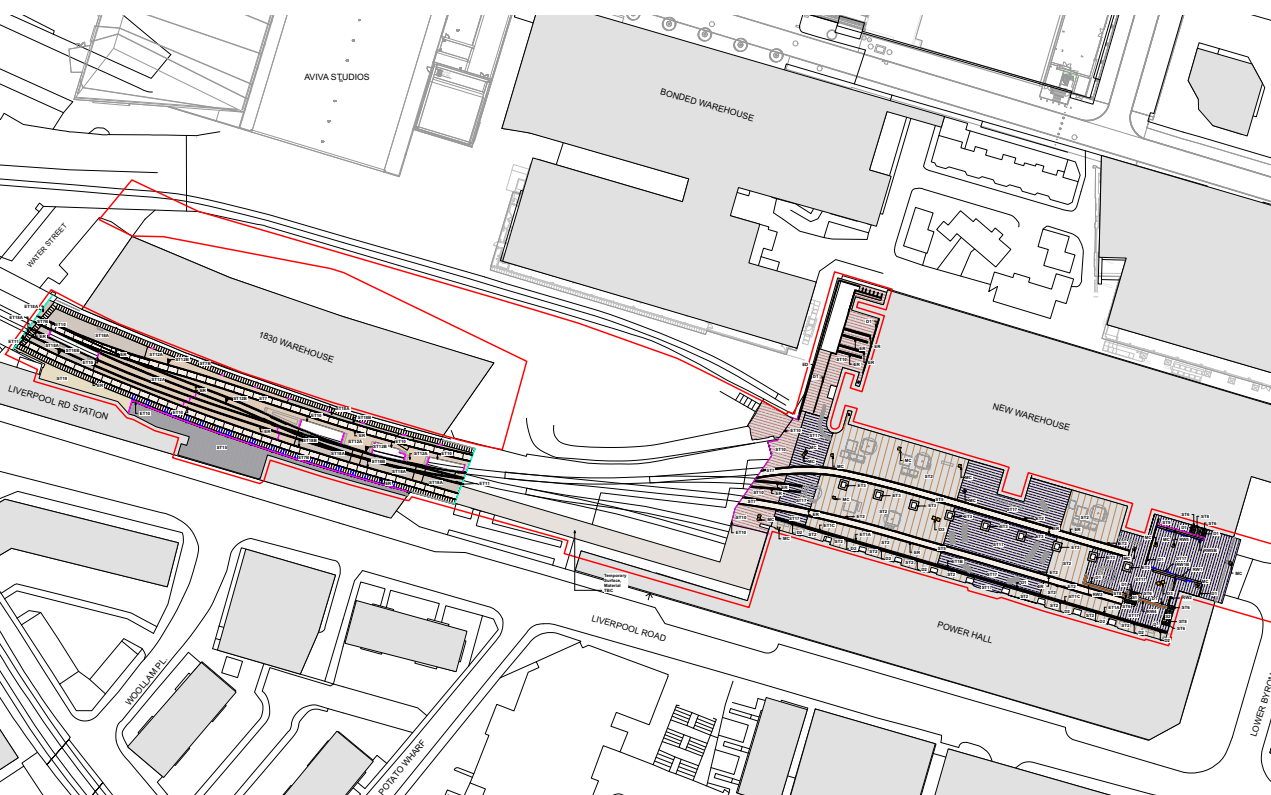
 ET53 - Corduroy Tactile Paving

 ET54 - Insitu Concrete

 ET55 - Proposed Gully

 ET56 - Borehole Recessed Cover

 ET57 - Corduroy Tactile Paving



 RW3 & 4 - Retaining Wall

 RW5 - Retaining Wall

 RW5b - Retaining Wall

 ET10 - Flush Steel Edge

 ET11 - Steel Edge

 ET12 - Proposed Gully

 ET13 - Granite Dished Sett Paving

 ET14 - Granite Sett Paving

 ET15 - Natural Stone Sett Paving

 ET16 - Reclaimed Loafed Cobbles

 ET17 - Corduroy Tactile Paving

 ET18 - Insitu Concrete

 ET19 - Proposed Gully

 ET20 - Borehole Recessed Cover

 ET21 - Corduroy Tactile Paving

 ET22 - Insitu Concrete

 ET23 - Proposed Gully

 ET24 - Borehole Recessed Cover

 ET25 - Corduroy Tactile Paving

 D1 - Proposed Drainage Channel

 E1 - Existing Drainage Channel

 D2 - Proposed Gully

 ET1A - Natural Stone Sett Paving

 ET1B - Granite Sett Paving

 ET1C - Granite Dished Sett Paving

 ET1D - Granite Sett Paving

 ET1E - Natural Stone Sett Paving

 ET1F - Reclaimed Loafed Cobbles

 ET1G - Corduroy Tactile Paving

 ET1H - Insitu Concrete

 ET1I - Proposed Gully

 ET1J - Borehole Recessed Cover

 ET1K - Corduroy Tactile Paving

 ET1L - Insitu Concrete

 ET1M - Proposed Gully

 ET1N - Borehole Recessed Cover

 ET1O - Corduroy Tactile Paving

 ET1P - Insitu Concrete

 ET1C - Granite Dished Sett Paving

 ET1B - Granite Sett Paving

 ET2 - Natural Stone Sett Paving

 ET3 - Reclaimed Loafed Cobbles

 ET4 - Corduroy Tactile Paving

Hardworks - Maintenance Operations

MAINTENANCE OPERATIONS – HARDWORKS

Surfaces need to be maintained such that they provide a safe passage for all pedestrians and highway users. It is also essential that areas, which have been subject to major investment, are protected and sustained through an effective maintenance regime. The success of any streetscape project will greatly depend on the attention given to maintenance.

It is important that paved surfaces are regularly inspected so that defects can be identified and rectified. Typically, early life maintenance or aftercare of new works will be the responsibility of the Main Contractor that delivered the works. The maintenance and defects liability period will generally be 12 months. The Main Contractor should visit the site at regular intervals during the maintenance period, to inspect all paved areas, and to undertake any remedial works. At the end of the maintenance period the contractor will be required to undertake remedial works to the satisfaction of the Client.

PAVING DEFECTS

Common defects - Paved roads deteriorate in a variety of ways, depending upon the type of construction and cause of distress. When deterioration presents a safety hazard

then maintenance becomes essential. Timely maintenance, in some instances can prevent deterioration progressing to a state where reconstruction is required. The majority of failures tend to be confined to the surface layers of paved roads, i.e. they concern the bedding and jointing that surrounds stone elements.

Descriptions and illustrations of common defects are given below:

Both Flexible and Rigid:

Punching - Vertical downward movement occurs in and around wheelpaths. Punching shear is resisted by both the joints and bedding. The lower of the two capacities, joint shear or bed bearing will control the elements resistance to punching. The defect occurs in flexible and rigid surfacing. Localised or isolated areas of punching are likely to be due to poor workmanship. More widespread punching is more likely to be due to under design.

Loss of jointing material - Mechanical breakdown or loss of jointing material in large elements allows the ingress of water. Load spreading ability will reduce if the bedding layer is broken down by the action of water, freezing effects, lateral movement etc.

Broken or damaged elements - Apart from being unsightly, cracking and spalling can become a hazard if it creates a trip. Spalling occurs during transport

and laying, but can less commonly be a fault in the material. It can result during manufacture, impact loading, abrasion and weathering. Inappropriate size or depth of element results in fracture under loading.

Rigid:

Progressive cracking - Debonding of the jointing material from stone elements commonly leads to progressive cracking. The continuous action of heavy vehicle tyres on the elements dislodges and pulverises sufficient quantities of the jointing material to cause a breakdown of the joint matrix. Inappropriate design and poor workmanship are likely causes. Factors likely to have contributed to this type of failure are:

- poor compaction of the bedding
- inadequate moisture content in stabilized bedding
- depth of elements
- low jointing strength
- early pavement trafficking
- inappropriate laying pattern

Movement - If the homogeneity of the upper layer is broken, it is impossible to control lateral movement with joint widths $\geq 10\text{mm}$. Once the surface matrix is broken, it allows the tyre interaction of the

traffic to move the setts in angular directions, thus perpetuating the breakdown of the rigid surface. Ingress of water then adds to the problems. Rutting is common and depending on the construction of the pavement the underlying layers of the structure will gradually deteriorate.

Flexible:

Flexible Movement - During the very early life of flexibly laid pavements, the joints between the units will be relatively porous. The ingress of water can consolidate jointing material and it is important that the joints are regularly 'topped up' to replace the sand consolidated by rainwater or removed by other

factors. The joints will soon become semi-impervious as the build up of surface detritus seals the joints. Until this has occurred the paving should only be brushed by hand. Mechanical sweepers, and in particular sweepers with high suction forces, should not be used as there is a real risk of further loss of jointing material.

When high traction forces exist such as with braking, accelerating and cornering. The surface profile and element orientation can be lost with flexible construction. The ability of the surface elements to move and the surface to deform without, necessarily, a loss of stability defines the layer as being a 'flexible' layer.

TREATMENT OPTIONS

Maintenance treatment will depend on the type of defect and what has caused the deterioration. For some surfacings, topping up of jointing may be all that is required, but poor surface profile may require a site investigation to provide information on the condition of the pavement at depth. Suitable strategies can then be formulated based upon informed engineering judgment.

The table below summarises some common defects, resulting problems and treatments.

Defect	Problem	Treatments	
		Temporary	Long-term
Expansion and contraction joint cracks	Cracking	Monitor/method statements from bedding and jointing material supplier required	Deep water ingress can lead to structural faults.
Debonding of jointing material	Initiation of failure mechanism	Monitor / investigate	Replace jointing or reconstruct if poor design
Broken or damaged elements	-	-	Replace or reconstruct
Missing elements	Trip, water ingress	Fill holes	Replace element
Rocking elements	Hazard to users	Relay	-
Spalling of arises or surfaces	Unightly trips	-	Replace
-	Loss of stability, water ingress	Fill wide gaps if hazard	Relay elements and strengthen edge restraint if necessary
Slippery surface	Hazard for users	Warn users or restore texture	Clean, restore texture or renew surfacing
Surface contamination	Hazard for users and unsightly	Clean or neutralize	Replace surfacing if necessary
Vegetation	Surface slippery	Warn users, clean	Consider increasing frequency of maintenance
Water	Surface water	Salt if freezing	Relay surfacing to correct gradients and crossfall
-	Blocked drain	Clear blockage	-

Guidance: To ensure the chosen treatment is cost effective, consideration should be given to the maintenance history of the paved surfacing, its future use and the likely failure mechanism.

Hardworks - Maintenance

Lifting, repair and relaying

Rigid Joint Repairs

Where elements are part of a rigid construction and degradation of the cement mortar joint has occurred, it will be necessary to refill the joint. If necessary the joint should be raked out, which is time-consuming and costly. It may be more appropriate to use a small hand-held grinder with an attachment to remove the dust and debris, in a controlled manner, into some form of hopper. Once the joints have been cleaned out they can be refilled with a mortar appropriate to the trafficking category. Care is required to confine the mixture to the joint and prevent staining of the surface. Trafficking should only be allowed once the mortar has gained the appropriate strength.

Flexible Joint Repairs

Relaying elements of flexible construction should be carried out in the same way as new construction (Refer to NBS specification). Additional guidance for flags is given in BS 7533-7:2010. Removing a damaged single element prior to relaying can be difficult, particularly if it is small element, as breaking it out may disturb adjacent modules. It may be necessary to consider relaying all elements, which about the damaged area, or to relay a full line of elements back to an edge restraint. If the surface has poor profile, elements will need to be lifted over the whole of the affected area. In all cases a complete renewal of the bedding material should

always take place. An experienced paver is required to execute a good reinstatement.

General Sealing

Proprietary sealing agents are commonly used on paved surfaces, to reduce moisture penetration of the laying course material, and minimise staining from spillages. The paving surface must be completely dry and clean before any sealer is applied with the manufacturer instructions adhered to at all times. Whilst such products may offer certain advantages, careful consideration must be given to the suitability of the sealant and any subsequent effect on the colour appearance and slip/skid resistance of the paving.

Cleaning

Generally

The following recommendations deal with vehicles and associated equipment for use on paved footways/footpaths/pedestrian areas and roads:

- The equipment should be purpose designed to sweep the particular area and surfacing product. If there is any doubt, the vehicle manufacturer should be consulted.
- Where possible, low ground pressure tyres should be fitted to reduce the risk of breaking or cracking of flags.

- Tyres should be inflated according to the manufacturer's recommendations, again to ensure minimum weight distribution per square mm.
- Polypropylene, not wire, brushes should be used.
- Sweeping brush pressures should be set to the minimum required to suit the particular task, i.e. surfaces swept regularly will require a lower setting than those swept infrequently or those covered with heavy deposits.
- When sweeping, engine revolutions should be set at the minimum required to maintain vacuum (suction) pressure.
- Operators, including reliefs, should be trained to manufacturers' recommendations and tyre and brush pressures should be regularly checked.
- Advice should be given to operators that, when equipment is stationary or left unattended, suction, brush rotation and water jetting equipment should be switched off to avoid the risk of damage to the area below the stationary equipment.
- In new or re-laid areas, agreement should be reached on a period of manual cleaning (at least four weeks) to allow the paving to settle and the joints to seal. This period may be reduced by using either a water-based bonding agent or elastomeric prepolymer sealant and by agreement with the cleansing authority on an appropriate sweeping regime.

General Dirt and Detritus

To remove general dirt and detritus, regular brushing is recommended. If detritus reduces the intensity of the colour of the material then this can be reestablished by scrubbing with a mild detergent e.g. washing up liquid, and hot water.

Ensure all the detergent has been thoroughly washed from the surface on completion of the cleaning and the resulting run-off is carefully channelled to either drainage points or containers where it can be safely disposed of.

Flexible Paving:

- Following the use of mechanical cleaning operations, re-sanding of the joints in flexibly laid areas may be necessary.

Moss, lichens and algae

Moss, lichen and algae can be prevalent on hard surfacing where the area is heavily shaded, is under trees or is not laid to an adequate fall. If such growths do occur and are considered undesirable then the area should be treated with a proprietary weed or moss killer used in accordance with the manufacturers' instructions. Such products take some days to be effective and are most effective when applied during a spell of dry weather. The washes work best if any thick growths are scraped off first and the wash is well brushed in. Some treatments leave a residue to discourage the re-

growth of the moss and algae but this will only be of limited value if the surrounding conditions leave the paving damp and in shade.

Rust Stains

Initially action must be taken to eliminate the sources of staining. To remove the rust stain, the surface should first be wetted with clean water and then the affected area treated with a 7 to 10% dilution of Hydrochloric acid solution.

Guidance on the safe use of chemical treatments (Acid Washing) is given later in this document.

Oil Stains

Oil can penetrate readily into hard surfacing materials, but it should not stain if any spillages are removed promptly with an absorbent material e.g. paper towels, cloth or absorbing granules. Do not attempt to wipe the stain as this will drive the oil into the surface of the units and spread it over a wider area.

If the stain persists then an emulsifying degreaser should be employed. Brush the cleaner onto the affected area, leave for a period of time according to the manufacturers instructions and then wash the emulsified oil away with plenty of clean water.

Alternatively the surface can be scrubbed with a detergent and hot water taking care to ensure that the strength of the detergent is not detrimental

to the appearance of the paving. However, for persistent oil staining, steam cleaning may have to be considered.

Bitumen Stains

Fresh bitumen should be allowed to cool down before removing it with a paint scraper or similar. If it is particularly resistant, the use of ice to make the bitumen brittle may be required prior to scraping it from the paving. Any residue should be removed with an abrasive powder and finally the whole area rinsed with clean water. Certain proprietary cleaning agents are available to remove bitumen but these should be tested on an inconspicuous area of paving first.

Graffiti and Paint Stains

Both paint and graffiti are difficult to remove from most hard surfacing materials. Fresh wet paint should be soaked up with an absorbent material without wiping the paint, as this will spread the stain. It should then be treated with a suitable solvent such as white spirit and then the area washed with a de-greasing agent taking care in the disposal of the run-off material.

Dried paint should be scraped off as far as possible and then an appropriate paint remover applied.

Paint manufacturers may often be able to give more detailed advice on the removal of paint and graffiti. Therefore they should be consulted directly for specific recommendations.

Epoxy and Polyester Stains

Areas of solidified epoxy or polyester resin can be removed by carefully burning off the area with a blowtorch. Care must be taken not to inhale any fumes given off.

If, after burning, a black stain remains, this can be removed by scrubbing with detergent and hot water. For larger areas grit blasting may have to be considered, however the effect of such treatment on the micro texture of the surface should be carefully considered. Again it is advised that a small area be tested before any large-scale operations are undertaken.

Smoke, Fire and Tobacco Stains

Normally such stains can be removed by scrubbing with detergent and hot water. Where the stains persist, a mixture of scouring powder and household bleach can be used. It is important the bleach is washed from the area with clean water once cleaning is completed and the run-off carefully disposed of.

Beverage Stains

These can normally be removed by scrubbing the stain with detergent and hot water. If the stain is persistent, apply a household bleach solution and then rinse the area with clean water taking care to dispose of the run-off safely.

Chewing Gum

Chewing gum is a particularly difficult substance to remove from hard surfaces.

Newly discarded gum can be scraped off by using a mechanical scraper but hardened gum can only be removed by both freezing the gum and chiselling it from the surface of the paving or utilising a hot water/steam cleaner.

For specific advice on chewing gum removal it is recommended that specialist contract cleaning companies be contacted directly for further details.

Scuff Marks from Vehicle Tyres

These can normally be removed by steam cleaning, or by scrubbing the area with detergent and hot water.

It is important that prior to any acid cleaning being undertaken, the paving is checked to ensure that any signs of vanadium staining have thoroughly weathered away before acid cleaners are applied.

If some form of chemical treatment is required to remove more stubborn vanadium staining, then this should be undertaken using an organic acid that will not have the aforementioned effect of “fixing” the stain to the paving.

Acid Washing

Stubborn and persistent stains that will not generally weather away naturally will require the application of a specific acid cleaning treatment to remove them.

Prior to any acid cleaner being applied, the surface must be thoroughly wetted with clean water to prevent the acid being absorbed directly into the paving. A dilution of 7 to 10% of hydrochloric acid should then be prepared and applied to the affected area.

As the staining begins to dissolve, some frothing may be apparent, which should be followed by agitation of the surface using a stiff bristle brush to completely remove all trace of the stain.

Once this process is complete the whole surface should be rinsed thoroughly with clean water, taking care to dispose of the run off safely. In the vast majority of cases, one treatment will be sufficient; however, in some cases re-treatment may be required.

When using any form of chemical treatment the following guidelines should be strictly adhered to:

- With deeper stains, the degree of acid treatment may result in an acid etched appearance.
- Protective clothing (gloves, boots, goggles etc.) should be worn at all times when using chemicals and the appropriate first aid measures must be available on-site.

- Take care to ensure that surrounding materials and landscaping are protected. Soft landscaping and exposed metals can be severely affected by chemical treatments.
- It is better to treat several times with the correct dilution than to use concentrated acid, which may damage the surface of the unit.
- When diluting acids, always add acid to water and not water to acid.

General Cleaning

An annual detergent wash is also recommended.

The Use of Power Washing Equipment on Paved Areas

Rigid Paving:

To aid in the removal of surface staining power washing equipment is often considered. Whilst such techniques offer certain benefits, particularly for larger areas, it is important that care is taken in their use to avoid damage to the structural integrity of the paving.

When using any form of Power Washer the following guidelines should be strictly adhered to:

- The power washer should be used on a setting, which is sufficient to remove the dirt without causing

any further distress. A low-pressure setting is recommended.

- Do not direct the power lance directly down on to the paving, as this can result in loss of jointing material.
- Ideally a spraying movement should be adopted holding the power lance at a shallow angle, not greater than 30° across the diagonal (i.e. not parallel to joints).
- Certain high-pressure jetting machines have been known to mark / damage the surface of certain types of paving material. It is therefore prudent to carry out a small test area before commencing on a larger area.
- The area should be inspected after cleaning to ensure that joints are full.

Flexible Paving:

Special consideration should be taken when cleaning pavements to the Station Approach where paved surfaces with loose grit jointing are adjacent to paved surfaces with jointing mortar.

- Inspect the area to identify sections with loose grit jointing and ensure proper containment of the grit during cleaning. Note any damage or excessive erosion in the joints that may require refilling after cleaning.

- Use low-pressure water cleaning or gentle sweeping to avoid dislodging the grit. Avoid mechanical sweepers or strong jet washes, as they may remove jointing material. Where necessary, use a soft-bristled brush and minimal water.
- Clean paving with loose grit jointing more frequently but gently to prevent build-up of debris that could compact and displace grit
- During winter, avoid de-icing salts near loose grit areas, as they may degrade both the stone and jointing material.

Vehicle Weight Limits Over Station Approach Viaduct and pedestrian only areas

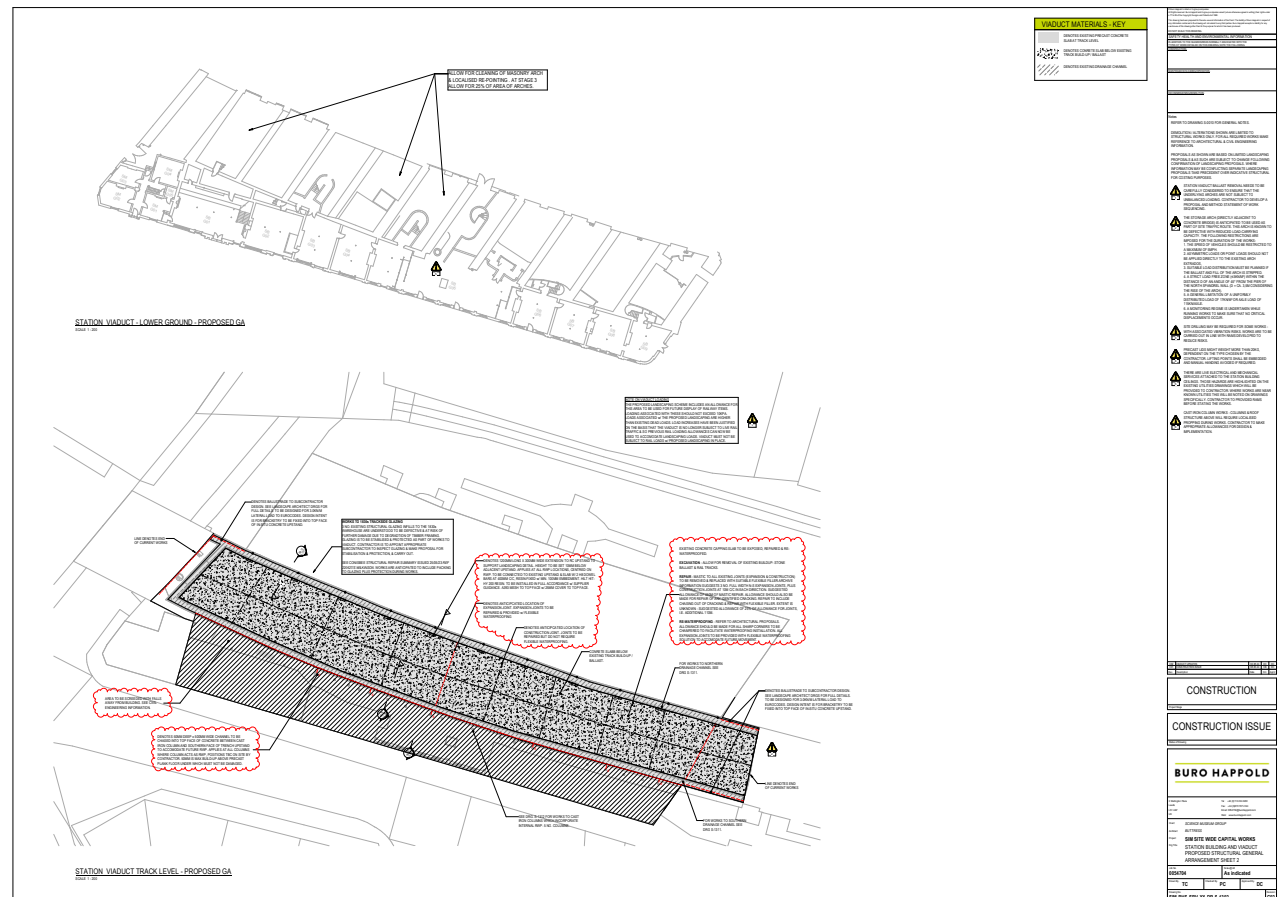
Vehicle access should be restricted to necessary maintenance only.

A risk assessment should be conducted before allowing any maintenance vehicles onto the paved surface. If access is unavoidable, vehicles should: Stay on designated reinforced routes if provided and distribute weight using temporary load-spreading mats or steel plates to prevent cracking or subsidence.

Note that there are a number of specific load limitations in place for the station approach area, including the following. Reference should be made to BH structural drawings for full details.

- Loading onto the concrete slabs covering the northern and southern drainage troughs is limited to pedestrian load at 5kPa.
- Loading to the storage arch area to the immediate east of the concrete bridge is limited due to defects in the arch structure.
- Imposed loads to the general station approach area is limited to 10kPa due to increased loading from the new landscaping buildups.

Refer to engineers drawing: SIM-BHE-SBV-XX-DR-S-1302 for further information regarding vehicle loading on Station Approach.



3 DRAINAGE

Drainage - Maintenance Operations

from the individual drainage suppliers. Advice from the suppliers can also be sought regarding the maintenance of their products using the contact details supplied.

Drainage Channels and Gullies

Each item should be checked to ensure it is free from leaves and debris every three months and more frequently during the autumn months. These items should also be checked immediately after a significant storm event.

Clean and unblock with a jet washer if necessary.

Inspection chambers and manholes

Inspection chamber and manhole covers should be lifted and be visually inspected annually. Any debris should be removed. If any blockages are found the pipeline should be rodded or flushed out by jetting.

Contact the supplier for further advice.

4 FURNITURE

Furniture General Arrangement

SITE FURNITURE

Existing Retained/Relocated

- 

Existing Gantry Structure
To be retained.
- 

F10 - Existing Timber Bench
Re-used on site
- 

F11 - Existing Loose Picnic Table
retained and relocated
- 

F12 - Existing Loose Deck Chairs
retained and relocated

Proposed

- 

F1-Curved Free Standing Bench
Product: Bespoke bench
Material: timber topped with steel support frame
To include back and arm rest
Size: (h) 300, 450, x (W) 1000 (L) varies
Support frame finish: Corten steel with Gussets to reflect details of gantry structure.
- 

F2- Free Standing Bench
Product: Bespoke bench
Material: timber topped with steel support frame
To include back and arm rest on 50% of seating
Size: (h) 450 x (W) 600 (L) varies
Support frame finish: Corten steel with Gussets to reflect details of gantry structure.
- 

F16 - Bespoke Two-tiered Bench
Material: timber topped
To include back and arm rest on 50% of seating
Size: 480-600mm high, varied length and varied width
- 

F15- Timber Top to Retaining Wall
Material: timber sleepers
To include back and arm rest
- 

F5-Recycling Bins
Material: mild steel frame with timber clad front
Finish: mild steel powder coated
Size: (H) 890 X (L) 350 X (W) 300mm
- 

F6- Bespoke Balustrade
Material: mild steel
Finish: PPC Tiger Drylac 29/80081 LL / C (Iron Glimmer Effect PF) or black (final colour subject to client approval)
Panel size: (H) 1100 x (L) 2280 x (W) 60mm
- 

F7 - Free Standing Removable Planters
Material: Mild steel
Finish: Corten
Size A: (H) 500 x (L) 1880 x (W) 1480
Size C: (H) 800 x (L) 2480 x (W) 2480
Size D: (H) 1100 x (L) 2980 x (W) 2980
- 

F8 - Gate
To allow level access from Lower Brynmor Street into Upper Yard removal of gate.
Material: Mild Steel
Finish: RAL 9005 (final colour subject to sample approval by client)
Size: 2.4m high
- 

F13 - Timber Seats
Material: UK sourced Oak
Size: (L) 450 X (W) 450 X 100mm
Finish: Tanalised treated timber
- 

F14 - Handrail
Material: Grade 316 Stainless Steel
Upper Rail Size: (L) 3645 x (h) 1100 diameter 50mm diameter
Lower Rail Size: (L) 3645 x (h) 600 diameter 50mm diameter
Fixing: fixed to Balustrade.

- 

F19A- Bespoke Planter Edge (600mm)
Material: Mild Steel
Finish: Corten
Size: Height: 750mm (600mm above ground).
Lengths: Varies
- 

Water Tap Provision
Existing retained and improved
- 

Water Stand Tap Provision Proposed
Details to c.
- 

Proposed Power Provision
BH engineer to provide ducting for a future connection
Currently two locations shown. One final position to c by client
- 

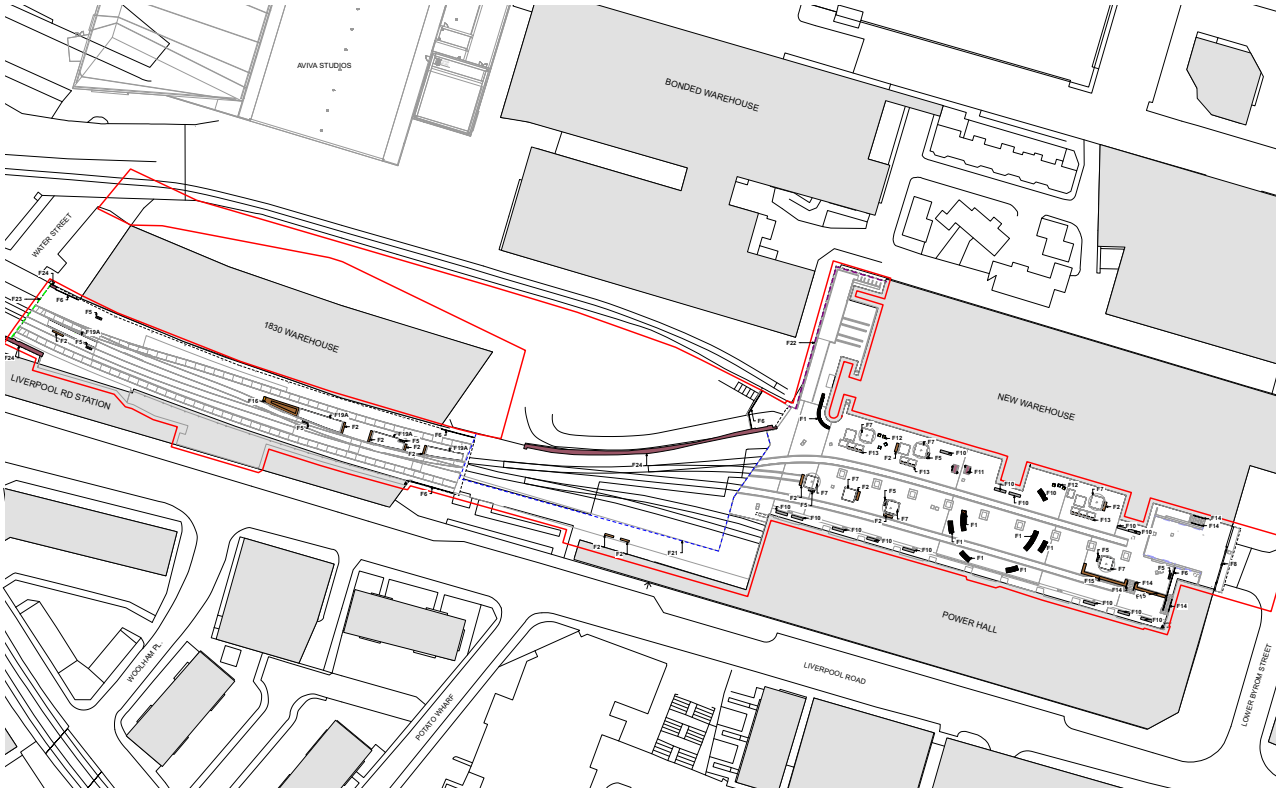
F21 - Temporary Balustrade
Location: Heart Space
relocated from Station Approach
galvanneal steel,
to include 1no. existing gate with keylock
- 

F22 - Fencing
Location: SEG and Western end of Station Approach,
existing retained
- 

F23 - Metal Fencing & Gate
Location: west end of Station Approach
retained
- 

F24 - Existing Wall
retained
- 

F25 - Existing Metal Balustrade
retained



Street Furniture - Maintenance Operations

In addition to the recommendations below, also refer to the maintenance and operational instructions from the individual street furniture suppliers. Advice from the suppliers can also be sought regarding the maintenance of their products using the contact details supplied.

Timber to Benches / Seating

As Oak timber is specified, more frequent monitoring of splitting is required within the first few years as the timber weathers. If splitting has occurred this should be checked for potential splinters and sanded to ensure user safety.

Following this period, timber components should be inspected every 6 months, more in exposed locations, and cleaned to prevent dirt or moss build up.

Hardwood can be cleaned with a Molecular Nano (MN) cleaning product and treated with an MN sealant (a non-film forming hardwood treatment that slows down greying, and protects against dirt and other factors that impact the quality of the wood). This is a good time to check for any damage or splintering that may require repair. Splinters, sharp edges or graffiti can be removed through light sanding.

Resin or gum exudation may occasionally occur on

the finished surface of timber, especially during periods of warm weather. The condition generally will diminish with the passage of time. Should excesses of resin remain on the surface, these may be removed using a sharp blade. Care should be taken to work with the grain and to avoid marking the surface.

If left in the natural state the long life expectancy of Naturally Very Durable Hardwood is not significantly impaired. A light sanding can bring back the colour of the grain.

Steel Furniture: Handrail

The stainless steel should be washed down with soap or mild detergent and warm water followed by a clear water rinse.

For folding bollards, ensure the post is kept clean and free of debris. Clean and lubricate the lock using a lubricant similar to WD40. Always ensure the cover plate is closed when the bollard is not in use. Clear any debris around the cover plate and hinge.

Powder coated Finishes: Balustrade, bins and gate

Powder coatings can be treated like most other paints and will benefit from regular washing. If the powder coating is chipped or the steel is exposed in anyway, it is recommended that this should be 'touched up' using external grade paint. Cleaning

should take place every 6 months. A mild detergent applied by cloth, sponge or soft brush should be used. The aesthetic life will be prolonged by waxing or polishing with good quality car shampoos and waxes.

Corten Steel Planter Edges, benches and retaining wall cladding

Monitoring of the Corten elements is required to ensure no staining is found to the adjacent paving. If paving is stained, refer to hardworks maintenance treatments found on pg 18-21. Any repairs, alterations or scratches to the Corten steel structure can be touched up using the specialist sealant. The coating can be applied via a spray, roller or brush.

Managing potential rat problems

Regular checks should be carried out to ensure rat populations have not inhabited the sites furniture items.

This should include regular checks between site planters, benches and bins. Ensuring drainage caps are secured and there are not potential access points.

Additionally on the bespoke timber seats located in the Station Approach, these are to have detachable end panels for equipment to be stored within. This space needs frequent checks to ensure these panels are secured and no rat populations have moved into

the space.

Equipment stores

Equipment stores are located in ... (SIM to Input) and managed by the Science and Industry Museum.

Fixings and Fittings

Regular checks should be carried out on fixings and fittings to ensure they remain secure and tamper proof.

In addition to the recommendations below, also refer to the maintenance and operational instructions

5 APPENDIX

Science and Industry Museum,
Manchester
Biodiversity Net Gain Assessment
2025



RACHEL
HACKING
ECOLOGY

Client	Science Museum Group
Project Title	SIM, Manchester
Project Reference	RHE.1805
Project Leader	Simon Holden
Contact Details	simon@rachelhackingecology.co.uk

	Name	Position	Date
Author	Simon Holden	Associate Ecologist	05/03/2024
Revision	Simon Holden	Associate Ecologist	01/05/2025



RACHEL
HACKING
ECOLOGY

The Stables
Paradise Wharf
Ducie Street
Manchester
M1 2JN

0161 465 8971

www.rachelhackingecology.co.uk

mail@rachelhackingecology.co.uk



RACHEL
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Report Contents

Executive Summary	3
1. Introduction	4
2. Methods	5
3. Baseline Habitats	6
4. Proposed Habitats	8
5. Assessment	9
6. Conclusion	10
Appendix 1: Headline Results	11



Executive Summary

Development Details

The client is proposing re-development at the Science and Industry Museum, Manchester, hereafter referred to as the 'Site'.

This report describes the predicted changes in biodiversity units resulting from the proposed development. Recommendations are provided so that the development is compliant with biodiversity policy and legislation.

Assessment

The site has a negligible level of ecological interest. Baseline habitats score 0.12 units. Proposed habitats score 0.18 units. This represents a net gain of 47.99%.

Outcomes

The proposed development is predicted to achieve biodiversity net gain and exceeds the requirements of national and local planning policy.



1. Introduction

1.1 Project Brief

- 1.1.1 Rachel Hacking Ecology Limited was commissioned in 2023 by the Science Museum Group to carry out a Biodiversity Net Gain (BNG) assessment of a proposed development at the Science and Industry Museum, Manchester, hereafter referred to as the 'Site'. The Site is in Castlefield on the site of the former Liverpool Road railway station at O.S. grid reference: SJ 830978.

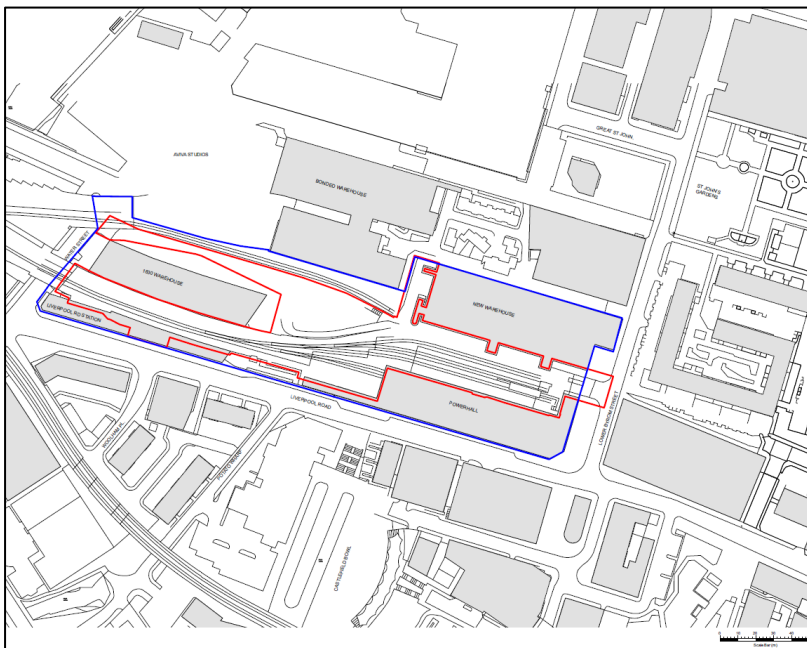


Figure 1. Map showing the planning boundary

Description of Development

- 1.1.2 Due to the Site's location within the curtilage of, and adjoining, several listed assets, six listed building consent applications will be submitted alongside one planning application for the works. The proposals are for landscaping works to the Upper Yard and Station Approach plus temporary landscaping between these two areas to allow for temporary access, removal of the vehicle ramp and associated making good works, and works to the plant room deck.

1.2 Scope of Work

- 1.2.1 The Client commissioned Rachel Hacking Ecology to calculate the baseline and predicted post-development biodiversity units.

2. Methods

2.1 Extended Phase 1 Habitat Survey

- 2.1.1 An Extended Phase 1 Habitat Survey of the Site was undertaken on 27th June 2023. The Site was walked, and habitats were recorded and mapped. The survey was undertaken by Simon Holden MCIEEM (Associate Ecologist).

2.2 Biodiversity Net Gain Assessment

- 2.2.1 The Defra statutory biodiversity metric tool was used to assess the predicted changes in habitat units resulting from the proposed development.
- The baseline habitats recorded during the Extended Phase 1 Habitat Survey were measured using QGIS software.
 - The baseline habitats were translated into UKHab classification using the translation tool in the metric.
 - Habitat conditions were assessed using the Defra Statutory Metric Habitat Condition Assessment sheets.
 - The strategic significance of baseline habitats was assessed on whether they were formally identified in a local strategy or policy, or whether they were in an ecologically desirable location.
 - The proposed habitats, including any retained or enhanced habitats, were assessed based on information provided by Plan-it (areas of proposed habitats).
 - The predicted change in biodiversity units was determined by calculating the difference between the baseline units and the post-development units.
- 2.2.2 This report should be read in conjunction with the Excel spreadsheet '*Statutory Biodiversity Metric Calculation Tool, SIM 010525*'.

3. Baseline Habitats

Urban; Developed Land-Sealed Surface

- 3.1.1 The vast majority of the Site comprises hardstanding and unvegetated railway ballast. These habitats are assessed together as they are of very low distinctiveness and low strategic significance. Condition assessment does not apply to these habitats which extend to 0.9559ha and score zero habitat units.

Sparsely Vegetated Land; Ruderal/Ephemeral

- 3.1.2 A small area of railway ballast extending to 0.024ha is sparsely vegetated with ephemeral/ruderal species including Sticky Ragwort, Herb Robert, Hare's-tail Grass, Black Medick and Bird's-foot Trefoil. This habitat is in poor condition as it fails Criteria A and B (see Table 1 below). Ruderal/ephemeral habitat scores 0.05 habitat units.

Condition Assessment Criteria		Criterion passed (Yes or No)	Notes (such as justification)
Core Criteria - must be assessed for all urban habitat types :			
A	Vegetation structure is varied, providing opportunities for vertebrates and invertebrates to live, eat and breed. A single structural habitat component or vegetation type does not account for more than 80% of the total habitat area.	No	Vegetation comprises all ground layer plants.
B	The habitat parcel contains different plant species that are beneficial for wildlife, for example flowering species providing nectar sources for a range of invertebrates at different times of year.	No	Limited species composition is unlikely to provide an extended flowering period.
C	Invasive non-native plant species (listed on Schedule 9 of WCA ¹) and others which are to the detriment of native wildlife (using professional judgement) ² cover less than 5% of the total vegetated area ³ . Note - to achieve Good condition, this criterion must be satisfied by a complete absence of invasive non-native species (rather than <5% cover).	Yes	No INNS recorded.
Number of criteria passed			
Condition Assessment Result		Condition Assessment Score	Score Achieved x/✓
Results for habitats requiring assessment of 3 core criteria only (all listed urban habitats except Open mosaic habitat on previously developed land, Bioswale, SuDS and Green roofs):			
• Passes all 3 core criteria; - AND • Meets the requirements for Good condition within criterion C.		Good (3)	
• Passes 2 of 3 core criteria; - OR • Passes 3 of 3 core criteria but does not meet the requirements for Good condition within criterion C.		Moderate (2)	
• Passes 0 or 1 of 3 core criteria.		Poor (1)	Yes

Table 1. Condition assessment for ephemeral/ruderal habitat



Ground Level Planters

- 3.1.3 Several planters are present containing ornamental species. This habitat is of low distinctiveness and low strategic significance. Condition assessment is not applicable. The planters extend to 0.00281ha and score 0.01 habitat units.

Individual Trees

- 3.1.4 Four small Birch and Cherry trees are present within planters. This habitat is of medium distinctiveness and low strategic significance. They are in poor condition as they fail four of the six criteria (see Table 2 below). The trees have an equivalent area of 0.0163ha and score 0.07 habitat units.

Condition Assessment Criteria		Criterion passed (Yes or No)	Notes (such as justification)
A	The tree is a native species (or at least 70% within the block are native species).	No	Ornamental Betula and Prunus species.
B	The tree canopy is predominantly continuous, with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide (individual trees automatically pass this criterion).	Yes	
C	The tree is mature (or more than 50% within the block are mature) ¹ .	No	Small specimens.
D	There is little or no evidence of an adverse impact on tree health by human activities (such as vandalism, herbicide or detrimental agricultural activity). And there is no current regular pruning regime, so the trees retain >75% of expected canopy for their age range and height.	No	Trees are in planters, which will limit their growth.
E	Natural ecological niches for vertebrates and invertebrates are present, such as presence of deadwood, cavities, ivy or loose bark.	No	
F	More than 20% of the tree canopy area is oversailing vegetation beneath.	Yes	In planters with other ornamental vegetation.
Number of criteria passed		2	
Condition Assessment Result (out of 6 criteria)		Condition Assessment Score	Score Achieved x/√
Passes 5 or 6 criteria		Good (3)	
Passes 3 or 4 criteria		Moderate (2)	
Passes 2 or fewer criteria		Poor (1)	x
Note that 'Fairly Good and Fairly Poor' condition categories are not available for this broad habitat type.			

Table 2. Condition assessment for individual trees

4. Proposed Habitats

4.1 Retained Habitats

- 4.1.1 The ornamental planters and individual trees will be retained, with a combined score of 0.08 habitat units.

4.2 Proposed Habitats

Ground Level Planters

- 4.2.1 Ornamental planters will be created, extending to 0.019ha and scoring 0.04 habitat units.

Individual Trees

- 4.2.2 Six small ornamental trees will be planted in containers, extending to 0.0244ha and scoring 0.07 habitat units.

Developed Land; Sealed Surface

- 4.2.3 The remainder of the Site (1.034ha) will comprise buildings, hardstanding and unvegetated ballast. These habitats score zero habitat units.

5. Assessment

- 5.1.1 Baseline habitats score 0.12 habitat units. Retained and proposed habitats score 0.18 habitat units.
This is a net gain of 0.06 habitat units (+47.99%).



6. Conclusion

- 6.1.1 The proposed development is predicted to achieve a net gain in habitat units that exceeds current requirements of national and local planning policy.



Appendix 1: Headline Results

FINAL RESULTS		
Total net unit change (Including all on-site & off-site habitat retention, creation & enhancement)	<i>Habitat units</i>	0.06
	<i>Hedgerow units</i>	0.00
	<i>Watercourse units</i>	0.00
Total net % change (Including all on-site & off-site habitat retention, creation & enhancement)	<i>Habitat units</i>	47.99%
	<i>Hedgerow units</i>	0.00%
	<i>Watercourse units</i>	0.00%
Trading rules satisfied?	Yes ✓	

SIM Manchester
Habitat Management and
Maintenance Plan
140203/FO/202



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Client	Science Museum Group
Project Title	SIM Manchester
Project Reference	RHE.1805
Project Leader	Simon Holden
Contact Details	simon@rachelhackingecology.co.uk

	Name	Position	Date
Author	Simon Holden	Associate	11/09/2024
Reviewer			
Revision	Simon Holden	Associate	01/05/2025



RACHEL
HACKING
ECOLOGY

The Stables, Paradise Wharf, Ducie Street, Manchester, M1 2JN

0161 465 8971

www.rachelhackingecology.co.uk

mail@rachelhackingecology.co.uk



RACHEL
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Executive Summary

This Habitat Management and Maintenance Plan (HMMP) has been produced to enable the discharge of condition 20 of planning application 140203/FO/2024.

The proposed development at SIM Manchester is predicted to result in a net gain of 0.06 habitat units (+47.99%).

This HMMP sets out the measures to ensure the created habitats are managed and monitored appropriately to deliver the predicted gain in biodiversity units.



Background

Rachel Hacking Ecology Ltd was commissioned in 2023 by the Science Museum Group to provide ecology consultancy services in connection with proposed development at the Science and Industry Museum (SIM), hereafter referred to as the 'site'. The site received full planning permission from Manchester City Council in 2024 for *Phased refurbishment of the Upper Yard and Station Approach public realm areas, including temporary landscaping in the Heart Space, and repairs and making good to the plant room deck and the former vehicle ramp area. Phase 1 includes works to Upper Yard areas including: new accessible routes; new planters; new fixed furniture; re-surfacing including with new materials; repair and relaying of existing cobbles; works to underground services to accommodate the scheme, building repairs and associated works. Phase 2 includes works to Station Approach areas including: new accessible routes; new planting areas; new fixed furniture; re-surfacing including with new materials; works to underground services to accommodate the scheme, building repairs and associated works. Phase 3 includes temporary re-surfacing works in the Heart space. Phase 4 includes repairs and making good works to the hard landscaping beneath and the viaduct facade adjacent to the location of the former vehicle ramp* (planning reference 140203/FO/2024). As part of the planning permission, several conditions were attached. Condition 208 relates to the provision of a Habitat Management and Maintenance Plan.

Condition Wording

Condition 20 states:

"The Biodiversity Gain Plan shall be prepared in accordance with the BNG Assessment, dated 13 March 2024 and prepared by Rachel Hacking Ecology. The development shall not commence until a Habitat Management and Monitoring Plan (the HMMP), prepared in accordance with the approved Biodiversity Gain Plan and including:

- (a) a non-technical summary;
- (b) the roles and responsibilities of the people or organisation(s) delivering the Habitat Management and Monitoring Plan;
- (c) the planned habitat creation and enhancement works to create or improve habitat to achieve the biodiversity net gain in accordance with the approved Biodiversity Gain Plan;
- (d) the management measures to maintain habitat in accordance with the approved Biodiversity Gain Plan for a period of 30 years from the completion of development; and
- (e) the monitoring methodology and frequency in respect of the created or enhanced habitat to be submitted to the local planning authority, Has been submitted to, and approved in writing by, the local planning authority.

Notice in writing shall be given to the Council when the:



(f) Habitat Management and Monitoring Plan has been implemented; and
(g) habitat creation and enhancement works as set out in the Habitat Management and Monitoring Plan have been completed.

The created and/or enhanced habitat specified in the approved Habitat Management and Monitoring Plan shall be managed and maintained in accordance with the approved Habitat Management and Monitoring Plan. Monitoring reports shall be submitted to local planning authority in writing in accordance with the methodology and frequency specified in the approved Habitat Management and Monitoring Plan”

Introduction

The proposed development is predicted to deliver a 47.99% gain in biodiversity units. The purpose of this management plan is to prescribe the management measures, timings and monitoring required to ensure the predicted changes to habitats are achieved.

The site currently comprises buildings, hardstanding, railway ballast, ornamental planters and small trees. Details of the baseline habitats are provided in the Biodiversity Net Gain Assessment¹.

The increase in biodiversity units will result from the creation of ornamental planters and the planting of small trees in containers.

Aims and Objectives

The aim of the HMMP is to ensure that the retained and created habitats are managed to maximise and maintain their value to wildlife in the long-term. The specific objectives are to:

- Identify the roles and responsibilities of those involved in managing the site
- Manage retained habitats to promote biodiversity
- Create and manage new habitats to promote biodiversity
- Monitor retained and created habitats
- Comply with legislation relating to wildlife

This document has been prepared alongside the General Arrangement Softworks Plan.

OBJECTIVE 1 – Tree planting

¹ RHE.1805 BNG Assessment at SIM 2024 REV.B. Report dated 22/04/2025.



OBJECTIVE 2 – Create ornamental planters

OBJECTIVE 3 – On-going management and maintenance

Prescriptions

OBJECTIVE 1 – Tree Planting

Six trees (Hazel *Corylus avellana* multistem, Apple *Malus sylvestris* subspecies TBC multistem and Rowan *Sorbus aucuparia* subspecies TBC multistem) to be planted in suitable containers adjacent to the existing ornamental planters. Trees will be planted in a suitably sized hole filled with peat-free soil/compost with stakes/guards, as appropriate. Bark mulch will be applied to a depth of 50mm. Newly planted trees will be watered weekly for the first three months until established. Watering may need to be extended during a hot spring/summer.

Any failed stock will be replaced annually.

Guards/stakes will be removed after 2-3 years, as appropriate.

OBJECTIVE 2 – Create Ornamental Planters

Additional planters will be installed adjacent to the existing planters. These will be filled with peat-free soil/compost and planted with a range of ornamental shrubs, bulbs, flowers and grasses, as shown in the General Arrangement Softworks Plan.

Planting/sowing shall be undertaken during April or October and watering shall be undertaken weekly for the first three months until established. Watering may need to be extended during a hot spring/summer.

OBJECTIVE 2 – On-going Management and Maintenance

The new habitats on site will be managed for a period of 30 years.

Any pruning of trees and shrubs will be undertaken outside of the bird nesting season (March to August inclusive) to avoid the risk of impacts to nesting birds. No pesticides or herbicides will be used unless specified for the treatment of unwanted or invasive species.

Monitoring will be undertaken regularly to assess the effectiveness of management measures and inform any requirements for amending the management plan. Monitoring will be undertaken in June/July at the intervals in Years 1, 2, 4, 10, 15, 20, 25 and 30.

Following monitoring a report will be produced to include the current habitats and their conditions. The Defra statutory metric will be used to assess the current biodiversity units and to reconcile the habitat establishment against predicted Habitat Units to be achieved at 30 years. The report will be issued to Greater Manchester Ecology Unit (GMEU), who will comment, as required.



Roles and Responsibilities

The proposed habitats will be created and maintained by the landscaping team (appointed by the Science Museum Group). Science Museum Group will be responsible for the ongoing management of the retained and new habitats. Science Museum Group will instruct a project ecologist, who will undertake the monitoring and provide advice as required.

Contingencies

The HMMP will be reviewed after each period of monitoring. If monitoring shows that habitats are not developing as expected, the HMMP will be updated by the project ecologist. This could include interventions such as extra seed sowing, the use of plug plants and more intensive management for a period of time. Any changes will be submitted within the monitoring reports for GMEU to review.

If inadvertent damage occurs to the retained or created habitats, the project ecologist be contacted for advice. The damage will be rectified with new planting, as appropriate.



Appendix 1. Works Schedule

Habitat	Management Tasks Work Schedule														
	Task	Timing of Works												Constraints	Details
		J	F	M	A	M	J	J	A	S	O	N	D		
Trees	Check newly planted trees annually. Replace any failed stock. Remove guards/stakes after 2-3 years.													N/A	Water newly planted trees weekly for 3-6 months until established. Any tree pruning should be undertaken between September and March, unless landscaping contractors are confident no nesting birds are present.
Ornamental planters	Check planting annually. Replace any failed stock.													N/A	Water planting weekly for 3-6 months until established.



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