Phil Worthing

DEVELOPMENT AT FORMER LECKWITH QUAY, CARDIFF

Drainage Strategy

3561-WSP-C-RP-001

FEB 2020

PUBLIC

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Drainage Strategy

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PROJECT NO. 70053561

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1

INTRODUCTION

1. INTRODUCTION

1.1.1. WSP have been commissioned by Gareth Davies Project Services on behalf of Phil Worthing to provide a Drainage Strategy report in support of the outline planning application for a proposed residential development at the former Leckwith Quay, Cardiff.

1.1.2. It is our understanding that the client is seeking to submit a planning application for an area of existing greenfield/brownfield site off Leckwith Road, the planning application will be a full application for the proposed highway works and an outline planning application for residential development, this report covers the drainage strategy for the residential development portion of the site.

1.1.3. The objectives of the report are to:-

- Review the existing drainage arrangements on site for both surface and foul water;
- Assess the feasibility of Sustainable Drainage Systems (SuDS) features within the development to control and discharge surface water runoff to comply with the requirements of the statutory National Standards for Sustainable Drainage System;
- Assess the options for the disposal of foul water from the development; and
- Provide a preliminary design for surface water (SuDS) systems including indicative sizing of storage/attenuation features and conceptual plan suitable for inclusion in a pre-application submission to the local authority's SuDS Approval Body (SAB).

1.1.4. The following tasks have been undertaken to complete this report:-

- Undertake a desktop investigation of the site's existing foul and surface water drainage arrangements;
- Outline anticipated solutions for foul sewage disposal, surface water disposal and access roads/highway drainage. This will include preliminary calculations, in order that the conceptual designs may be agreed with the relevant authorities.
- In preparing the surface water drainage strategy, we cannot consider inundation of the floodplain and assess flood levels as this information has not be provided to us at the time of writing this report;
- Determine the area of impermeable surfaces that will be added by the proposed development and estimate the equivalent greenfield run-off rates for this area;
- Assess the feasibility of using infiltration as a disposal method, based on soakaway test results or any other available information on ground conditions;
- Estimate the size of storm water storage needed to manage run-off from the site post-development, using drainage design software (WinDes);
- Provide general information on the maintenance and adoption of SuDS via the SAB's approval process; and
- Give consideration to drainage exceedance. In particular, use topographic information to identify overland flow paths and areas susceptible to surface water ponding.

1.1.5. A number of sources have been used to compile this drainage strategy. Whilst WSP believe them to be trustworthy, WSP is unable to guarantee the accuracy of the information that has been provided by others.

1.1.6. This report is based on information available at the time of preparation. Consequently, there is potential for further information to become available. These changes may lead to future alteration to the conclusions drawn in this report for which WSP cannot be held responsible.

2

EXISTING SITE

2. EXISTING SITE

2.1. SITE LOCATION

2.1.1. Figure 2-1 indicates the site location, which is located south west of the river Ely and is intersected by the B4267 (Leckwith Road), Cardiff, CF11 8AU (Approximate Grid Reference X-315889, Y-175204).

2.2. SITE DESCRIPTION

2.2.1. The site comprises predominantly of brownfield land made up of two parcels of land which are intersected by the B4267, trees and hedgerows are located along the main boundaries and the river Ely runs along the eastern boundary of the site. To the north of the B4267 there is a network of roads, hard standings and existing buildings and also to the south of the B4267 highway there are further hard standings and existing buildings forming a small industry estate. The site is approximately 7.418 hectares in area with the topography sloping generally from west to east on the plateau that forms the hard standings, the ground does raise up towards the southern boundary of the site. There is also a large embankment between the existing B4267 highway and the main site plateau. Existing topographical survey plan can be found in Appendix C of this report.

2.2.2. The site has allowance for direct vehicle access off the public highway via an existing bridge and junction off Leckwith Road on the eastern boundary of the site.

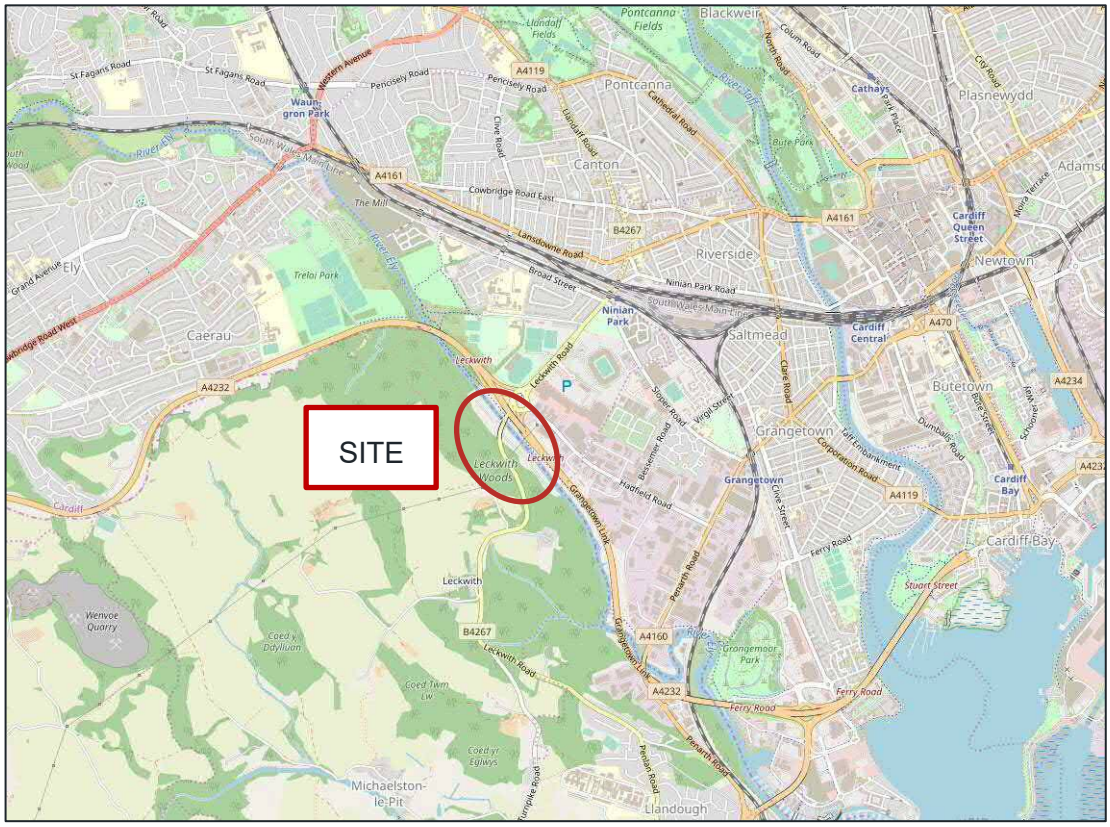


Figure 2-1 - Site Location Plan

2.3. EXISTING WATERCOURSES AND DRAINAGE

2.3.1. From available mapping information it has been established that the nearest watercourse is located along the eastern boundary of the site in the form of the river Ely which runs north to south.

2.3.2. Based on the information available it is assumed that there are no public sewers currently crossing the site and the nearest public sewer system is a 1600mm combine sewer which flows north and south along Hadfield Road which is located approximately 150m east of the River Ely. There is also a 300mm combine sewer which is located approximately 100m south along Hadfield Road from the roundabout. Figure 2-2 below contains an extract of Dwr Cymru Welsh Water (DCWW) asset plan for the area.

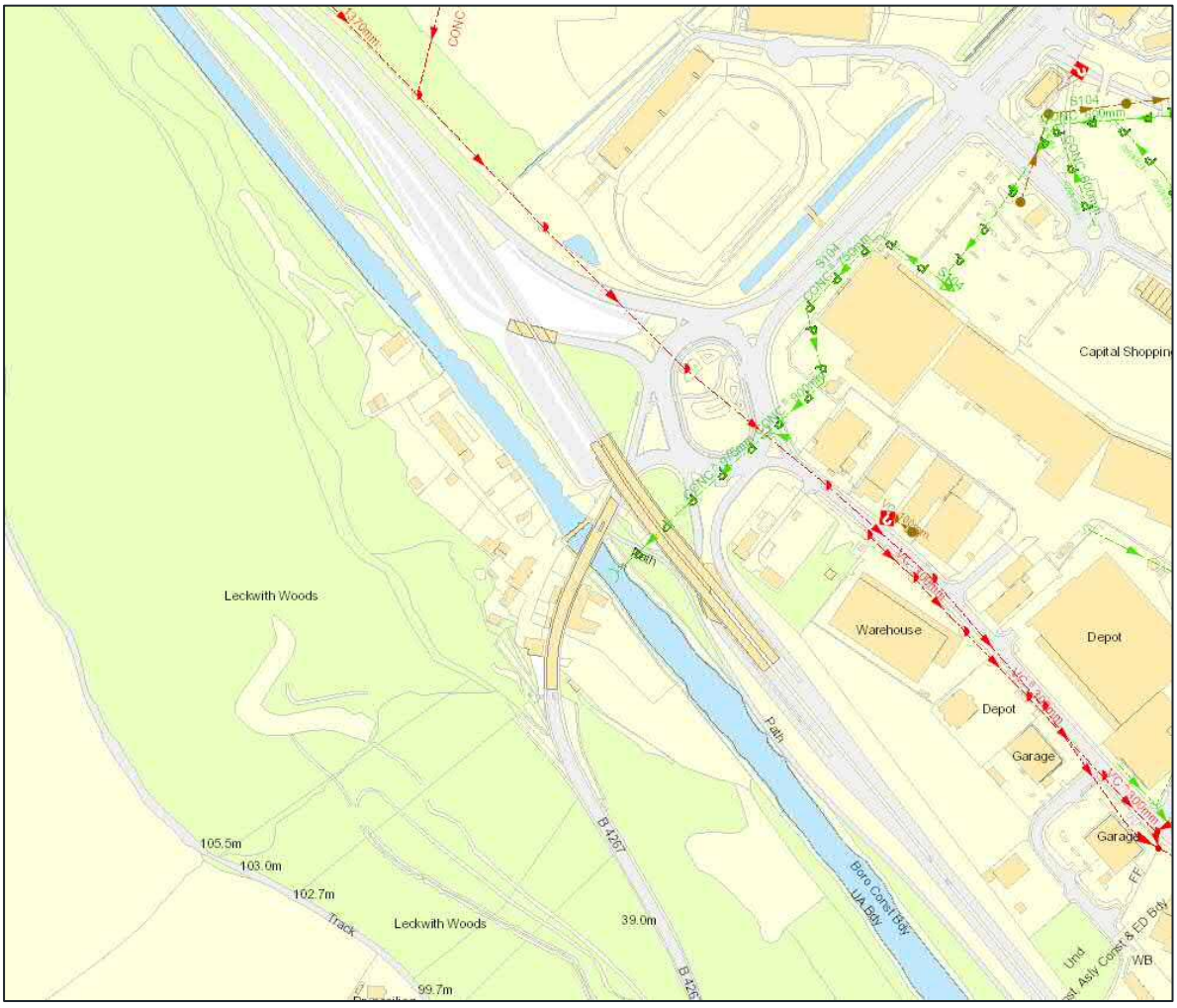


Figure 2-2 - Extract of DCWW Asset Plan

2.3.3. From information we have obtained there would appear to be no positive foul drainage on site.

2.3.4. Based on the survey data we have received to date there would appear to be positive surface water drainage on site, however it would be to be informal and is likely to discharge to ground or directly into the adjacent river Ely. The topographical survey did not include lifting the manhole chambers, it is recommended that further investigation works are undertaken to establish the current surface water network.

2.4. EXISTING CONTRIBUTING AREAS & RUN-OFF RATES

2.4.1. The total site area is circa 7.418ha, which is predominantly impermeable areas (3.047 ha) with the exception of a large embankment along the western boundary of the site. The existing B4267 highway which intersects the site is approximately 0.302 ha in and has been excluded from the run-off calculations for the development. The global greenfield run-off rates have been calculated using various methods including WinDes Micro Drainage, FEH and ICP SuDS methods with table 2-1 below summarising the results and table 2-2 summaries the runoff off rates for each return period (Qbar, 30 & 100) based on ICP SuDS method. Calculations detailing the derivation of the values in full are available in Appendix A.

Table 2-1 - Global Greenfield/Brownfield Run-off Rates

Method	QBar - (l/s/ha)	
	Greenfield Rate	Brownfield (Urban) Rate
FEH	6.4	-
ICP SuDS	5.9	10.3
Average	**6.15**	**10.3**
	8.2	

Table 2-2 - Global Greenfield Run-off Rates by Return Period based on ICP SuDS

Return Period	Greenfield Run-off Rate (l/s/ha)	Brownfield Run-off Rate (l/s/ha)
Qbar	5.9	10.3
30 YRP	10.4	16.4
100 YRP	12.9	18.6

3

PROPOSED DEVELOPMENT

3. PROPOSED DEVELOPMENT

3.1. DEVELOPMENT PROPOSALS

3.1.1. For assessment purposes it has been assumed that the proposed development will be a residential development of 217 units with associated infrastructure including access roads and external car parking areas.

3.2. FOUL DRAINAGE

3.2.1. The most sustainable method for the disposal of foul water discharge from the proposed development site is via the mains sewerage network. The nearest public foul sewer system is located on the opposite site of the river Ely from the development in Hadfield Road. DCWW have been consulted as part of the development process for the site and they have confirmed the appropriate point of connection to the public sewer system to be manhole ST16751201 which is shown in figure 3-1.

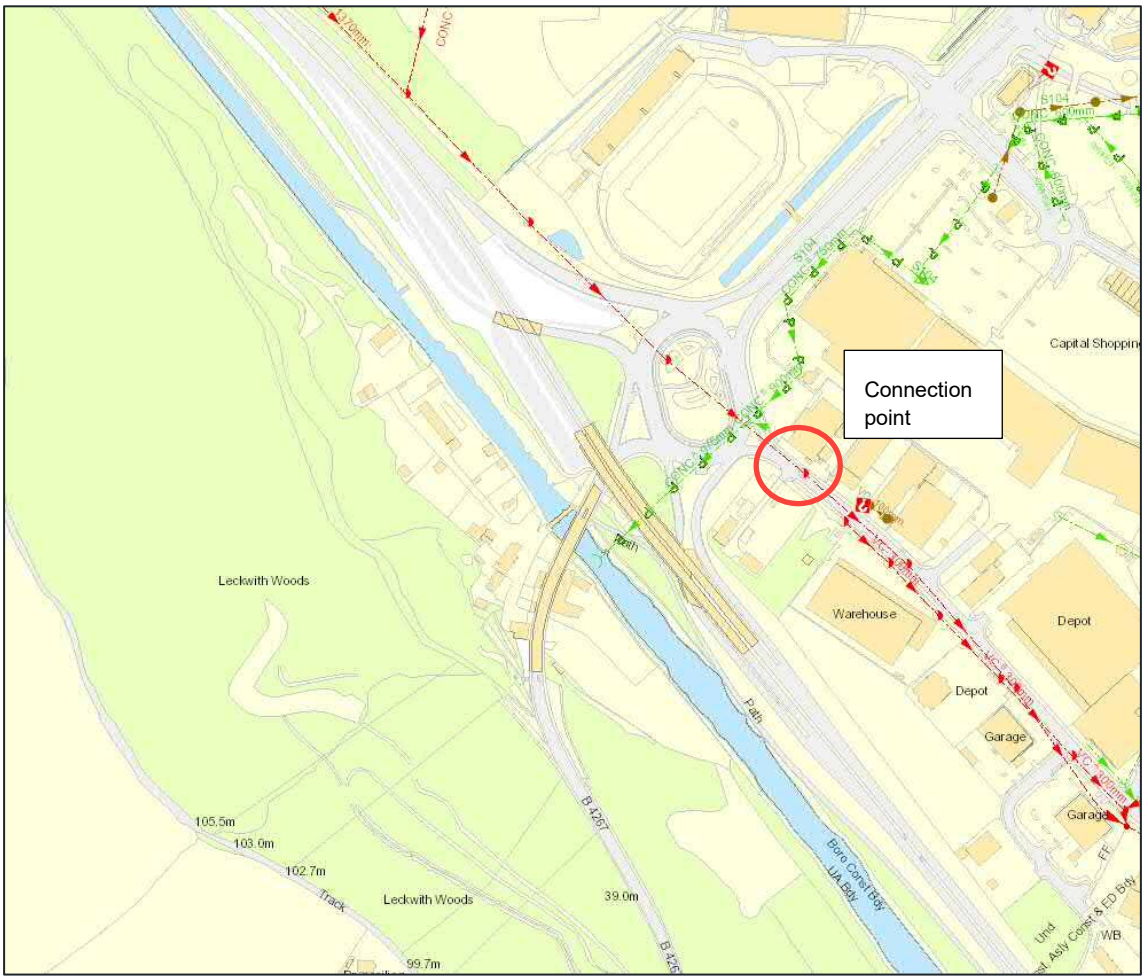


Figure 3-1 – Foul Connection Points

3.2.2. Given the location and levels of the proposed connection the flows from the site will need to be pumped to the connection point and a public pump station incorporated into the site layout.

3.2.3. All on site and off site sewerage systems will be designed and constructed to comply with building regulations requirements with any adopted elements in accordance with the latest edition of “Sewers for Adoption” and any of the adopting authority’s (DCWW) specific requirements.

3.3. HIGHWAY DRAINAGE

3.3.1. The scheme involves the realignment of the existing carriageway (B4267), the area of the proposed realigned road which is approximately 0.302ha has been excluded for this assessment, the runoff from these areas is to form part of the detailed highway design package with storage being provided within the site boundary as shown on the drainage strategy plan in appendix C, the storage structure for the highway drainage will have its own dedicated outfall to the river Ely and allowance has been made within the masterplan for an easement to the outfall which is also shown on the plan in appendix C.

3.3.2. A brief description of the highway system is given below, for further details refer to the detailed highways design package;

3.3.3. North east of the southern bridge abutment (i.e. bridge deck and tie-in to Leckwith roundabout) will be connected into the existing highway drainage system on the Cardiff side with linear kerb drainage generally throughout. The diverted section of the B4267 will be collected via traditional drainage systems (kerb and/or gullies) and connected through the new attenuation basin within the proposed site boundary and outflow limited to greenfield rates, additional storage if required will be located within the cycleway in the form of storage crates. The outfall from the storage structures will be straight from the basin to the river Ely. The proposed system will pick up the existing highway drainage from our tie-in point and accommodate the run-off from the ‘uphill’ section of the carriageway, because the development intercepts the existing highway drain this will feed into the new drainage system, so it can pass through the attenuation basin unattenuated meaning the flow from the existing road will have the benefit of passing through a treatment stage.

3.4. SURFACE WATER

3.4.1. The aim of the surface water drainage strategy is to mimic the natural catchment processes as closely as possible and adopt the principles of water management scheme as stated in section 2 of the statutory “Sustainable Drainage Systems Standards for Wales” (SDSSW) document 2018. The previous sections of this report have established the current drainage arrangements on site and have also determined the current discharge rates for surface water leaving the site.

3.4.2. From the 7th January 2019 Schedule 3 of the Flood and Water Management Act has been implement by the Welsh Government which requires any development of more than 1 unit or where the construction area is greater than 100m² to comply with the SuDS Approving Bodies (SAB’s) design guidance and ministers standards which will require all sites to adopt SuDs in their design. The standards are listed below;

- S1 – Surface Water Runoff Destination
- S2 – Surface Water Runoff Hydraulic Control
- S3 – Water Quality
- S4 – Amenity
- S5 – Biodiversity
- S6 – Design of Drainage for Construction, Operation and Maintenance

3.4.3. The Standards listed will need to be met by the design in order to comply with the SDSSW. S1 is a hierarchy standard with standards S2-S6 being fixed.

S1 – Surface Water Runoff Destination

3.4.4. In determining a suitable methodology for disposal of surface water flows from this development, it is necessary to explore the technical options outlined under Standard S1 of the SDSSW 2018 document published by Welsh Government. This states that disposal should be made through the hierarchical approach which are, in order of preference; surface water runoff collected for use, infiltration methods, discharge to surface water body, discharge to a surface water sewer, highway sewer or another drainage system and finally discharge to a combine sewer. Each of these options are considered below.

3.4.5. Collected for Use

The suitability of this option will depend on the proposed water usage of the development, if the development has low grey water demand, as is typical of residential developments the collection of water for reuse would be not be economical or feasible, however if the demand for grey water is deemed to be high then rainwater harvesting would be an appropriate solution for parts of the development. The use of rainwater harvesting would need to be used in conjunction with one of the below methods of discharge in order to cater for exceedance flows in extreme rainfall events where the rainfall volume exceeds the volume of surface water storage provided by the rainwater harvesting tanks.

3.4.6. Infiltration Methods

Based on the Cranfield University Soilscapes mapping the subsoils in the area of the site are noted as Loamy Clay with impeded drainage therefore it is assuming that infiltration will not be a feasible solution for the disposal of surface water. Infiltration testing will be required to be undertaken as part of the ground investigation to either validate this assumption or determine a suitable infiltration rate.

3.4.7. Discharge to Surface Water Body

Sequentially, the next consideration in the hierarchical approach is discharge to a surface water body. There is a watercourse located on the eastern boundary of the site in the form the river Ely. With the use of SuDS features and above ground conveyance a gravity discharge will be possible from the northern and southern areas of the site. Further investigation would need to be carried out on the existing watercourse to establish the water levels within the river for each flood event in order to establish the discharge level from the site to avoid surcharging the proposed system.

3.4.8. Discharge to Surface Water Sewer

Based on the development's ability to discharge to a watercourse there is no requirement for the site to discharge to a surface water sewer.

3.4.9. Discharge to Combined Sewer

Based on the above there would be no requirement for the site to discharge to the public combined sewer network.

S2 – Surface Water Runoff Hydraulic Control

3.4.10. This standard requires surface water to be managed to prevent as far as possible any discharge from the development for rainfall events of less than 5mm and that the surface water runoff rate and volume for up to a 1 in 100-year return period should be managed to protect people, properties and the receiving water body. Consideration is also required to the risk associated with runoff from events greater than 1 in 100-year return period with mitigating proposals developed for the scheme.

3.4.11. Interception of Runoff

3.4.12. Interception will need to be considered under the statutory standards. Interception aims to mimic greenfield runoff conditions by preventing runoff from the majority of all small rainfall events. This can contribute to reducing pollution load to receiving surface water bodies. Meeting the Interception criterion is not expected during particularly wet periods, when permeable surfaces and subsoils are saturated, so a suggested target is that 80% compliance should be achieved during the summer and 50% in winter. Refer to table G2.1 in the Statutory Standards for Sustainable Drainage Systems 2018 document published by Welsh Government for details of interception mechanisms and their assumed compliance with the standards. Interception of site runoff has been accounted for as close to source of possible by the use of permeable paving systems, raingardens and highway adjacent swale features.

3.4.13. Hydraulic Control and Storage

3.4.14. For the purposes of this report it is assumed that infiltration will not be a feasible means of disposing surface water runoff generated from the development, however given the proposed development will reduce the overall impermeable area the discharge volume for the site will decrease. In order to meet the standards this report has adopted the simple approach outlined in the statutory standards of restricting all runoff from the development site for all return periods to the equivalent return period including the 1 in 100-year event as given in table 2-2 of this report which will provide betterment over the existing runoff rates.

3.4.15. In accordance with statutory guidelines, the development of this site should not increase flood risk elsewhere and as such, all runoff from attenuated areas on site should be contained within the site boundary for up to and including a 1 in 100 year design period storm, plus 40% climate change allowances. These allowances will have to be agreed with the SAB prior to detailed design to include any consideration of urban creep during the design lifetime. It is proposed to discharge surface water runoff from the development at runoff rates equivalent to the current Qbar greenfield runoff which will need to be agreed with the adopting SAB's authority. Surface water flows from the proposed development would need to be attenuated via a flow control chamber, and on-site storage provided for surface water runoff for all rainfall events up to and including a 1 in 100 year event with 40% allowance for climate change.

3.4.16. Given the proposed site usage overland storage in the form of swales, raingardens and/or ponds across the site should be achievable, alternately storage could also be provided in the form of a permeable paving system beneath carparks and access road across the site with the surface water storage being provided with the sub-base layer of the carriageway makeup as well as offline below ground storage tanks.

3.4.17. For the purposes of this report storage requirements have been calculated based on an open storage void. The estimated storage volumes for the development have been calculated using the

source control suite within WinDes Microdrainage and table 3-1 below provides a summary of the values. For the purposes of this calculation the overall impermeable area for the development has been taken as 2.3ha as shown extracted from the latest Architectural masterplan, and the maximum discharge rate assumed to be the equivalent greenfield run-off rate for each return period with the use of alternative complex controls to satisfy clause G2.30 of the standards, liaison will need to be undertaken with the SAB at detailed design stage to confirm the acceptability of the proposed runoff rates and the use of a complex control.

3.4.18. The tables below provide the estimated storage volumes based on the proposed discharge rates in Table 2-2 with 40% allowance for climate change. Calculations deriving these figures are found in Appendix B. It should be noted that the estimated attenuation storage volumes set out below are still subject to agreement of a site masterplan and detailed analysis/design. The below volumes would be split between a number of storage/SuDS features across the sites indicated in the drainage strategy drawing found within the Appendix. Attenuation requirements have been sized and provided based on approximately 70% of the 1:100 year return period requirements and any revisions to the impermeable catchment areas will require a revaluation of both the greenfield restriction rates and onsite attenuation volumes.

Imp Area (23,041sqm) Return Period	Discharge rate	Indicative storage volume
Qbar	13.6 l/s	657 - 1196m³
30 YRP	23.9 l/s	1035 – 1695m³
100 YRP	29.8 l/s	1361 – 2122m³

**The size and depth of the storage will be dependent on the form of storage used and the depth of the proposed outfall location which will need to be establish following further on-site investigation works.*

3.4.19. As the site is intersected by the B4267 it is proposed to have two outfall locations into the adjacent river Ely, in tables 3-2 & 3-3 the discharge rates to indicative storage are broken down into the northern and southern areas of the site.

Table 3-2 – Northern Area *Storage Requirements*

Imp Area (7,353sqm) Return Period	Discharge rate	Indicative storage volume
Qbar	4.3 l/s	188 - 341m³
30 YRP	7.6 l/s	295 - 482m³
100 YRP	9.5 l/s	386 - 603m³

Table 3-3 – Southern Area *Storage Requirements*

Imp Area (15,688sqm) Return Period	Discharge rate	Indicative storage volume
Qbar	9.3 l/s	319 - 633m³
30 YRP	16.3 l/s	753 - 1214m³
100 YRP	20.3 l/s	985 - 1518m³

3.4.20. Exceedance Flows and Flood Pathways

3.4.21. "*It is inevitable that as a result of extreme rainfall the capacities of sewers, covered watercourses and other drainage systems will be exceeded on occasion. Periods of exceedance occur when the rate of surface runoff exceeds the drainage system inlet capacity, when the pipe system becomes overloaded, or when the outfall becomes restricted due to flood levels in the receiving water. Underground conveyance cannot economically or sustainably be built large enough for the most extreme events and, as a result, there will be occasions when surface water runoff will exceed the design capacity of drains. When drainage exceedance capacity is exceeded the excess water (exceedance flow) is conveyed above ground, and will travel along streets and paths, between and through buildings and across open space. Indiscriminate flooding of property can occur when this flow of water is not controlled."* (CIRIA C753).

3.4.22. Flood-flow pathways would be designed to convey the overland flows from rainfall events above a 1in100 year return period to suitable areas of open space, such as landscaped areas, car parking areas and other hard surfaced areas in order to protect properties against flooding. Consideration should also be given to exceedance pathways from storage areas in the event of extreme rainfall or failure with allowance made to convey flows away from properties both on and off the site. These should be considered as part of the detailed drainage and levels design of the development.

3.4.23. Flood Risks to People

3.4.24. "People are at risk of suffering death or serious injury when flooding occurs. People are unable to stand in deep or fast flowing floodwater. Once they are unable to stand, there is a high risk of death or serious injury. Adults are unable to stand in still floodwater with a depth of about 1.5m or greater, although this is obviously affected by the height of a person. The depth of flowing floodwater where people are unable to stand is much less. For example, some people will be at risk when the water depth is only 0.5m, if the velocity is 1m/s (about 2 mph). If the velocity increases to 2m/s (about 4 mph) some people will be unable to stand in a depth of water of only 0.3m. Most people will be unable to stand when the velocity is 2m/s and the depth is 0.6m." (Defra/ Environment Agency, FD2321/TR2)

3.4.25. During the detailed design, a hydraulic model will be built to assist the design of the proposed surface water drainage networks. When an extreme storm event is simulated within the model, potential flooding locations will become evident and the flood flow pathways can be designed/defined based on the proposed layout and levels of the hard areas and landscaping. The depth and velocity of the overland flood water can be determined and then compared with Figure 2.1 (Combinations of flood depth and velocity that cause danger to people) in the Defra / EA Flood

Risks to People publication. The velocity and depth as described above would then give a category of flood hazard and the corresponding risk to people. If the risk is deemed to be too high, then the design would require reassessment.

S3 – Water Quality

3.4.26. This standard requires treatment of surface water runoff to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems including sewers.

3.4.27. The only exception to this standard is where drainage connections directly to a combined sewer, where the quality requirements are limited to preventing the discharge of oil and sediments to the sewer system.

3.4.28. The aim of the surface water management strategy with regards to water quality is to follow the guiding principles of the SDSSW and use simple, natural processes that promote biodiversity and long-term sustainability. As such, it employs a SuDS management train approach, providing drainage components in series. Figure 3-2 below provides a typical example of the onsite management trains.

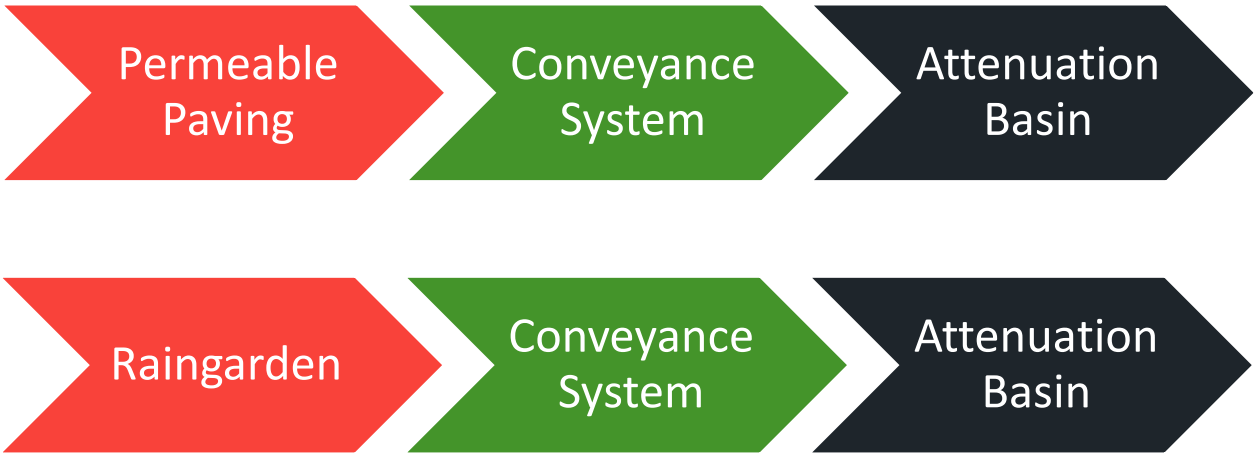


Figure 3-2 - SuDS Management Train Examples

3.4.29. The management trains to be used on the project would have been assessed using the Simple Index Assessment (SIA) tool available publicly (http://www.ukSuDS.com/drainage-calculation-tools/water-quality-assessment-for-SuDS-developments) which is built around the principles for simple assessment outlined in CIRIA C753 to assess the levels of treatment provided by the proposals.

3.4.30. Sediment will need to be trapped and retained on site and consideration for maintenance access to be provided for the purpose of intermittent sediment removal.

3.4.31. The possible impact of accidental spills will need to be addressed with the most vulnerable areas to a spill or other pollution incident being the car park areas and access roads. The carpark areas and some access roads could be constructed in preamble paving which will provide a level of treatment for pollution. These areas will also have to pass through swales and an attenuation basin before

leaving the site boundary. As such, by having a cut-off point upstream of the discharge location, this allows the isolation of any spills within the site boundary, which can then be addressed before the surface water system is then allowed to discharge freely again.

3.4.32. Planting within the SuDS features should form part the water quality strategy. SuDS components like swale and raingardens providing initial water quality improvements by reducing sediment and contaminants from runoff either through settlement or biological breakdown of pollutants are most likely to be exposed to contaminants as part of their interceptor function, so only robust and tolerant species of planting should be specified. Once these species establish this will decrease the flow rate of water travelling through and filter pollutants and contaminants before entering any downstream waterbodies, i.e attenuation basin & pond.

3.4.33. Overall the combination of the planting will create a new eco-system and once colonised will be able to decrease the flow rate of the water within the swale, filter contaminants & pollutants and create an overall attractive biological community.

S4 – Amenity

3.4.34. This standard requires that the design of the surface water management system should maximise amenity benefits.

3.4.35. The primary amenity focus of the SuDS scheme should be to improve the health and well-being of the residents. The scheme will need to be based on natural forms that mimic natural landscapes found within the region and the vegetated swales and detention pond areas are designed with natural slope forms, safe and accessible paths and locally contextual species that will encourage natural colonisation. Other key amenity benefits should include improving air quality around the development, increasing carbon sequestration and improving water quality through removal of pollutants via vegetated swales & attenuation pond.

S5 – Biodiversity

3.4.36. This standard requires that the surface water management system should maximise biodiversity benefits.

3.4.37. The SuDS scheme biodiversity strategy should revolve around the creation of significant and varied habitat to increase the overall biodiversity of the site and ecological value. The inclusion of plant species that will enhance the general eco system and simultaneously act as a water filtration system to clean pollutants and contaminants should be used and where possible provide meandering swales and a large attenuation basin to maximise the variety of habitats available.

3.4.38. The plant species selected should be both locally contextual and appropriate for the varied habitat zones including primary characteristics that shall ensure:

- Good soil binding and filtration species
- Minimised erosion
- Improved filtration via dense root and stem species
- Tolerance to seasonal variations including droughts and inundations
- Good suspended solids retention
- Pollutant tolerant

- Emergent and pioneering species for natural ecological colonisation
- The creation of diverse, self-sustaining and resilient ecosystems for high species biodiversity
- Support for local and regional habitat strategies

3.4.39. In general, the proposed detention ponds will be the focal habitats for the development and consists of a large basin that is resilient to inundation and a smaller permanent aquatic habitat with a variety of water depths. The pond should not be over planted to allow for natural colonisation and to ensure high visibility of people particularly children in and around the pond. Sight lines should be left open to attract certain species and shaded areas under adjacent tree canopies further enhance the varied ecosystem potential.

3.4.40. The northern attenuation basin should be constructed in a manner that avoids compacted sub bases and healthy organic matter will be backfilled to ensure ideal growing conditions. The pools varying depths will provide refuge for overwintering species and structural diversity and the pond will be resilient to seasonal changes, drought periods and inundation.

S6 – Design of Drainage for Construction and Maintenance and Structural Integrity

3.4.41. The surface water drainage system should be designed with the overriding ethos of simplicity in construction, use and maintenance. This then allows a very simple translation from the principles described within standard S6, namely that all elements of the surface water drainage system should be designed so that they can be constructed, as well as maintained and operated "…easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy)." (SDSSW).

3.4.42. The proposed system will be formed for adoption as it will serve more than one property, therefore the SAB will be responsible for the maintenance of the system to ensure it continues to comply with SuDS standards. In order for the drainage system to be adopted it must be designed and constructed in accordance with the SDSSW document and any conditions of approval stipulated by the SAB.

3.4.43. Information with regards to the construction methodology and requirements of the proposed system will be developed as part of the detailed design stage of the project, likewise the maintenance requirements and regime of the proposed system will be developed into the full maintenance strategy for the site during the next phase of design development. This will be developed in conjunction with the client's maintenance team and the SAB, as it is not considered appropriate for these details to be developed by the design team in isolation from the end users. This will then need to be confirmed and submitted for approval to the SAB prior to construction commencing on site.

4

CONCLUSION

4. CONCLUSION

4.1. FOUL DRAINAGE

4.1.1. The most sustainable method for the disposal of foul water discharge from the proposed development site is via the mains sewerage network. The nearest public foul sewer system is located on the opposite site of the river Ely from the development in Hadfield Road. DCWW have been consulted as part of the development process for the site and they have confirmed the appropriate point of connection to the public sewer system to be manhole ST16751201 which is shown in figure 3-1.

4.1.2. This connection location will require the construction off an offsite sewer across third party land which will need to be agreed prior to undertaking detailed design of the scheme.

4.1.3. Given the location and levels of the proposed connection the flows from the site will need to be pumped to the connection point and a public pump station incorporated into the site layout.

4.1.4. All on site and off-site sewerage systems will be designed and constructed to comply with building regulations requirements with any adopted elements in accordance with the latest edition of “Sewers for Adoption” and any of the adopting authority’s (DCWW) specific requirements.

4.2. SURFACE WATER DRAINAGE

4.2.1. The aim of the surface water drainage strategy is to mimic the natural catchment processes as closely as possible. It is anticipated that the proposed surface water system will be adopted by the SAB and the proposed system will need to be designed in accordance with the statutory “Sustainable Drainage Systems Standards for Wales” (SDSSW) document 2018 and any local authority’s SAB requirements and CIRIA’s C753 SuDS Manual as well as meeting the requirements of Building Regulations, Document H.

4.2.2. In determining a suitable methodology for disposal of surface water flows from this development, it is necessary to explore the technical options outlined under Standard S1 in the statutory “Sustainable Drainage Systems Standards for Wales” (SDSSW) document 2018 published by the Welsh Government. Based on the hierarchy it is proposed to discharge surface water runoff from the development to the adjacent watercourses as per the current regime.

4.2.3. It is proposed to attenuate the runoff generated from site to the equivalent greenfield run-off rate for all rainfall events up to and including 100YRP with 40% allowance for climate change as given in Table 2-2.

4.2.4. The site is split into three catchments – northern catchment, southern catchment and the B4267 highway. Each area will have a separate outfall to the adjacent river Ely. The B4267 highway drainage design will form part of the detailed highway application and allowance has been made within the site master plan for storage and an easement to the outfall.

4.2.5. Given the proposed site layout and land usage, overland conveyance and storage in the form of swales, raingardens and ponds may be achievable. As well as swales, raingardens and ponds, treatment and storage could also be provided in the form of a permeable paving systems beneath the highway and carpark areas across the site with the surface water storage being provided within the sub-base layer of the carriageway makeup. For the purposes of this report the storage

requirements have been calculated based on an open storage void with indicative sizes being provided in **Error! Reference source not found.**. A copy of the schematic site layout plan can be found in appendix C.

4.2.6. All on site surface water drainage systems will be designed and constructed to comply with the (SDSSW) and building regulations requirements. The detailed design of the scheme will incorporate the philosophies outline in this report regarding standards S1-S6 listed in section 3 of this report.

Appendix A

RUN-OFF CALCULATIONS

ICP SUDS Mean Annual Flood

Input

Return Period (years) 1 SAAR (mm) 1125 Urban 0.428
Area (ha) 7.418 Soil 0.400 Region Number Region 9

Results l/s

QBAR Rural 44.0
QBAR Urban 76.3

Q1 year 67.1

Q1 year 67.1
Q30 years 121.4
Q100 years 137.6

ICP SUDS Mean Annual Flood

Input

Return Period (years) 1 SAAR (mm) 1125 Urban 0.000
Area (ha) 7.418 Soil 0.400 Region Number Region 9

Results l/s

QBAR Rural 44.0
QBAR Urban 44.0

Q1 year 38.7

Q1 year 38.7
Q30 years 77.5
Q100 years 95.9

HR Wallingford
Working with water

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Christopher Stone
Site name:	Leckwith Quay
Site location:	Cardiff

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.46900° N
Longitude:	3.21164° W
Reference:	4060492958
Date:	Feb 18 2020 11:38

Runoff estimation approach

FEH Statistical

Site characteristics

Total site area (ha):	7.116

Methodology

Q_{MED} estimation method:	Calculate from BFI and SAAR
BFI and SPR method:	Calculate from dominant HOST
HOST class:	8
BFI / BFIHOST:	0.56
Q_{MED} (l/s):	42.62
Q_{BAR} / Q_{MED} factor:	1.08

Hydrological characteristics

	Default	Edited
SAAR (mm):	1060	1060
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

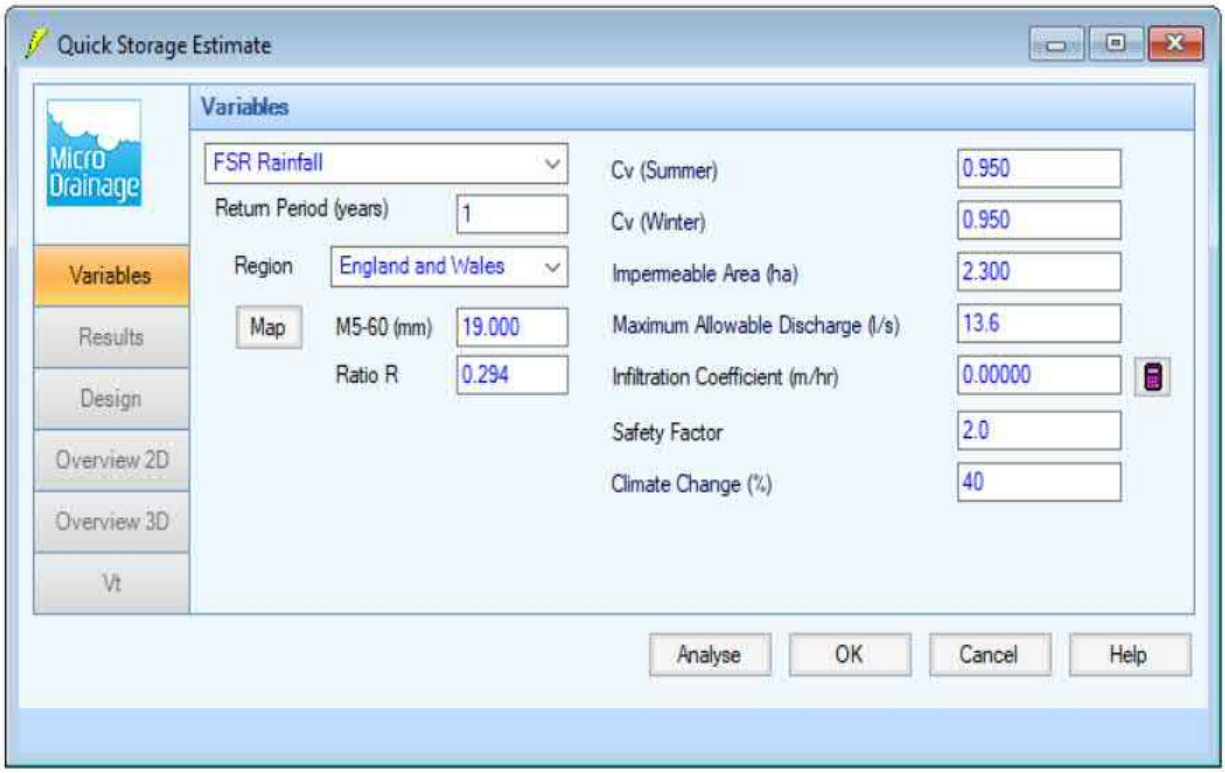
Greenfield runoff rates

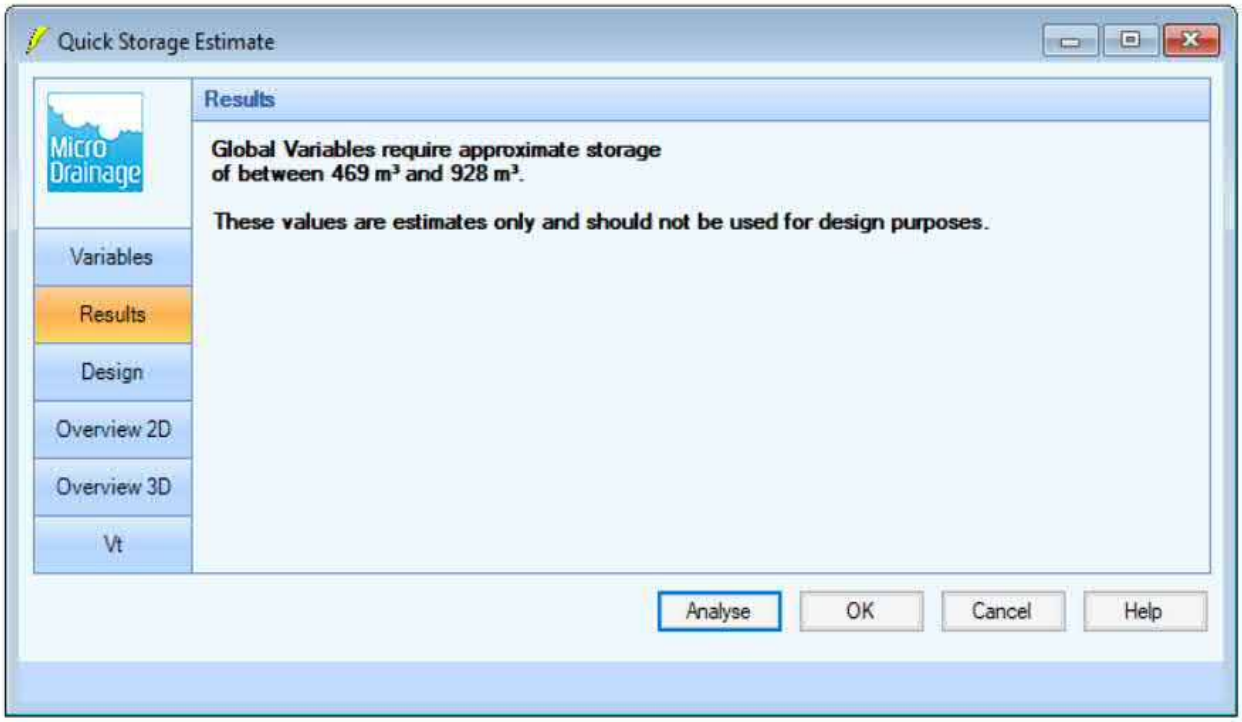
	Default	Edited
Q_{BAR} (l/s):	45.81	45.81
1 in 1 year (l/s):	40.32	40.32
1 in 30 years (l/s):	81.55	81.55
1 in 100 year (l/s):	99.87	99.87
1 in 200 years (l/s):	112.7	112.7

Appendix B

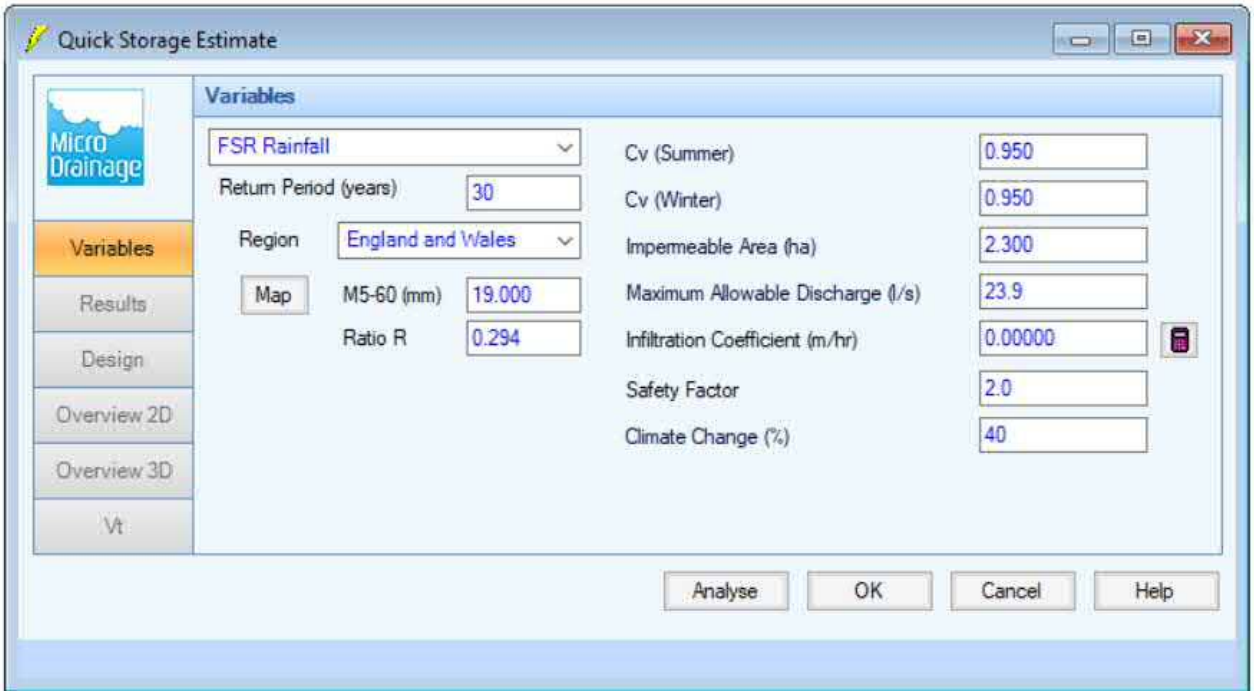
STORAGE CALCULATIONS

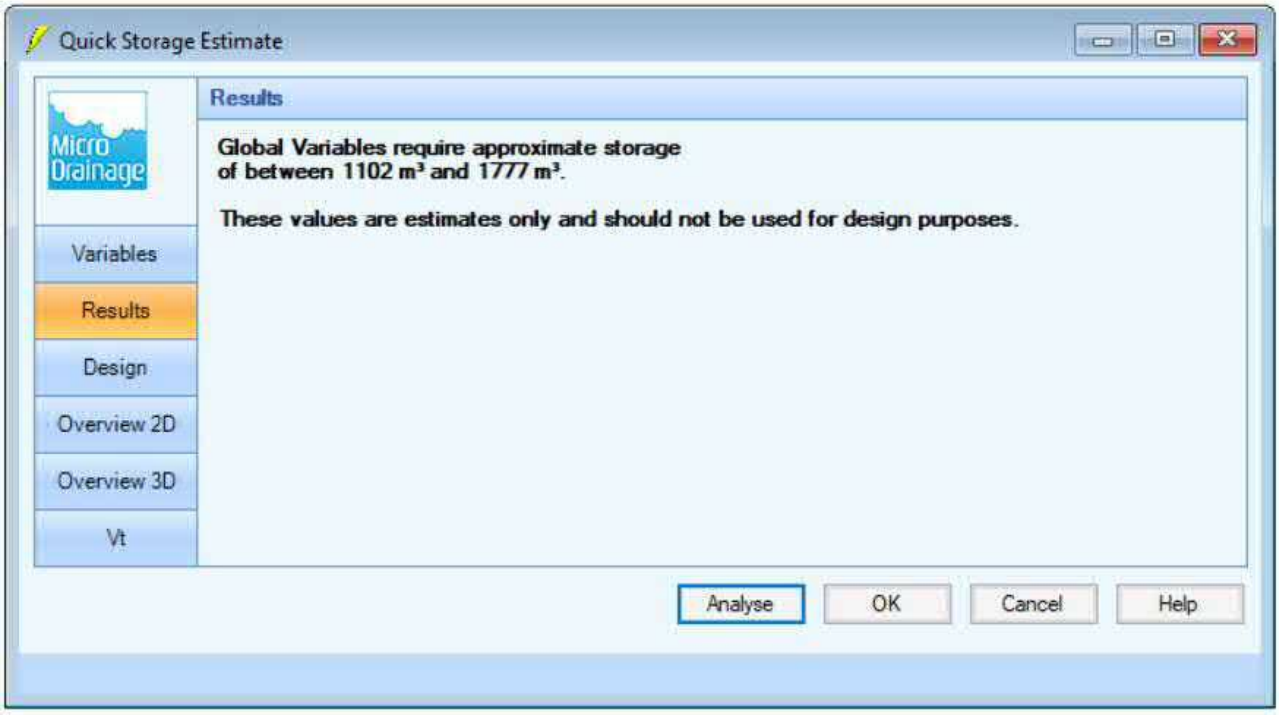
Overall Site storage Qbar



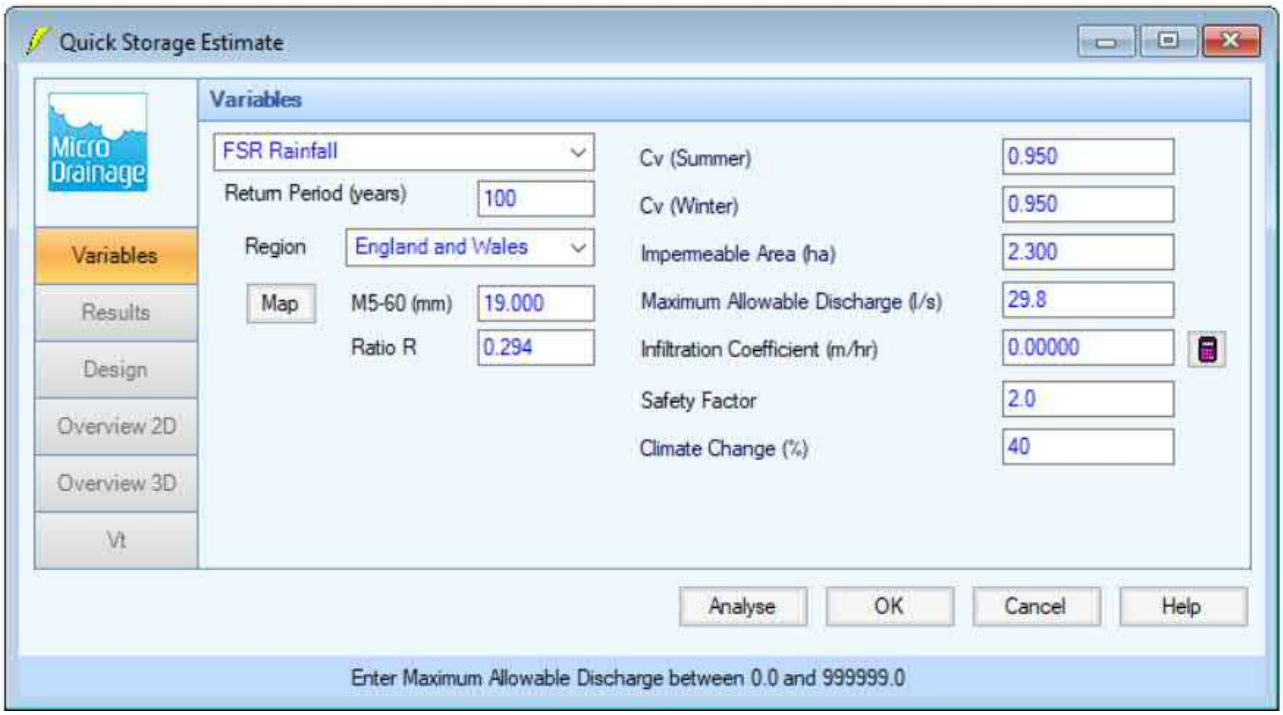


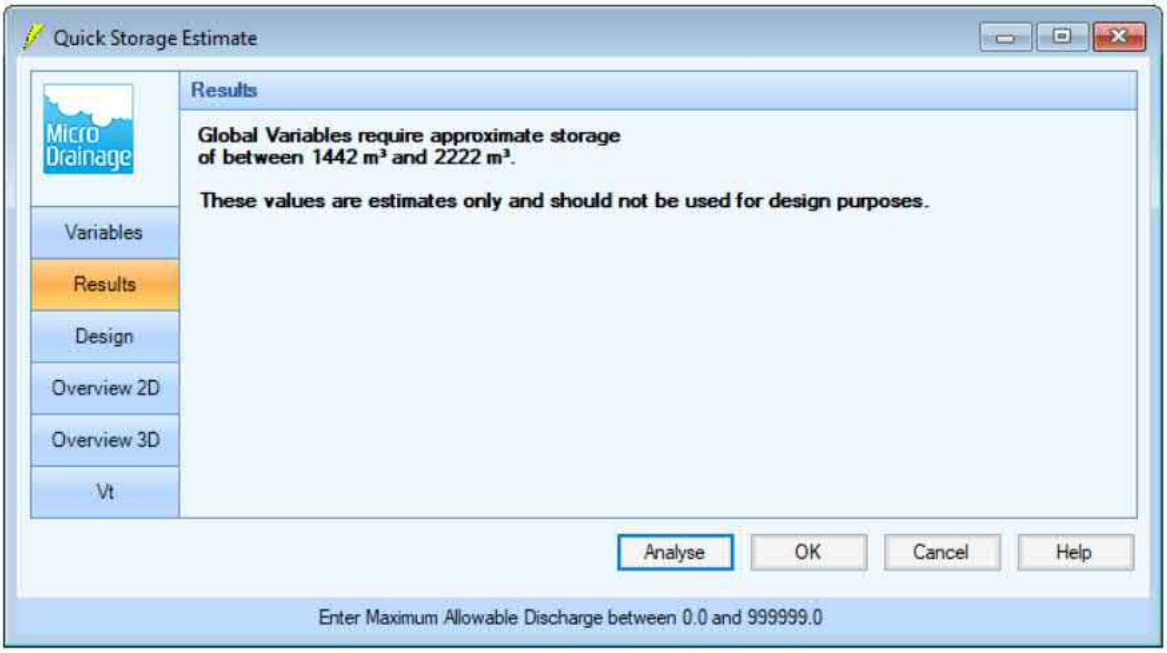
Overall Site storage 30YRP



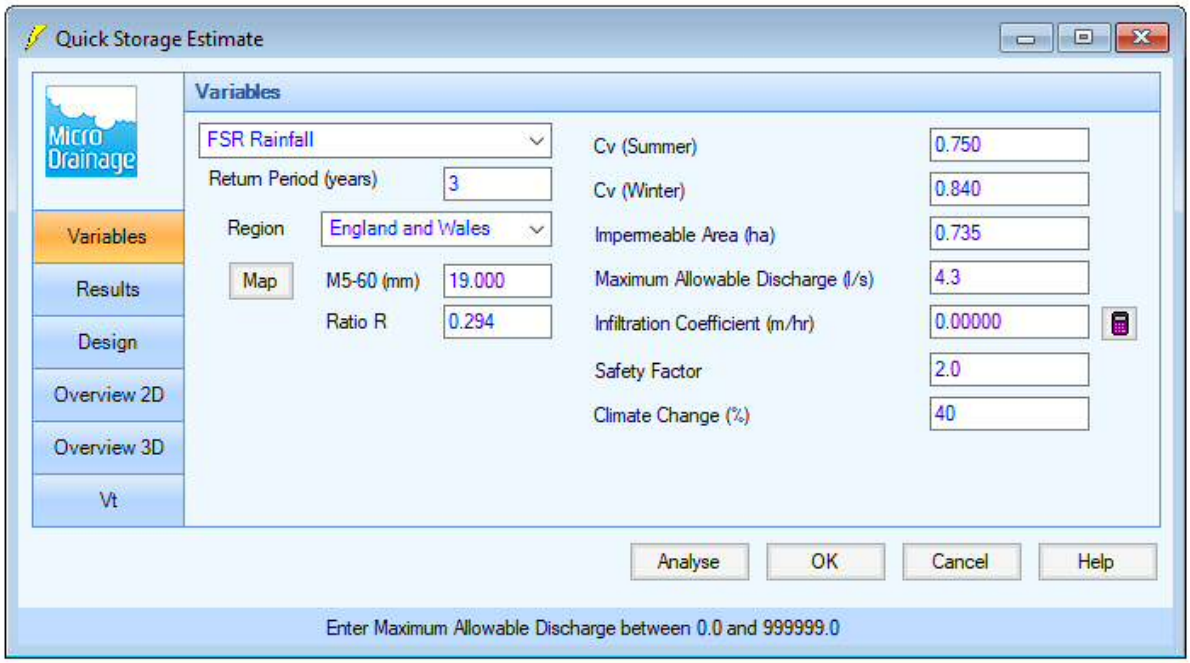


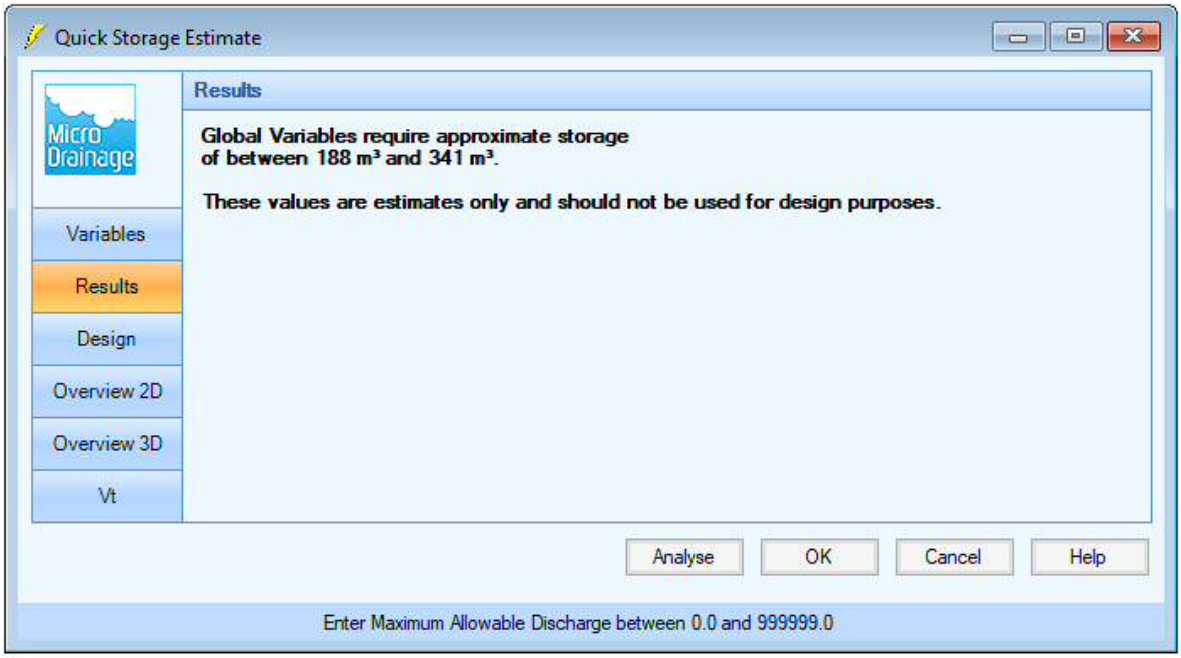
Overall Site storage 100YRP



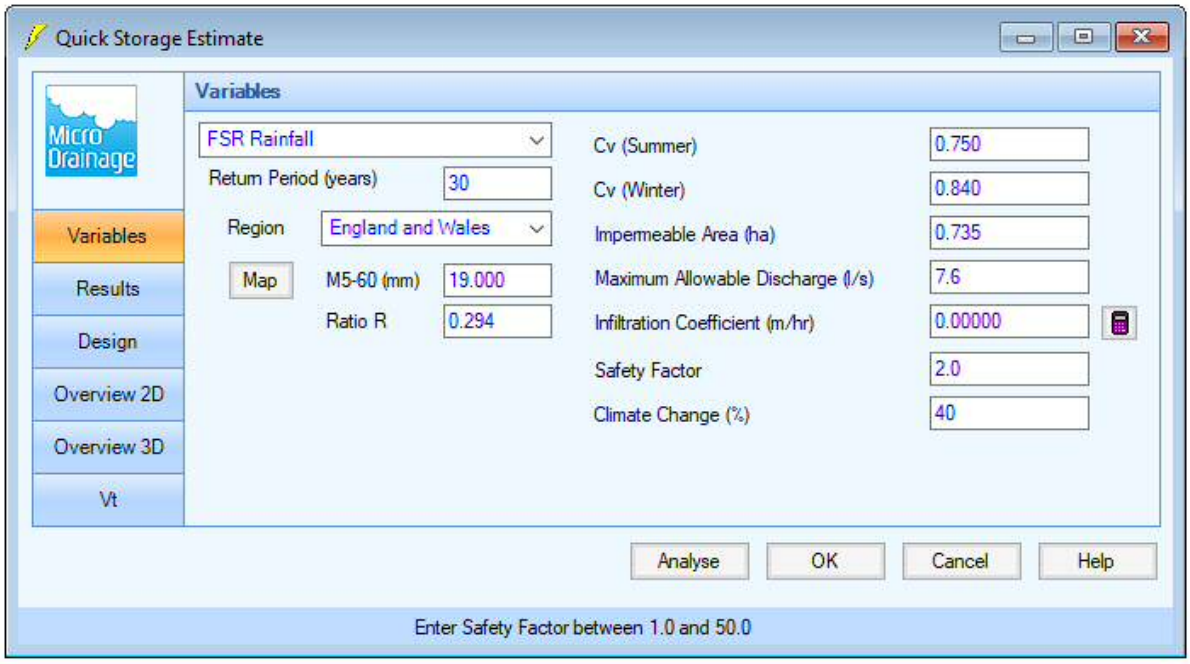


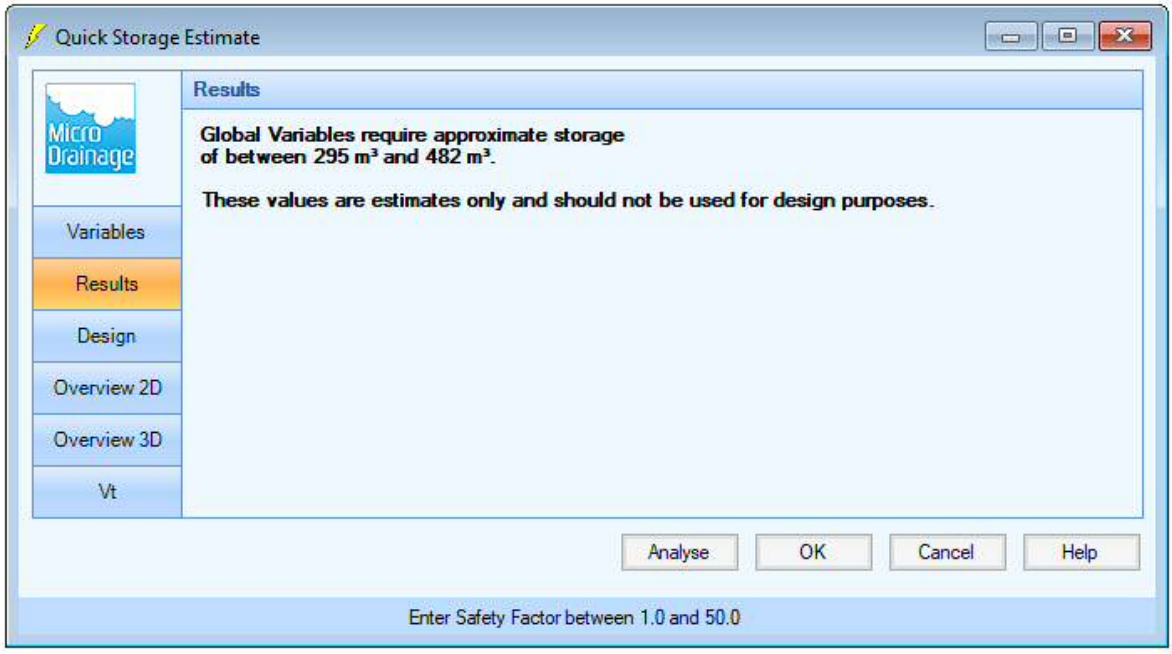
Northern Area storage Qbar





Northern Area storage 30YRP





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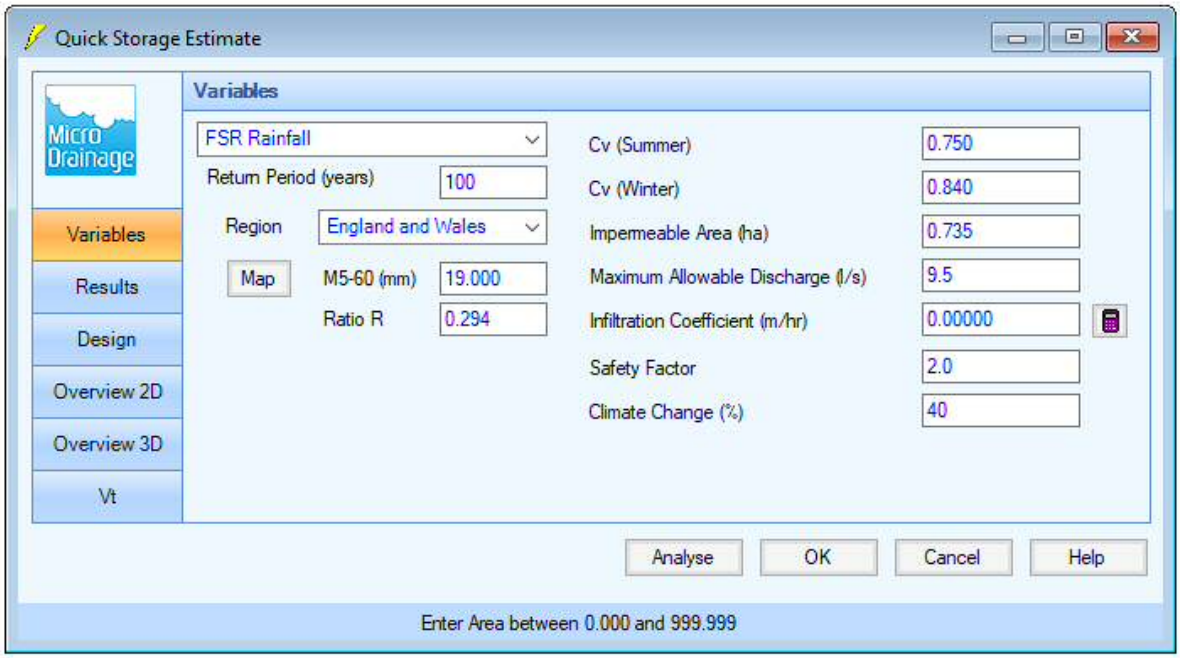
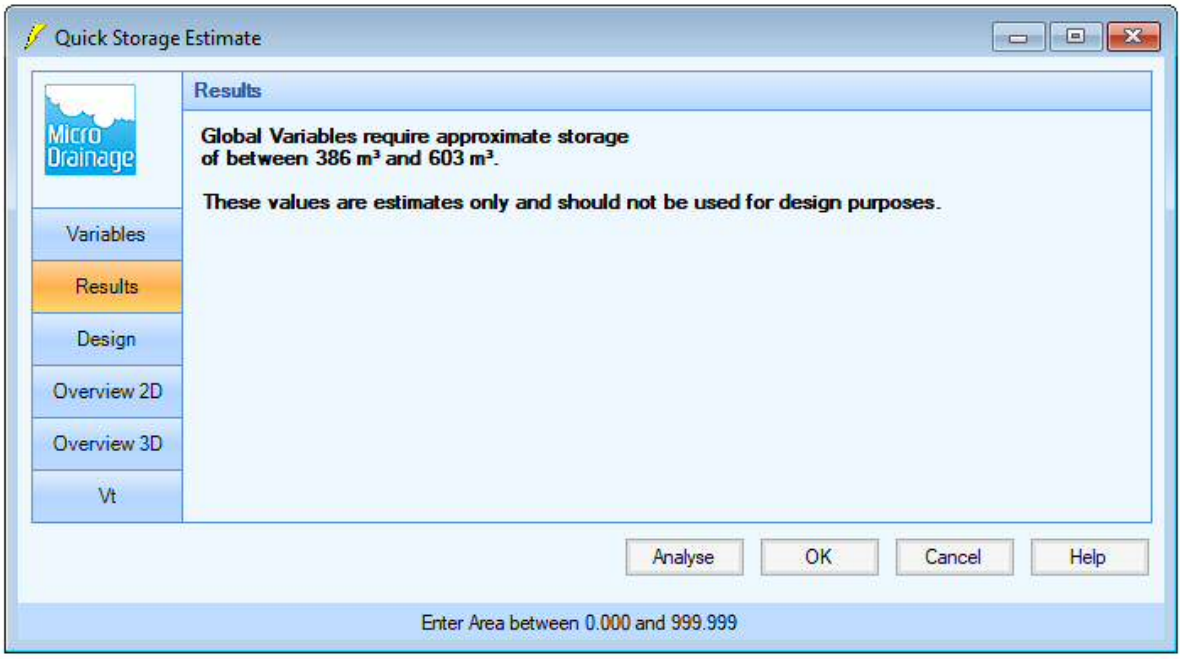
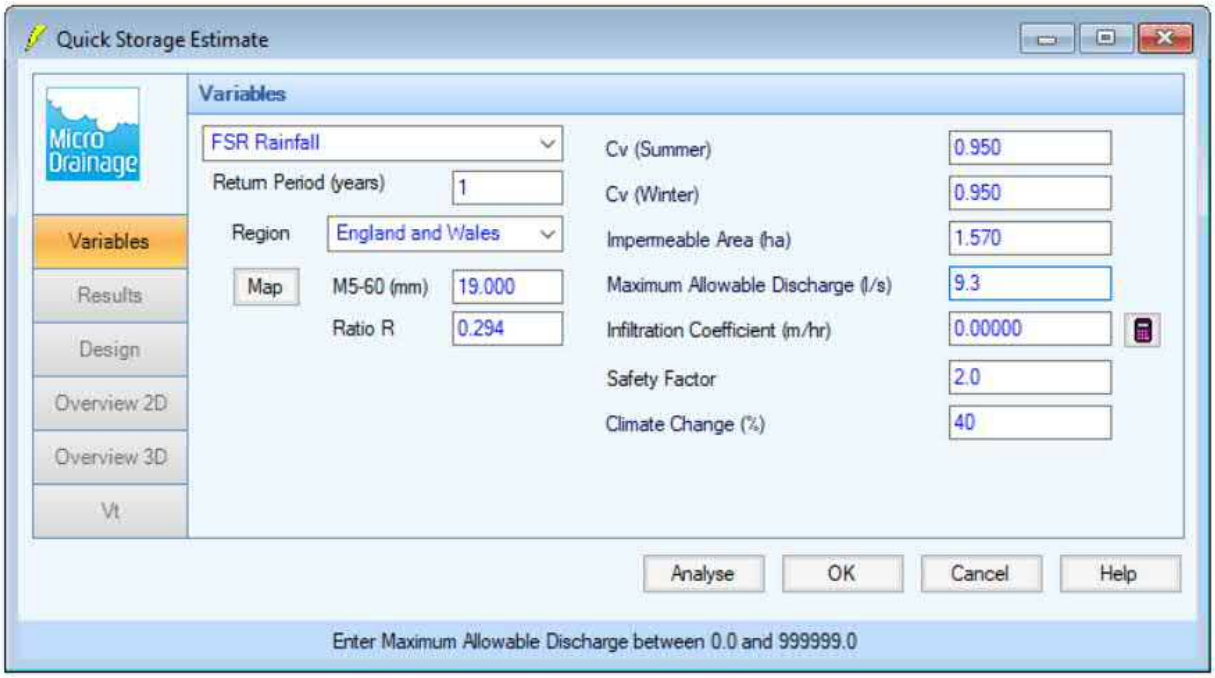
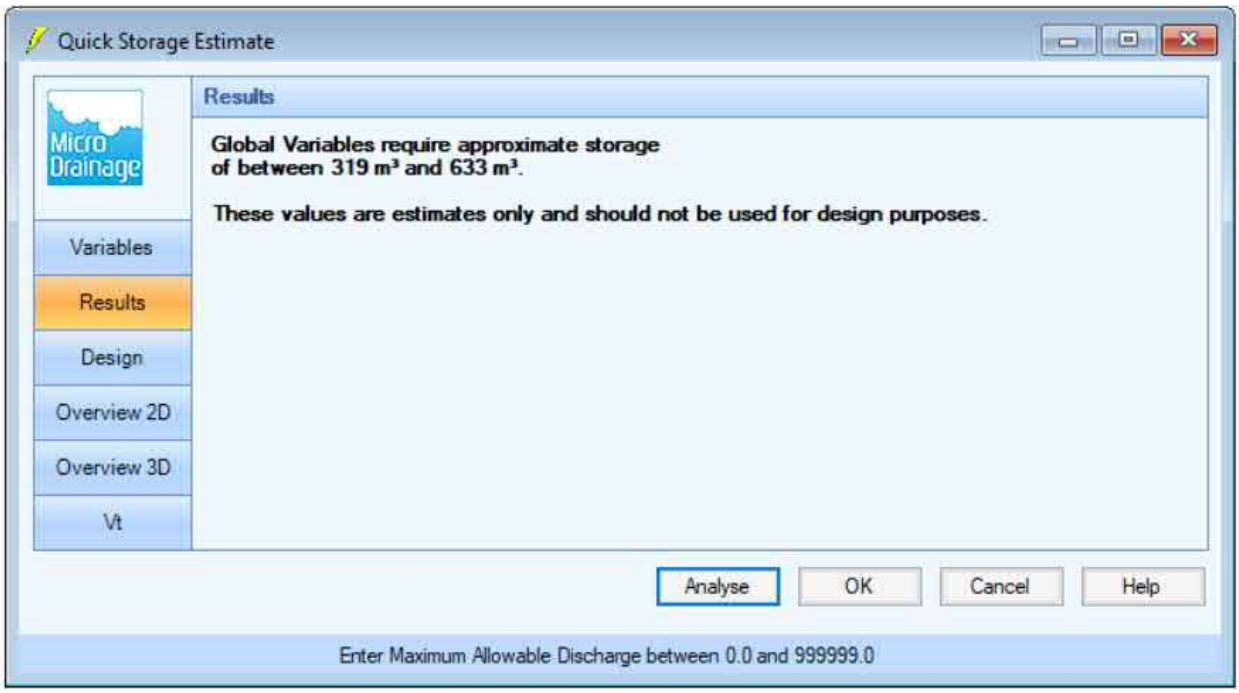




Southern Area storage Qbar





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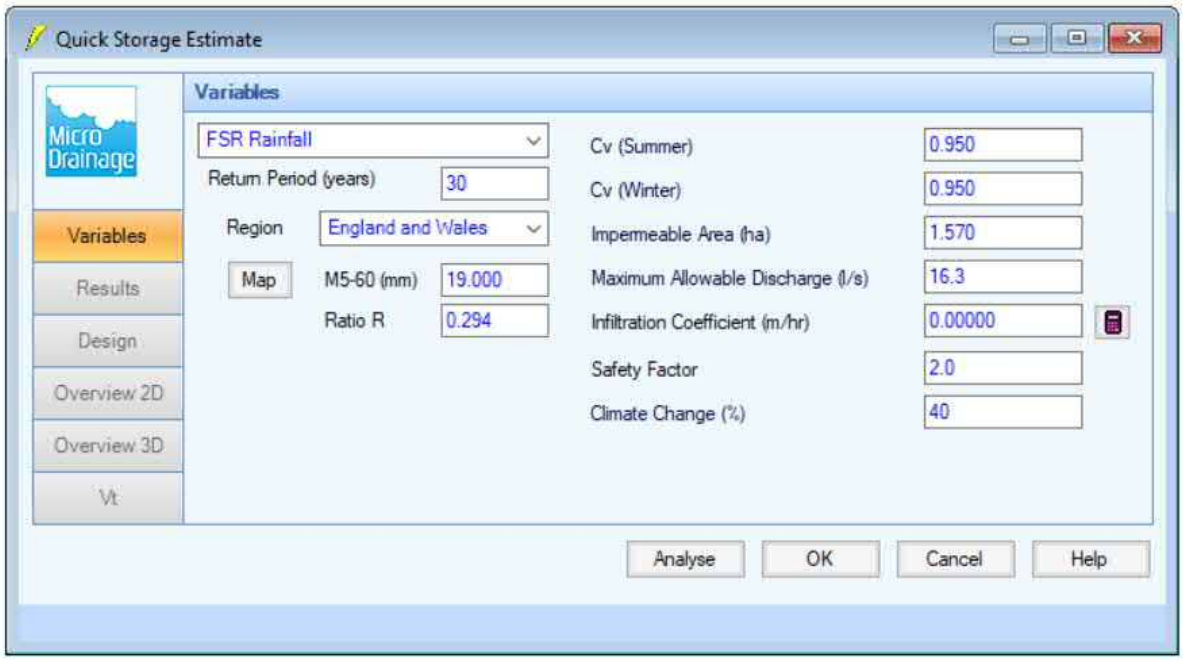

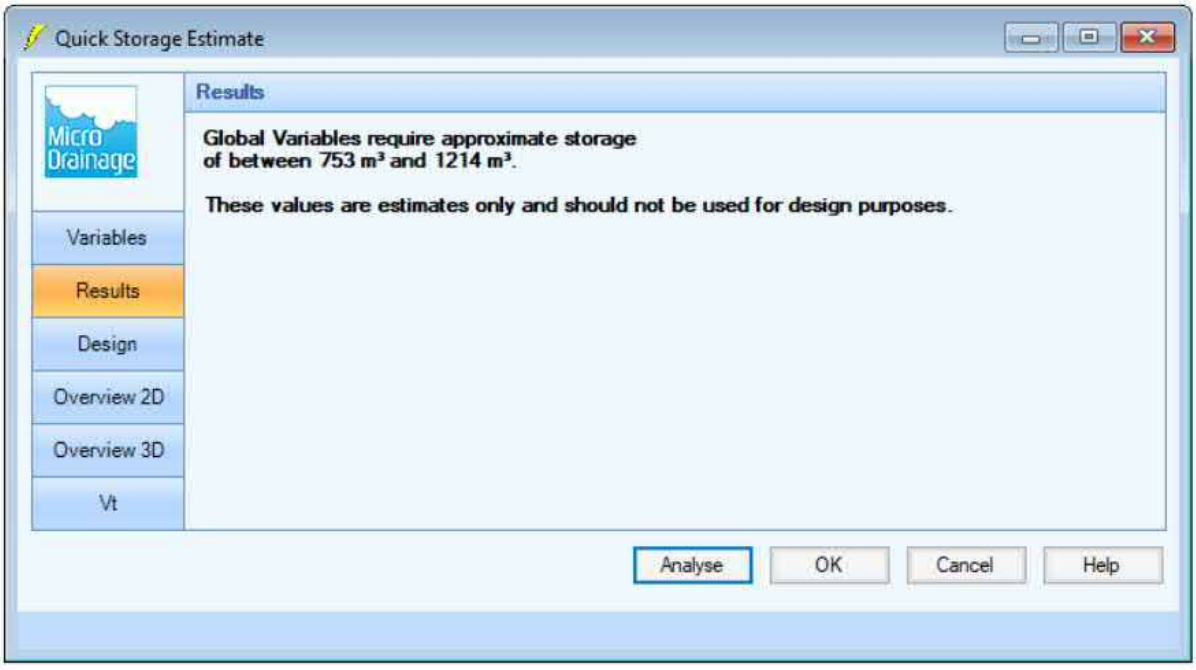

Southern Area storage 100YRP