



Windmill Street, Gravesend.

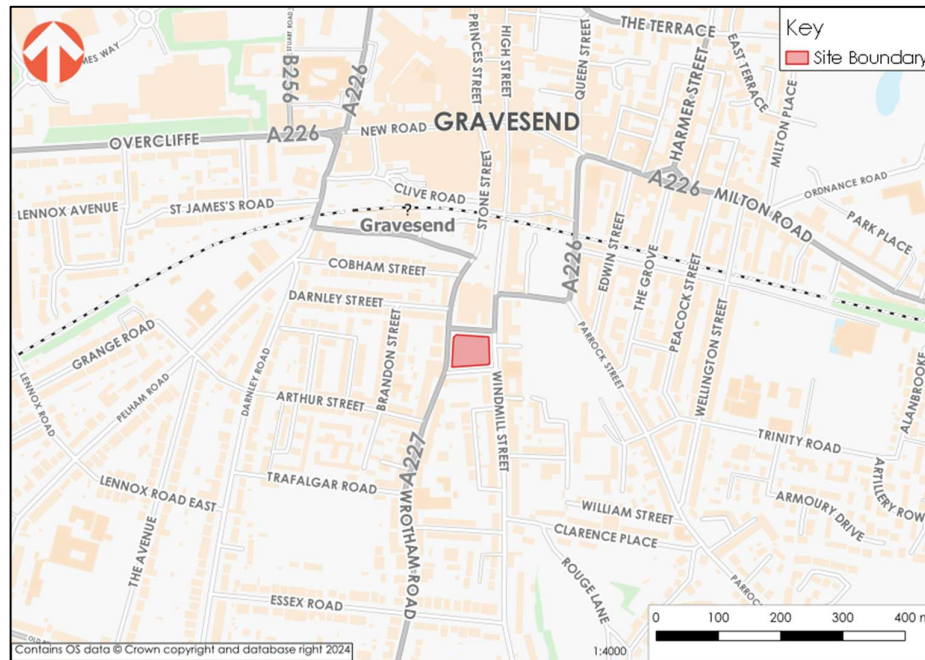
Flood Risk & Drainage Technical Note

Project No.	1305
Revision	F [changes highlighted]
Date	22 April 2026
Client	Churchill Living and Housing 21
Prepared	M Ayers
Checked	B Fenton
Authorised	C Yalden
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1 Introduction

Introduction & Background

- 1.1 AWP (Exeter) LLP has been commissioned by Churchill Living and Housing 21 to prepare a Flood Risk and Drainage Technical Note in support of an Outline Planning Application at the former Gravesend Police Station at Windmill Street, Gravesend, Kent, DA12 1DB.
- 1.2 The proposed development consists of 67 self-contained retirement apartments over four storeys and associated car park for 22 parking spaces.
- 1.3 The site occupies a block of land bounded on all sides by adopted highway. The location of the site in relation to its surroundings can be seen within Figure 1.1.

Figure 1.1 – Site Location

- 1.4 This Technical Note has been prepared in accordance with the National Planning Policy Framework (NPPF) and Kent County Council's (KCC) drainage guidance document 'The Kent Design Guide Making It Happen – Sustainability (drainage systems)' (KCC Design Guide).
- 1.5 The National Standards for SuDS (NSfSuDS) have been referred to throughout the inception of the surface water drainage strategy, though given the previously developed nature of the site it is expected that in line with the standards, a 'relaxation factor' can be applied, given the significant reduction in downstream flood risk achieved through development compared to existing conditions.
- 1.6 The Note sets out the existing baseline conditions, development proposals and the proposed Surface Water Management Plan and foul water strategy that will serve the development.

2 Existing Baseline Conditions

Existing Site

- 2.1 The existing brownfield site comprises a former Police Station Building and associated accesses and parking, with the site accessed from Woodville Place to the north. The former buildings occupying the site have been largely demolished leaving the external boundary wall (and presumably

associated structure to support it) together with the internal paved courtyard.

- 2.2 The topographic survey confirms that the majority of the site is enclosed by a boundary wall. The areas of the site between the wall and the edge of the highway generally fall and drain to gullies in the highway.
- 2.3 Within the boundary wall, the existing site is relatively flat and generally below highway level at circa 19.8m Above Ordnance Datum (AOD). Pedestrian access to the existing site is via steps to the south-east.
- 2.4 A copy of the topographic survey for the site can be seen as Appendix A.

Existing Flood Risk

Fluvial Sources (River and Sea Flooding)

- 2.5 An extract of the 'Flood Map for Planning' has been reproduced as Figure 2.1 and shows the site as being entirely within 'Flood Zone 1', as land assessed as having less than 1 in 1,000 annual probability of flooding from fluvial sources (<0.1%).

Figure 2.1 – EA Flood Map for Planning



Pluvial sources (surface water flooding)

- 2.6 An extract of the EA's 'Flooding from Surface Water' map has been reproduced as Figure 2.2. The mapping is based on LiDAR data and

indicates the typical conveyance routes of surface water runoff in up to the 1 in 1,000-year return period storm.

- 2.7 Figure 2.2 indicates a small area of surface water flooding expected to occur in the low-risk event. This represents the only area of flooding shown within the site boundary and occurs due to a local low point within the site, where flows are expected to impound. This low-lying area will be mitigated through levels reprofiling as part of future development.

Figure 2.2 – EA Risk of Flooding from Surface Water



- 2.8 The mapping indicates no on-site surface water flooding during medium or high risk events within the site boundary.
- 2.9 Minor surface water flooding is indicated in the local highway network during the low risk scenario. Woodville Place, to the north, is expected to remain free from surface water flooding in all foreseeable events.
- 2.10 Additional EA surface water flood maps indicate that routes from the site to the local distributor road network south of the site will not encounter flooding exceeding 0.2m depth in the low-risk event, remaining passable for vehicles and most pedestrians.
- 2.11 Surface water flooding will therefore not prohibit safe access and egress to the site, even in the most severe rainfall events.

Groundwater Sources

- 2.12 The site does not lie within a groundwater flood risk area. The site is not located at the lowest elevation within the local area and therefore the site is not likely to be susceptible to groundwater flooding.

Artificial Sources

- 2.13 The site does not lie within the maximum extent of flooding from any reservoirs, either alone or in combination with river flooding, and there are no known on-site flood risks associated with infrastructure failure.

Ground Conditions

- 2.14 A ground investigation has been undertaken by Crossfield Consulting and concluded;

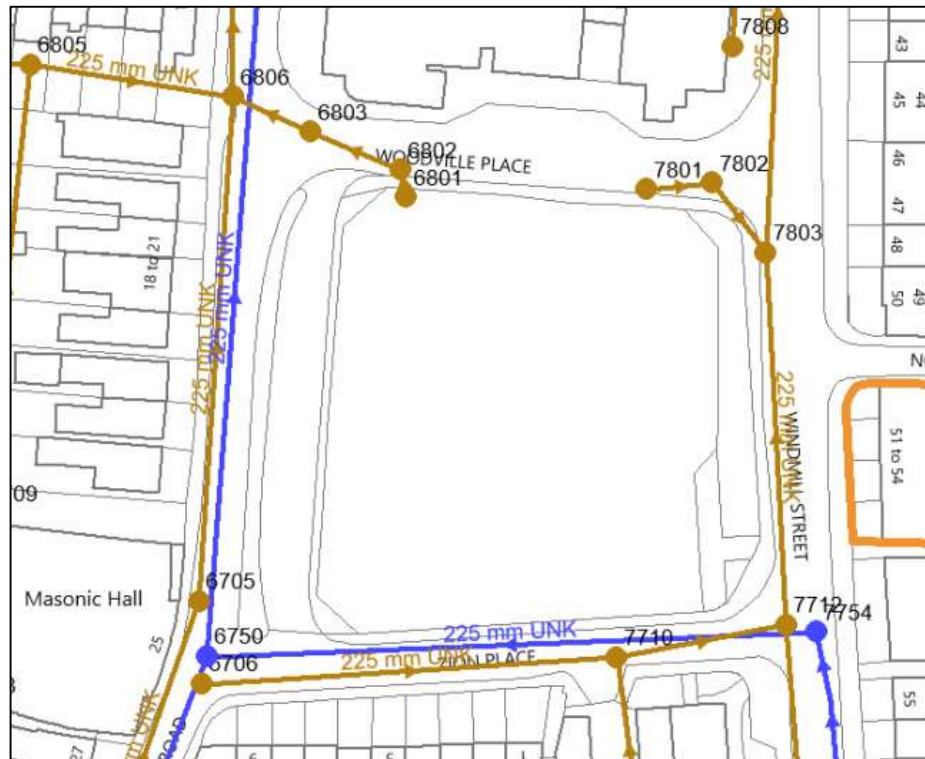
"The ground conditions comprise clays and silts (including matrix supported Grade Dm structureless chalk strata), which may preclude the use of shallow soakaway drainage.

Due to the presence of potential soluble strata beneath the site, ground support conditions relating to the underlying chalk will need to be considered if an infiltration drainage solution is to be proposed [...]. Based on the available information, it would be prudent to identify an alternative drainage solution at this stage."

- 2.15 Extracts from the ground investigation can be found within Appendix B of this Technical Note.

Existing Site Drainage

- 2.16 Southern Water's (SW) asset plans indicate the site is connected directly to the public foul network, with adopted chambers located on the site.
- 2.17 The mapping also indicates an adopted surface water sewer in Wrotham Road and Zion Place.
- 2.18 It is not known exactly how surface water from within the boundary wall drains, however, it is likely it either drains to the public foul or surface water network via on-site, unattenuated connections. The area of the site within the boundary wall is 2,830m².
- 2.19 SW's sewer records plan can be found within Appendix C of this Technical note, with an extract included as Figure 2.3.

Figure 2.3 – Southern Water Sewer Records

- 2.20 SW's records indicate the existing site connection with the public foul network has an invert of 20.63mAOD, at a depth of 0.75m below ground level.
- 2.21 The invert of the adopted chamber in the highway is 18.30mAOD at a depth of 2.91m below ground and therefore it is anticipated a gravity connection to the adopted foul network will be achievable.
- 2.22 The invert of the most local adopted surface water manhole is not directly available but based on minimum gradients and pipe sizes, may lie between 20.08mAOD and 19.21mAOD at the anticipated point of connection from the site.
- 2.23 It may therefore be possible to discharge an attenuated flow from a belowground tank via a gravity connection to the public surface water sewer, but should this not be possible, a private pumped connection would be feasible.
- 2.24 The invert of public surface water sewer local to the site should be verified prior to commencement to inform the detailed drainage design. Wherever practicable, existing sewer connections should be retained to minimise off-site disruptions.

Existing surface water runoff

2.25 Runoff generated by the existing site would be limited by the existing drainage systems that discharge to the SW sewer network. Excess flows would overwhelm the system and may pond locally on site before routing off-site to the surrounding road network to the north.

2.26 The 'KCC Design Guide' states, in relation to brownfield sites:

"If the greenfield runoff rate cannot be achieved, full justification should be made by the applicant to KCC. The final discharge rate should seek to provide betterment from the existing rate but should not exceed 50% of the existing rate for each of the critical rainfall event.

- 1. the current discharge rate from the site at the time of the planning application; or*
- 2. the capacity of the current connection to the surface water system."*

2.27 KCC Design Guide places the following limits on control sizes:

"The use of flow control devices such as weirs, pumps, orifice plates (hydrobrakes), etc. within a system to be adopted by Kent County Council will require approval. Minimum size of hydraulic devices for unprotected controls shall usually be as follows:

- 100mm for orifice plates*
- 75mm for vortex control devices (and in accordance with manufactures recommendations)*
- 150mm for throttle pipes. Throttle pipes should be less than 15m in length."*

2.28 Based on KCC guidance, it is proposed that any discharge to the SW sewer network should be limited to a maximum of 50% of existing brownfield 1 in 1-year discharge rates.

2.29 The sites existing brownfield discharge rates to the SW network have been calculated using the Rational Method, based on an existing impermeable catchment of 0.283 ha, within Hydrological Region 7 and with a rainfall intensity of 50.4 mm/hr.

2.30 The output from this calculation, including growth curve factors to estimate the 1, 30 and 100-year return periods can be seen within Appendix D, with a summary included in Table 2.2.

Table 2.2 – Brownfield Runoff Rates

Return Period	Brownfield Rate (l/s)
Q_{Bar}	39.7
1-year	33.7
30-years	95.2
100-years	126.5

- 2.31 Given the proximity of an adopted surface water network in the highways bounding the site it is feasible the previous building and the associated hard standings discharge to more than one point on the adopted network. If this was not the case, it is unlikely the existing site drainage would be sized for extreme events.
- 2.32 To present a worst-case scenario, assuming a single point of connection for the existing site at a size of 150mm, with a gradient consistent with self-cleansing velocities, it is estimated the site may have been throttled to 17.8l/s by its connection to the public surface water network. In accordance with KCC Design Guidance, which requires a 50% reduction, an upper limit for discharge from this site is therefore 8.9 l/s.
- 2.33 A proposed controlled discharge of 5.0 l/s would provide 72% betterment over the estimated throttled brownfield discharge rates based on a single 150mm site connection at a gradient of 1 in 100. This also ensures that the minimum 75mm vortex control, without fine screening, is not exceeded, as required by the 'KCC Design Guide'.

3 Development Proposal

- 3.1 The proposed development comprises redevelopment of the site to form 67 no. retirement apartments including communal facilities, access, car parking and landscaping.
- 3.2 A copy of the proposed site layout has been included within Appendix E of this report.

4 Surface Water Management Plan

- 4.1 The site is less than 1.0 ha. is located within Flood Zone 1, and not at significant risk of flooding from any other sources, therefore a Flood Risk Assessment is not required. This technical note has been prepared to assess

any relevant flood risks and drainage constraints and to identify an appropriate drainage strategy for the proposed development.

- 4.2 To ensure the development is safe throughout its lifetime, the surface water strategy accounts for runoff in up to the 100-year return period.
- 4.3 The strategy also safeguards against the upper end allowances for climate change (45%) providing betterment over existing conditions, where the rate and volume of runoff would continue to increase due to climate change.
- 4.4 The site is not within any of the areas identified within the 'General requirements' of the National Standards for SuDS where rainwater harvesting should be considered. Rainwater harvesting is therefore not considered necessary for this development.
- 4.5 The Crossfield Consulting ground investigation indicates that the brownfield site is underlain by solution sensitive strata and recommends consideration of a drainage strategy other than infiltration.
- 4.6 The current connection of the sites former surface water sewerage system is considered likely to be with the adopted public sewers local to the site.
- 4.7 There are no nearby watercourses, but adopted surface water sewers are mapped adjacent to the site in Wrotham Road and Zion Place.
- 4.8 It is proposed that development runoff will be discharged to the existing SW surface water sewer in Wrotham Road.
- 4.9 The attenuation of runoff will significantly reduce existing peak rates of discharge from current impermeable surfaces on site; and in line with 'KCC Design Guide', achieves 72% betterment (in excess of the minimum 50% betterment required for brownfield site) over the existing 1 in 1-year brownfield discharge rates.
- 4.10 Runoff from access and parking areas will be directed to areas of permeable surfacing installed on parking bays, with subsequent discharge under gravity to a cellular attenuation tank beneath the parking area. The permeable surfacing will provide water quality treatment, as well as interception.
- 4.11 Where practicable, roof runoff will be directed to two private raingarden features, situated within amenity areas. The raingarden features will provide water quality treatment, as well as interception, biodiversity, and amenity.

- Flows from the raingardens will be collected via distribution crates, subsequently discharging under gravity to a cellular attenuation tank beneath the parking area.
- 4.12 At the detailed design stage, the attenuation capacity of the permeable surfacing and raingardens may be modelled and will either offset a proportion of the cellular tank volume, or site discharge rates may be further reduced in accordance with the additional attenuation provided.
- 4.13 The proposed SuDS features reflect the needs of the NSfSuDS, providing significant water quality, biodiversity, and amenity benefit compared to the existing site. The proposed SuDS features satisfy the requirements of the comments received from KCC LLFA, included within Appendix H.
- 4.14 All chambers immediately upstream of the cellular attenuation tank will include silt traps, whilst the tank itself will include vented covers or a high-level vent pipe to mitigate air-locks. Runoff from the tank will pass through a flow control chamber prior to discharging to surface water network under Wrotham Road. The control solution proposed on the drainage strategy is a hydrobrake with a peak discharge of 5.0l/s. SW previously accepted discharge to their network on this basis, with a copy of correspondence included within Appendix C
- 4.15 Should the invert of the surface water sewer be found to be above the invert of the site discharge, then a pump control set at 5.0 l/s would be necessary.
- 4.16 Causeway FLOW software has been used to determine the storage requirements for the development. In line with comments received from KCC, included in Appendix H, a Cv value of 1.0 has been used, to provide a robust estimate of attenuation requirements.
- 4.17 The output of this exercise has been summarised within Table 4.1, with copies of the modelling outputs included within Appendix F.

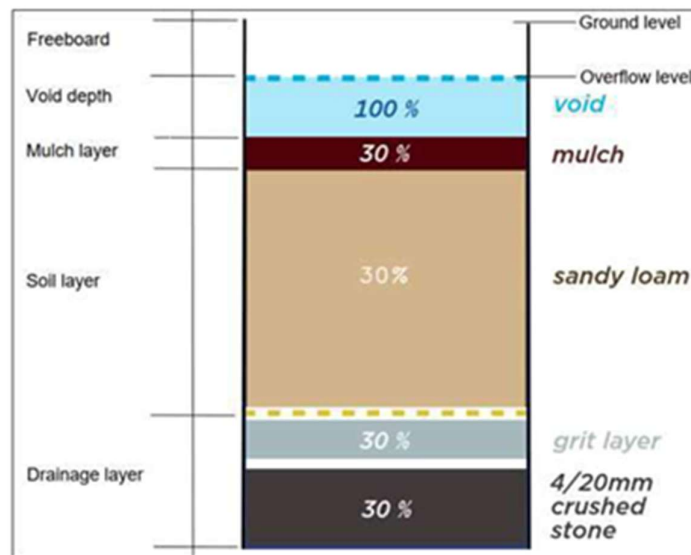
Table 4.1 – Attenuation Storage Volumes

Attenuation Feature	Attenuation Volume
Requirement: 100yr + 45% Requirement	116.8 m ³
Provision: Cellular Attenuation Tank	118.8 m ³

- 4.18 Raingardens attenuation will be used for additional on-site surface water storage, where raingardens are typically only 30% porous, they can hold

some surface water, as shown in image 4.2. Still, they will mainly be used as a pollution mitigation and conveyance to the cellular tank.

Image 4.2 – Raingarden Section from SuDS Manual



- 4.19 The proposed development will provide a peak rate of discharge from the site of 5.0 l/s, subject to capacity enquiries. Future connection to the existing public surface water network will provide 72% betterment compared to the existing 1 in 1-year brownfield rate, estimated at 17.8 l/s.
- 4.20 Any redundant surface water drainage infrastructure that served the former building to be abandoned and replaced with a new private gravity network to serve the proposed development.
- 4.21 A copy of the preliminary drainage layout can be found on drawing 1305-01-PDL-1001 included within Appendix G.

Long-Term Storage

- 4.22 Long-Term Storage has been assessed in accordance with CIRIA C753 'The SuDS Manual'.
- 4.23 The proposed scheme layout does not increase the existing impermeable drained catchment (0.283ha) and will not increase the volume of runoff compared to existing brownfield conditions. It is therefore concluded that Long Term Storage is not required as part of this application.

Water Quality

- 4.24 In line with the pollution indices set out in CIRIA SuDS Manual (C753) the development is required to provide 'SuDS component features' which have a 'total SuDS mitigation index' greater than or equal to the 'pollution hazard index'.
- 4.25 Residential development is considered to have a 'Low' pollution hazard level. Table 4.2 outlines the pollution hazard indices required for residential developments, taken from Table 26.2 of C753.

Table 4.2 – Pollution Hazard Indices (Ref. C753 Table 26.2)

Pollution Hazard Level	Total Suspended Solids	Metals	Hydrocarbons
Low	0.5	0.4	0.4

- 4.26 The SuDS components proposed for the site and its relevant 'mitigation indices' are identified within Table 4.3.

Table 4.3 – Pollution Hazard Indices (Ref. C753 Table 26.2)

SuDS Component	Total Suspended Solids	Metals	Hydrocarbons
Permeable pavement	0.7	0.6	0.7
Bioretention system (raingarden)	0.8	0.8	0.8

- 4.27 Tables 4.2 and 4.3 demonstrate that for both proposed SuDS features, the total 'mitigation index' is greater than the 'pollution hazard index', and therefore an appropriate level of water quality management is being achieved.

Exceedance Runoff

- 4.28 Beyond the 100-year critical storm, exceedance runoff will be directed towards any residual areas of open space and/or the proposed car park, where any aboveground capacity can be utilised. The level of external perimeters to the site, including planting beds, should be considered in relation to opportunities to retain exceedance on site, and limit exceedance flow off-site to lower ground.
- 4.29 Beyond the limits of the site, exceedance flows would continue to the surrounding road network, where flows are directed north.

5 Foul Water Strategy

- 5.1 Foul flows generated by the proposed development will drain through a new private gravity foul network and will discharge to the public foul sewer in Woodville Place, via the indicated adopted site connection.
- 5.2 SW previously confirmed through consultation that the foul system within Woodville Place would have capacity to accept development. A copy of correspondence with SW is included within Appendix C.
- 5.3 The existing on-site foul connection will be retained wherever possible. If this is not possible due to existing levels, a new connection to the existing adopted foul invert in Woodville Place may be necessary.
- 5.4 The proposed foul drainage arrangements can be seen on the preliminary drainage layout drawing 1305-01-PDL-1001 within Appendix G.

6 Ownership & Maintenance

- 6.1 All on-site piped drainage will remain private and will be designed in accordance with Building Regulations Part H and will become the responsibility of the building operator.
- 6.2 The proposed attenuation will also be retained under private ownership and operated and maintained by an appointed management company in accordance with CIRIA C753 and any manufacturer specific guidance.
- 6.3 At the detailed design stage, a 'Drainage Maintenance Plan' will be prepared. The Plan will set out maintenance tasks, responsibilities and frequencies for the entire drainage network.

7 Conclusion

- 7.1 The proposed development has been assessed in line with the National Planning Policy Framework, to allow the planning application to be progressed and to show that the development can be undertaken in an acceptable manner from a flood risk perspective.
- 7.2 The proposed development is located within Flood Zone 1 and is not known to be susceptible to flooding from pluvial, groundwater, infrastructure or artificial sources.

- 7.3 To ensure the development is safe throughout its lifetime, the surface water strategy accounts for runoff in up to the 1 in 100-year return period.
- 7.4 The strategy also safeguards against climate change (45%), providing betterment over existing conditions, where the rate and volume of runoff would continue to increase due to climate change.
- 7.5 The existing ground conditions may be susceptible to solution features and therefore advice indicates drainage strategies should consider discharges other than by infiltration.
- 7.6 AWP have assumed that the existing site discharges via a 150mm diameter connection, with a gradient consistent with self-cleansing velocities. Such a connection would be expected to throttle flows to 17.8 l/s. In accordance with Kent County Council Design Guidance, which requires a 50% reduction, an upper limit for discharge from this site is therefore 8.9 l/s.
- 7.7 Where practicable, surface water runoff generated within the proposed development will be received by SuDS features, providing water quality treatment, prior to discharging into a belowground cellular attenuation tank, with flows subsequently discharged at restricted rates to the existing Southern Water surface water sewer beneath Wrotham Road.
- 7.8 Flows from the cellular attenuation tank will pass through a gravity vortex control limited to 5.0 l/s. This provides 72% betterment compared to existing 1 in 1-year brownfield conditions and thereby exceeds the 50% requirement outlined within the Kent County Council design guidance.
- 7.9 The impermeable drained catchment is not being increased by the development, meaning Long Term Storage is not required.
- 7.10 In line with comments received from Kent County Council a Cv value of 1.0 has been used, to provide a robust estimate of attenuation requirements.
- 7.11 All surface water runoff will receive an appropriate level of treatment by means of SuDS features. This is considered a significant betterment over existing conditions, where the site has no pollution mitigation or stormwater attenuation. The proposed raingarden features will also contribute towards amenity and biodiversity enhancement.
- 7.12 Beyond the 100-year critical storm, exceedance runoff will be directed towards any residual areas of open space and/or car parking, where any above ground storage can be utilised.



- 7.13 Foul flows generated by the proposed development will be served by a new private gravity network, with existing connections to the Southern Water foul sewer to be prioritised for re-use.
- 7.14 All on-site proposed drainage will remain private and will be designed in accordance with Building Regulations Part H and CIRIA C753 and will become the responsibility of the building operator or appointed management company.
- 7.15 As the development will be safe from flooding throughout its lifetime and will actively reduce the flood risk to properties within the downstream catchment, it is recommended that the Local Planning Authority confirm they have no objections to the proposed development.



Appendix A Topographic Survey



Appendix B Ground Investigation (Extracts)

Generally, all formations should be placed wholly within the same material type, unless specific geotechnical inspection and assessment have been undertaken.

Care should be taken to ensure that any existing services encountered are carefully and satisfactorily blocked to prevent water seeping through the drains and into any excavations.

10. TEMPORARY WORKS

Conventional plant is considered to be suitable for excavation works at the site. However, hydraulic breakers will be required to break up existing reinforced hardstanding and any buried obstructions associated with the existing development.

Shallow excavations may remain stable in the short term but should not be left open for extended periods of time, particularly during inclement weather. Support should be provided, or the sides battered back, in any excavations requiring man entry, in compliance with a suitable risk assessment. Likewise, support is likely to be necessary in deeper excavations.

With regards to a piled foundation solution, it will be necessary to construct a working platform for tracked plant involved in the works. The platform should be designed by a suitably qualified geotechnical specialist in accordance with the guidance given in BRE Document BR470 (2004). The platform can be either designed to be placed on existing ground and then removed following completion of the works, or ground levels can be reduced, and the working platform can be incorporated into the final development.

11. ASSESSMENT OF SOAKAWAY DRAINAGE

The ground conditions comprise clays and silts (including matrix supported Grade Dm structureless chalk strata), which may preclude the use of shallow soakaway drainage. Due to the presence of potential soluble strata beneath the site, ground support conditions relating to the underlying chalk will need to be considered if an infiltration drainage solution is to be proposed and further investigation is recommended to provide additional data in this regard. Based on the available information, it would be prudent to identify an alternative drainage solution at this stage.

12. ROAD PAVEMENTS

Based on the nature of the shallow soils beneath the site a preliminary design equilibrium CBR of 3% may be considered for the design of road pavements. The materials at shallow depth may be regarded as frost susceptible.

13. ASSESSMENT OF MATERIALS FOR WASTE DISPOSAL

It is not known if there is a requirement to remove soils from site and, therefore, development levels should be set such that soils can be retained and reused on site where possible. Providing development levels are set to accommodate soil arisings (for example, from foundation excavations), such materials would not be classified as waste if retained and re-used on site. However, if materials are excess to requirements, they should be taken to an appropriately permitted waste facility.



Appendix C Southern Water Records

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
5618	F	0.00	0.00	
5701	F	22.60	21.27	
5702	F	22.11	20.39	
6602	F	26.05	23.95	
6603	F	0.00	0.00	
6605	F	0.00	0.00	
6607	F	23.60	22.21	
6608	F	23.18	21.03	
6701	F	0.00	0.00	
6702	F	0.00	0.00	
6703	F	0.00	0.00	
6704	F	22.72	19.80	
6705	F	22.24	19.45	
6706	F	22.34	20.26	
6707	F	23.10	21.85	
6708	F	22.57	19.69	
6709	F	0.00	19.30	
6713	F	22.14	22.09	
6801	F	21.38	20.63	
6802	F	21.21	18.30	
6803	F	21.05	18.10	
6804	F	0.00	0.00	
6805	F	20.84	0.00	
6806	F	20.94	17.83	
6807	F	0.00	0.00	
6808	F	20.39	0.00	
6905	F	20.18	0.00	
6906	F	19.94	8.27	
7701	F	24.51	0.00	
7702	F	24.01	21.27	
7703	F	23.44	0.00	
7704	F	22.23	20.89	
7705	F	22.44	19.16	
7706	F	0.00	0.00	
7707	F	0.00	0.00	
7708	F	25.24	0.00	
7709	F	23.21	0.00	
7710	F	22.63	20.04	
7711	F	24.25	21.19	
7712	F	0.00	0.00	
7801	F	21.16	18.43	
7802	F	20.89	0.00	
7803	F	20.77	0.00	
7804	F	21.38	0.00	
7805	F	20.75	0.00	
7806	F	20.46	17.85	
7807	F	20.32	17.93	
7808	F	20.46	16.93	

[illegible]



James Blyth
Awcock Ward Partnership Ltd
Ada House
Pynes Hill
Exeter
Devon
EX2 5TU

Your ref

Our ref

DSA000010003

Date

10 August 2022

Contact

Tel 0330 303 0119

Dear Mr Blyth,

Level 1 Capacity Check Enquiry: Windmill Street, Former Police Station, 133 Windmill Street, Gravesend, Kent, DA12 1DB.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

There is currently inadequate capacity within the foul sewerage network to accommodate a foul flow of **0.65 l/s** for the above development at manhole reference **TQ64736801** or **TQ64737801**. The proposed development would increase flows to the public sewerage system which may increase the risk of flooding to existing properties and land. Additional off-site sewers or improvements to existing sewers will be required to provide sufficient capacity to service the development. Southern Water has a duty to provide Network capacity from the point of practical connection (point of equivalent or larger diameter pipe) funded by the New Infrastructure Charge.

Southern Water aim to provide this within 24 months following the date that planning has been granted for developments not identified as strategic sites in our current business plan. Strategic sites are larger developments and will often take longer than 24 months for a full solution to be provided.

The nearest point where capacity is currently available is at **GRAV WTW** which is located approximately **2 Km** Northeast of the proposed development site. Rights are not issued for a direct connection to Wastewater Treatment Works (WTW). Please note that connection to the WTW will have to be agreed by Southern Water Services before being carried out.

Alternatively, the developer can discharge foul flow no greater than existing levels if proven to be connected and it is ensured that there is no overall increase in flows into the foul system. You will be required to provide a topographical site survey and/or a CCTV survey showing the existing connection points, pipe sizes, gradients and calculations confirming the proposed foul flow will be no greater than the existing contributing flows.



Surface Water

The documents submitted indicate that the proposed surface water flows are now restricted and hence will support the system to be more efficient. Therefore, surface water may be discharged to the existing sewer, provided the rate of discharge to the sewer is no greater than existing contributing flows.

New Infrastructure Charging

Please note as of 1st April 2018 we have moved to the “New Connections Services Charging Arrangements”. We understand that this may cause uncertainty for customers, particularly where they may have already committed to a development based on previous charging arrangements. We have worked with our stakeholders and Water UK to agree a set of principles by which we will base our charges. Please read through our new charging arrangement documents available at the following link: southernwater.co.uk/developing-building/connection-charging-arrangements

Alternatively, New Appointees and Variations (NAVs), also known as ‘inset’ companies, can provide new connection services or take ownership of the new water and wastewater connection infrastructure provided for a new development. NAVs are appointed by Ofwat and replace the regional water company. It is for the developer to choose whether to use a NAV or the regional water company to supply services for new sites, according to certain legal criteria.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: developerservices.southernwater.co.uk

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.

Should it be necessary to contact us please quote our above reference number relating to this application by email at southernwaterplanning@southernwater.co.uk

Yours sincerely,

Future Growth Planning Team
Business Channels

southernwater.co.uk/developing-building/planning-your-development



James Blyth
Awcock Ward Partnership Ltd
Ada House
Pynes Hill
Exeter
Devon
EX2 5TU

Your ref

Our ref
DSA000010003

Date
21 October 2022

Contact
Tel 0330 303 0119

Dear Mr Blyth,

Level 1 Capacity Check Enquiry: Windmill Street, Former Police Station, 133 Windmill Street, Gravesend, Kent, DA12 1DB.

We have completed the capacity check for the above development site and the results are as follows:

Foul Water

There is currently adequate capacity in the local sewerage network to accommodate a foul flow of **0.65 l/s** for the above development at manhole reference TQ6473**6801** or TQ6473**7801**. Please note that no surface water flows (existing or proposed) can be accommodated within the existing foul sewerage system unless agreed by the Lead Local Flood Authority in consultation with Southern Water, after the hierarchy Part H3 of Building Regulations has been complied with.

Connecting to our network

It should be noted that this information is only a hydraulic assessment of the existing sewerage network and does not grant approval for a connection to the public sewerage system. A formal Sewer Connection (S106) application is required to be completed and approved by Southern Water Services. To make an application visit: developerservices.southernwater.co.uk

Please note the information provided above does not grant approval for any designs/drawings submitted for the capacity analysis. The results quoted above are only valid for 12 months from the date of issue of this letter.



Should it be necessary to contact us please quote our above reference number relating to this application by email at southernwaterplanning@southernwater.co.uk

Yours sincerely,

Future Growth Planning Team
Business Channels

southernwater.co.uk/developing-building/planning-your-development



Appendix D Brownfield Runoff Rates

Colebrook-White Pipe Capacity Analysis

Project No.	1305	
Project Title	Windmill Street, Gravesend	
Client	Planning Issues Ltd	
Sheet Ref	P:\1305 Windmill Street, Gravesend\Design and Analysis\SPREADSHEETS\01 Drainage\03 Sewer Design\[Colebrook White Equation (pipe velocity & capacity).xlsx]Colebrook-White	

Calcs by	BF
Checked by	CPY
Approved by	CPY
Date	17.10.2025
Revision	B

Pipe capacity calculation based on the Colebrook White Equation (HR Wallingford, 1990);

$$V = -2\sqrt{(2gDS)} \log_{10} \left(\frac{k_s}{3.7D} + \frac{2.51\nu}{D\sqrt{(2gDS)}} \right)$$

Fluid type:

Surface

Where:

D	Pipe diameter	1 in	150 mm
S	Hydraulic gradient		100 m/m
k _s	Effective pipe roughness		0.6 mm
g	Gravitational acceleration		9.81 m/s ²
ν	kinematic viscosity		1.01E-06 m ² /s
A	Cross-sectional flow area		0.018 m ²
Q	Discharge		17.754 l/s
V	Velocity		1.00 m/s

Catchment area analysis based on Modified Rational Method equation (HR Wallingford, 1990);

$$Q_{BAR} = 2.78 \cdot i \cdot A$$

Hydrological Region:

7

 *see map

Where:	Q _{BAR}	Average discharge (l/s)	
	i	Rainfall intensity (mm/hr)	50.4 mm/hr *see map
	A	Catchment area (m ²)	

Return Period	2yr	30yr	100yr	
Growth Factor (Q/QBAR)	0.88	2.4	3.19	
Critical Area (ha)	0.1440	0.0528	0.0397	(area that can freely drain)

Brownfield flow rate analysis based on Modified Rational Method (HR Wallingford, 1990);

		2yr	30yr	100yr	QBAR	
Area (ha):	0.283	BF flow (l/s):	34.89	95.16	126.49	39.65

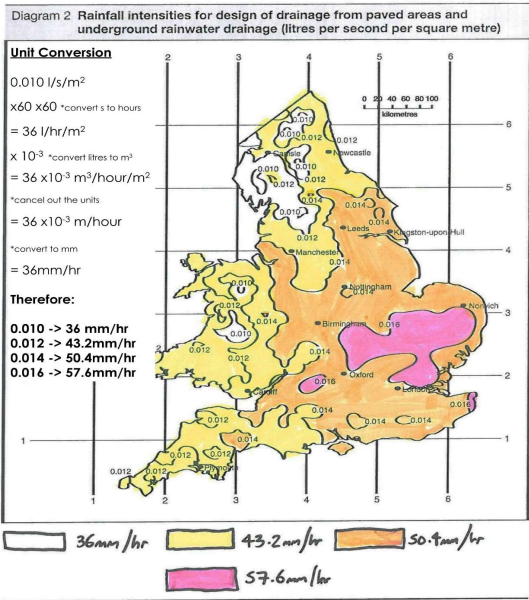
Foul capacity analysis for dwellings based on Sewers for Adoption (6th Edition);

l/dwelling/day	0.046
No. dwellings served	383
No. dwellings served +10% infiltration	349

Appendix 1 Figures and graphs



Figure A1.1 Hydrological regions of UK



UK and Ireland growth curve factors (after NERC, 1993)									
Hydrometric area	Return period								
	1 ¹	2	5	10	25	30 ²	50	100	500
1	0.85	0.90	1.20	1.45	1.81	1.99	2.12	2.48	3.25
2	0.87	0.91	1.11	1.42	1.81	1.99	2.17	2.63	3.45
3	0.86	0.94	1.25	1.45	1.70	1.75	1.90	2.08	2.73
9	0.88	0.93	1.21	1.42	1.71	1.80	1.94	2.18	2.86
10	0.87	0.93	1.19	1.38	1.64	1.70	1.85	2.08	2.73
4	0.83	0.89	1.23	1.49	1.87	1.99	2.20	2.57	3.62
5	0.87	0.89	1.29	1.65	2.25	2.55	2.83	3.56	5.02
6/7	0.85	0.88	1.28	1.62	2.14	2.40	2.62	3.19	4.49
8	0.78	0.88	1.23	1.49	1.84	1.98	2.12	2.42	3.41
Ireland	0.83 ²	0.95	1.20	1.37	1.60	1.65	1.77	1.96	2.40

Notes
1 1 year return period growth curve factors are taken from NERC (1977)
2 30 year (and 1 year for Ireland) return period growth curve factors are interpolated estimates

Design rainfall intensities

3.8 Design rainfall intensities of 0.014 litres/second/m² may be assumed for normal situations. Alternatively the rainfall intensity may be obtained from Diagram 2.

(Part H - this is where 50mm/hr comes from)

3.9 Where low levels of surface flooding could cause flooding of buildings the rainfall intensities should be obtained from BS EN 752-4 (see paragraph 3.36).

Region lookup

7

True velocity 1.0046983

		Region	2yr	30yr	Hundred
Fluid lookup	Foul	1	0.9	1.99	2.48
	Surface	2	0.91	1.99	2.63
	Combined	3	0.94	1.75	2.08
		4	0.89	1.99	2.57
		5	0.89	2.55	3.56
		6	0.88	2.4	3.19
		7	0.88	2.4	3.19
		8	0.88	1.98	2.42
		9	0.93	1.8	2.18
		10	0.93	1.7	2.08
		IRISH	0.95	1.65	1.96

Taken from CIRIA C753, based on NERC Flood Studies Report, 1993
pdf page 544

TABLE 24.2 UK and Ireland growth curve factors (after NERC, 1993)									
Hydrometric area	Return period								
	1 ¹	2	5	10	25	30 ²	50	100	500
1	0.85	0.90	1.20	1.45	1.81	1.99	2.12	2.48	3.25
2	0.87	0.91	1.11	1.42	1.81	1.99	2.17	2.63	3.45
3	0.86	0.94	1.25	1.45	1.70	1.75	1.90	2.08	2.73
9	0.88	0.93	1.21	1.42	1.71	1.80	1.94	2.18	2.86
10	0.87	0.93	1.19	1.38	1.64	1.70	1.85	2.08	2.73
4	0.83	0.89	1.23	1.49	1.87	1.99	2.20	2.57	3.62
5	0.87	0.89	1.29	1.65	2.25	2.55	2.83	3.56	5.02
6/7	0.85	0.88	1.28	1.62	2.14	2.40	2.62	3.19	4.49
8	0.78	0.88	1.23	1.49	1.84	1.98	2.12	2.42	3.41
Ireland	0.83 ²	0.95	1.20	1.37	1.60	1.65	1.77	1.96	2.40

- Notes
- 1 1 year return period growth curve factors are taken from NERC (1977)
 - 2 30 year (and 1 year for Ireland) return period growth curve factors are interpolated estimates



Appendix E Proposed Site Plan

	1BED
G	13
1st	18
2nd	18
3rd	18
TOTAL	67

BOUNDARY TREATMENTS

A to B- New Pedestrian & Vehicular Access
B to A- New 1.2m Metal Railing with brick piers to match main facing brick. New railing to include 3 x Dry Riser Access (gated)

Key:

1 bed

Communal areas

Site boundary

Existing trees to be pruned back and crowns lifted (not in ownership)



P2	Proposed GRP substation added to previously approved location.	17/04/26	AS	BS
	Gated access in boundary to access dry riser in stair 3 moved to achieve 18m max hose distance.	28/01/26	AS	BS
P1	Planning Issue			
Rev		Date	By	Ck

Churchill Living
Your lifestyle • Your choice

In partnership with

Housing 21

Proposed Retirement Development
On land formerly Gravesend Police Station
Windmill Street, Gravesend
DA12 1DB

Site Plan

PLANNING

Scale	1:200 @ A1	Date	JAN 2026
Drawn	AS/CB	Checked	BS
Drawing No.		Rev.	

20085GD_PL102 P2

planningissues
TOWN PLANNING AND ARCHITECTURE

Churchill House • Parkside • Ringwood • Hampshire • BH24 3SG
Tel: 01429 462375 E-mail: design@planningissues.co.uk

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Proposed Retirement Apartments on
land formerly Gravesend Police Station, Windmill St, Gravesend, DA12 1DB

C:\Users\ChrisB\OneDrive - Churchill Retirement Plc\Desktop\20085GD_PL100 SERIES_15.04.26 [SITE PLAN_FLOOR PLANS_ELEVATIONS]



Appendix F Causeway FLOW Calculations

Design Settings

Rainfall Methodology	FEH-22	Minimum Velocity (m/s)	1.00
Return Period (years)	100	Connection Type	Level Soffits
Additional Flow (%)	40	Minimum Backdrop Height (m)	0.200
CV	1.000	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	4.00	Include Intermediate Ground	x
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	✓
Maximum Rainfall (mm/hr)	50.0		

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Depth (m)	Invert Level (m)
Tank	0.197	4.00	21.760	1.950	19.810

Simulation Settings

Rainfall Methodology	FEH-22	Skip Steady State	x	2 year (l/s)	0.1
Rainfall Events	Singular	Drain Down Time (mins)	240	30 year (l/s)	0.3
Summer CV	1.000	Additional Storage (m³/ha)	0.0	100 year (l/s)	0.4
Winter CV	1.000	Starting Level (m)		Check Discharge Volume	x
Analysis Speed	Normal	Check Discharge Rate(s)	✓		

Storm Durations

15	60	180	360	600	960	2160	4320	7200	10080
30	120	240	480	720	1440	2880	5760	8640	

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	45	0	0
30	45	0	0
100	45	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	2.40
Greenfield Method	FEH	Growth Factor 100 year	3.19
Positively Drained Area (ha)	0.362	Betterment (%)	0
SAAR (mm)	555	QMed	0.1
Host	1	QBar	0.1
BFIHost	0.875	Q 2 year (l/s)	0.1
Region	7	Q 30 year (l/s)	0.3
QBar/QMed conversion factor	1.136	Q 100 year (l/s)	0.4
Growth Factor 2 year	0.88		

Node Tank Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	x	Sump Available	✓
Invert Level (m)	19.810	Product Number	CTL-SHE-0112-5000-0500-5000
Design Depth (m)	0.500	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Node Tank Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	19.810
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	280

Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)	Depth (m)	Area (m ²)	Inf Area (m ²)
0.000	250.0	250.0	0.500	250.0	278.0	0.501	0.0	278.0

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
2 year +45% CC 15 minute summer	152.650	43.195
2 year +45% CC 15 minute winter	107.123	43.195
2 year +45% CC 30 minute summer	97.169	27.495
2 year +45% CC 30 minute winter	68.188	27.495
2 year +45% CC 60 minute summer	64.092	16.938
2 year +45% CC 60 minute winter	42.581	16.938
2 year +45% CC 120 minute summer	43.902	11.602
2 year +45% CC 120 minute winter	29.167	11.602
2 year +45% CC 180 minute summer	34.990	9.004
2 year +45% CC 180 minute winter	22.744	9.004
2 year +45% CC 240 minute summer	28.149	7.439
2 year +45% CC 240 minute winter	18.702	7.439
2 year +45% CC 360 minute summer	21.788	5.607
2 year +45% CC 360 minute winter	14.162	5.607
2 year +45% CC 480 minute summer	17.165	4.536
2 year +45% CC 480 minute winter	11.404	4.536
2 year +45% CC 600 minute summer	14.004	3.830
2 year +45% CC 600 minute winter	9.568	3.830
2 year +45% CC 720 minute summer	12.414	3.327
2 year +45% CC 720 minute winter	8.343	3.327
2 year +45% CC 960 minute summer	10.070	2.652
2 year +45% CC 960 minute winter	6.670	2.652
2 year +45% CC 1440 minute summer	7.206	1.931
2 year +45% CC 1440 minute winter	4.843	1.931
2 year +45% CC 2160 minute summer	5.114	1.413
2 year +45% CC 2160 minute winter	3.524	1.413
2 year +45% CC 2880 minute summer	4.254	1.140
2 year +45% CC 2880 minute winter	2.859	1.140
2 year +45% CC 4320 minute summer	3.280	0.858
2 year +45% CC 4320 minute winter	2.160	0.858
2 year +45% CC 5760 minute summer	2.776	0.711
2 year +45% CC 5760 minute winter	1.797	0.711
2 year +45% CC 7200 minute summer	2.436	0.621
2 year +45% CC 7200 minute winter	1.572	0.621
2 year +45% CC 8640 minute summer	2.199	0.561
2 year +45% CC 8640 minute winter	1.420	0.561
2 year +45% CC 10080 minute summer	2.029	0.518
2 year +45% CC 10080 minute winter	1.310	0.518
30 year +45% CC 15 minute summer	400.969	113.460
30 year +45% CC 15 minute winter	281.382	113.460
30 year +45% CC 30 minute summer	259.209	73.347
30 year +45% CC 30 minute winter	181.901	73.347
30 year +45% CC 60 minute summer	171.173	45.236

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
30 year +45% CC 60 minute winter	113.723	45.236
30 year +45% CC 120 minute summer	103.235	27.282
30 year +45% CC 120 minute winter	68.587	27.282
30 year +45% CC 180 minute summer	78.448	20.187
30 year +45% CC 180 minute winter	50.993	20.187
30 year +45% CC 240 minute summer	61.565	16.270
30 year +45% CC 240 minute winter	40.902	16.270
30 year +45% CC 360 minute summer	46.521	11.971
30 year +45% CC 360 minute winter	30.240	11.971
30 year +45% CC 480 minute summer	36.415	9.623
30 year +45% CC 480 minute winter	24.193	9.623
30 year +45% CC 600 minute summer	29.704	8.125
30 year +45% CC 600 minute winter	20.295	8.125
30 year +45% CC 720 minute summer	26.403	7.076
30 year +45% CC 720 minute winter	17.744	7.076
30 year +45% CC 960 minute summer	21.631	5.696
30 year +45% CC 960 minute winter	14.329	5.696
30 year +45% CC 1440 minute summer	15.634	4.190
30 year +45% CC 1440 minute winter	10.507	4.190
30 year +45% CC 2160 minute summer	11.108	3.070
30 year +45% CC 2160 minute winter	7.654	3.070
30 year +45% CC 2880 minute summer	9.175	2.459
30 year +45% CC 2880 minute winter	6.166	2.459
30 year +45% CC 4320 minute summer	6.855	1.792
30 year +45% CC 4320 minute winter	4.514	1.792
30 year +45% CC 5760 minute summer	5.626	1.440
30 year +45% CC 5760 minute winter	3.642	1.440
30 year +45% CC 7200 minute summer	4.821	1.230
30 year +45% CC 7200 minute winter	3.111	1.230
30 year +45% CC 8640 minute summer	4.264	1.088
30 year +45% CC 8640 minute winter	2.752	1.088
30 year +45% CC 10080 minute summer	3.863	0.986
30 year +45% CC 10080 minute winter	2.493	0.986
100 year +45% CC 15 minute summer	513.428	145.282
100 year +45% CC 15 minute winter	360.300	145.282
100 year +45% CC 30 minute summer	334.823	94.743
100 year +45% CC 30 minute winter	234.964	94.743
100 year +45% CC 60 minute summer	222.786	58.876
100 year +45% CC 60 minute winter	148.014	58.876
100 year +45% CC 120 minute summer	132.973	35.141
100 year +45% CC 120 minute winter	88.344	35.141
100 year +45% CC 180 minute summer	101.215	26.046
100 year +45% CC 180 minute winter	65.792	26.046
100 year +45% CC 240 minute summer	79.853	21.103
100 year +45% CC 240 minute winter	53.053	21.103
100 year +45% CC 360 minute summer	61.230	15.757
100 year +45% CC 360 minute winter	39.801	15.757
100 year +45% CC 480 minute summer	48.654	12.858
100 year +45% CC 480 minute winter	32.324	12.858
100 year +45% CC 600 minute summer	40.169	10.987
100 year +45% CC 600 minute winter	27.446	10.987
100 year +45% CC 720 minute summer	36.046	9.661

Rainfall

Event	Peak Intensity (mm/hr)	Average Intensity (mm/hr)
100 year +45% CC 720 minute winter	24.225	9.661
100 year +45% CC 960 minute summer	29.877	7.867
100 year +45% CC 960 minute winter	19.791	7.867
100 year +45% CC 1440 minute summer	21.765	5.833
100 year +45% CC 1440 minute winter	14.627	5.833
100 year +45% CC 2160 minute summer	15.421	4.262
100 year +45% CC 2160 minute winter	10.625	4.262
100 year +45% CC 2880 minute summer	12.612	3.380
100 year +45% CC 2880 minute winter	8.476	3.380
100 year +45% CC 4320 minute summer	9.175	2.399
100 year +45% CC 4320 minute winter	6.042	2.399
100 year +45% CC 5760 minute summer	7.354	1.883
100 year +45% CC 5760 minute winter	4.760	1.883
100 year +45% CC 7200 minute summer	6.162	1.572
100 year +45% CC 7200 minute winter	3.977	1.572
100 year +45% CC 8640 minute summer	5.344	1.363
100 year +45% CC 8640 minute winter	3.449	1.363
100 year +45% CC 10080 minute summer	4.760	1.214
100 year +45% CC 10080 minute winter	3.072	1.214

Results for 2 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m ³)	Flood (m ³)	Status
240 minute summer	Tank	152	19.950	0.140	15.4	33.1837	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m ³)
240 minute summer	Tank	Hydro-Brake®	4.9	53.2

Results for 30 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
180 minute summer	Tank	156	20.170	0.360	42.8	85.5822	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)				
180 minute summer	Tank	Hydro-Brake®	5.0	100.5				

Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
360 minute summer	Tank	264	20.302	0.492	33.5	116.9220	0.0000	OK
Link Event (Upstream Depth)	US Node	Link	Outflow (l/s)	Discharge Vol (m³)				
360 minute summer	Tank	Hydro-Brake®	5.0	143.6				



Appendix G Preliminary Drainage Layout



Surface Water Strategy:

1. Surface Water Discharge

Surface water to discharge to a new manhole connection on Southern Water Storm Sewer beneath Wrotham Road at peak flow rate of 5.0 l/s. Subject to capacity check and confirmation of existing invert levels.

2. Flow Control

Gravity vortex flow control to discharge at 5.00 l/s. Controlled flows are to Southern Water adopted surface water network in Wrotham Road.

3. Cellular Attenuation

Cellular tank to receive flows from external hard paving and roof catchments. Chambers immediately upstream of tank to include silt traps.

4. Maintenance

Geocellular Attenuation Tank to be fitted with access turrets for maintenance of feature. Minimum 1no. cover to be vented in accordance with manufacturer recommendations.

5. Exceedance Flows

Beyond the capacity of the proposed surface water network and attenuation, exceedance flows would be directed away from the proposed building and towards areas of landscaping, and/or car parking, wherever possible. Beyond the capacity of the site, flows would continue north on to Woodville Place as per existing conditions.

6. Parking Bays (Lined Permeable Surfacing)

As well as pollution mitigation for the access and parking areas, the lined permeable surfacing used for parking bays will also contribute some attenuation, calculated below:

Total plan area: 247.9m²
Porosity: 30%
Indicative storage depth: 0.3m
Indicative attenuation volume: 22.3m³

Whilst this indicative attenuation volume of 22.3m³ has not been included in the hydraulic model, it is expected that the additional attenuation provided will allow for reduced overall discharge rates when modelled as part of a full detailed drainage design.

Pollution Mitigation

Proposed private raingarden feature to receive runoff from roof runoff, providing water quality treatment, biodiversity, amenity and interception.

A proposed land drain and overflow will serve the proposed raingarden, with flows directed to the external surface water network.

The raingarden is expected to provide a degree of attenuation, not modelled at this stage of planning, and will be approximately 1.0m depth, subsequently discharging to the attenuation tank by gravity.

Foul Drainage Strategy:

Foul flows generated by the proposed site to connect to the existing adopted foul sewer network in Woodville Place, via on-site connection. If necessary, a new connection at an appropriate invert could be established.

Position and invert the existing on-site foul connection to be confirmed.

Alternative foul connection to existing public foul network to east may be possible.

Connections subject to capacity checks with Southern Water.

Pollution Mitigation

Proposed private raingarden feature to receive runoff from roof runoff, providing water quality treatment, biodiversity, amenity and interception.

A proposed land drain and overflow will serve the proposed raingarden, with flows directed to the external surface water network.

The raingarden is expected to provide a degree of attenuation, not modelled at this stage of planning, and will be approximately 1.0m depth, subsequently discharging to the attenuation tank by gravity.

Additional attenuation: Eastern Raingarden

Assumed total depth of 1.0m across 37.2 m² plan area. Indicative layers of:

Layer	Depth (m)	Porosity	Volume (m ³)
Freeboard	0.075	0%	0.000
Void Depth	0.075	100%	2.790
Mulch	0.075	30%	0.837
Soil	0.450	15%	2.511
Drainage	0.400	30%	4.464
Total	1.000		~10.60

Whilst this indicative attenuation volume of 10.6m³ has not been included in the hydraulic model, it is expected that the additional attenuation provided will allow for reduced overall discharge rates when modelled as part of a full detailed drainage design.

Additional attenuation: Southern Raingarden

Assumed total depth of 1.0m across 110.0 m² plan area. Indicative layers of:

Layer	Depth (m)	Porosity	Volume (m ³)
Freeboard	0.075	0%	0.000
Void Depth	0.075	100%	8.250
Mulch	0.075	30%	2.475
Soil	0.450	15%	7.425
Drainage	0.400	30%	13.200
Total	1.000		~31.4

Whilst this indicative attenuation volume of 31.4m³ has not been included in the hydraulic model, it is expected that the additional attenuation provided will allow for reduced overall discharge rates when modelled as part of a full detailed drainage design.

Key:	
	Site Boundary
	RPA
	Existing drainage:
	Surface Water Sewer
	Foul Water Sewer
	Foul Water Chamber
	Surface Water Chamber
	Proposed drainage:
	Building Impermeable Catchment
	Hardstanding Impermeable Catchment
	Cellular Storage Tank
	Under-drained permeable paving
	Raingarden
	Surface Water Distribution Crate
	Surface Water Land Drain / ACO
	Surface Water Sewer
	Foul Water Sewer
	Private Surface Inspection Chamber
	Private Foul Inspection Chamber
	Private Flow Control Chamber
	Adaptable Surface Water Manhole
	Overland Flow Row Route
	Drainage to be abandoned

D	09.04.2026	ADDITION OF RAINGARDEN FEATURES	MDA	BF	CPY
C	27.11.2025	REVISED SITE LAYOUT	BF	BF	CPY
B	12.04.2022	UPDATED TO SUIT CLIENTS LATEST LAYOUT	RF	JB	CPY
A	15.03.2022	INITIAL ISSUE	VS	JB	CPY
REV	DATE	DESCRIPTION	BY	CHK	APD

CLIENT: CHURCHILL LIVING

DRAWING STATUS: PLANNING APPLICATION

PROJECT: WINDMILL STREET, GRAVESEND

TITLE: PRELIMINARY DRAINAGE LAYOUT

PROJECT No: 1305

DRAWING No: 01-PDL-1001

REV: E

SCALE @ A1: 0 1:200 10 metres

Area Summary Schedule

Net Developable Area	0.362 ha
Proposed Impermeable Catchment	0.197 ha

Pre-Development Runoff

The greenfield runoff rates have been assessed for the 'net developable area' using the ICP-SUDS Method. The calculation excludes large areas of open space which will remain undeveloped.

The brownfield runoff rates have been assessed, using the Modified Rational Method, for a contributing area (0.283 ha) that is considered likely to discharge to the existing drainage network on site.

Return Period	Brownfield Rate
1yr	33.7 l/s
30yr	95.2 l/s
100yr	126.5 l/s

The site proposes to restrict flows to 5.0 l/s, providing 72% betterment over the estimated throttled brownfield discharge rates (17.8 l/s) based on a single 150mm site connection at a gradient of 1 in 100. This also provides more than the 50% betterment required within the 'KCC Design Guide' and ensures that the minimum 75mm vortex control, without fine screening, is not exceeded, as required by the KCC Design Guide.

Attenuation Summary

As per the request of Kent County Council, a Cv value of 1.0 has been used within hydraulic model calculations.

Cellular Tank	0.197 ha
Catchment	Hydrabreak limited to 5.0 l/s @ 0.5m head
Hydraulic Control	Ref: MD-SHE-0112-5000-0500-5000
Porosity	25%
Dimension	Tank 250.0m ² x 0.5m deep

Total 100yr + 45%CC Volume Requirement	116.9 m ³
Total 100yr + 45%CC Volume Provision	118.8 m ³
Total 100yr + 45%CC Discharge:	5.0 l/s

SUDS Attenuation

The proposed permeable paving and raingarden features will provide additional attenuation storage within the site. This will allow for either a reduced tank footprint, or for overall discharge rates of the site to be reduced. Additional SUDS features will be modelled as part of a full detailed drainage design. An indicative estimate of the total additional attenuation provided through these SUDS features is shown below:

Feature	Plan Area	Storage Depth (m)	Volume (m ³)
Permeable Paving	250 m ²	0.3	22.3
Raingarden (S)	110.0 m ²	1.0	31.4
Raingarden (E)	37.2 m ²	1.0	10.6
Total			64.3

Water Quality

The proposed surface water drainage network includes permeable paving in parking bays, and two raingarden features to provide water quality treatment and interception of access areas and roof runoff, respectively. The raingarden features will also provide biodiversity and amenity benefit, in line with Kent County Council requirements.

The final raingarden arrangements and receiving catchment areas will be determined at the detailed design stage.

Notes:

- The proposed development has been assessed in line with the National Planning Policy Framework, to allow the planning application to be progressed and to show that the development can be undertaken in an acceptable manner from a flood risk perspective.
- The proposed development is located within Flood Zone 1 and is not known to be susceptible to flooding from pluvial, groundwater, infrastructure or artificial sources.
- To ensure the development is safe throughout its lifetime, the surface water strategy accounts for runoff in up to the 1 in 100-year return period.
- The strategy also safeguards against climate change (45%), providing betterment over existing conditions, where the rate and volume of runoff would continue to increase due to climate change.
- The existing ground conditions may be susceptible to solution features and therefore advice indicates drainage strategies should consider discharges other than by infiltration.
- AWP have assumed that the existing site discharges via a 150mm diameter connection, with a gradient consistent with self-cleansing velocities. Such a connection would be expected to throttle flows to 17.8 l/s. In accordance with Kent County Council Design Guidance, which requires a 50% reduction, an upper limit for discharge from this site is therefore 8.9 l/s.
- Where practicable, surface water runoff generated within the proposed development will be received by SUDS features, providing water quality treatment, prior to discharging into a belowground cellular attenuation tank, with flows subsequently discharged at restricted rates to the existing Southern Water surface water sewer beneath Wrotham Road.
- Flows from the cellular attenuation tank will pass through a gravity vortex control limited to 5.0 l/s. This provides 72% betterment compared to existing 1 in 1-year brownfield conditions and thereby exceeds the 50% requirement outlined within the Kent County Council design guidance.
- The impermeable drained catchment is not being increased by the development, meaning Long Term Storage is not required.
- In line with comments received from Kent County Council a Cv value of 1.0 has been used, to provide a robust estimate of attenuation requirements.
- All surface water runoff will receive an appropriate level of treatment by means of SUDS features. This is considered a significant betterment over existing conditions, where the site has no pollution mitigation or stormwater attenuation. The proposed raingarden features will also contribute towards amenity and biodiversity enhancement.
- Beyond the 100-year critical storm, exceedance runoff will be directed towards any residual areas of open space and/or car parking, where any above ground storage can be utilised.
- Foul flows generated by the proposed development will be served by a new private foul water network, with existing connections to the Southern Water foul sewer to be prioritised for re-use.
- All on-site proposed drainage will remain private and will be designed in accordance with Building Regulations Part H and CIRIA C753 and will become the responsibility of the building operator or appointed management company.
- As the development will be safe from flooding throughout its lifetime and will actively reduce the flood risk to properties within the downstream catchment, it is recommended that the Local Planning Authority confirm they have no objections to the proposed development.



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Appendix H Kent County Council LLFA Comments



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Gravesham Borough Council
Civic Centre
Windmill Street
Gravesend
Kent
DA12 1AU

Flood and Water Management
Sessions House
County Hall
Maidstone, Kent
ME14 1XQ

Website: www.kent.gov.uk/flooding
Email: suds@kent.gov.uk
Tel: 03000 41 41 41
Our Ref: GBC/2026/109026
Date: 3 March 2026

Application No: 20260131

Location: Site Of Former Police Station, 133 Windmill Street, Gravesend, Kent DA12 1DB

Proposal: Erection of 67 Retirement Living Apartments for older people (comprising 67no. 1 bedrooms) including communal facilities, access, car parking and landscaping

Thank you for your consultation on the above referenced planning application.

Kent County Council as Lead Local Flood Authority have the following comments:

We note the proposals for the use of a combination of permeable paving and below-ground attenuation for surface water management, with a final outfall to the surface water sewer. Given the site constraints and ground conditions, we consider this may appropriate in this instance, although opportunities for infiltration are noted to require further investigation in the report.

We note that there would be a reduction in impermeable area and the introduction of surface water flow controls that would help to ensure surface water flood risk is managed, but the proposals as submitted do not reference or meet all the requirements of the National Standards for Sustainable Drainage Systems.

We highlight that there is a need to consider opportunities for rainwater harvesting as the priority for water collection and re-use (Standard 1), prior to discharge as close as possible to greenfield run-off rates (Standard 3), and the inclusion of SuDS features which provide interception of the first 5 mm of rainfall (Standard 2). At present, the design relies on engineered features which do not provide interception for the roof area run-off and have no benefit in terms of providing amenity and biodiversity value, or better incorporation into the landscaping strategy.

We also highlight that hydraulic modelling should utilise a Cv value of 1 when modelling only impermeable area contributions to the drainage system, to ensure that the drainage system is appropriately modelled.

We currently request a holding objection and recommend that the proposals are reviewed against the latest national standards to ensure that they align with the requirements set out within.

This response has been provided using the best knowledge and information submitted as part of the planning application at the time of responding and is reliant on the accuracy of that information.

Yours faithfully,

Alex Brauning

Senior Flood Risk Officer

Flood and Water Management