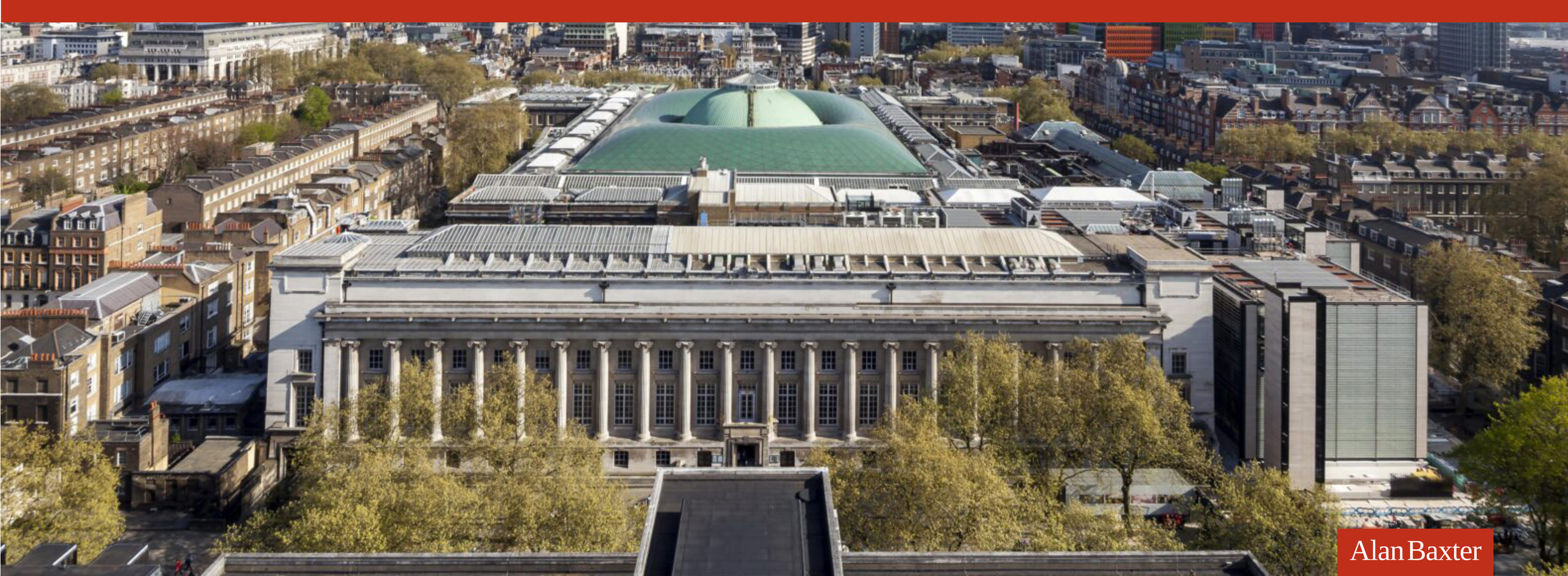
British Museum
Civil engineering notes on below ground drainage and SuDS for planning submission

Prepared for the British Museum

February 2024



Alan Baxter

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1.0
Introduction

The British Museum is progressing with its strategy for transitioning to sustainable, low-carbon infrastructure. This project focuses on the design of two key infrastructure upgrades needed to deliver this strategy. A major infrastructure building is proposed: the South West Energy Centre (SWEC), and the distribution of the site-wide services will also be upgraded. A new Intake Substation (ISS) is also proposed. This report discusses the proposals for the below-ground drainage and SuDs in association with the new infrastructure buildings in association with the new infrastructure buildings (the SWEC and ISS). The structural engineering proposals for the new infrastructure buildings and the services distribution routes are discussed in a separate report.

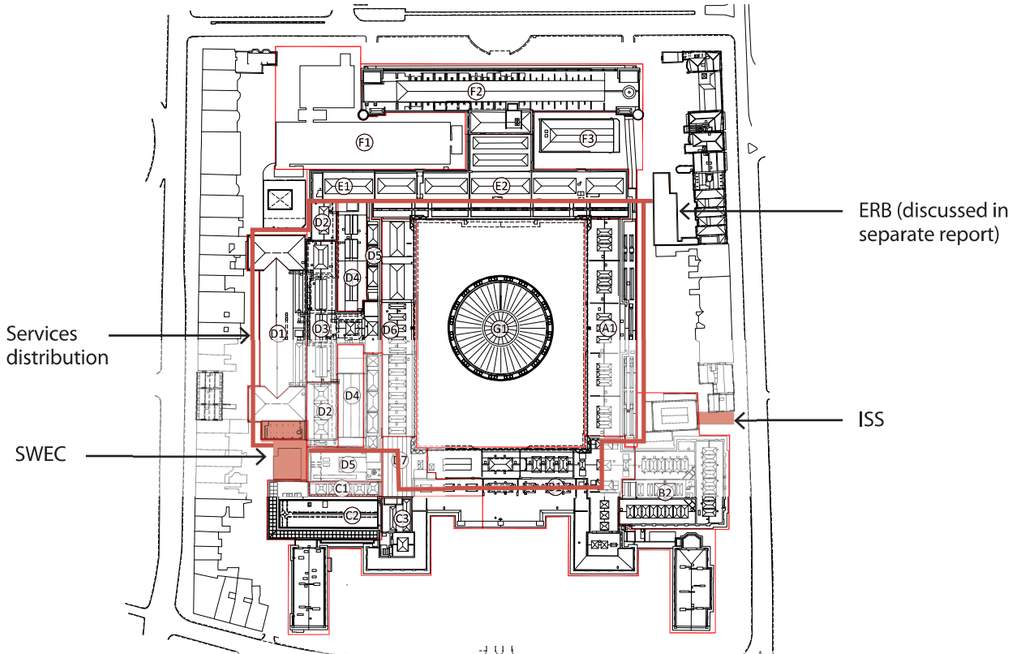

Fig. 1: Site key plan

Fig. 2: Site of proposed SWEC, currently occupied by portacabins

Fig. 3: View of proposed ISS location currently occupied by portacabin

2.0
Below-ground drainage and SuDS

The sites of the new SWEC development and ISS building are currently hard landscaped or occupied by buildings, and rainwater that lands on these areas drains into the Museum's combined surface and foul below-ground drainage network, shown on the diagram on the right. Therefore, the proposed scheme will not increase the amount of hard landscaping or the quantity of surface water draining into the Museum's below-ground drainage system.

However, regardless of maintaining the status quo, planning regulations require surface water flows for significant new developments to reduce the discharge rates into the public sewers by adopting sustainable drainage systems (SuDS). Camden Local Plan policy CC3 recommends that major developments limit flows to greenfield rates where possible. Therefore, we have considered how surface water can be managed to achieve the planning requirements and reduce the impact on the Museum's drainage network and the public sewers.

Our understanding of the arrangement of the Museum's below-ground drainage network is based on our desk study of the available record surveys and other record information. Large parts of the arrangement and condition of the existing network need to be verified to finalise the proposals. The Museum is currently arranging a CCTV survey to verify the missing information.

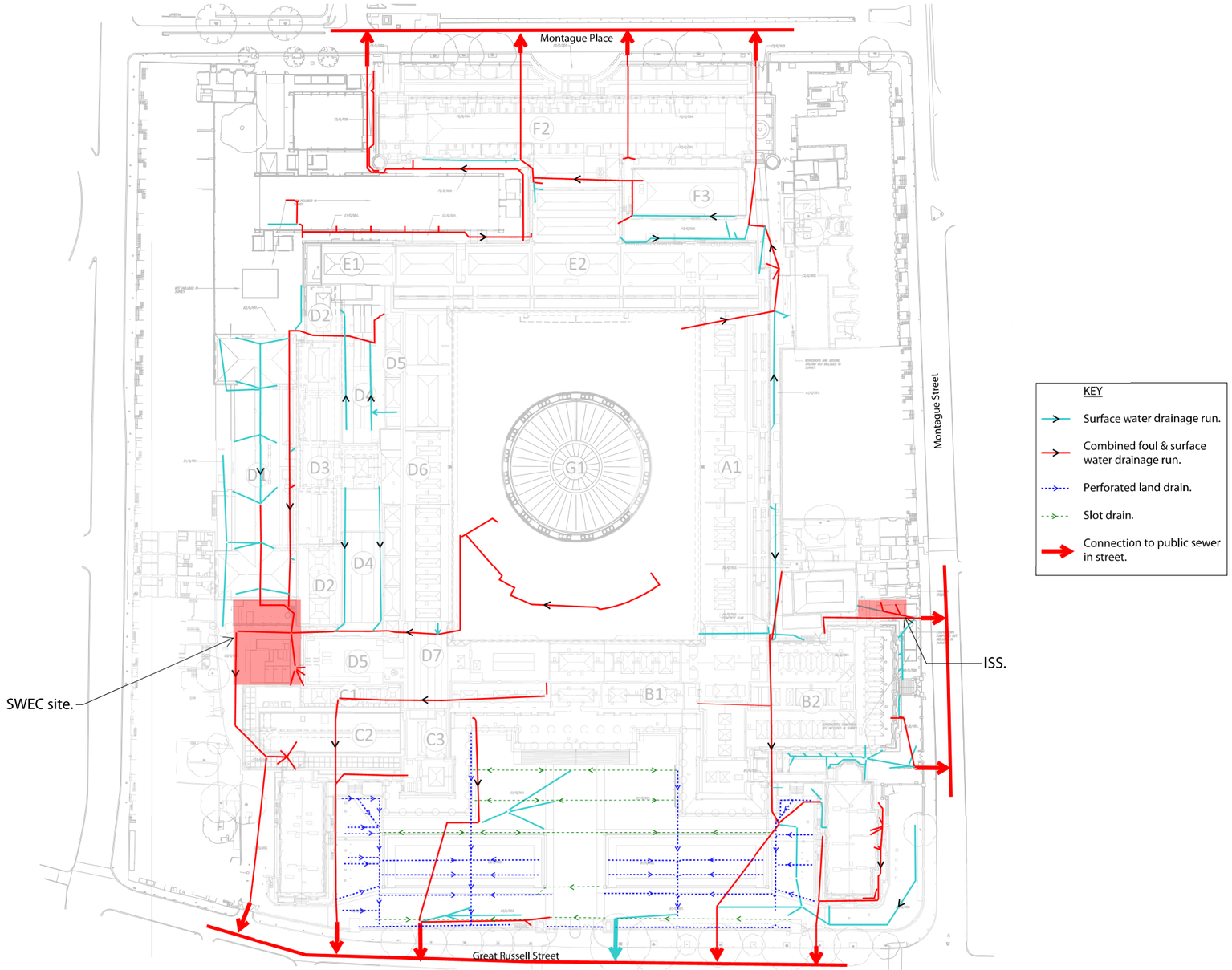

Fig. 4: Site wide below ground drainage layout

2.1 SWEC existing below-ground drainage network

The main below-ground drainage artery that carries the discharge from the Western Range runs east-west beneath the thoroughfare which divides the site and collects combined foul and surface water from the Western Range and the Great Court. Surface water from the New Wing and the Lycian building connects into this from the south. Combined foul and surface water from the Duveen building flows underneath the South West Boiler House (SWBH) and connects to the main artery from the north. Where the east-west thoroughfare meets the West Road, the main artery turns south and runs to the main sewer on Great Russell Street.

2.2 SWEC proposed foul water strategy

We propose maintaining the status quo by discharging all proposed foul water into the existing main combined sewer, as shown in the diagram below.

2.3 SWEC surface water strategy

As part of developing the surface water strategy, the design team have considered the opportunities to incorporate SuDS in line with the drainage hierarchy described in clause 3.11 of the Camden planning guidance document 'Water and Flooding'. Despite the constraints of the site and the infrastructure building, we have identified an opportunity to significantly improve the current arrangement regarding surface water discharge into the public sewer.

It should be noted that the desire for increasing green infrastructure in line with LB Camden policy CC2-a must be balanced against risk this poses to the Museum's world class collection, and conflicts this may have with infrastructure critical to the Museums Operations. Under the British Museum Act (1963), the Trustees of The British Museum are responsible for the care of the collection. The objects in the collection are preserved for the benefit of the public, present and future. For example, Integrated Pest Management (IPM) techniques are used across the estate to minimise risk of damage to the collection and to support the wider objectives of

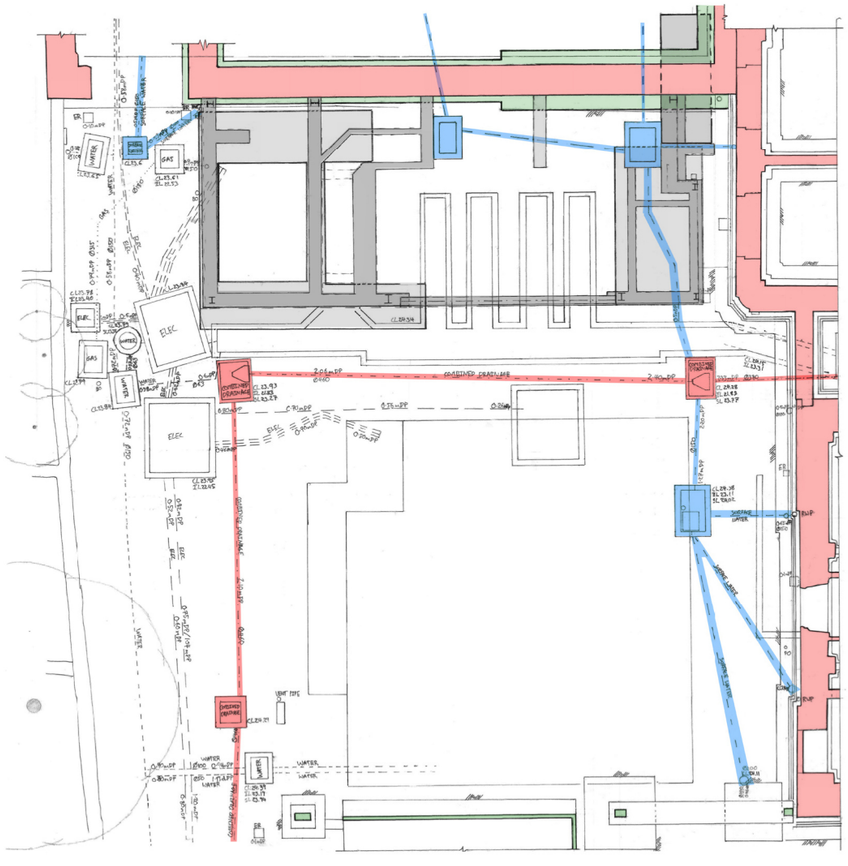

Fig. 5: Existing SWEC site below ground drainage

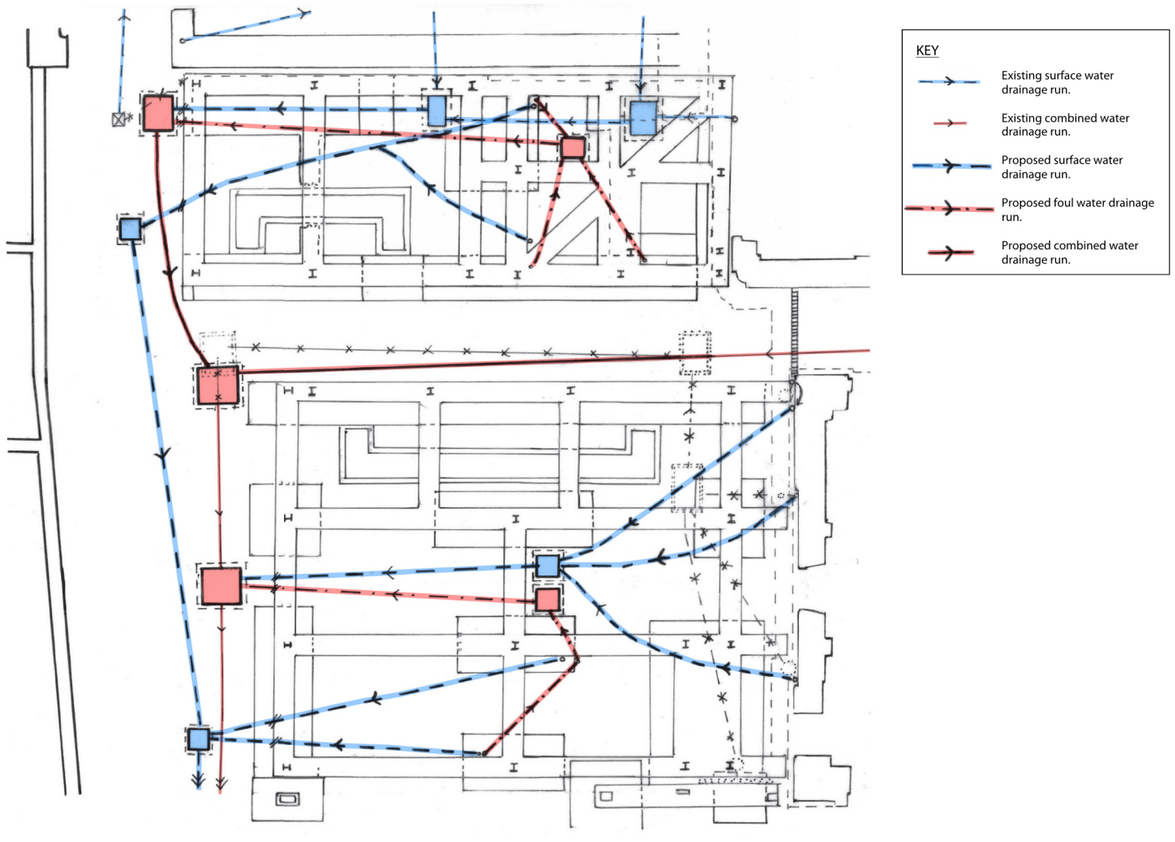

Fig. 6: Proposed SWEC below ground drainage layout

the Museum. The establishment of further planting on the estate, near to openings (windows, doors) to areas where collections are held could facilitate the development of populations of pest species that then have access to vulnerable collections.

Rainwater harvesting using water butts has been considered for the SWEC site but discounted, as there are no garden spaces adjacent to the SWEC for any water butts to serve, and their external appearance would have a negative impact on the setting of the Museum. Trees within the external access road surrounding the SWEC is not appropriate as they would block vehicular access to the Museum's West Road, critical for operations such as post, goods deliveries, and collections loans. Green roofs were also deemed impractical as the roof of the SWEC is occupied in full by attenuated air-source heat pumps which rely on consistent and large air intake and exhaust and access on all sides (including the top and bottom) to operate. A green roof would block or limit airflow, therefore preventing the new sustainable plant installation from operating effectively. Green walls were also considered but deemed inappropriate as they would introduce unwarranted and challenging maintenance regimes for the Museum, would not be in keeping with the architectural and material quality of the surrounding listed buildings and Bloomsbury Conservation Area, and would present increased risk of damage to the Museum buildings and collections.

In summary, the proposals have been carefully considered to balance the introduction of green infrastructure with Museum operational requirements and its duty of care for the collection. Consequently, some green infrastructure and new landscaped space is achieved (see section 2.4 on the ISS), without presenting an unacceptable increased risk of pest activity, negative impacts on the Museum's setting, or rendering critical operational infrastructure unviable or unduly impractical.

We have assessed and summarised the SuDS options below:

- **Storing water for later use** – the design team have considered this option, but due to the site and building constraints, there is no space to adopt this option. As discussed above, water butts have been considered but are not appropriate for the site

- **Infiltration into the ground via soakaways** – any soakaway must be positioned away from all buildings so that the large amounts of water infiltrating the ground do not impact them. Due to the site's spatial constraints, no zones are available far enough away from the SWEC building to accommodate a soakaway.

- **Infiltration into the ground via permeable paving** - in principle, permeable paving could be considered. However, Level 01 of the buildings is generally set below the level of external roads and hard paved areas, and the introduction of permeable paving would therefore present a risk of water ingress and damp within the buildings.

- **Infiltration into the ground via green infrastructure**- as discussed above, providing green infrastructure is not appropriate on the SWEC site. As discussed in section 2.4, there is some green landscaped infrastructure proposed on the ISS site.

- **Attenuate surface water in open water features –** this option is not suited to the constraints of the public museum site.

- **Green roofs and attenuation using blue roofs –** the design team have considered and discounted blue or green roofs above this infrastructure building as this would create long-term maintenance challenges for the Museum.

- **Attenuate in below-ground attenuation tanks or pipes –** there is an opportunity to provide attenuation in below-ground tanks. Surface water collected on the SWEC building will be separated and discharged into a new dedicated surface water run within the West Road. This new run will connect to the existing combined sewer close to the Museum site boundary and then discharge into the Great Russell Street public sewer.

- **Discharge water to a surface water sewer** - A search of Thames Water assets (see Appendix A) shows that there are no surface water sewers in the vicinity of the site.

The design team have identified a zone in the West Road adjacent to the West Residence, where a buried reinforced concrete attenuation tank could be accommodated. This tank will be sized to provide attenuation for a volume of surface water equal to that landing on the combined footprints of the new SWEC and the new ISS building. Rainfall from the new SWEC building and an area of existing roof equivalent to the new ISS building will be directed into the tank. The outflow from the tank will be throttled to 2 l/s using a Hydrobrake or similar vortex flow control device and then discharged into the existing combined water run, which then discharges into the Great Russell Street public sewer.

Final levels of the attenuation tank will be confirmed as part of the detailed drainage design. However, we have included an indicative section showing approximate levels in Figure 8.

As the SWEC and ISS roof areas are small, greenfield run-off rates are too low to feasibly restrict flows to via a flow control device. We are instead proposing to limit discharge to 2 l/s, which is generally accepted as the lowest rate it is practical to adopt with a flow control device.

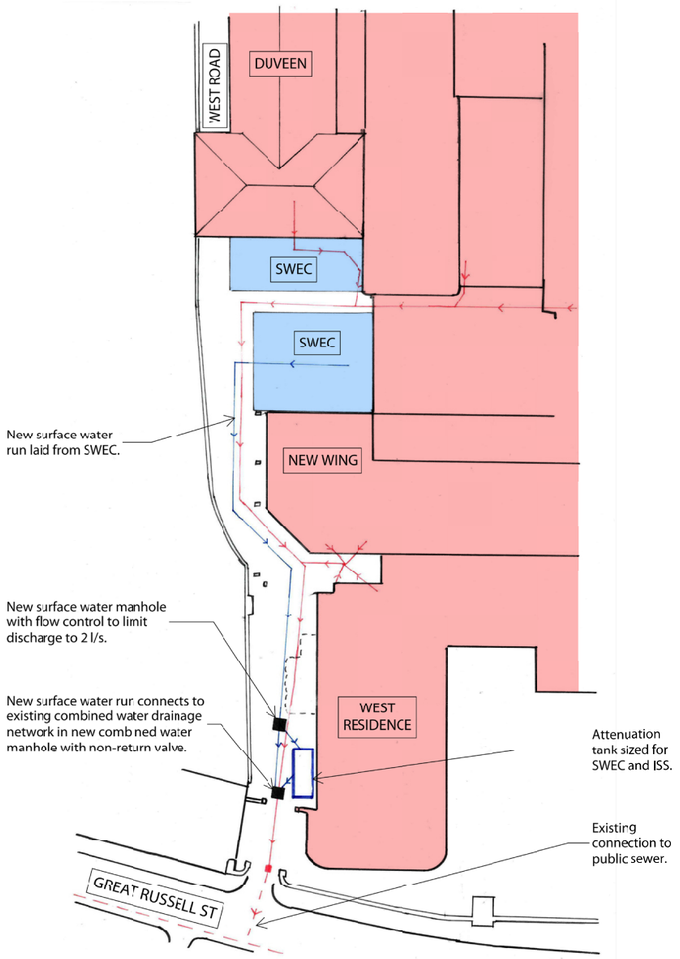

Fig. 7: Proposed below ground drainage

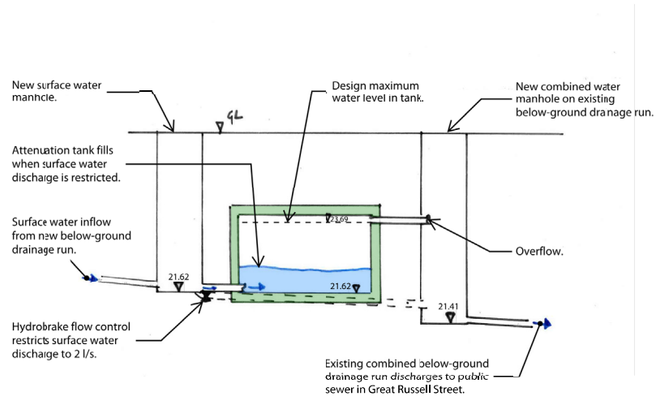

Fig. 8: Diagrammatic section through attenuation tank

The attenuation tank has been sized as 24 m^3, which provides sufficient storage volume for storms up to and including the 1:100 year + 40% climate change without overtopping, and allowing for controlled discharge from the tank at 2 l/s. UK SuDS calculations are shown in Appendix C.

We have provided in the completed Camden Council SuDS Proforma in Appendix B the storage volume required to attenuate flows to greenfield rates (50 m^3 for a 1 in 100 year storm) with supporting calculations in Appendix C. As it is not possible to attenuate flows to greenfield rates, the proposed storage volume of 24 m^3 relates to the proposed discharge rate of 2 l/s instead.

2.3.1 Existing and proposed discharge volumes

A greenfield run-off rate for a 1:100 year storm of 0.3 l/s (see Appendix C) over a storm duration of 6 hours would generate a total run-off volume of 6.5 m^3.The existing run-off volume for the same storm is 42.3 m^3 (see Appendix C). The proposed run-off volume is the same as the existing, but discharge will be attenuated to a controlled flow rate and therefore the peak discharge rate will be significantly reduced.

2.3.2 Exceedance

The attenuation tank provides enough storage volume to constrain run-off for a 1 in 100 year + 40% climate change event, without flooding the site.

All internal manholes within the SWEC building will be sealed, so in an exceedance event, water will not overtop inside the building and will back up within rainwater pipes.

The new surface water run will collect surface water from roofs only, with no connections to external drainage serving hard landscaped areas such as gullies or drainage channels. In an exceedance event, the only points where surface water could overtop the proposed drainage run is at new manholes in the West Road.

Should the manholes overtop, surface water will flow north along the boundary wall to the west. Water will gather in the area shown on drawing 1910/41/133 in Appendix A, where gullies will drain into the existing below-ground drainage network.

2.3.3 Maintenance

The SuDS features on the site will be maintained by the British Museum. The following is typical of the maintenance activities that will be required for the buried attenuation tank. The final maintenance demands will also need to consider the relevant manufacturers requirements and recommendations.

Attenuation tank & flow control

Activity	Frequency
Inspection of tank, inlets/outlets/ withdrawal devices, overflow areas, pumps, filters for debris and sediment build-up.	Annually (and following poor performance).
Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris.	Annually (and following poor performance).
Cleaning and/or replacement of any filters.	Three monthly (or as required).
Repair of overflow erosion damage or damage to tank.	As required.