Project Name: Nuneham Solar Farm

Report Name: Response to Flood Risk & Drainage Objections

Author: Lucy Ginn

Approved by: Stephen Drew

Date: 30/08/2024

Project Number: P21-2947

Introduction

This document provides a response to the holding objection from Oxfordshire County Council Lead Local Flood Authority and the objection from South Oxfordshire and Vale of White Horse District Council drainage team to the proposed Nuneham Solar Farm (application no: P24/S1336/FUL).

The comments from Oxfordshire County Council Lead Local Flood Authority were received on the 25th June 2024 and are enclosed at the end of this document. The comments from the South Oxfordshire and Vale of White Horse District Council drainage team were received on 26th June 2024 and are also enclosed at the end of this document.

This document has been split into two key sections to reflect the comments received from both Oxfordshire County Council Lead Local Flood Authority and South Oxfordshire and Vale of White Horse District Council drainage team, respectively.

Oxfordshire County Council Lead Local Flood Authority Holding Objection

Following a review of the submitted Flood Risk Assessment and Surface Water Drainage Strategy (RO01v3-IN_P21-2947- Nuneham Solar FRA & Drainage Strategy prepared by Pegasus Group), Oxfordshire County Council Lead Local Flood Authority have recommended a holding objection.

In their comments which are enclosed at the end of this document, the council have stated that "incorrect Cvs have been used" and advised that the submitted surface water drainage strategy should be "corrected in line with the Oxfordshire Flood Toolkit, Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire, Appendix D, Page 35". These standards state that "when running calculations, the LLFA expect Cv values should be set to 0.95 for roofed areas and 0.9 for paved areas".

Following these comments, all MicroDrainage calculations have been updated to include a Cv value of 0.95 and the submitted surface water drainage strategy has also been updated to reflect the increased storage requirements based on this higher Cv value. The updated surface water drainage calculations and associated surface water drainage strategy drawing are enclosed at the end of this document.

South Oxfordshire and Vale of White Horse District Council Drainage Objection

The South Oxfordshire and Vale of White Horse District Council drainage team have objected to the site proposals and highlighted four key concerns with the submitted Flood Risk Assessment and Surface Water Drainage Strategy (RO01v3-IN_P21-2947- Nuneham Solar FRA & Drainage Strategy prepared by Pegasus Group). The response to each of these four concerns is included below.

1. Provision of Watercourse Easements

South Oxfordshire and Vale of White Horse District Council drainage team have advised that the 3m easement from all watercourses on site proposed in the submitted Flood Risk Assessment and Surface Water Drainage Strategy (RO01v3-IN_P21-2947- Nuneham Solar FRA & Drainage Strategy prepared by

Pegasus Group) are not in accordance with Policy ENV4 of South Oxfordshire Local Plan 2035 which states:

"Development should include a minimum 10m buffer zone along both sides of the watercourse to create a corridor favourable to the enhancement of biodiversity. Where a 10m wide buffer zone is not considered possible by the local planning authority, (for example in dense urban areas where existing development comes closer to the watercourse) a smaller buffer zone may be allowed, but should still be accompanied by detailed plans to show how the land will be used to promote biodiversity and how maintenance access to the watercourse will be created. Wherever possible within settlements a minimum 10m buffer should be maintained."

The council have subsequently requested that the Applicant "provide a plan clearly showing a 10m corridor either side of the Ordinary Watercourses".

Following review of these comments and discussions with the project's ecology consultants, it is considered that a 10m watercourse easement is not required in addition to the current proposals. A detailed commentary on Policy ENV4 has been provided in a further document "P24-S1336-FUL_Nuneham Solar_Ecology Response_09.08.24" which has been prepared by the project's ecology consultants Clarkson & Woods.

In terms of ensuring maintenance access to the watercourses is maintained, the proposed 3m easement will be upheld and is considered sufficient to ensure maintenance access is not impacted by the proposed development.

2. Half Drain Times

Noting the fact that "the microdrainage calculations submitted alongside the application show half drain times in excess of 7 days", South Oxfordshire and Vale of White Horse District Council drainage team have stated that "the applicant needs to provide information that the features will have sufficient storage to accommodate a follow on 1 in 10 year rainfall event". Following these comments, further drainage calculations have been complete of 1 in 10 year rainfall event plus an allowance for climate change and the proposed SuDS features have been re-sized to ensure they have capacity for 1 in 100 year plus climate change rainfall event plus a follow on 1 in 10 year plus climate change rainfall event. The updated surface water drainage calculations and associated surface water drainage strategy drawing are enclosed at the end of this document. The surface water drainage strategy drawing includes details of the total storage volume provided by the SuDS, and details what proportion of this volume is required to manage a 1 in 100 year plus climate change rainfall event and a 1 in 10 year plus climate change rainfall event.

The South Oxfordshire and Vale of White Horse District Council drainage team have also stated that "infiltration testing should be carried out at the proposed depth and location of infiltration features". It is requested that infiltration testing is conditioned.

3. Swales on Site

South Oxfordshire and Vale of White Horse District Council drainage team have stated that "swales have been discussed within the text to drain access tracks, but no reference to these on the drainage strategy drawing is provided".

All access tracks on site will have a swale alongside them. A typical access track detail for the site is enclosed at the end of this report. It's noted on this enclosed plan (Figure 6), in reference to the swales, that "actual requirements" will be "determined during detailed design". In addition to the typical access track detail enclosed at the end of this report, a "Proposed Swales" plan has also been prepared and is enclosed at the end of this report. This plan highlights the access tracks across the site where swales will be provided. The plan also shows several additional swales proposed on site where it has been identified there was not an access track and associated swale at the downslope end of blocks of solar arrays. The proposed swales will help capture and infiltrate and surface water runoff from the site.

4. SuDS Management and Maintenance

South Oxfordshire and Vale of White Horse District Council drainage team have stated that "no proposed future management and maintenance schedules have been provided". An Operation and Maintenance Manual has now been prepared and is enclosed at the end of this document. This manual should be read in conjunction with the submitted Flood Risk Assessment and Surface Water Drainage Strategy (RO01v3-IN_P21-2947- Nuneham Solar FRA & Drainage Strategy prepared by Pegasus Group). It is noted that the management company for the site has not yet been appointed and as such, the manual provides general advice which should be reviewed and revised following appointment of the management company.

Summary

Based on the above, we would request that Oxfordshire County Council Lead Local Flood Authority and South Oxfordshire and Vale of White Horse District Council drainage team remove their holding objection/objection. We would welcome their earliest consideration of this additional information.

Enclosures

Oxfordshire County Council LLFA Holding Objection

South Oxfordshire and Vale of White Horse District Council Objection

Updated Surface Water Drainage Strategy Calculations – 0.95 Cv Values

Updated Surface Water Drainage Strategy Drawing

Typical Access Track Detail

Proposed Swales

Operation and Maintenance Manual

Oxfordshire County Council LLFA Holding Objection

OXFORDSHIRE COUNTY COUNCIL'S RESPONSE TO CONSULTATION ON THE FOLLOWING DEVELOPMENT PROPOSAL

District: South Oxfordshire
Application no: P24/S1336/FUL
Proposal: Construction and operation of a solar farm with all associated works, equipment, necessary infrastructure and biodiversity net gains- known as 'Nuneham Solar Farm'.(Hard copies of the Environmental Statement can be found at South Oxfordshire District Council, Abbey House, Abbey Close, Abingdon OX14 3JE).
Location: Land north-west of Nuneham Courteney situated to the west of the A4074 north of Upper Farm and south of Lower Farm.

Response Date: 25/06/2024

This report sets out the officer views of Oxfordshire County Council (OCC) on the above proposal. These are set out by individual service area/technical discipline and include details of any planning conditions or Informatives that should be attached in the event that permission is granted and any obligations to be secured by way of a S106 agreement. Where considered appropriate, an overarching strategic commentary is also included. If the local County Council member has provided comments on the application these are provided as a separate attachment.

Application no: P24/S1336/FUL
Location: Land north-west of Nuneham Courteney situated to the west of the A4074 north of Upper Farm and south of Lower Farm.

General Information and Advice

Recommendations for approval contrary to OCC objection:
If within this response an OCC officer has raised an objection but the Local Planning Authority are still minded to recommend approval, OCC would be grateful for notification (via planningconsultations@oxfordshire.gov.uk) as to why material consideration outweigh OCC's objections, and to be given an opportunity to make further representations.

Outline applications and contributions
The anticipated number and type of dwellings and/or the floor space may be set by the developer at the time of application which is used to assess necessary mitigation. If not stated in the application, a policy compliant mix will be used. The number and type of dwellings used when assessing S106 planning obligations is set out on the first page of this response.

In the case of outline applications, once the unit mix/floor space is confirmed by reserved matters approval/discharge of condition a matrix (if appropriate) will be applied to establish any increase in contributions payable. A further increase in contributions may result if there is a reserved matters approval changing the unit mix/floor space.

Where a S106/Planning Obligation is required:

- **Index Linked** – in order to maintain the real value of S106 contributions, contributions will be index linked. Base values and the index to be applied are set out in the Schedules to this response.

- **Administration and Monitoring Fee -TBC**
  This is an estimate of the amount required to cover the monitoring and administration associated with the S106 agreement. The final amount will be based on the OCC's scale of fees and will adjusted to take account of the number of obligations and the complexity of the S106 agreement.

- **OCC Legal Fees** The applicant will be required to pay OCC's legal fees in relation to legal agreements. Please note the fees apply whether a S106 agreement is completed or not.

Security of payment for deferred contributions - Applicants should be aware that an approved bond will be required to secure a payment where a S106 contribution is to be paid post implementation and

- the contribution amounts to 25% or more (including anticipated indexation) of the cost of the project it is towards and that project cost £7.5m or more
- the developer is direct delivering an item of infrastructure costing £7.5m or more
- where aggregate contributions towards bus services exceeds £1m (including anticipated indexation).

A bond will also be required where a developer is direct delivering an item of infrastructure.

The County Infrastructure Funding Team can provide the full policy and advice, on request.

Application no: P24/S1336/FUL
Location: Land north-west of Nuneham Courteney situated to the west of the A4074 north of Upper Farm and south of Lower Farm.

Transport Schedule

Recommendation:

Objection. However, subject to addressing the comments below, the Highway Authority will reconsider its position.

Key issues:

As detailed comments.

Legal agreement required to secure:

None

Conditions:

1. Prior to the commencement of any works within the site, the existing means of access that will serve the development shall be upgraded and improved in accordance with drawing No. 04531-RES-ACC-DR-PE-001 Rev 1 and the local highway authority's specifications. Visibility splays from the access shall be provided at 4.5m x 215m in both directions along the adjacent highway. Within the visibility envelope, there shall be no obstructions whatsoever, including vegetation above 0.9 metres above the adjacent carriageway channel edge. **Reason:** In the interest of highway safety and in accordance with Policy TRANS5 of the South Oxfordshire Local Plan 2035.

2 Prior to the commencement of any works, a Construction Traffic Management Plan (CTMP) identifying appropriate traffic management measures to be employed shall be submitted to and approved in writing by the Local Planning Authority. The approved CTMP shall be implemented prior to any works being carried out on site and shall be maintained throughout the course of all works associated with the development. The CTMP shall also state that no deliveries of plant or materials will take place between the hours of 0730 – 0900 and 1630 – 1800. **Reason:** In the interests of highway safety and to mitigate the impact of construction vehicles on the surrounding highway network, road infrastructure and local residents, particularly at morning and afternoon peak traffic times and in accordance with Policy TRANS5 of the South Oxfordshire Local Plan 2035

Informatives:

1. Where works are required to be carried out within the public highway, the applicant is advised not to commence such work before formal approval has been granted by Oxfordshire County Council by way of either:

    i. A Section 184 Notice under the Highways Act 1980, or

    ii. A legal agreement between the applicant and Oxfordshire County Council.

2. No vehicles associated with the construction or operation of the development shall be parked on the public highway, so as to cause an obstruction. Any such obstruction is an offence under S137 of the Highways Act 1980.

3. Public Rights of Way.

    - All Public Rights of Way across the site that pass through/adjacent to solar fields need to be provided as landscaped 'greenway' public rights of way – with a minimum 15m overall 'corridor' width (additional width to be dedicated), access for small Public Right of Way maintenance vehicles, planted with an appropriate non-injurious/thorny hedge, shrub & tree planting palette.

- All fenced-in Public Rights of Way need to be stone surfaced to 2-3m width with 2m plus clear grass verges each side of this and then the graded landscaped edges between the path and the fencing. The full width of the Public Right of Way needs to be dedicated as Public Right of Way to ensure permanent protection.

- Public Rights of Way crossed by underground HV and other cables, ditches and ducts etc need to be disturbed as little as possible, if at all. Pipes and cables should be horizontally dug/bored so that the Public Right of Way isn't disturbed. Where this isn't possible, disturbance needs to be kept to a minimum and safety of users maximised. A way to achieve this could be by excavating each side of the Public Right of Way and only excavating just prior to duct work or the cable being laid. The ditch must not be left open/exposed and should be filled in, compacted/consolidated and path made good immediately after cables laid, in order to reduce disturbance to path and user.

- Phased and planned temporary closures/diversions of Public Rights of Way only when necessary i.e. if works cannot be undertaken with the Public Right of Way open, access must made safe by using banksman/fencing etc. Closures should be for a minimal duration to cover the essential works and in all cases an alternative route should be agreed by OCC Countryside Access and provided in advance and maintained for the duration of the temporary closure.

- No use of Public Rights of Way other than if essential as a crossing point between fields. All vehicle crossing points to be monitored when active. Crossing point along Public Rights of Way to be protected from HGV by weight spreading mats, appropriate stone reinforcement and making good within 24 hours.

Detailed comments:

Summary

The development is for the construction and operation of a solar farm on agricultural land to the west of the A4074, northwest of Nuneham Courtenay. Access to the site will be provided via an existing field access from the A4074, which will be upgraded.

The applicant has submitted a Construction Traffic Management Plan (CTMP) and associated plans in support of the proposals. The CTMP includes a review of the development in terms of traffic generation, the means of access and traffic management measures to be employed during the construction process.

The following comments are provided in relation to the details submitted.

Assessment

An assessment of the likely traffic generation associated with the construction phase of the development has been undertaken within the CTMP. This identifies a peak of up to 140 two-way trips per day (100 construction/delivery trips and 40 staff trips) within the first 3 months of construction during enabling works. While these trips do not include those in relation to earthworks, it is considered that the associated impact would not be significant in terms of the operation of the adjacent highway network. Furthermore, it is noted that when operational, the sola farm would generate minimal trips by small maintenance vehicles, typically one per month.

The route for construction traffic to/from the site is proposed along the A4142/A423 Oxford Eastern Bypass (which connects to the A34 and A40) and onto the A4074, turning right in and left out of the site. Based on the nature of the highway along the delivery route and noting that it will not pass through the village of Nuneham Courtenay, this is considered acceptable.

The CTMP has undertaken a review of road traffic accidents along the highway immediately adjacent to the site, based on information obtained from the Crashmap website for a 5-year period, between 2017 and 2021. However, data obtained from the Crashmap website is not accepted as this is not considered accurate or up to date. Nevertheless, from reviewing the most up to date data held by the Council, it is agreed that there are no established collision patterns along the highway adjacent to the site.

Access

The existing access to the site will be widened to 8.0m for the first 25m from the adjacent highway, which will allow a single large articulated vehicle to wait off the carriageway when entering the site. However, due to the nature of the highway, the access is required to be widened for a distance of 35m, to allow 2 No. vehicles to wait.

The CTMP informs that the access track within the site will be provided at a width of 4.0m. However, where the track travels into the site from the access, this is required to be provided at a width of 5.5m to enable large delivery vehicles to pass side by side.

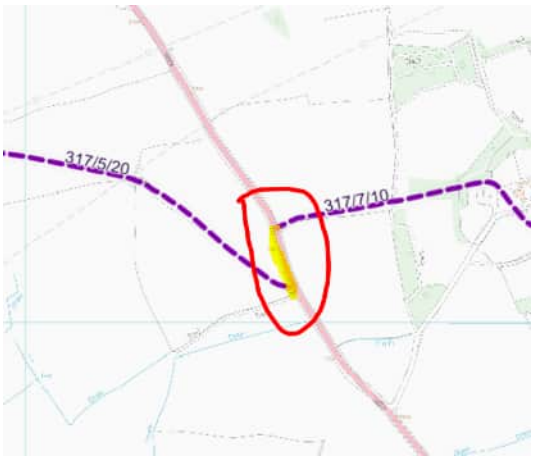
Visibility splays from the access are shown on associated plans at 4.5m x 215m in both directions along the adjacent carriageway, which is in accordance with associated standards and is therefore accepted. However, in order that a formal review can be undertaken, the means of access and the proposed visibility splays are required to be provided on a topographical base plan and not an aerial photograph. In addition, the plans are required to show the full extent of the highway boundary.

Swept paths of a 16.5m articulated vehicle entering/exiting the site have been provided within the CTMP. However, as above, these are also required to be provided on a topographical survey base plan.

Mitigation

The CTMP identifies a number of "typical" measures to mitigate the impact of construction traffic along the adjacent highway and informs that these are to be agreed at a later date. These include (but not limited to) the provision of appropriate signing along the highway, wheel washing facilities, scheduling of deliveries and issuing of route plans for delivery vehicles etc. While these measures are considered appropriate, the details are required to be confirmed and agreed within a CTMP, to be secured by way of a planning condition.

The Councils rights of way officer has recommended that a link is provided within the site to connect the existing Public Rights of Way either side of the A4074, as shown below. This could be provided as a mown path with signposts.



Officer's Name: Paul Harrison
Officer's Title: Development Control Consultant (Transport)
Date: 21/06/2024

Application no: P24/S1336/FUL
Location: Land north-west of Nuneham Courteney situated to the west of the A4074 north of Upper Farm and south of Lower Farm.

Lead Local Flood Authority

Recommendation:

Holding objection

Key issues:

- Incorrect Cvs have been used

Detailed comments:

The applicant has taken notice of the pre-application advice given and has not got any of their development in Flood Zones 2 or 3, which is excellent.

There is, however, an issue with the Cvs which are the software default and must be corrected in line with the Oxfordshire Flood Toolkit, Local Standards and Guidance for Surface Water Drainage on Major Development in Oxfordshire, Appendix D, Page 35. This may lead to higher storage volumes.

Officer's Name: Diane Rotherham
Officer's Title: Flood Risk Engineer
Date: 20/06/2024

Application no: P24/S1336/FUL
Location: Land north-west of Nuneham Courteney situated to the west of the A4074 north of Upper Farm and south of Lower Farm.

Archaeology

Recommendation:

Objection for the following reason/s:

Key issues:

The applicant has submitted the results of an archaeological desk-based assessment and field evaluation (SUMO Survey 2023, Cotswold Archaeology 2024 and Pegasus Group 2024), these considered further within the Archaeology and Cultural Heritage chapter of the submitted Environmental Statement (ES) (Pegasus Group 2024).

As recognised in the Environmental Statement, the application site in part contains and lies immediately adjacent to a Scheduled Ancient Monument, this comprising a Romano-British pottery site, prehistoric ring-ditches and enclosures including medieval ridge and furrow, Lower Farm, Nuneham Courtenay (NHL 1471867). The national importance of the monument as so described is recognised through its good state of survival and preservation of below ground archaeological remains and the large-scale nature of the Romano-British pottery site that are rare nationally.

Proposed development is identified to directly impact upon the designated Scheduled Monument, as identified for the Grid Connection, and accordingly consideration of this impact will be required in line with the provisions of paragraphs 205 and 206 of the NPPF and in consultation with Historic England. We would however note that the submitted ES concludes that any such impacts as identified arising would result in less than substantial harm and not be considered significant in EIA terms. We would however question how these judgements have been reached in the Archaeology and Cultural Heritage chapter of the ES where no previous evaluation to fully clarify the underlying archaeological resource present has been undertaken to inform this conclusion and the acceptability of any proposed mitigation by record. As development proposed will affect the Scheduled Monument the LPA should consult Historic England with regards to this application.

The submitted Heritage Baseline (ES Appendix 8.1) recognises from the results of evaluation conducted that the northern extent of the application site contributes to the significance of the adjacent Scheduled Monument, this noted as understood only through the documentary and archaeological record. Such a direct contribution can be seen through the results of initial geophysical survey conducted across the application site (ES Appendix 8.2) wherein significant evidence for the southerly extension of the Scheduled pottery production site and associated activity was recognised and following which

adjustment to the previously proposed northern boundary of the application site was made accordingly to avoid the densest concentration of such, further associated enclosure and trackway anomalies remaining within and across its adjusted northern limits. Trenched evaluation (ES Appendix 8.3) across the application site and these further anomalies subsequently confirmed the presence of significant archaeological remains dated to the Romano-British period across the northern extents of the application site.

The results of the trenched evaluation, coupled with the results of previous geophysical survey, have therefore confirmed the extension southwards of occupation and associated activity relating to the Scheduled Roman pottery production site within the application site (ES Appendix 8.3 - comprising as illustrated Area 1, the northern extents of Area 2 (Trenches 81-83, 26 and 28) and the likely northern extent of Area 3 at Trench 45), this recognised by the Archaeology and Cultural Heritage chapter of the ES.

The recent evaluation work undertaken to inform this application to the south of the currently Scheduled area of the Roman pottery production site has now clearly demonstrated that this recognised nationally important monument is substantially more extensive than has been previously recorded or subject to designation, its results significantly contributing to, and building upon, previous surveys for informing as to its scale and extent.

Whilst recognising that archaeological remains recorded across the northern extents of the application site contribute to the designated Scheduled Monument, there is little clarity provided within either the submitted Heritage Baseline (ES Appendix 8.1) or corresponding Archaeology and Cultural Heritage chapter of the ES, to qualify the extent of this contribution to the monuments significance beyond a discussion of previous scheduling decisions reached by Historic England resulting from past surveys that do not consider the results of the recent evaluation evidence. Whilst a purely agrarian nature to the archaeology recorded within the northern limits of the application site is assumed, this is by no means certain or proven and indeed the presence of kiln wasters and density of pottery recorded within enclosures at the northwestern and northern extents of the application site could indeed infer closer and more direct activity associated with pottery production.

The significance of the archaeological remains recorded within the northern limits of the application site therefore needs to be considered in the context of their evidential value and potential (this including range of features/functions) that they will hold in contributing to our understanding of the Scheduled pottery production site. Accordingly, it can be recognised that the archaeological remains recorded across the northern extents of the application site will hold significant evidential value contributing to an understanding and interpretation of the evolution and function of the Scheduled pottery production site for which they can be seen to relate, and we would therefore consider that in this context these remains should be regarded as therefore being of an equivalent national significance.

In this regard and given the moderate to high level of harm identified as arising from construction to the archaeological remains recorded on the application site, we would therefore further consider that development as proposed will result in a significant environmental effect on known recorded archaeological heritage assets.

The Archaeology and Cultural Heritage chapter of the ES identifies the proposed development as having embedded mitigation that is to include '*the use of an area of 'no-dig' foundations in an area within the northern portion of the Site with a dense concentration of archaeology'*. The location and extent of any such embedded mitigation and the recorded archaeological remains upon which this would be focused however remains undefined. The adoption of any such design mitigation approach would serve to secure the preservation in situ of recorded below ground archaeological remains on the application site should development be consented. Overall, we would therefore be supportive of such a mitigation approach where this would remove any resultant moderate to high level of harm of proposed development on the known archaeological resource.

We would consider that as such a 'no-dig' design approach can be adopted by proposed development, as set out in the submitted ES, the extent of such an approach should be clearly defined in the ES and we would advise that this should extend to encompass the area of significant archaeological remains recorded by evaluation across the proposed developments northern extent. We would therefore not accord with the proposed mitigation by record approach for identified archaeological remains in this area as set out in the Archaeology and Cultural Heritage chapter of the ES where preservation in situ of recorded archaeological remains can be achieved as directed by paragraph 211 of the NPPF that states '….*the ability to record evidence of our past should not be a factor in deciding whether such loss should be permitted*.'

Officer's Name: County Archaeological Services
Officer's Title: Archaeologist
Date: 25/06/2024

Application no: P24/S1336/FUL
Location: Land north-west of Nuneham Courteney situated to the west of the A4074 north of Upper Farm and south of Lower Farm.

Landscape / Green Infrastructure

Comments

The District Council Landscape Officer should be consulted on the application.

Officer's Name: Haidrun Breith
Officer's Title: Landscape Specialist
Date: 22/05/2024

South Oxfordshire and Vale of White Horse District Council Objection

Planning Application P24/S1336/FUL

William Piotrowski [redacted]

Wed 26/06/2024 14:06

To:Planning Registration <registration@southandvale.gov.uk>
Cc:Cathie Scotting [redacted]

Hi Cathie,

I currently have objections to this proposal.

Section 6.5 of the Flood Risk Assessment states that an easement of at least 3m from the top of banks of all watercourses has been left clear in development. This Is not in accordance with Policy ENV4 of South Oxfordshire Local Plan 2035 Which states:

Development should include a minimum 10m buffer zone along both sides of the watercourse to create a corridor favourable to the enhancement of biodiversity. Where a 10m wide buffer zone is not considered possible by the local planning authority, (for example in dense urban areas where existing development comes closer to the watercourse) a smaller buffer zone may be allowed, but should still be accompanied by detailed plans to show how the land will be used to promote biodiversity and how maintenance access to the watercourse will be created. Wherever possible within settlements a minimum 10m buffer should be maintained. Please amend and provide a plan clearly showing a 10m corridor either side of the ordinary watercourses.

The microdrainage calculations submitted alongside the application show half drain times in excess of 7 days. Whilst I appreciate infiltration testing has yet to be carried out on site, and the sizing of infiltration features is yet to be carried out, the applicant needs to provide information that the features will have sufficient storage to accommodate a follow on 1 in 10 year rainfall event. Infiltration testing should be carried out at the proposed depth and location of infiltration features.

Swales have been discussed within the text to drain access tracks, but no reference to these on the drainage strategy drawing is provided.

No proposed future management and maintenance schedules have been provided.

Thank you

Will

Email: [redacted]

Direct dial: [redacted]

Development and Corporate Landlord

South Oxfordshire and Vale of White Horse District Councils

Abbey House

Abbey Close

Abingdon

OX14 3JE

For further information, please see our website:
http://www.whitehorsedc.gov.uk or http://www.southoxon.gov.uk

To find out more about how the council holds, uses and stores your personal data, please click on the appropriate council's link

http://www.southoxon.gov.uk/about-us/contact-us/requesting-information/data-protection-0

http://www.whitehorsedc.gov.uk/about-us/contact-us/requesting-information/data-protection

Updated Surface Water Drainage Strategy Calculations – 0.95 Cv Values

Summary of Results for 10 year Return Period (+25%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.156	0.156	0.0	4.8	O K
30 min Summer	98.200	0.200	0.0	6.2	O K
60 min Summer	98.247	0.247	0.0	7.6	O K
120 min Summer	98.316	0.316	0.0	9.7	O K
180 min Summer	98.356	0.356	0.0	11.0	O K
240 min Summer	98.384	0.384	0.0	11.8	O K
360 min Summer	98.420	0.420	0.0	13.0	O K
480 min Summer	98.444	0.444	0.0	13.7	O K
600 min Summer	98.461	0.461	0.0	14.2	O K
720 min Summer	98.475	0.475	0.0	14.7	O K
960 min Summer	98.496	0.496	0.0	15.3	O K
1440 min Summer	98.526	0.526	0.0	16.2	O K
2160 min Summer	98.559	0.559	0.0	17.3	O K
2880 min Summer	98.587	0.587	0.0	18.1	O K
4320 min Summer	98.638	0.638	0.0	19.7	O K
5760 min Summer	98.683	0.683	0.0	21.1	O K
7200 min Summer	98.728	0.728	0.0	22.5	O K
8640 min Summer	98.771	0.771	0.0	23.8	O K
10080 min Summer	98.814	0.814	0.0	25.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	81.061	0.0	19
30 min Summer	52.114	0.0	34
60 min Summer	32.072	0.0	64
120 min Summer	20.518	0.0	124
180 min Summer	15.431	0.0	184
240 min Summer	12.478	0.0	244
360 min Summer	9.114	0.0	364
480 min Summer	7.223	0.0	484
600 min Summer	6.007	0.0	604
720 min Summer	5.157	0.0	724
960 min Summer	4.040	0.0	964
1440 min Summer	2.857	0.0	1444
2160 min Summer	2.029	0.0	2164
2880 min Summer	1.601	0.0	2884
4320 min Summer	1.162	0.0	4324
5760 min Summer	0.936	0.0	5768
7200 min Summer	0.799	0.0	7208
8640 min Summer	0.707	0.0	8648
10080 min Summer	0.641	0.0	10088

Summary of Results for 10 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	98.156	0.156	0.0	4.8	O K
30 min Winter	98.200	0.200	0.0	6.2	O K
60 min Winter	98.247	0.247	0.0	7.6	O K
120 min Winter	98.316	0.316	0.0	9.7	O K
180 min Winter	98.356	0.356	0.0	11.0	O K
240 min Winter	98.384	0.384	0.0	11.8	O K
360 min Winter	98.420	0.420	0.0	13.0	O K
480 min Winter	98.444	0.444	0.0	13.7	O K
600 min Winter	98.461	0.461	0.0	14.2	O K
720 min Winter	98.475	0.475	0.0	14.7	O K
960 min Winter	98.496	0.496	0.0	15.3	O K
1440 min Winter	98.526	0.526	0.0	16.2	O K
2160 min Winter	98.559	0.559	0.0	17.3	O K
2880 min Winter	98.587	0.587	0.0	18.1	O K
4320 min Winter	98.638	0.638	0.0	19.7	O K
5760 min Winter	98.683	0.683	0.0	21.1	O K
7200 min Winter	98.728	0.728	0.0	22.5	O K
8640 min Winter	98.771	0.771	0.0	23.8	O K
10080 min Winter	98.814	0.814	0.0	25.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	81.061	0.0	19
30 min Winter	52.114	0.0	34
60 min Winter	32.072	0.0	64
120 min Winter	20.518	0.0	124
180 min Winter	15.431	0.0	184
240 min Winter	12.478	0.0	244
360 min Winter	9.114	0.0	364
480 min Winter	7.223	0.0	484
600 min Winter	6.007	0.0	604
720 min Winter	5.157	0.0	724
960 min Winter	4.040	0.0	964
1440 min Winter	2.857	0.0	1444
2160 min Winter	2.029	0.0	2164
2880 min Winter	1.601	0.0	2884
4320 min Winter	1.162	0.0	4324
5760 min Winter	0.936	0.0	5768
7200 min Winter	0.799	0.0	7200
8640 min Winter	0.707	0.0	8640
10080 min Winter	0.641	0.0	10080

Rainfall Details

Rainfall Model	FEH
Return Period (years)	10
FEH Rainfall Version	2013
Site Location	GB 454180 200184 SP 54180 00184
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.025

Time (mins) From:	To:	Area (ha)
0	4	0.025

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.00004	Trench Width (m)	2.1
Infiltration Coefficient Side (m/hr)	0.00004	Trench Length (m)	49.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	2.000
Invert Level (m)	98.000	Cap Infiltration Depth (m)	2.000

Summary of Results for 100 year Return Period (+25%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.268	0.268	0.0	8.3	O K
30 min Summer	98.351	0.351	0.0	10.8	O K
60 min Summer	98.437	0.437	0.0	13.5	O K
120 min Summer	98.530	0.530	0.0	16.4	O K
180 min Summer	98.587	0.587	0.0	18.1	O K
240 min Summer	98.628	0.628	0.0	19.4	O K
360 min Summer	98.681	0.681	0.0	21.0	O K
480 min Summer	98.715	0.715	0.0	22.1	O K
600 min Summer	98.740	0.740	0.0	22.9	O K
720 min Summer	98.759	0.759	0.0	23.4	O K
960 min Summer	98.787	0.787	0.0	24.3	O K
1440 min Summer	98.822	0.822	0.0	25.4	O K
2160 min Summer	98.856	0.856	0.0	26.4	O K
2880 min Summer	98.883	0.883	0.0	27.3	O K
4320 min Summer	98.930	0.930	0.0	28.7	O K
5760 min Summer	98.973	0.973	0.0	30.0	O K
7200 min Summer	99.016	1.016	0.0	31.4	O K
8640 min Summer	99.059	1.059	0.0	32.7	O K
10080 min Summer	99.101	1.101	0.0	34.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.477	0.0	19
30 min Summer	91.239	0.0	34
60 min Summer	56.780	0.0	64
120 min Summer	34.456	0.0	124
180 min Summer	25.458	0.0	184
240 min Summer	20.402	0.0	244
360 min Summer	14.757	0.0	364
480 min Summer	11.634	0.0	484
600 min Summer	9.634	0.0	604
720 min Summer	8.237	0.0	724
960 min Summer	6.405	0.0	964
1440 min Summer	4.464	0.0	1444
2160 min Summer	3.103	0.0	2164
2880 min Summer	2.403	0.0	2884
4320 min Summer	1.692	0.0	4324
5760 min Summer	1.330	0.0	5768
7200 min Summer	1.113	0.0	7208
8640 min Summer	0.968	0.0	8648
10080 min Summer	0.865	0.0	10088

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	98.268	0.268	0.0	8.3	O K
30 min Winter	98.351	0.351	0.0	10.8	O K
60 min Winter	98.437	0.437	0.0	13.5	O K
120 min Winter	98.530	0.530	0.0	16.4	O K
180 min Winter	98.587	0.587	0.0	18.1	O K
240 min Winter	98.628	0.628	0.0	19.4	O K
360 min Winter	98.681	0.681	0.0	21.0	O K
480 min Winter	98.715	0.715	0.0	22.1	O K
600 min Winter	98.740	0.740	0.0	22.9	O K
720 min Winter	98.759	0.759	0.0	23.4	O K
960 min Winter	98.787	0.787	0.0	24.3	O K
1440 min Winter	98.822	0.822	0.0	25.4	O K
2160 min Winter	98.856	0.856	0.0	26.4	O K
2880 min Winter	98.883	0.883	0.0	27.3	O K
4320 min Winter	98.930	0.930	0.0	28.7	O K
5760 min Winter	98.973	0.973	0.0	30.0	O K
7200 min Winter	99.016	1.016	0.0	31.4	O K
8640 min Winter	99.059	1.059	0.0	32.7	O K
10080 min Winter	99.101	1.101	0.0	34.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	139.477	0.0	19
30 min Winter	91.239	0.0	34
60 min Winter	56.780	0.0	64
120 min Winter	34.456	0.0	124
180 min Winter	25.458	0.0	184
240 min Winter	20.402	0.0	244
360 min Winter	14.757	0.0	364
480 min Winter	11.634	0.0	484
600 min Winter	9.634	0.0	604
720 min Winter	8.237	0.0	724
960 min Winter	6.405	0.0	964
1440 min Winter	4.464	0.0	1444
2160 min Winter	3.103	0.0	2164
2880 min Winter	2.403	0.0	2884
4320 min Winter	1.692	0.0	4324
5760 min Winter	1.330	0.0	5768
7200 min Winter	1.113	0.0	7208
8640 min Winter	0.968	0.0	8640
10080 min Winter	0.865	0.0	10080

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 454180 200184 SP 54180 00184
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.025

Time (mins) From:	To:	Area (ha)
0	4	0.025

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.00004	Trench Width (m)	2.1
Infiltration Coefficient Side (m/hr)	0.00004	Trench Length (m)	49.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	2.000
Invert Level (m)	98.000	Cap Infiltration Depth (m)	2.000

Summary of Results for 100 year Return Period (+25%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.796	0.296	0.0	6.5	O K
30 min Summer	98.888	0.388	0.0	8.6	O K
60 min Summer	98.983	0.483	0.0	10.6	O K
120 min Summer	99.086	0.586	0.0	12.9	O K
180 min Summer	99.149	0.649	0.0	14.3	O K
240 min Summer	99.194	0.694	0.0	15.3	O K
360 min Summer	99.252	0.752	0.0	16.6	O K
480 min Summer	99.291	0.791	0.0	17.4	O K
600 min Summer	99.318	0.818	0.0	18.0	O K
720 min Summer	99.339	0.839	0.0	18.5	O K
960 min Summer	99.370	0.870	0.0	19.2	O K
1440 min Summer	99.408	0.908	0.0	20.0	O K
2160 min Summer	99.446	0.946	0.0	20.9	O K
2880 min Summer	99.476	0.976	0.0	21.5	O K
4320 min Summer	99.528	1.028	0.0	22.7	O K
5760 min Summer	99.575	1.075	0.0	23.7	O K
7200 min Summer	99.622	1.122	0.0	24.7	O K
8640 min Summer	99.669	1.169	0.0	25.8	O K
10080 min Summer	99.715	1.215	0.0	26.8	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.477	0.0	19
30 min Summer	91.239	0.0	34
60 min Summer	56.780	0.0	64
120 min Summer	34.456	0.0	124
180 min Summer	25.458	0.0	184
240 min Summer	20.402	0.0	244
360 min Summer	14.757	0.0	364
480 min Summer	11.634	0.0	484
600 min Summer	9.634	0.0	604
720 min Summer	8.237	0.0	724
960 min Summer	6.405	0.0	964
1440 min Summer	4.464	0.0	1444
2160 min Summer	3.103	0.0	2164
2880 min Summer	2.403	0.0	2884
4320 min Summer	1.692	0.0	4324
5760 min Summer	1.330	0.0	5768
7200 min Summer	1.113	0.0	7208
8640 min Summer	0.968	0.0	8648
10080 min Summer	0.865	0.0	10088

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	98.832	0.332	0.0	7.3	O K
30 min Winter	98.934	0.434	0.0	9.6	O K
60 min Winter	99.041	0.541	0.0	11.9	O K
120 min Winter	99.156	0.656	0.0	14.5	O K
180 min Winter	99.227	0.727	0.0	16.0	O K
240 min Winter	99.277	0.777	0.0	17.1	O K
360 min Winter	99.343	0.843	0.0	18.6	O K
480 min Winter	99.386	0.886	0.0	19.5	O K
600 min Winter	99.416	0.916	0.0	20.2	O K
720 min Winter	99.440	0.940	0.0	20.7	O K
960 min Winter	99.474	0.974	0.0	21.5	O K
1440 min Winter	99.518	1.018	0.0	22.4	O K
2160 min Winter	99.560	1.060	0.0	23.4	O K
2880 min Winter	99.593	1.093	0.0	24.1	O K
4320 min Winter	99.652	1.152	0.0	25.4	O K
5760 min Winter	99.704	1.204	0.0	26.6	Flood Risk
7200 min Winter	99.758	1.258	0.0	27.7	Flood Risk
8640 min Winter	99.810	1.310	0.0	28.9	Flood Risk
10080 min Winter	99.862	1.362	0.0	30.0	Flood Risk

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	139.477	0.0	19
30 min Winter	91.239	0.0	34
60 min Winter	56.780	0.0	64
120 min Winter	34.456	0.0	124
180 min Winter	25.458	0.0	184
240 min Winter	20.402	0.0	244
360 min Winter	14.757	0.0	364
480 min Winter	11.634	0.0	484
600 min Winter	9.634	0.0	604
720 min Winter	8.237	0.0	724
960 min Winter	6.405	0.0	964
1440 min Winter	4.464	0.0	1444
2160 min Winter	3.103	0.0	2164
2880 min Winter	2.403	0.0	2884
4320 min Winter	1.692	0.0	4324
5760 min Winter	1.330	0.0	5768
7200 min Winter	1.113	0.0	7200
8640 min Winter	0.968	0.0	8640
10080 min Winter	0.865	0.0	10080

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 454180 200184 SP 54180 00184
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.750
Cv (Winter)	0.840
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.025

Time (mins) From:	To:	Area (ha)
0	4	0.025

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.00004	Trench Width (m)	1.5
Infiltration Coefficient Side (m/hr)	0.00004	Trench Length (m)	49.0
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	1.500
Invert Level (m)	98.500	Cap Infiltration Depth (m)	1.500

Summary of Results for 10 year Return Period (+25%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.161	0.161	0.0	6.4	O K
30 min Summer	98.207	0.207	0.0	8.2	O K
60 min Summer	98.255	0.255	0.0	10.1	O K
120 min Summer	98.327	0.327	0.0	12.9	O K
180 min Summer	98.368	0.368	0.0	14.5	O K
240 min Summer	98.397	0.397	0.0	15.6	O K
360 min Summer	98.435	0.435	0.0	17.1	O K
480 min Summer	98.459	0.459	0.0	18.1	O K
600 min Summer	98.478	0.478	0.0	18.8	O K
720 min Summer	98.492	0.492	0.0	19.4	O K
960 min Summer	98.513	0.513	0.0	20.2	O K
1440 min Summer	98.544	0.544	0.0	21.4	O K
2160 min Summer	98.579	0.579	0.0	22.8	O K
2880 min Summer	98.608	0.608	0.0	23.9	O K
4320 min Summer	98.660	0.660	0.0	26.0	O K
5760 min Summer	98.707	0.707	0.0	27.9	O K
7200 min Summer	98.753	0.753	0.0	29.7	O K
8640 min Summer	98.798	0.798	0.0	31.4	O K
10080 min Summer	98.842	0.842	0.0	33.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	81.061	0.0	19
30 min Summer	52.114	0.0	34
60 min Summer	32.072	0.0	64
120 min Summer	20.518	0.0	124
180 min Summer	15.431	0.0	184
240 min Summer	12.478	0.0	244
360 min Summer	9.114	0.0	364
480 min Summer	7.223	0.0	484
600 min Summer	6.007	0.0	604
720 min Summer	5.157	0.0	724
960 min Summer	4.040	0.0	964
1440 min Summer	2.857	0.0	1444
2160 min Summer	2.029	0.0	2164
2880 min Summer	1.601	0.0	2884
4320 min Summer	1.162	0.0	4324
5760 min Summer	0.936	0.0	5768
7200 min Summer	0.799	0.0	7208
8640 min Summer	0.707	0.0	8648
10080 min Summer	0.641	0.0	10088

Summary of Results for 10 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	98.161	0.161	0.0	6.4	O K
30 min Winter	98.207	0.207	0.0	8.2	O K
60 min Winter	98.255	0.255	0.0	10.1	O K
120 min Winter	98.327	0.327	0.0	12.9	O K
180 min Winter	98.368	0.368	0.0	14.5	O K
240 min Winter	98.397	0.397	0.0	15.6	O K
360 min Winter	98.435	0.435	0.0	17.1	O K
480 min Winter	98.459	0.459	0.0	18.1	O K
600 min Winter	98.478	0.478	0.0	18.8	O K
720 min Winter	98.492	0.492	0.0	19.4	O K
960 min Winter	98.513	0.513	0.0	20.2	O K
1440 min Winter	98.544	0.544	0.0	21.4	O K
2160 min Winter	98.579	0.579	0.0	22.8	O K
2880 min Winter	98.608	0.608	0.0	23.9	O K
4320 min Winter	98.660	0.660	0.0	26.0	O K
5760 min Winter	98.707	0.707	0.0	27.9	O K
7200 min Winter	98.754	0.754	0.0	29.7	O K
8640 min Winter	98.798	0.798	0.0	31.4	O K
10080 min Winter	98.842	0.842	0.0	33.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	81.061	0.0	19
30 min Winter	52.114	0.0	34
60 min Winter	32.072	0.0	64
120 min Winter	20.518	0.0	124
180 min Winter	15.431	0.0	184
240 min Winter	12.478	0.0	244
360 min Winter	9.114	0.0	364
480 min Winter	7.223	0.0	484
600 min Winter	6.007	0.0	604
720 min Winter	5.157	0.0	724
960 min Winter	4.040	0.0	964
1440 min Winter	2.857	0.0	1444
2160 min Winter	2.029	0.0	2164
2880 min Winter	1.601	0.0	2884
4320 min Winter	1.162	0.0	4324
5760 min Winter	0.936	0.0	5768
7200 min Winter	0.799	0.0	7200
8640 min Winter	0.707	0.0	8640
10080 min Winter	0.641	0.0	10080

Rainfall Details

Rainfall Model	FEH
Return Period (years)	10
FEH Rainfall Version	2013
Site Location	GB 454180 200184 SP 54180 00184
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.033

Time (mins) From:	To:	Area (ha)
0	4	0.033

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.00004	Trench Width (m)	2.1
Infiltration Coefficient Side (m/hr)	0.00004	Trench Length (m)	62.5
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	2.000
Invert Level (m)	98.000	Cap Infiltration Depth (m)	2.000

Summary of Results for 100 year Return Period (+25%)

Half Drain Time exceeds 7 days.

Outflow is too low. Design is unsatisfactory.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	98.278	0.278	0.0	10.9	O K
30 min Summer	98.363	0.363	0.0	14.3	O K
60 min Summer	98.452	0.452	0.0	17.8	O K
120 min Summer	98.549	0.549	0.0	21.6	O K
180 min Summer	98.608	0.608	0.0	23.9	O K
240 min Summer	98.649	0.649	0.0	25.6	O K
360 min Summer	98.704	0.704	0.0	27.7	O K
480 min Summer	98.740	0.740	0.0	29.2	O K
600 min Summer	98.766	0.766	0.0	30.2	O K
720 min Summer	98.786	0.786	0.0	30.9	O K
960 min Summer	98.815	0.815	0.0	32.1	O K
1440 min Summer	98.851	0.851	0.0	33.5	O K
2160 min Summer	98.886	0.886	0.0	34.9	O K
2880 min Summer	98.914	0.914	0.0	36.0	O K
4320 min Summer	98.963	0.963	0.0	37.9	O K
5760 min Summer	99.007	1.007	0.0	39.7	O K
7200 min Summer	99.052	1.052	0.0	41.4	O K
8640 min Summer	99.096	1.096	0.0	43.1	O K
10080 min Summer	99.140	1.140	0.0	44.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	139.477	0.0	19
30 min Summer	91.239	0.0	34
60 min Summer	56.780	0.0	64
120 min Summer	34.456	0.0	124
180 min Summer	25.458	0.0	184
240 min Summer	20.402	0.0	244
360 min Summer	14.757	0.0	364
480 min Summer	11.634	0.0	484
600 min Summer	9.634	0.0	604
720 min Summer	8.237	0.0	724
960 min Summer	6.405	0.0	964
1440 min Summer	4.464	0.0	1444
2160 min Summer	3.103	0.0	2164
2880 min Summer	2.403	0.0	2884
4320 min Summer	1.692	0.0	4324
5760 min Summer	1.330	0.0	5768
7200 min Summer	1.113	0.0	7208
8640 min Summer	0.968	0.0	8648
10080 min Summer	0.865	0.0	10088

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Winter	98.278	0.278	0.0	10.9	O K
30 min Winter	98.363	0.363	0.0	14.3	O K
60 min Winter	98.452	0.452	0.0	17.8	O K
120 min Winter	98.549	0.549	0.0	21.6	O K
180 min Winter	98.608	0.608	0.0	23.9	O K
240 min Winter	98.649	0.649	0.0	25.6	O K
360 min Winter	98.704	0.704	0.0	27.7	O K
480 min Winter	98.740	0.740	0.0	29.2	O K
600 min Winter	98.766	0.766	0.0	30.2	O K
720 min Winter	98.786	0.786	0.0	30.9	O K
960 min Winter	98.815	0.815	0.0	32.1	O K
1440 min Winter	98.851	0.851	0.0	33.5	O K
2160 min Winter	98.886	0.886	0.0	34.9	O K
2880 min Winter	98.914	0.914	0.0	36.0	O K
4320 min Winter	98.963	0.963	0.0	37.9	O K
5760 min Winter	99.007	1.007	0.0	39.7	O K
7200 min Winter	99.052	1.052	0.0	41.4	O K
8640 min Winter	99.096	1.096	0.0	43.2	O K
10080 min Winter	99.140	1.140	0.0	44.9	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Winter	139.477	0.0	19
30 min Winter	91.239	0.0	34
60 min Winter	56.780	0.0	64
120 min Winter	34.456	0.0	124
180 min Winter	25.458	0.0	184
240 min Winter	20.402	0.0	244
360 min Winter	14.757	0.0	364
480 min Winter	11.634	0.0	484
600 min Winter	9.634	0.0	604
720 min Winter	8.237	0.0	724
960 min Winter	6.405	0.0	964
1440 min Winter	4.464	0.0	1444
2160 min Winter	3.103	0.0	2164
2880 min Winter	2.403	0.0	2884
4320 min Winter	1.692	0.0	4324
5760 min Winter	1.330	0.0	5768
7200 min Winter	1.113	0.0	7208
8640 min Winter	0.968	0.0	8640
10080 min Winter	0.865	0.0	10080

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 454180 200184 SP 54180 00184
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.033

Time (mins) From:	To:	Area (ha)
0	4	0.033

Model Details

Storage is Online Cover Level (m) 100.000

Trench Soakaway Structure

Infiltration Coefficient Base (m/hr)	0.00004	Trench Width (m)	2.1
Infiltration Coefficient Side (m/hr)	0.00004	Trench Length (m)	62.5
Safety Factor	2.0	Slope (1:X)	0.0
Porosity	0.30	Cap Volume Depth (m)	2.000
Invert Level (m)	98.000	Cap Infiltration Depth (m)	2.000

Summary of Results for 10 year Return Period (+25%)

Half Drain Time : 2030 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	97.769	0.269	0.0	1.2	1.2	102.2	O K
30 min Summer	97.844	0.344	0.0	1.2	1.2	130.9	O K
60 min Summer	97.921	0.421	0.0	1.2	1.2	159.8	O K
120 min Summer	98.031	0.531	0.0	1.2	1.2	202.0	O K
180 min Summer	98.092	0.592	0.0	1.2	1.2	225.0	O K
240 min Summer	98.131	0.631	0.0	1.2	1.2	239.6	O K
360 min Summer	98.174	0.674	0.0	1.2	1.2	256.2	O K
480 min Summer	98.196	0.696	0.0	1.2	1.2	264.4	O K
600 min Summer	98.206	0.706	0.0	1.2	1.2	268.4	O K
720 min Summer	98.210	0.710	0.0	1.2	1.2	270.0	O K
960 min Summer	98.208	0.708	0.0	1.2	1.2	269.0	O K
1440 min Summer	98.184	0.684	0.0	1.2	1.2	260.0	O K
2160 min Summer	98.140	0.640	0.0	1.2	1.2	243.2	O K
2880 min Summer	98.107	0.607	0.0	1.2	1.2	230.7	O K
4320 min Summer	98.064	0.564	0.0	1.2	1.2	214.3	O K
5760 min Summer	98.035	0.535	0.0	1.2	1.2	203.3	O K
7200 min Summer	98.014	0.514	0.0	1.2	1.2	195.3	O K
8640 min Summer	97.997	0.497	0.0	1.2	1.2	188.7	O K
10080 min Summer	97.982	0.482	0.0	1.2	1.2	183.0	O K
15 min Winter	97.769	0.269	0.0	1.2	1.2	102.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	81.061	0.0	96.0	19
30 min Summer	52.114	0.0	98.3	34
60 min Summer	32.072	0.0	163.4	64
120 min Summer	20.518	0.0	186.0	124
180 min Summer	15.431	0.0	184.3	184
240 min Summer	12.478	0.0	183.0	244
360 min Summer	9.114	0.0	181.8	362
480 min Summer	7.223	0.0	181.3	482
600 min Summer	6.007	0.0	181.0	602
720 min Summer	5.157	0.0	180.8	722
960 min Summer	4.040	0.0	180.6	962
1440 min Summer	2.857	0.0	180.2	1440
2160 min Summer	2.029	0.0	362.7	1880
2880 min Summer	1.601	0.0	354.7	2276
4320 min Summer	1.162	0.0	327.5	3064
5760 min Summer	0.936	0.0	458.0	3912
7200 min Summer	0.799	0.0	489.0	4752
8640 min Summer	0.707	0.0	519.2	5544
10080 min Summer	0.641	0.0	549.0	6448
15 min Winter	81.061	0.0	96.0	19

Summary of Results for 10 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	97.844	0.344	0.0	1.2	130.9	O K
60 min Winter	97.921	0.421	0.0	1.2	159.8	O K
120 min Winter	98.032	0.532	0.0	1.2	202.0	O K
180 min Winter	98.092	0.592	0.0	1.2	225.1	O K
240 min Winter	98.131	0.631	0.0	1.2	239.8	O K
360 min Winter	98.175	0.675	0.0	1.2	256.6	O K
480 min Winter	98.197	0.697	0.0	1.2	264.9	O K
600 min Winter	98.208	0.708	0.0	1.2	269.2	O K
720 min Winter	98.213	0.713	0.0	1.2	271.0	O K
960 min Winter	98.212	0.712	0.0	1.2	270.5	O K
1440 min Winter	98.191	0.691	0.0	1.2	262.4	O K
2160 min Winter	98.147	0.647	0.0	1.2	245.9	O K
2880 min Winter	98.107	0.607	0.0	1.2	230.6	O K
4320 min Winter	98.051	0.551	0.0	1.2	209.2	O K
5760 min Winter	98.004	0.504	0.0	1.2	191.5	O K
7200 min Winter	97.964	0.464	0.0	1.2	176.3	O K
8640 min Winter	97.921	0.421	0.0	1.2	160.1	O K
10080 min Winter	97.880	0.380	0.0	1.2	144.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	52.114	0.0	98.3	34
60 min Winter	32.072	0.0	163.4	64
120 min Winter	20.518	0.0	186.0	122
180 min Winter	15.431	0.0	184.2	182
240 min Winter	12.478	0.0	182.9	240
360 min Winter	9.114	0.0	181.6	358
480 min Winter	7.223	0.0	181.1	476
600 min Winter	6.007	0.0	180.7	592
720 min Winter	5.157	0.0	180.4	708
960 min Winter	4.040	0.0	180.0	940
1440 min Winter	2.857	0.0	179.5	1386
2160 min Winter	2.029	0.0	362.2	2032
2880 min Winter	1.601	0.0	354.9	2308
4320 min Winter	1.162	0.0	330.7	3240
5760 min Winter	0.936	0.0	458.3	4160
7200 min Winter	0.799	0.0	489.0	5112
8640 min Winter	0.707	0.0	519.5	5968
10080 min Winter	0.641	0.0	549.0	6760

Rainfall Details

Rainfall Model	FEH
Return Period (years)	10
FEH Rainfall Version	2013
Site Location	GB 454180 200184 SP 54180 00184
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.537

Time (mins) From:	To:	Area (ha)
0	4	0.537

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 97.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	400.0	400.0	2.010	0.0	1050.0
2.000	400.0	1050.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0054-2000-2550-2000
Design Head (m)	2.550
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	54
Invert Level (m)	97.450
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.550	2.0
Flush-Flo™	0.233	1.2
Kick-Flo®	0.482	0.9
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	1.4	3.000	2.2	7.000	3.2
0.200	1.2	1.400	1.5	3.500	2.3	7.500	3.3
0.300	1.1	1.600	1.6	4.000	2.5	8.000	3.4
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.5
0.500	1.0	2.000	1.8	5.000	2.7	9.000	3.6
0.600	1.0	2.200	1.9	5.500	2.8	9.500	3.7
0.800	1.2	2.400	1.9	6.000	3.0		
1.000	1.3	2.600	2.0	6.500	3.1		

Summary of Results for 100 year Return Period (+25%)

Half Drain Time : 3025 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	97.965	0.465	0.0	1.2	1.2	176.8	O K
30 min Summer	98.107	0.607	0.0	1.2	1.2	230.7	O K
60 min Summer	98.252	0.752	0.0	1.2	1.2	285.6	O K
120 min Summer	98.403	0.903	0.0	1.3	1.3	343.3	O K
180 min Summer	98.492	0.992	0.0	1.3	1.3	377.1	O K
240 min Summer	98.551	1.051	0.0	1.4	1.4	399.4	O K
360 min Summer	98.621	1.121	0.0	1.4	1.4	426.0	O K
480 min Summer	98.659	1.159	0.0	1.4	1.4	440.3	O K
600 min Summer	98.679	1.179	0.0	1.4	1.4	448.1	O K
720 min Summer	98.690	1.190	0.0	1.4	1.4	452.2	O K
960 min Summer	98.693	1.193	0.0	1.4	1.4	453.4	O K
1440 min Summer	98.666	1.166	0.0	1.4	1.4	443.0	O K
2160 min Summer	98.598	1.098	0.0	1.4	1.4	417.4	O K
2880 min Summer	98.534	1.034	0.0	1.4	1.4	392.8	O K
4320 min Summer	98.444	0.944	0.0	1.3	1.3	358.7	O K
5760 min Summer	98.384	0.884	0.0	1.3	1.3	335.9	O K
7200 min Summer	98.343	0.843	0.0	1.2	1.2	320.3	O K
8640 min Summer	98.311	0.811	0.0	1.2	1.2	308.3	O K
10080 min Summer	98.286	0.786	0.0	1.2	1.2	298.7	O K
15 min Winter	97.965	0.465	0.0	1.2	1.2	176.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	139.477	0.0	92.0	19
30 min Summer	91.239	0.0	87.3	34
60 min Summer	56.780	0.0	184.0	64
120 min Summer	34.456	0.0	191.6	124
180 min Summer	25.458	0.0	201.1	184
240 min Summer	20.402	0.0	207.2	244
360 min Summer	14.757	0.0	214.4	364
480 min Summer	11.634	0.0	218.2	482
600 min Summer	9.634	0.0	220.3	602
720 min Summer	8.237	0.0	221.5	722
960 min Summer	6.405	0.0	221.9	962
1440 min Summer	4.464	0.0	219.0	1442
2160 min Summer	3.103	0.0	405.2	2160
2880 min Summer	2.403	0.0	401.7	2476
4320 min Summer	1.692	0.0	386.1	3200
5760 min Summer	1.330	0.0	651.1	4032
7200 min Summer	1.113	0.0	681.2	4832
8640 min Summer	0.968	0.0	678.8	5704
10080 min Summer	0.865	0.0	644.1	6552
15 min Winter	139.477	0.0	92.0	19

Summary of Results for 100 year Return Period (+25%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	98.107	0.607	0.0	1.2	230.7	O K
60 min Winter	98.252	0.752	0.0	1.2	285.7	O K
120 min Winter	98.404	0.904	0.0	1.3	343.4	O K
180 min Winter	98.493	0.993	0.0	1.3	377.3	O K
240 min Winter	98.552	1.052	0.0	1.4	399.8	O K
360 min Winter	98.622	1.122	0.0	1.4	426.5	O K
480 min Winter	98.661	1.161	0.0	1.4	441.1	O K
600 min Winter	98.682	1.182	0.0	1.4	449.2	O K
720 min Winter	98.693	1.193	0.0	1.4	453.5	O K
960 min Winter	98.698	1.198	0.0	1.4	455.3	O K
1440 min Winter	98.675	1.175	0.0	1.4	446.3	O K
2160 min Winter	98.614	1.114	0.0	1.4	423.2	O K
2880 min Winter	98.548	1.048	0.0	1.4	398.2	O K
4320 min Winter	98.448	0.948	0.0	1.3	360.1	O K
5760 min Winter	98.374	0.874	0.0	1.3	332.2	O K
7200 min Winter	98.317	0.817	0.0	1.2	310.6	O K
8640 min Winter	98.270	0.770	0.0	1.2	292.5	O K
10080 min Winter	98.229	0.729	0.0	1.2	277.1	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	91.239	0.0	87.3	34
60 min Winter	56.780	0.0	184.0	64
120 min Winter	34.456	0.0	191.5	122
180 min Winter	25.458	0.0	201.0	182
240 min Winter	20.402	0.0	207.1	240
360 min Winter	14.757	0.0	214.1	358
480 min Winter	11.634	0.0	217.8	476
600 min Winter	9.634	0.0	219.8	594
720 min Winter	8.237	0.0	220.8	712
960 min Winter	6.405	0.0	221.0	944
1440 min Winter	4.464	0.0	217.6	1400
2160 min Winter	3.103	0.0	403.7	2072
2880 min Winter	2.403	0.0	399.9	2680
4320 min Winter	1.692	0.0	384.5	3332
5760 min Winter	1.330	0.0	651.1	4264
7200 min Winter	1.113	0.0	681.1	5192
8640 min Winter	0.968	0.0	682.4	6136
10080 min Winter	0.865	0.0	649.8	7056

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 454180 200184 SP 54180 00184
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	0.950
Cv (Winter)	0.950
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+25

Time Area Diagram

Total Area (ha) 0.537

Time (mins) From:	To:	Area (ha)
0	4	0.537

Model Details

Storage is Online Cover Level (m) 100.000

Cellular Storage Structure

Invert Level (m) 97.500 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	400.0	400.0	2.010	0.0	1050.0
2.000	400.0	1050.0			

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0054-2000-2550-2000
Design Head (m)	2.550
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	54
Invert Level (m)	97.450
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.550	2.0
Flush-Flo™	0.233	1.2
Kick-Flo®	0.482	0.9
Mean Flow over Head Range	-	1.4

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.0	1.200	1.4	3.000	2.2	7.000	3.2
0.200	1.2	1.400	1.5	3.500	2.3	7.500	3.3
0.300	1.1	1.600	1.6	4.000	2.5	8.000	3.4
0.400	1.1	1.800	1.7	4.500	2.6	8.500	3.5
0.500	1.0	2.000	1.8	5.000	2.7	9.000	3.6
0.600	1.0	2.200	1.9	5.500	2.8	9.500	3.7
0.800	1.2	2.400	1.9	6.000	3.0		
1.000	1.3	2.600	2.0	6.500	3.1		

Updated Surface Water Drainage Strategy Drawing

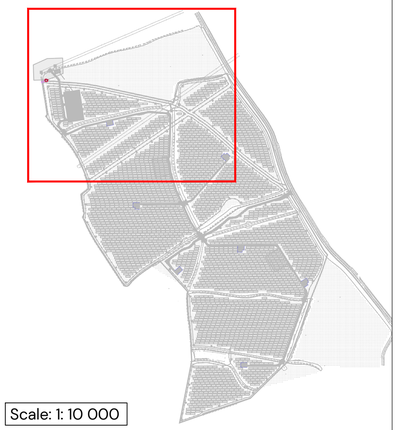
Scale: 1: 1000

N

Notes:

A Site specific Topographical Survey was undertaken by Landmark Surveys Wales (date: September 2022; drawing reference: 6387)

Site Layout was produced by RES (date: N/A; drawing reference: 04531-RES-LAY-DR-PT-004)



Scale: 1: 10 000

REV	DATE	DESCRIPTION	REVISED	CHECKED	APPROVED
P4	19/08/2024	Updated in accordance with LLFA comments	AJM	LG	LAJ
P3	21/03/2024	Updated Site Layout	LG	LAJ	LAJ
P2	12/02/2024	Updated Site Layout	LG	LAJ	LAJ
P1	21/12/2023	First Issue	MR	LG	LAJ

Drainage Strategy Drawing Sheet 1

Land West of A4074, South Oxfordshire

CLIENT:
RES Ltd

DATE: 21/12/23
SCALE: As Noted
DRAWN BY: MR
CHECKED BY: LG
APPROVED BY: LAJ

DRAWING NUMBER: P21-2947 - PEG - XX - XX - DR - C - 0100 - P4
PG OFFICE / TEAM: BRS/IN

PEGASUS REF No: P21-2947
DRAWING STATUS: S0

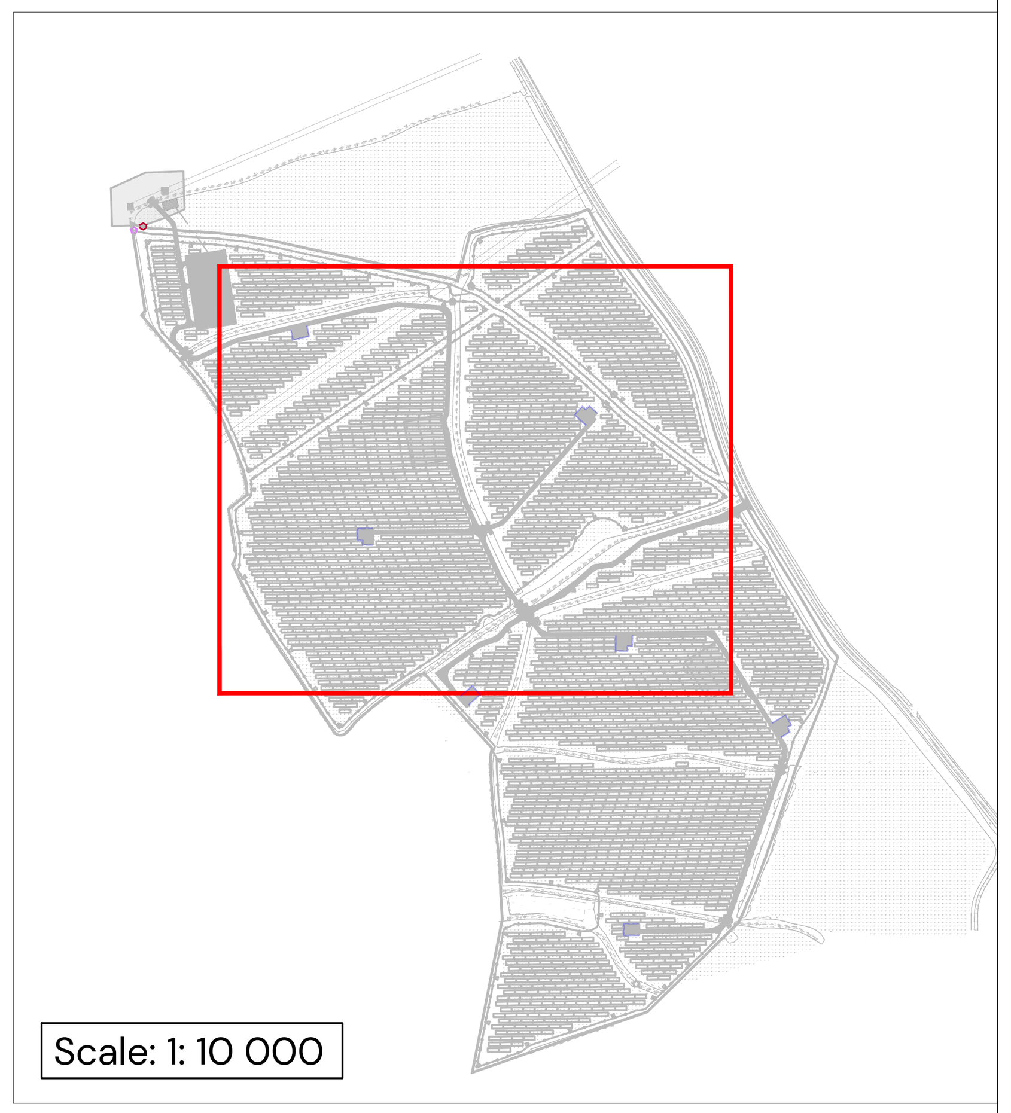
PEGASUS GROUP

N

Notes:

A Site specific Topographical Survey was undertaken by Landmark Surveys Wales (date: September 2022; drawing reference: 6387)

Site Layout was produced by RES (date: N/A; drawing reference: 04531-RES-LAY-DR-PT-004)



Scale: 1: 10 000

REV	DATE	DESCRIPTION	REVISED	CHECKED	APPROVED
P4	14/08/2024	Updated in accordance with LLFA comments	AJM	LG	LAJ
P3	21/03/2024	Updated Site Layout	LG	LAJ	LAJ
P2	12/02/2024	Updated Site Layout	LG	LAJ	LAJ
P1	21/12/2023	First Issue	MR	LG	LAJ

Drainage Strategy Drawing
Sheet 2

Land West of A4074,
South Oxfordshire

CLIENT:
RES Ltd

DATE:
21/12/2023

SCALE:
As Noted

DRAWN BY: MR
CHECKED BY: LG
APPROVED BY: LAJ

DRAWING NUMBER:
P21-2947 - PEG - XX - XX - DR - C - 0101 - P4

PG OFFICE / TEAM:
BRS/IN

PEGASUS REF No:
P21-2947

DRAWING STATUS
SO

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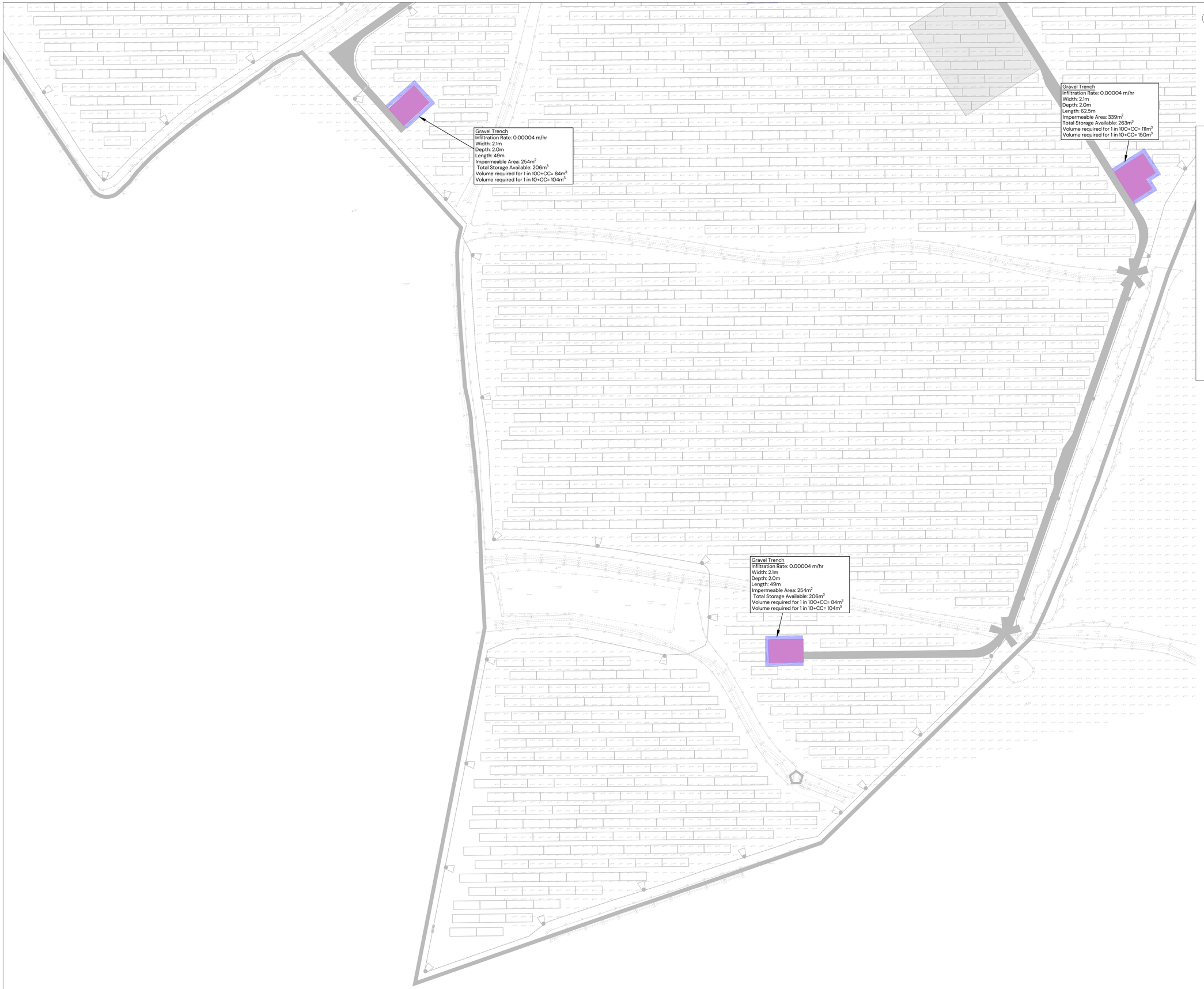

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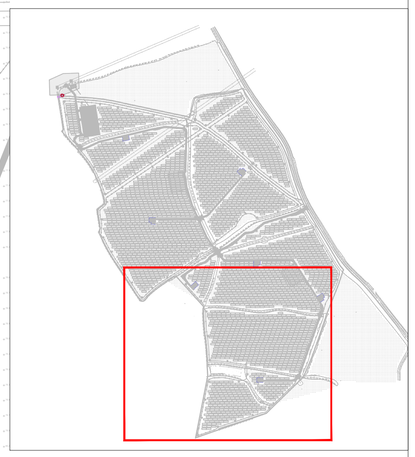
Notes:

A Site specific Topographical Survey was undertaken by Landmark Surveys Wales (date: September 2022; drawing reference: 6387)

Site Layout was produced by RES (date: N/A; drawing reference: 04531-RES-LAY-DR-PT-004)



REV	DATE	DESCRIPTION	REVISED	CHECKED	APPROVED
P4	14/08/2024	Updated in accordance with LLFA comments	AJM	LG	LAJ
P3	21/03/2024	Updated Site Layout	LG	LAJ	LAJ
P2	12/02/2024	Updated Site Layout	LG	LAJ	LAJ
P1	21/12/2023	First Issue	MR	LG	LAJ

Drainage Strategy Drawing Sheet 3

Land West of A4074, South Oxfordshire

CLIENT:
RES Ltd

DATE: 21/12/2023
SCALE: As Noted
DRAWN BY: MR
CHECKED BY: LG
APPROVED BY: LAJ

DRAWING NUMBER: P21-2947 - PEG - XX - XX - DR - C - 0102 - P4
PG OFFICE / TEAM: BRS/IN

PEGASUS REF No: P21-2947
DRAWING STATUS: SO

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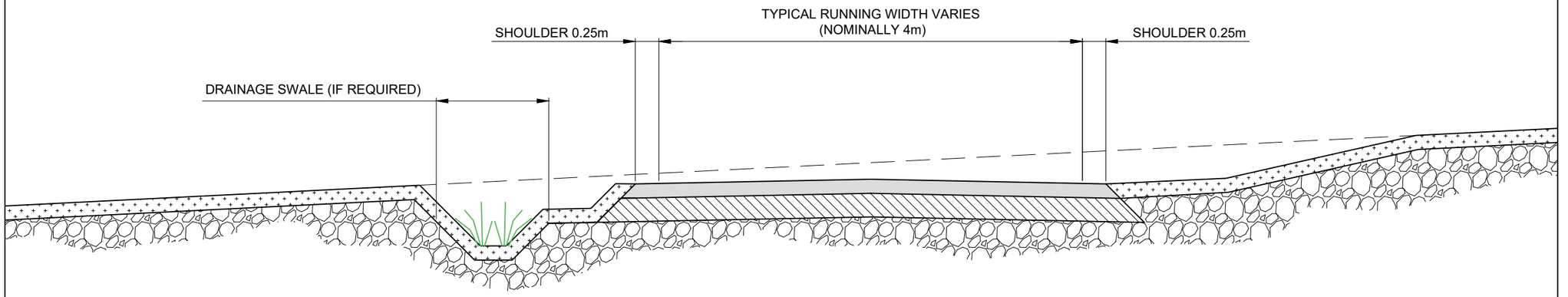
Typical Access Track Detail



TYPICAL TRACK SECTION

KEY

- RUNNING SURFACE
- BASE/CAPPING LAYER
- TOPSOIL
- SUBGRADE
- EXISTING GROUND LEVEL

NOTES

1. DO NOT SCALE FROM THIS DRAWING.
2. ALL EMBANKMENT SLOPES TO BE PROVIDED AT A STABLE ANGLE BASED ON THE PROPERTIES OF THE MATERIAL ENCOUNTERED ON SITE.
3. TRACK CONSTRUCTION TYPE TO BE DETERMINED DURING DETAILED DESIGN. LAYOUT OF DRAINAGE MAY VARY.
4. RUNNING SURFACE AND BASE/CAPPING LAYER TO BE FORMED FROM SUITABLE MATERIALS COMPACTED IN LAYERS.
5. GEOSYNTHETIC REINFORCEMENT OR SOIL STABILISATION MAY BE USED TO REDUCE THE DEPTH OF TRACK CONSTRUCTION. REQUIREMENT TO BE DETERMINED DURING DETAILED DESIGN.
6. OPTIONAL DRAINAGE SWALES SHOWN. ACTUAL REQUIREMENTS TO BE DETERMINED DURING DETAILED DESIGN.

ISSUE	DRAWN	CHKD	APPD	DATE	REVISION NOTES
1	FG	JM	BD	2024-01-10	First Issue

PURPOSE: PERMITTING	COORDINATES: N/A
SCALE: 1:50 @A3	DATUM: N/A
LAYOUT DRAWING: N/A	T-LAYOUT NO: N/A

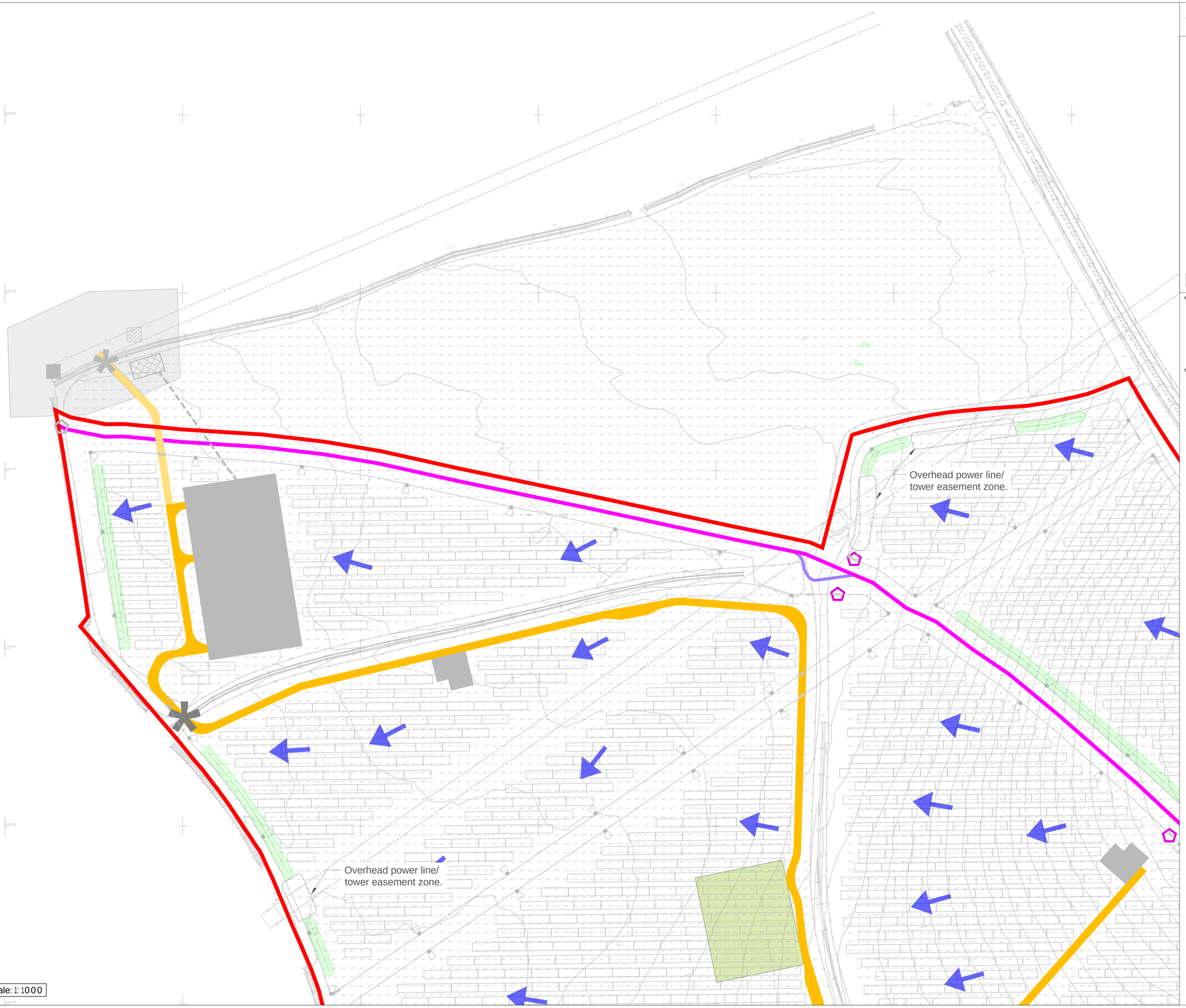
PROJECT TITLE
NUNEHAM
SOLAR FARM

DRAWING TITLE
FIGURE 6
TYPICAL ACCESS TRACK DETAIL

RES DRAWING NUMBER	REV
04531-RES-ERW-DR-PT-001	1

BEAUFORT COURT,
EGG FARM LANE,
KINGS LANGLEY,
HERTS WD4 8LR. UK
TEL +44 (0) 1923 299200
WWW.RES-GROUP.COM

Proposed Swales



Scale: 1: 1000

Scale: 1: 10 000

Key:

- Proposed Access Track
- Proposed Additional Swales
- Overland Flow Path

Notes:

1. This drawing has been provided for information purposes, not to be used for construction or costing.
2. Do not use this drawing to scale from.
3. Pegasus group take no responsibility for the misuse of this drawing.
4. Swales have been designed to be 0.5 wide x 0.5m deep with a 1:3 embankment plus an additional 1m provisional allowance for earthworks.
5. A site specific topographical survey was undertaken by Landmark Surveys Wales (Dated : September 2022; drawing reference :6387)
6. The site layout was produced by RES (Dated : N/A ; drawing reference 0453I:-RES-LAY-DR-PT-004)
7. Reference to be made to Figure 6 Typical Access Track Detail (Drawing No. 0453I:-RES-ERW-DR-PT-001) for access track/drainage swale interface.

REV	DATE	DESCRIPTION	REVISED	CHECKED	APPROVED
P1	2024.08.15	First Issue	EG	LG	ST

Proposed Swales
Sheet 1

Nuneham Solar Farm
Land West of A4074, South Oxfordshire

CLIENT:
RES Ltd

DATE:	SCALE:	DRAWN BY: / CHECKED BY: / APPROVED BY:
2024.08.15	As Noted	EG / LG / ST

DRAWING NUMBER: P21-2947 - PEG - XX - XX - DR - C - 0103 - P1

PG OFFICE / TEAM: BRS/IN

PEGASUS REF No: P21-2947

DRAWING STATUS: S0

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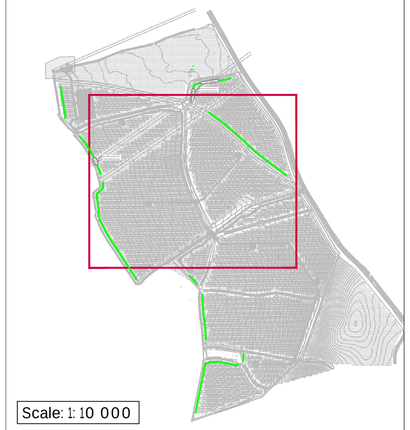
Overhead power line/
tower easement zone.

Scale: 1: 1000

N



Scale: 1: 10 000

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REV	DATE	DESCRIPTION	REVISED	CHECKED	APPROVED
P1	2024.08.15	First Issue	EG	LG	ST

Proposed Swales
Sheet 2

Nuneham Solar Farm
Land West of A4074, South Oxfordshire

CLIENT:
RES Ltd

DATE: 2024.08.15	SCALE: As Noted	DRAWN BY: EG CHECKED BY: LG APPROVED BY: ST

DRAWING NUMBER: P21-2947 - PEG - XX - XX - DR - C - 0104 - P1
PG OFFICE / TEAM: BRS/IN

PEGASUS REF No: P21-2947
DRAWING STATUS: S0

PEGASUS GROUP

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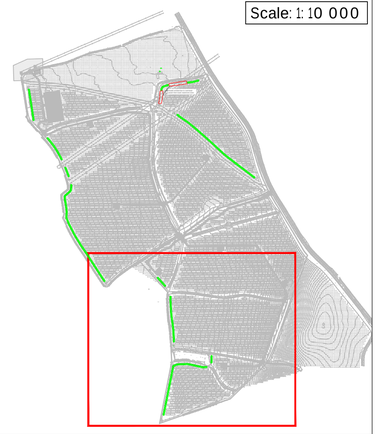
Scale: 1: 10 000



Key:

- Proposed Access Track
- Proposed Additional Swales
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Notes:

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Scale: 1: 1000

REV	DATE	DESCRIPTION	REVISED	CHECKED	APPROVED
P1	2024.08.15	First Issue	EG	LG	ST

Proposed Swales
Sheet 3

Nuneham Solar Farm
Land West of A4074, South Oxfordshire

CLIENT:
RES Ltd

DATE:	SCALE:	DRAWN BY: / CHECKED BY: / APPROVED BY:
2024.08.15	As Noted	EG / LG / ST

DRAWING NUMBER: P21-2947 - PEG - XX - XX - DR - C - 0105 - P1

PG OFFICE / TEAM: BRS/IN

PEGASUS REF No: P21-2947

DRAWING STATUS: S0

PEGASUS GROUP

Operation and Maintenance Manual

DRAINAGE OPERATION & MAINTENANCE MANUAL

Nuneham Solar Farm Oxford

On behalf of RES Ltd.

Date: 2024/08/15 | Pegasus Ref: P21-2947 – Author: Edwin Govender

Document Management

Version	Date	Author	Checked/ Approved by:	Reason for revision
V01	2024/08/15	Edwin Govender	Lucy Ginn	FIRST ISSUE

Contents

Figures & Tables

1. INTRODUCTION

Scope of the O&M Manual

1.1. This manual is intended to give an overview of the operation and maintenance for the range of SuDs features included with the drainage strategy and in relation to typical details only.

1.2. Where proprietary products are specified the manufacturer's instructions and recommendations should be followed in priority to this document unless specifically noted otherwise due to project constraints.

1.3. The recommended operations and frequencies are typical only and should be more frequent initially to ensure that there are no unforeseen issues with the operation and then adjusted to suit the site requirements.

1.4. This drainage operation and maintenance manual should be read in conjunction with the drainage strategy drawings (P21-2947-PEG-XX-XX-DR-C-0100 to 102 Sheet 1-3) and the proposed swales drawings (P21-2947-PEG-XX-XX-DR-C-0103 to 105, Sheets 1-3)

2. GEOCELLULAR/MODULAR SYSTEMS

2.1. Modular plastic geocellular systems with a high void ratio, that can be used to create a below ground storage structure.

2.2. The below ground crates are intended to be a surface water storage feature to attenuate the discharge from the substation up to and including the 1 in 100 year plus 25% climate change event.

2.3. Regular inspection and maintenance is required to ensure the effective long-term operation of below ground modular storage systems. Maintenance responsibility for systems should be placed with the sites management company.

2.4. Specific maintenance needs of the system should be monitored, and maintenance schedules adjusted to suit requirements.

2.5. Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, especially where run-off is taken from potentially contaminated areas such as car parks/service yards.

2.6. Maintenance requirements for modular systems are described in the table below.

Table 2.1 – Geocellular/Modular Systems Maintenance Requirements

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually, or as required
Remedial Actions	Repair/rehabilitation of inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually and after large storms

3. PIPEWORK & MANHOLES

3.1. Pipes are proprietary products, and the materials can vary across the site and as such where used the manufacture's recommendations should be followed. Regardless of the product used the pipes will be fully compliant with the drainage specification.

3.2. Pipes are intended to be dry except during rainfall events. These have been designed to be self-cleaning.

3.3. Access for maintenance is provided through access chambers, manholes, rodding plates and rodding eyes.

3.4. Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be draining correctly thus exposing the development to a greater level of flood risk. Maintenance responsibility for the pipes should be placed with the sites management company.

3.5. Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Table 3.1 – Pipework & Manholes Maintenance Requirements

Maintenance Schedule	Required Action	Typical Frequency
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required
	If continued poor performance jet and CCTV survey poorly performing runs.	As required
	Seek advice as to remediation techniques suitable for the type of performance issue and location.	As required if above does not improve performance
Monitoring	Initial inspection should be provided	Monthly for three months after installation

	as post construction CCTV survey.	
	Inspect for evidence of poor operation via water level in chambers and if required, take remedial action	Three monthly, 48 hours after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

4. FLOW CONTROL CHAMBER

4.1. Flow control chambers are proprietary products and as such where used the manufacturer's recommendations should be followed. Regardless of the flow control used it will be fully compliant with the drainage specification.

4.2. Flow control chambers are intended to restrict the surface water runoff discharge rate from the site to a designed rate utilising techniques such as an orifice plate, vortex separator or mechanical float control.

4.3. Regular inspection and maintenance is important to identify areas which may have been obstructed/clogged and may not be drainage correctly thus exposing the development to a greater level of flood risk. Maintenance responsibility for the flow control chamber should be placed with the sites management company.

4.4. Should sediment/material result in a blockage within the outfall of the flow control chamber, a high-level overflow outfall will prevent flooding occurring on site as a result of the blockage.

4.5. Once the storm event has passed it will be necessary to remove the sediment/material to allow the flow control to operate correctly. The bypass penstock valve will discharge blocked water within the chamber to allow for safe entry and maintenance of the flow control chamber.

4.6. Sediment\material removal should be undertaken in consultation with the environmental regulator to confirm appropriate protocols, as run-off is taken from potentially contaminated areas such as car parks/service yards.

Table 4.1 – Flow Control Chamber Maintenance Requirements

Maintenance Schedule	Required Action	Typical Frequency
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required
	If continued poor performance jet and CCTV survey poorly performing runs.	As required
	Seek advice as to remediation	As required if above does not improve performance

	techniques suitable for the type of performance issue and location.	
Monitoring	Initial inspection should be provided as post construction CCTV survey.	N/A
	Inspect for evidence of poor operation via water level in chambers and if required, take remedial action	Three monthly, 48 hours after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

5. SWALES

5.1. The swales will require regular maintenance to ensure continuing operation to design performance standards, and all designers should provide detailed specifications and frequencies for the required maintenance activities along with likely machinery requirements and typical annual costs – within the Maintenance Plan. The treatment performance of a swale is dependent on the maintenance, and robust management plans will be required to ensure maintenance is carried out in the long term. Different designs will have different operation and maintenance requirements.

5.2. Maintenance of the swales are relatively straightforward for landscape contractors, and typically there should only be a small amount of extra work (if any) required for a swale over and above what is required for standard public open space. Provided that landscape management is already required at site, swale maintenance should have marginal cost implications.

5.3. Adequate access should be provided to the swale areas for inspection and maintenance, including for appropriate equipment and vehicles. Litter and debris removal should be undertaken as part of general landscape maintenance for the site and before any other SuDS management task.

5.4. The major maintenance requirement for a swale is mowing. Mowing should ideally retain grass lengths of 75-100mm across the main treatment surface, to assist in filtering pollutants and retaining sediments and to reduce the risk of flattening during runoff events. However, longer vegetation lengths, where appropriate, are not considered to pose a significant risk to functionality.

5.5. Occasionally sediment will need to be removed (once exceeding 25mm in depth) although this can be minimised by ensuring that upstream areas are stabilised and by incorporating effective pre-treatment devices.

Table 5.1 – Swale Maintenance Requirements

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Remove litter and debris	Monthly, or as required
	Cut grass – to retain grass height within specified design range	Monthly (during growing season), or as required
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect infiltration surface for ponding, compaction, silt accumulation, record areas where water is ponding for >48 hours	Monthly, or when required

	Inspect vegetation coverage	Monthly for 6 months, quarterly for 2 years, then half yearly
	Inspect inlets and facility surface for silt accumulation, establish silt removal frequencies	Half yearly
Occasional maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions if required	As required or if bare soil is exposed over 10% or more of the swale treatment area
Remedial actions	Repair erosion or other damage by re-turfing or reseeding	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up soil deposits and prevent compaction of the soil surface	As required
	Remove build-up of Sediment on upstream gravel trench, flow spreader or at top of filter strip	As required
	Remove and dispose of oils or petrol residues using safe standard practices	As required

6. INFILTRATION SYSTEMS – SOAKAWAYS, TRENCHES AND BLANKETS

6.1. The design of soakaways, infiltration trenches and blankets should include monitoring points where the water level in the system can be observed or measured. This can either be via an inspection well or inspection cover (where the attenuation storage space is a void). For larger installations the inspection access should provide clear view of the infiltration surface (even if the storage zone is filled). For small, filled soakaways, a 50mm perforated pipe is adequate.

6.2. The useful life and effective operation of an infiltration component is related to the frequency of maintenance and the risk of sediment being introduced into the system.

6.3. An easement should be considered where multiple properties discharge to a single soakaway, to ensure long-term access for maintenance purposes.

6.4. Maintenance will usually be carried out manually, although a suction tanker can be used for sediment/debris removal for large systems. If maintenance is not undertaken for long periods, deposits can become hard-packed and require considerable effort to remove.

6.5. Replacement of the aggregate or geocellular units will be necessary if the system becomes blocked with silt. Effective monitoring will give information on changes in infiltration rate and provide a warning of potential failure in the long term.

6.6. Roads and/or parking areas drainage to infiltration components should be regularly swept to prevent silt being washed off the surface. This will minimise the need for maintenance.

6.7. Maintenance responsibility should be placed with an appropriate organisation, and maintenance schedules should be developed during the design phase.

Table 6.1 – Infiltration systems – Soakaways, Trenches, and blankets maintenance requirements

Maintenance Schedule	Required Action	Typical Frequency
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required based on inspections)

Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings.	As required
Remedial actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation.	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

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