51 CALTHORPE STREET, LONDON

Flood Risk Assessment

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REGISTRATION OF AMENDMENTS

Revision	Amendment Details	Date	Revision Prepared By	Revision Approved By

1.0 INTRODUCTION

Brief

1.1 Create Consulting Engineers Ltd has been commissioned by Mr. Simon Firth to provide a Flood Risk Assessment (FRA) in support of the planning application for the proposed development at 51 Calthorpe Street, London, WC1X 0HH (the Site) in the London Borough of Camden.

1.2 The Site location is shown on Figure 1.1.

Project Context

1.3 It is understood that this FRA report will be used by Simon Firth to support a planning application for the re-development of 51 Calthorpe Street.

1.4 The development proposals include the partial demolition and removal of some existing structures (including the roof) with the retention of the external walls and some floors followed by the construction of 8 new flats and office accommodation over six storeys, including a new basement level below the footprint of the building, and the excavation of the forecourt.

Objectives

1.5 To prepare an FRA report (including a drainage strategy) for the scheme in accordance with the National Planning Policy Framework (NPPF)[1] and associated Planning Practice Guidance (PPG)[2].

1.6 The drainage strategy will be designed to comply with national standards and local and regional planning policy.

Constraints and Limitations

1.7 This FRA addresses the flood risk posed to and from the development, the extent of which is shown in Figure 1.1. Development plans for the refurbishment are shown on Drawings 939-108 – 939-114. The existing layout of the building is shown on Drawings 939-P1-008, 939-P1-010, 939-P1-011 and 939-P1-012.

1.8 The conclusions resulting from this study are not necessarily indicative of future conditions or operating practices at or adjacent to the site.

[1] NPPF accessed online (May 2015) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/6077/2116950.pdf
[2] PPG accessed online (May 2015) http://planningguidance.planningportal.gov.uk/

1.9 Create Consulting disclaims any responsibility to the Client and others in respect of any matters outside the scope of this report.

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1.11 Create Consulting Engineers Ltd accepts no responsibility whatsoever to other parties to whom this report, or any part thereof, is made known. Any such other parties rely upon the report at their own risk.

2.0 SOURCES OF INFORMATION

2.1 The information contained in this report is based on a review of readily available information pertinent to the site and consultation with interested parties.

Records Review

2.2 Key reports, drawings and websites pertinent to this assessment are detailed below in Table 2.1.

Document/Website	Author/Publisher	Date
Fluvial/Tidal Flood Maps, Surface Water Flood Maps, Groundwater Mapping, Reservoir Flood Map – www.environment-agency.gov.uk	Environment Agency	Accessed May 2015
BGS GeoIndex – Geology and borehole records - www.bgs.ac.uk/geoindex	British Geological Survey	Accessed May 2015
North London Strategic Flood Risk Assessment	Mouchel	2008
London Borough of Camden Strategic Flood Risk Assessment	URS	2014
London Borough of Camden Preliminary Flood Risk Assessment	London Borough of Camden/Drain London	2011
London Borough of Camden Surface Water Management Plan	Drain London/Halcrow	2011
The Lost Rivers of London	Nicholas Barton	1992
Existing Site Layout Plans (Drawings 939-P1-008, 939-P1-010, 939-P1-011, 939-P1-012)	Centre Line Surveys	2012
Proposed Site Layout Plans (Drawings 939-108 – 939-114)	Brooks/Murray Architects	April/May 2015
Thames Water asset plans (Appendix B)	Thames Water	2012
51 Calthorpe Street Basement Impact Assessment	Create Consulting Engineers	2016
Camden Geological, Hydrogeological and Hydrological Study Guidance for Subterranean Development	Arup	2010
Thames Water Sewer Flooding History Enquiry (Appendix C)	Thames Water	April 2015

Table 2.1: Key Information Sources

Consultation

2.3 The parties consulted as part of this Flood Risk Assessment are detailed in Table 2.2.

Consultee	Form of Consultation	Topics Discussed and Actions Agreed
Nick Humphrey, Sustainability Officer, London Borough of Camden (18 April 2013)	Telephone/email correspondence	Latest surface water flood maps reviewed (Figure 2.1) and it was confirmed Camden Council do not consider the vicinity of Calthorpe Street and Mount Pleasant as an area of significant surface water flood risk and have no records of flooding there (Appendix A).
Amy Farthing, Sustainability officer, London Borough of Camden (23 April 2015)	Email correspondence	Updated surface water flood maps were requested. It was confirmed that these can now be found in the 2014 Strategic Flood Risk Assessment. It was also confirmed that Camden Council do not hold records of any particular properties being flooded in the area.
Thames Water	Sewer Flooding History Enquiry	Requested standard search for historic sewer flooding at and in the locality of the Site

Table 2.2: List of Parties consulted

3.0 SITE SETTING

Site Location

3.1 The Site is located on the northern side of Calthorpe Street in the London Borough of Camden. The Site lies at grid reference 530931E 182471N at Postcode WC1X 0HH. The area of the Site is approximately 640 m^2.

Description of Site and Surroundings

3.2 The Site comprises an existing three storey Victorian-era building that is currently used as offices and storage. The building's eastern side is located adjacent to the Crowne Plaza Hotel and the western side abuts other residential buildings on Calthorpe Street. The front of the existing development faces south-east over Calthorpe Street and is opposite the Mount Pleasant Royal Mail sorting centre. The rear north-west elevation of the development faces the Cubitt Street play centre. The Site is accessed solely via Calthorpe Street.

3.3 Relative to ordnance datum the site lies at approximately 20.0 mAOD. Calthorpe Street is generally flat. However, the surrounding area generally falls towards the south west.

Hydrological Setting

Surface Watercourses

3.4 The tidal River Thames is located 1.70 km to the south of 51 Calthorpe Street.

Estuaries and Coastal Watercourses

3.5 The River Thames is tidally influenced at its closest point to the site as it is downstream of the tidal limit at Teddington Lock.

Flood Defence Protection

3.6 The Environment Agency flood map (Figure 3.1) shows there to be flood defences associated with the River Thames (1.70km to the south of the site). However, the site is shown to be outside of the defended tidal/fluvial floodplain and therefore does not rely on these defences for protection.

Ground Conditions

3.7 British Geological Survey mapping shows bedrock geology at the site to be comprised of the London Clay Formation (Clay and Silt) whilst superficial deposits are made up of the Hackney Gravel member (Sand and Gravel).

3.8 Site investigation in the form of two window samples (as part of the Basement Impact Assessment carried out by Create Consulting Engineers) has shown made ground exists at the site to a depth of between approximately 4.0 and 7.0 mbgl, below which the permeable superficial deposits were encountered.

Groundwater

3.9 The site does not lie within any groundwater source protection zones, as identified by the Environment Agency mapping (EA website, accessed April 2015). This mapping also shows the site overlies a Secondary A aquifer in the permeable superficial deposits. An aquifer of this type is important at a local rather than strategic scale.

3.10 Borehole records (accessed online at BGS GeoIndex, August 2013) for the area show groundwater was not struck down to the maximum depth of the boreholes at 27 mbgl.

3.11 However, the site investigation mentioned above (carried out in 2013 and 2015) notes groundwater maintained a level of 3.87 mbgl during the first investigation and 7.36 mbgl during the second investigation. Therefore, it is assumed this groundwater is perched above the London Clay.

Artificial Waterbodies

3.12 The Grand Union Canal is located approximately 980 m to the north of the site.

Public Sewers

3.13 A Thames Water Asset location search is included in Appendix B. This shows a 3658 mm diameter combined trunk sewer flowing in a southerly direction along Pakenham Street and subsequently Phoenix Place. It is assumed this is the River Fleet, which is understood to have been culverted over a century ago. A series of box culverts and circular pipes flow into this trunk sewer along the length shown on the appended asset plans; however, there are no recorded sewers in Calthorpe Street. Sewer records show a spur to the combined sewer in Pakenham Street (marked as a part combined part surface water sewer) which runs along rear gardens from Pakenham Street to the Site.

3.14 Surface water runoff in the area is assumed to drain to the combined public sewer network. The Thames Water sewers in the area of the site are noted to be between approximately 5.0 and 6.0 mbgl.

Site Drainage

3.15 Observations made during the site walkover and site investigation works have noted that all roof areas, existing light wells and foul drainage appears to drain to a chamber located in the

western lightwell of the site. This subsequently appears to flow towards the combined spur noted on the Thames Water asset plans (Appendix B).

3.16 Therefore, it is possible that the site (including basement level) discharges to the Thames Water network by gravity. However, a full CCTV drainage survey should be carried out at the detailed design stage to determine this, as well as to establish the condition of the existing drainage.

3.17 It is assumed therefore that foul and surface water from the site currently drains via a private combined network to the combined Thames Water sewer in Pakenham Street (via the nearby spur).

3.18 There appears to be one gully drain in the front forecourt, but it is most likely that most of the external areas in front of the property directly run off to Calthorpe Street.

Water Mains

3.19 Thames Water supply assets (Appendix B) show a 125 mm supply main in Calthorpe Street, which most likely supplies the site. In addition to this there are two 600 mm trunk supply mains also flowing along Calthorpe Street.

Flood Zones

3.20 The site lies within the Environment Agency's (EA) Flood Zone 1, as shown in Figure 3.1, which is described within the NPPF Technical Guidance as having less than a 1 in 1000 (<0.1%) annual probability of river or sea flooding in any one year. This zone is the lowest risk area.

3.21 A review of the Environment Agency reservoir flood maps (accessed online, April 2015) confirms that the site is not at risk from breach or overtopping in the unlikely event of a reservoir failure.

3.22 The site is located within an 'area with potential to be at risk of surface water flooding' according to Camden Geological, hydrogeological and hydrological study (Arup, 2010) – see Figure 3.2. It is understood that this outline broadly follows the route of the 'lost' River Fleet which runs to the west of the site. The site is not shown to have flooded in 1975 or 2002 according to this map.

3.23 However, as noted in Table 2.2, consultation with Camden Council has provided more up to date and accurate surface water flood modelling (dated July 2012), which is shown in Figure 2.1. This shows the predicted extent of flooding for a 1 in 75-year event. It shows that the site is not at risk of flooding during this event. This has been confirmed by Camden's Sustainability Officer responsible for Flooding, who indicated that the site is not considered to be at significant risk of flooding from this source (Appendix A).

3.24 The EA Surface Water Flood Maps (accessed online, April 2015) and updated Camden SFRA (URS, 2014) confirm the site is at a 'very low' risk of surface water flooding. The site is therefore classified as being at a less than 1 in 1000 (<0.1%) risk of flooding from extreme rainfall in any one year.

3.25 No mapping of the risk from sewer flooding is provided in the PFRA or SFRA.

Flood History

3.26 The SFRA (Map 22) notes a number of areas which experienced flooding during the extreme rainfall events in 1975 and 2002. The site is not within any of these locations. Also Maps 13 and 20 and the SFRA show historic flood events from sewers and surface water, none of which have affected the site.

3.27 There is no available information on historic groundwater flooding.

3.28 A Thames Water Sewer Flooding History Enquiry (Appendix C) confirms no historic records of any surcharging sewers in the immediate vicinity of the site.

3.29 The client has confirmed there have been issues relating to flooding from internal building drainage in the past. However, it is understood this was a result of blockage in the internal building drainage and the issues have now been remediated. The client has no knowledge of flooding of the external areas and surrounding roads.

4.0 SCHEME DESCRIPTION

The Scheme

4.1 The development proposals include the partial demolition and removal of some existing structures (including the roof) with the retention of the external walls and some floors followed by the construction of 8 new flats and office accommodation over six storeys, including a new basement level below the footprint of the building, and the excavation of the forecourt.

4.2 The outline of the building remains generally unaltered except for the addition of the two new floors.

4.3 Plans showing the scheme are appended with this report.

Proposed Drainage Strategy

Planning considerations informing the drainage strategy

4.1 The London Plan Sustainable Design and Construction Supplementary Planning Guidance (Mayor of London, 2014) and London Plan (Mayor of London, 2015) state that equivalent site greenfield runoff rates should be targeted where possible and where they are not proposed a full justification as to why they cannot be achieved should be provided with runoff rates reduced to as low as possible.

4.2 However, where greenfield rates for a particular site are restricted below 5.0 l/s, issues with orifice blockage may result and therefore a discharge rate of 5.0 l/s per outfall is generally considered acceptable.

4.3 National, regional and local planning policy requires consideration of the use of SUDS and implementation where appropriate.

4.4 The Camden Development Policies 2010-2025 (Policy DP22) notes that development should be resistant to climate change by restricting runoff. CPG 3 notes that development is expected to include green roofs, brown roofs and green walls unless it is demonstrated it is not possible/appropriate.

Potential for infiltration systems

4.5 The Building Regulations Part H state that no soakage device can be placed within 5.0 m of a building or adoptable road. Given the site is almost fully occupied by buildings, it is not possible to include soakaways in the scheme despite the potentially favorable superficial geology.

Drainage Strategy – Overview

4.6 All new on-site drainage will be separated until the point of connection to the public sewer in order to meet Thames Water requirements. To inform the detailed design of the drainage, a full CCTV drainage survey will be carried out to agree the existing points of connection to be reused as part of the development with Thames Water and to confirm any necessary diversions to existing private drainage.

4.7 An indicative foul and surface water drainage strategy is included on SK/001 and SK/002.

Proposed surface water drainage

4.8 Micro Drainage calculations have been included in Appendix E which show that the 1 in 100-year plus 30% climate change event will need to be accommodated below ground in a attenuation tank with at least 13.6 m^3 effective storage. A tank (measuring approximately 10.5 m^2 with an effective depth of 1.5 m) is shown on SK/002 beneath the lower ground floor slab within a private storage area.

4.9 A Hydrobrake manhole in accordance with Part H of the building regulations is proposed to restrict the outflow from the attenuation feature to 5.0 l/s (in line with best practice – see paragraphs 4.1– 4.4), based on greenfield runoff rates which have been estimated to be less than 5.0 l/s for the site.

4.10 The tank will drain under gravity to the public sewer network via a new final manhole constructed west of the existing terminal manhole on site which will be relocated as a raised feature within one of the basement gardens as shown on SK/001.

4.11 The basement light wells will be drained using suitable pumped devices connecting to the public sewer via the new final manhole which will act as a disconnect manhole.

4.12 In summary, with the inclusion of sufficient attenuation, the preferred standards of the London Plan Supplementary Planning Guidance will be met with a significant reduction in runoff rates achieved.

4.13 A summary of the potential SUDS options which led to the above drainage strategy is included in Table 4.2.

SUDS Option	Suitability/Included in the Scheme?	Comments
Soakaways and porous paving	X	Space constraints on the site preclude the use of soakaway features.
Porous paving (storage)	X	A lack of significant outdoor space on the site precludes the use of permeable paving.
Rainwater Harvesting	✓	Will be limited to external irrigation for flats with garden areas
Swales	X	Not suitable for use given on site constraints relating to open space.
Attenuation Ponds (above ground storage)	X	Not suitable for use given on site constraints relating to open space.
Below ground storage in cellular systems	✓	An attenuation tank providing 13.6 m^3 of storage is included within the scheme.
Flow control devices	✓	The peak flow rates will be managed by a simple flow control device (e.g. a pump as shown in Appendix D). This will restrict flows to 5.0 l/s whilst taking into account the 30% inclusion for climate change.
Green Roofs/Brown Roofs/Blue Roofs	✓	An area of green roof is included within the scheme.

Table 4.1: SUDS Options

Key:

✓ *Suitable for use and included in the scheme*

* *Possibly suitable for use – not included in the client and architect design proposal at present – should be considered further as part of the detailed design*

X Unlikely to be suitable for use

Pollution Control Measures

4.14 The surface water drainage system will incorporate pollution control measures in line with the SUDS Manual.

Foul Water

4.15 It is proposed that foul flows will drain to a sump beneath the store/plant room, from which they will be pumped to the aforementioned raised disconnecting manhole and Thames Water network within one of the rear basement gardens.

4.16 An indicative foul water drainage layout is included on SK/001.

Maintenance

4.17 Regular inspection and maintenance of highway drainage, public and private drainage by Camden Council, Thames Water, and site management respectively, will minimise the residual risks associated with surface water/sewers.

5.0 FLOOD RISK ASSESSMENT

Scope of Work

5.1 The scope of this Flood Risk Assessment was refined to meet the brief outlined in section 1.4 and 1.5 of this report and considers the following:

- Flood risk to the development from all sources;
- Potential for the design, construction and operation of the site to increase the risk of flooding to neighbouring properties;
- Any necessary mitigation measures to mitigate identified potential flood risks;
- Climate change;
- Residual flood risks.

5.2 The approach is consistent with the NPPF and the associated PPG.

Flood Risk to the Proposed Development

5.3 Based on our understanding of the scheme and the site setting, the potential sources of flooding have been identified and assessed in Table 5.1.

Potential Source	Pathway	Potential Linkage to Site	Justification
Fluvial/Tidal (River Thames)	Breach of the Thames tidal defences and/or overtopping and overland flow	No	The site is located within Environment Agency flood risk zone 1 (**low** risk of fluvial/tidal flooding) and no further consideration of these sources of flooding is necessary within this report.
Groundwater (shallow)	Perched/shallow groundwater may be present	Yes	Perched groundwater was encountered between 3.87 and 7.36 mbgl. Provided the basement is appropriately waterproofed, however, the risk of flooding from this source can be managed and will be **low**.
Artificial water Bodies (Grand Union Canal)	Breach or overtopping of embankments.	No	The site is not within an area at risk of flooding from such water bodies (as defined by Environment Agency mapping). Therefore flood risk to the proposed scheme is considered to be **low**. No further consideration of these sources of flooding is necessary within this report.
Infrastructure failure from water mains and internal water supply system	Failure of the Thames Water network and/or internal water supply and	Yes	Flood risk from this source is considered to be a residual risk, with the main threat being from internal pipe work during any building works as any external flooding from Thames Water assets will most likely flow within the

	distribution system. Such a failure may result in flooding of the internal building as well as the surrounding area		kerb lines of Calthorpe Street away from the building. Flooding from this source generally poses a **low** risk to the proposed development.
Sewer flooding from Thames Water assets and private site drainage (combined drainage)	Surcharge in site drainage and public sewer network due to blockage or exceedance of capacity	Yes	No specific issues have been identified, and the risk of sewer flooding is considered to be **low**. However, sewer flooding from blockage is a residual risk which will be managed by the design of the site drainage and regular inspection and maintenance of the public and private sewer network. The flood risk associated with this source may also increase over time due to the effects of climate change.
Failure of pumped on-site foul water drainage	Failure of pump system and subsequent surcharge of pipe work within building	Yes	If a pumped system is used to remove foul flows from the basement there is potential for this system to fail, resulting in backing up and surcharging of the foul sewer network on site. Flooding from a failure of such a system is a residual risk managed by the drainage design and regular inspection and maintenance of the private sewer network and is considered to pose a **low** risk of flooding.
Surface water flooding as a result of extreme rainfall and runoff from overland flow	Flooding of the surrounding roads due to extreme rainfall	Yes	No records of historic flooding from this source are reported at the site. As noted in Table 2.2 and Figure 2.1, the most recent surface water flood mapping produced by Camden Council shows that the site is not at risk of surface water flooding. Camden Council's Sustainability Officer has confirmed this. Consequently, the risk of surface water flooding is considered to pose a residual risk. The EA's Surface Water Flood Maps also confirm this.

Table 5.1: Potential sources of flooding to the development

5.4 Table 5.1 has identified a number of residual risks associated with surface water flooding, sewer flooding and water supply infrastructure failure, which are typical risks with any building like this in an urban location. Provided that the water supply infrastructure and

drainage assets are correctly managed by Thames Water and the site owner then the residual risk of flooding will be minimised as far as possible.

5.5 In summary, the risk of flooding from all sources is generally considered to be low, however a number of mitigation measures are recommended to address and manage the residual risk from these forms of flooding in Table 5.2.

Flood Risk from the Proposed Development

Changes in sewer flows

5.6 The development will change the foul flows from the building, as a result of the proposed conversion from office space (approximately 1100 m^2) to residential use (17 units). Using the method described in Sewers for Adoption 7th Edition and industry accepted methodologies (including guidance in BS EN 752 and Butler & Davies, 2011), the estimated existing peak foul flows from the site will increase slightly from 0.63 l/s to 0.79 l/s based on the proposed number of units.

5.7 Given that peak surface water flows from the site will be significantly reduced it is envisaged that the overall impact on the public sewer network will be positive.

Mitigation Measures

5.8 Table 5.2 sets out appropriate mitigation measures to minimise the identified flood risks.

Type of Flooding	Issue	Mitigation Measures	Justification	Residual Risk
Flooding from surface and foul water – pump failure, sewer blockage/surcharging and intense rainfall	Pump failure, blockages or surcharges in the site drainage or the public sewer network in the site vicinity may result in flooding of the proposed basement.	• Routine inspection and maintenance of the site and public drainage systems by the site owner and Thames Water. • Monitor flood risk throughout the life of the development in order to confirm the risk posed to the scheme over time and ensure any necessary amendments are incorporated as required; • Ensure appropriate surface water drainage is provided to basement stairwells and basement services – use of pumps should be minimised and the need for non-return valves carefully considered; • Careful design of basement drainage to provide appropriate connections to the existing network and to ensure suitable volume of storage or appropriate warning in the event of a failure is included in the event of pump failure (as required).	These measures will ensure flood risk from these sources is minimised.	Low
Flooding from Water mains (internal water supply system and external Thames Water assets)	Flooding of the water supply and distribution system may result in flooding of the internal building.	• Routine inspection of the site and public water supply and distribution system by the site owner and Thames Water.	Will ensure the risk of flooding is minimised.	Low
Flooding from shallow groundwater	Perched/shallow groundwater may be present which may flood basement.	• Incorporate appropriate waterproofing into the substructure design;	Will ensure the risk of flooding is minimised.	Low
Flooding from Public/private sewer network during construction	There may be privately owned drainage serving the site and/or neighboring properties that may be exposed or damaged during site enabling works	• Undertake appropriate drainage survey to confirm the extent of existing/retained drainage and determine the extent of any necessary abandonments, reinforcement, temporary diversions and/or upgrades;	Will ensure the risk of flooding is minimised.	Low

	and/or construction which may result in flooding of the site or neighbouring properties	• Any changes/impacts to public/private drainage (including retained outfalls to the public sewer) should be agreed with any affected parties and relevant authorities as required; • Temporary drainage proposals (during construction) to be agreed with Thames Water as necessary.		

Table 5.2. Mitigation Measures

Residual Flood Risks

5.9 Assuming the mitigation measures are adopted (as set out in Table 5.2), the principal residual risks relate to surcharges or blockages in the public sewers and site drainage as well as infrastructure failure (burst water mains and pump failure) and intense rainfall. As long as the sewers, site drainage and water supply infrastructure are maintained by Thames Water and the site owner respectively then the residual risk will be minimised.

Climate Change

5.10 Climate change has important implications for the assessment of flood risk. The NPPF requires that the effect of climate change is considered when assessing flood risk posed to development.

5.11 Climate change has the potential to affect all sources of flooding at the site. The likely impacts of climate change relevant to the scheme could include increased severity and frequency of storms, wetter winters leading to higher groundwater levels and an increase in the frequency of sewer flooding incidents.

5.12 Where practicable the design of site drainage for the proposed scheme should allow for increases in climate change.

5.13 Flood risk associated with sewer flooding is expected to increase over time, and it would be prudent for the owners of the property to monitor local flood risk studies prepared by the council (including the Surface Water Management Plan, SFRA and PFRA) for any changes in flood risk posed to the site and respond accordingly.

6.0 CONCLUSIONS AND RECOMMENDATIONS

6.1 Based on our understanding of the site setting and the development proposals, it is considered that the risk of flooding from all sources is generally **low**, and the development can be operated safely without significantly increasing flood risk elsewhere. However, a number of residual risks, associated with sewer/surface water flooding and water supply infrastructure were identified. These are considered typical of any urban location and mitigation measures have been provided in Table 5.2 to address and manage the residual risk from these forms of flooding.

6.2 Assuming the mitigation measures are adopted, the principal residual risks relate to surcharges or blockages in the public sewers and site drainage as well as infrastructure failure (burst water mains and pump failure) and intense rainfall. As long as the sewers, site drainage and water supply infrastructure are maintained by Thames Water and the site owner respectively then the residual risk will be minimised.

6.3 We recommend that the assessment of residual risks should be reviewed by the site owner for the life of the development as future publications relating to flood risk become available, and the flood risk associated with adjacent sewers may also increase over time in the area due to climate change.

7.0 REFERENCES

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