Section 19 Flood Investigation

23rd December 2020

Sully, Vale of Glamorgan

Final Report

July 2021

www.jbaconsulting.com

Revision History

Revision Ref/Date	Amendments	Issued to
21/06/2021	Draft Report v1.0	Vale of Glamorgan Council
14/07/2021	Draft Report v2.0	Vale of Glamorgan Council
15/07/2021	Draft Report v3.0	Vale of Glamorgan Council
15/07/2021	Final Report v4.0	Vale of Glamorgan Council

Contract

This report describes work commissioned by Michael Clogg on behalf of Vale of Glamorgan Council, by an email dated 10 May 2021. Toby Jones and Bethlyn Jones of JBA Consulting carried out this work.

Prepared by ..... Toby Jones BSc MSc

Senior Analyst

Faye Tomalin BSc (Hons) MSc MCIWEM C.WEM

Chartered Senior Analyst

Reviewed by ..... Bethlyn Jones BA MSc MCIWEM C.WEM

Principal Analyst

Purpose

This document has been prepared as a Draft Report for the Vale of Glamorgan Council. JBA Consulting accepts no responsibility or liability for any use that is made of this document other than by the Client for the purposes for which it was originally commissioned and prepared.

JBA Consulting has no liability regarding the use of this report except to Vale of Glamorgan Council.

Copyright

Carbon Footprint

A printed copy of the main text in this document will result in a carbon footprint of 206g if 100% post-consumer recycled paper is used and 262g if primary-source paper is used. These figures assume the report is printed in black and white on A4 paper and in duplex.

JBA is aiming to reduce its per capita carbon emissions.

Executive summary

This report has been produced in-line with the duties placed upon The Vale of Glamorgan Council (VoCG) under Section 19 of the Flood and Water Management Act 2010. The Act states, "*On becoming aware of a flood in its area, a lead local flood authority (LLFA) must, to the extent that it considers it necessary or appropriate, investigate:*

a) which risk management authorities have relevant flood risk management functions and

b) *whether each of those risk management authorities has exercised or is proposing to exercise those functions in response to the flood*".

This Section 19 investigation provides a factual report of the storm event which occurred on 23rd December 2020 and the flooding that happened in the community of Sully as a result. The investigation focuses on the residential area located to the north of South Road, Sully and reviews evidence provided by responders and residents regarding the flood event. It has also been informed in part by Section 19 data analysis for Dinas Powys produced by JBA Consulting in March 2021.

The Section 19 data analysis report identifies that due to a series of storm events which occurred throughout the month of December 2020, the soils were already saturated prior to the rainfall on 23rd December.

The nearby Cog Moors rainfall gauge recorded an initial short and intense burst of rainfall between 09:00 and 10:00. However, the main burst of rainfall started at 12:45 and continued until 18:00, with 47.8mm of rainfall falling over this 5.25hr period, giving an average intensity of 9.1mm/hr. The maximum hourly intensity over the period was 14.4mm/hr between 14:00 and 15:00. The rainfall intensity was >10mm/hr between 13:15 and 15:30 and between 15:45 and 17:00. The storm is reported to have been equivalent to a 1 in 20 year rainfall event.

Following the flood event, VoGC issued flood incident forms to approximately 280 properties throughout the Sully area as well as conducting face to face interviews with residents by means of a door knocking exercise. Responses were received from 74 property owners/residents and it was identified that 18 properties were flooded internally and 26 externally as a result of the storm, as well as transport links being affected. The residential areas impacted were situated around Conybeare Road and Swanbridge Grove.

The source of the flooding originated from the heavy storm event which caused localised surface water flooding. The flood incident reports completed by residents within the vicinity of Swanbridge Grove identified three main flow paths; one flowing south through the disused railway embankment and two from the field east of Swanbridge Road. In addition, a further flow path was identified from the top of the adjoining field flowing down the footpath and into the Conybeare Road residential area.

The evidence gathered in this report demonstrates that the cause of the internal flooding at the residential area north of South Road, Sully was a result of heavy rainfall causing rapid runoff from the adjoining fields which overwhelmed the capacity of the surface water drainage network. The flooding of Conybeare Road occurred as a result of the heavy rainfall combined with blockage of a perched gully inlet which drains towards Brean Close.

Although there is CCTV evidence of debris build up through sections of the surface water drainage system, the event is thought to have exceeded the capacity of the drainage system and as such the impact of this build up is considered to be fairly low. However, it is noted

that the capacity of the existing surface and highway drainage system is not fully understood and so the full impact of this reduced capacity cannot be accurately determined.

Key recommendations of this report include a need for the LLFA to model the capacity of the existing surface and highway drainage systems at both locations to improve understanding of flood risk and to assess viability of FRM schemes to manage surface water flood risk at both Conybeare Road and Swanbridge Grove. Consideration should also be given to benefits of Property Flood Resilience and an enhanced maintenance schedule for the South Road surface water drainage system and for the rear of Conybeare Road. Furthermore, ownership and maintenance responsibilities of the perched gully inlet in the south west corner of the adjoining field should also be confirmed by VoGC and DCWW.

Contents

List of Figures

List of Tables

Abbreviations

AEP	Annual Exceedance Probability
DCWW	Dŵr Cymru Welsh Water
FWMA	Flood and Water Management Act 2010
JBA	Jeremy Benn Associates Ltd
LiDAR	Light Detection and Ranging
LLFA	Lead Local Flood Authority
LTA	Long Term Average
NRW	Natural Resources Wales
RMA	Risk Management Authority
SuDS	Sustainable Drainage System
S19	Section 19
TBR	Tipping bucket rain gauge
VoGC	The Vale of Glamorgan Council

Definitions

Annual Exceedance Probability: The probability that a given rainfall total accumulated over a given duration will be exceeded in any one year.

Risk: In flood risk management, risk is defined as a product of the probability or likelihood of a flood occurring, and the consequence of the flood.

Surface water flooding: Flooding as a result of surface water runoff as a result of high intensity rainfall when water is ponding or flowing over the ground surface before it enters the underground drainage network or watercourse, or cannot enter it because the network is full to capacity, thus causing pluvial flooding.

1 Introduction

1.1 Background to investigation

As the Lead Local Flood Authority (LLFA) The Vale of Glamorgan Council (VoGC) has a duty to prepare and publish the results of investigations into significant flood incidents, as detailed within Section 19 (S19) of the Flood and Water Management Act 2010 (FWMA). The Act states, "On becoming aware of a flood in its area, a lead local flood authority (LLFA) must, to the extent that it considers it necessary or appropriate, investigate:

a) which risk management authorities have relevant flood risk management functions and

b) whether each of those risk management authorities has exercised or is proposing to exercise those functions in response to the flood".

This report has been prepared for the purpose of meeting the LLFA S19 requirements by providing a detailed, factual account of the flooding that occurred in December 2020 in the vicinity of Sully, Vale of Glamorgan, South Wales. It also investigates which Risk Management Authorities (RMAs) have flood risk management functions in respect of the flooding. During this event, internal flooding was reported at 18 properties, with 12 outbuildings also affected and 24 gardens flooded. Additionally, approximately 600m of the highway and footway within the Swanbridge Grove area was affected by flood water. This report will focus on investigating the causes of the internal flooding of properties to the north of South Road (B426), Sully as a result of the storm event (Figure 1-1).

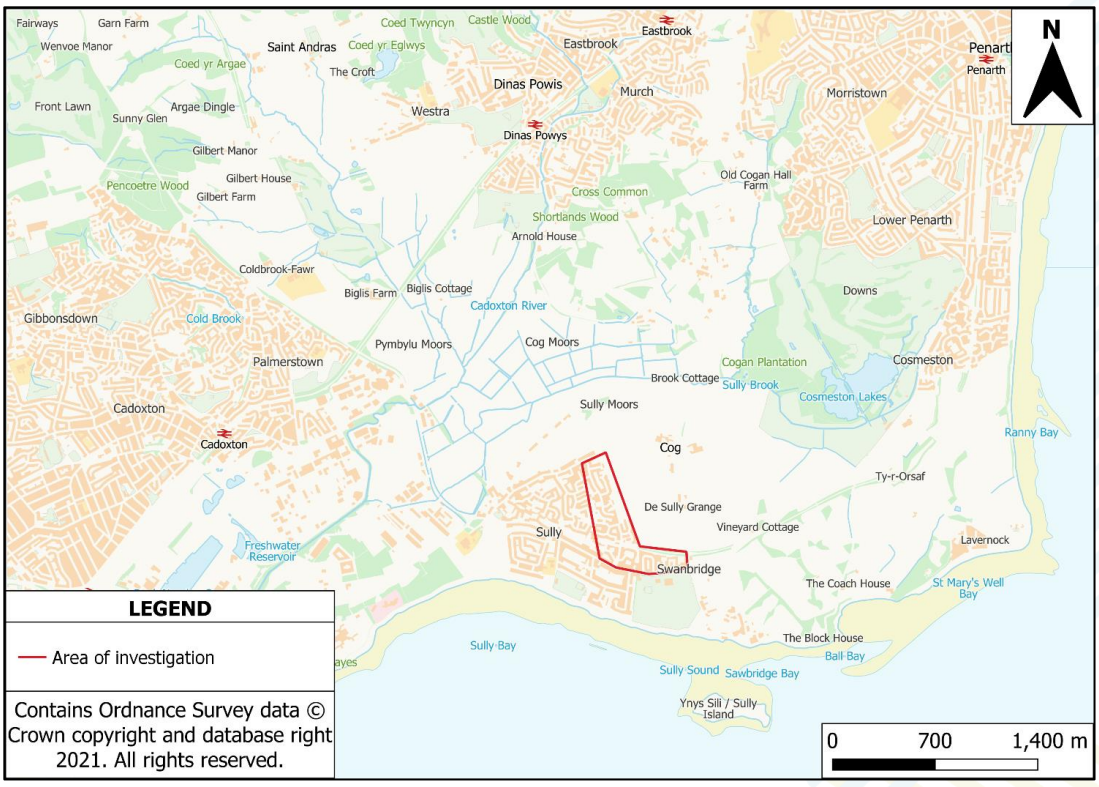


Figure 1-1 Site location

Previous to this report, a flood reconnaissance study, undertaken by JBA Consulting for Natural Resources Wales (NRW), documented widespread flooding in the area. Section 19 data analysis was also undertaken by JBA Consulting for The Vale of Glamorgan Council to collect and analyse hydrological data relating to the flood event and document the findings.

To provide an accurate account of the flood event, this S19 Report will:

- Identify events leading up to the flood;
- Investigate the number of properties flooded;
- Investigate which Risk Management Authorities (RMAs) have flood risk management functions in respect of the flooding;
- Investigate whether each RMA has exercised or is proposing to exercise those functions in response to the flood.

1.2 Site location

Sully is a large coastal village located in the Vale of Glamorgan, South Wales, approximately 18km south-west of Cardiff (Figure 1-1). The village comprises a large residential population. Key infrastructure includes the B4267, which intersects the village east to west connecting it to Barry (south-west), Penarth and Cardiff (north-east). This road is also known as Sully Moors Road as it enters Sully, then becoming South Road and finally Lavernock Road as it travels out towards the east of Sully past the junction with Swanbridge Road. The population in the 2011 census was 4,543 with a 2019 population estimate of 4,867.

The site location investigated in this report is the residential area north of South Road as identified in Figure 1-2. It forms an L-shape, bordered to the east by Swanbridge Road and then follows the boundary line of the field to the west of Swanbridge Road up to Cog Road in the north. The southern boundary of the field is characterised by a disused railway line and embankment.

This area of investigation is characterised by two sub-catchments. The residential streets affected by the flooding in the sub-catchment to the south, hereby referred to as the 'Swanbridge Grove residential area' are:

- Swanbridge Road
- South Road
- Swanbridge Grove
- Highbridge Close
- Winsford Road

The second residential area affected by the flooding in the sub-catchment to the west is Conybeare Road.

Figure 1-3 shows the topography of the site using Opensource LiDAR data. Ground levels are shown to be highest towards the north of the site, at approximately 44m AOD south of Cog Road. The ground level reduces to approximately 24m AOD towards the southern boundary of the site at South Road.

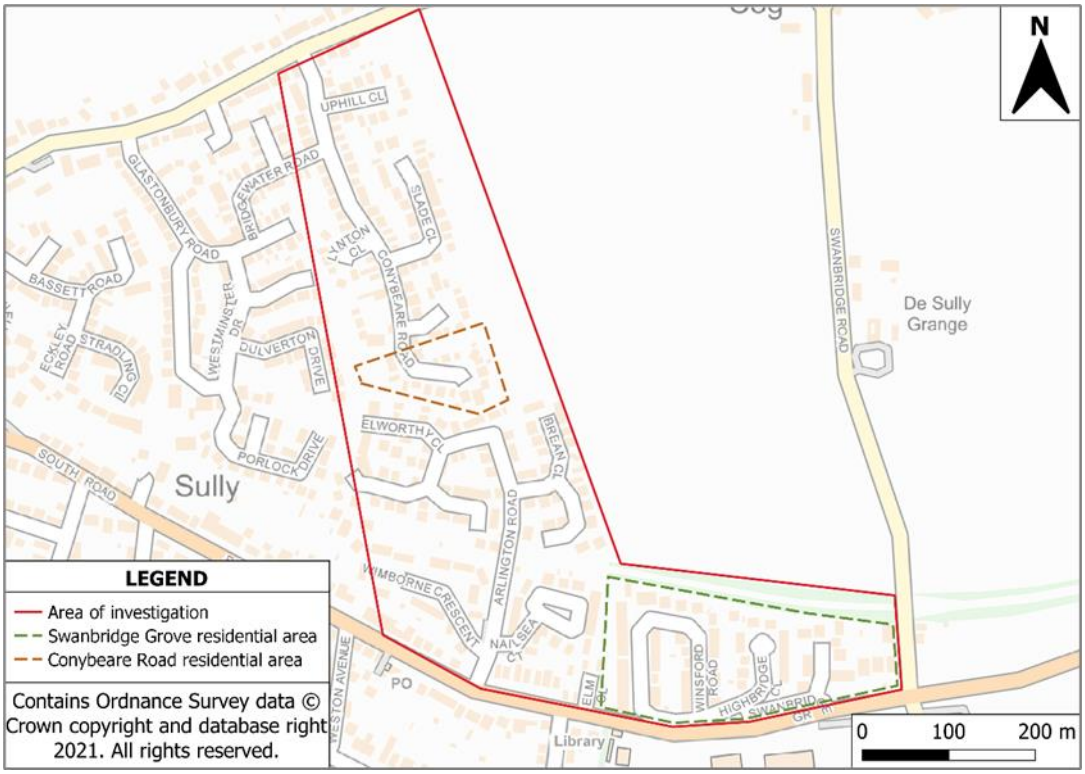


Figure 1-2 Areas of investigation

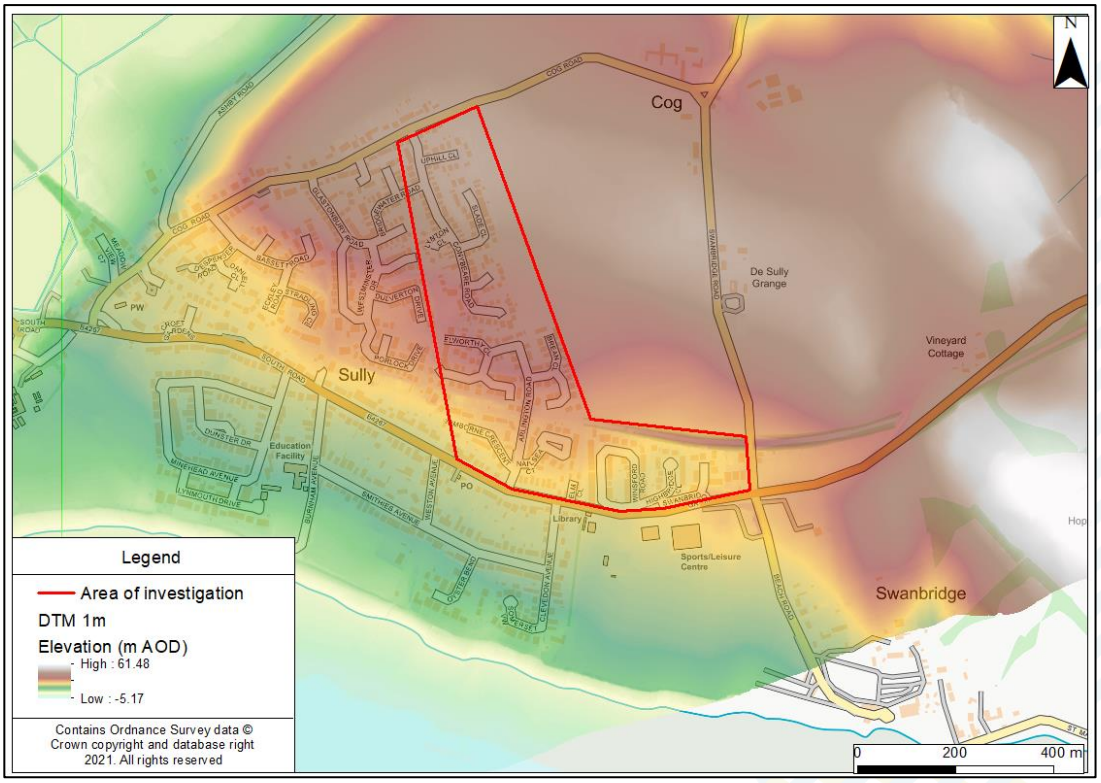


Figure 1-3 LiDAR

2 Roles and responsibilities

2.1 Duties under 'Flood and Water Management Act (2010): Section 19 - Local authorities: Investigations'

Under Section 19 of the Flood and Water Management Act 2010, the Lead Local Flood Authority, VoGC, have a duty to investigate and publish reports on flood events that occur within its area to the extent that it considers it necessary or appropriate.

(1) On becoming aware of a flood in its area, a lead local flood authority must, to the extent that it considers it necessary or appropriate, investigate -

(a) which risk management authorities have relevant flood risk management functions, and

(b) whether each of those risk management authorities has exercised, or is proposing to exercise, those functions in response to the flood.

(2) Where an authority carries out an investigation under subsection (1) it must-

(a) publish the results of its investigation, and

(b) notify any relevant risk management authorities.

2.2 Risk Management Authorities

2.2.1 Lead Local Flood Authority

The Vale of Glamorgan Council has been established as the Lead Local Flood Risk Authority (LLFA) for its administrative area under the Flood and Water Management Act 2010. It is responsible for managing the risk of flooding from ordinary watercourses, surface runoff and groundwater.

Additionally, the LLFA takes on role of the Sustainable Drainage Systems (SuDS) Adopting and Approving Body in which they are responsible for approving designs and adopting and maintaining finished SuDS.

As the LLFA, VoGC have statutory duties:

1 to prepare local flood risk management strategies;

2 to comply with the National Strategy for Flood and Coastal Erosion Risk Management;

3 to co-operate with other authorities, including sharing data;

4 to investigate all flooding within its area, insofar as a LLFA consider it necessary or appropriate;

5 to maintain a register of structures and features likely to affect flood risk;

6 to contribute to sustainable development; and

7 through consenting powers on ordinary watercourses.

2.2.2 Natural Resources Wales

Under the Flood and Water Management Act 2010 NRW has the following responsibilities:

1. Operational responsibilities for flooding from main rivers, the sea and coastal erosion.
2. Oversight responsibilities in relation to all flood and coastal erosion risk management in Wales.

Natural Resources Wales's role with regard to Flood Risk Management is primarily to reduce flood risk through the management and maintenance of drainage channels, ordinary watercourses, pumping stations and control structures. This includes constructing new flood risk management assets, maintaining levels and conducting planning assessments to consider the risks of flooding from main rivers, the sea and reservoirs, alongside an oversight role providing guidance to Local Authorities for planning and taking a strategic role for flooding from all sources.

Natural Resources Wales has a statutory duty to provide a flood warning service to communities at risk of flooding. This is provided through a direct flood warning service and is primarily for areas at risk of fluvial and coastal flooding.

2.2.3 Highways Authority

The Vale of Glamorgan Council undertake the role of the Highways Authority, being responsible for the maintenance of all adopted highways in the Vale and the associated infrastructure. This includes ensuring the highway has a drainage system that controls the surface water that enters onto the highway, providing and managing highway drainage and roadside ditches to ensure they are clear of obstructions. The above duties and responsibilities of the Highways Authority are not applicable to Trunk Roads, which are the responsibility of the Welsh Government.

2.2.4 Dŵr Cymru Welsh Water

As a Water Utility Company, the role of Dŵr Cymru Welsh Water as a risk management authority is to manage the risk of flooding to water supply and sewerage facilities and flood risk arising from their infrastructure. The main responsibilities of the Water Utility Company are to:

- Ensure their systems have the appropriate level of resilience to flooding, and maintain essential services during emergencies;
- maintain and manage their water supply and sewerage systems to manage the impact and reduce the risk of flooding and pollution to the environment;
- advise LLFAs on how their assets affect local flood risk and work with RMAs to coordinate management of flood risk management assets; and
- work with developers, landowners and LLFAs to understand and manage risks

2.3 Other Authorities

2.3.1 Network Rail

Network Rail has an operational responsibility as a riparian owner and is required to undertake regular maintenance of all assets that pose a risk to flooding.

2.3.2 Landowners and riparian owners

Riparian Landowners are legally responsible under common law for the maintenance of the land from the edge of the waterbed to the middle of the riverbed. The landowner is responsible for removal of obstructions caused within

the boundaries of their land affecting the watercourse. This includes the maintenance of the bed, banks and any boundary features e.g. through routine clearance of debris and/or blockages. Due to the surface water source of the flooding Riparian Landowner responsibilities are not applicable to this flood event.

2.3.3 Residents

Residents and property owners are responsible for the protection of their own properties against flooding. Residents have the right to defend their property provided they do not increase the risk of flooding to other properties.

2.4 Permissive Powers

Risk Management Authorities have direct permissive powers under the Flood and Water Management Act 2010, as well as the Land Drainage Act 1991. For NRW and the LLFA this includes:

- Powers to request information.
- The ability to raise levies for local flood risk management works.
- Powers to designate certain structures or features that affect flood or coastal erosion risk.
- The expansion of powers to undertake works to include broader risk management actions.
- The ability to cause flooding or coastal erosion under certain conditions.

3 Stakeholder engagement

Following the flooding in December 2020, VoGC issued flood incident forms to approximately 280 properties throughout the Sully area as well as conducting face to face interviews with residents by means of a door knocking exercise. Responses were received from 74 property owners/residents regarding the impact of flooding. From this engagement, information was collated regarding:

- date of flooding;
- extent of flooding to private land and properties;
- depth of flooding on private land and in properties;
- perceived source/cause of flooding; and
- impacts and estimated cost of damages.

In addition, photographs and videos of the flooding were provided by residents that were used in investigations for this report.

4 Catchment characteristics

4.1 Drainage system

It should be noted that responsibility for different sections of drainage systems lies with individual RMA's, and that RMA's have different system capacity targets for their drainage networks. DCWW aim to maintain a 1 in 30 year (0.33% AEP) capacity, while the Highways Authority aims to maintain a 1 in 5 year (20% AEP) capacity. It should be noted that any DCWW surface water system is designed to take roof and yard drainage only, whilst the highway network is designed to take flows from the highway only. Most systems are not designed with the intention of receiving sheeting overland flows from greenfield areas.

4.1.1 Swanbridge Grove residential area

4.1.1.1 Surface water

The surface water network in the Swanbridge Grove residential area is primarily managed by the Highways Authority and DCWW with private sewers serving individual residential properties.

The DCWW surface water network, an extract of which is shown in Figure 4-1 with the full plan contained in Appendix A, runs from Highbridge Close, Swanbridge Grove and Winsford Road, down to South Road before tracking south by the public library, parallel to Clevedon Avenue, and discharging into the sea at an uncontrolled rate. The outfall is located at a higher elevation than the tidal range at this location and therefore the outfall discharges freely during all storm events.

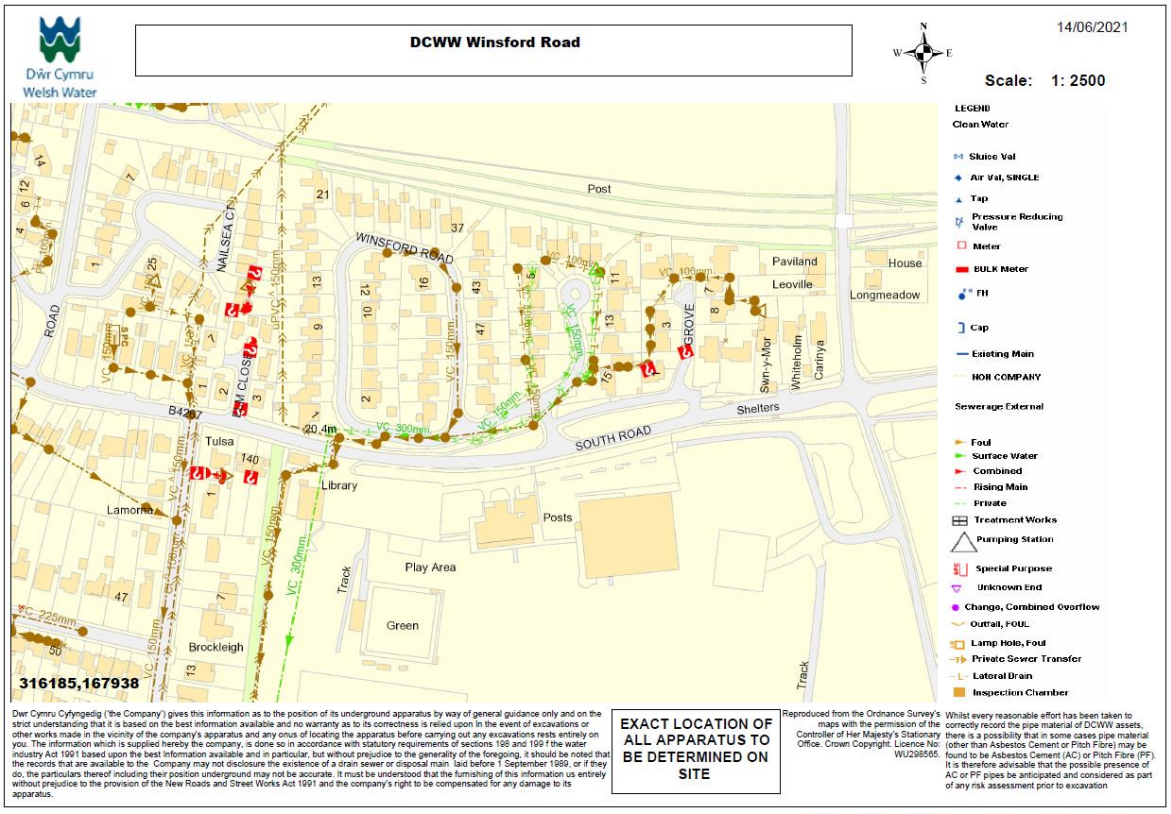


Figure 4-1 DCWW Public Sewerage Network

A private sewer runs from South Road in a southerly direction across Sully Sports Fields, to an outfall into the Severn Estuary, as shown in Figure 4-2.

The highway surface water network within Highbridge Close, Swanbridge Grove and Winsford Road is drained via the highway gullies which are reported to be cleansed annually. The water discharges to the public DCWW network detailed above.

On Swanbridge Road there is an open channel which collects highway run off, located north of the railway bridge. The channel discharges into the highway surface water network at the location of the railway bridge. The highway network at this location, shown in Figure 4-2, flows in a southerly direction along Swanbridge Road and Beach Road prior to discharging into the sea at an uncontrolled rate. The outfall is situated above the tidal range and the system would therefore discharge freely during all storm events. This highway system is designed to take flows from the highway only, and not to receive sheeting overland flows from the surrounding fields. Full bore pipe capacity of the 150mm dia clay pipe along Swanbridge Road to the junction of South Road is estimated at 19.4l/s.

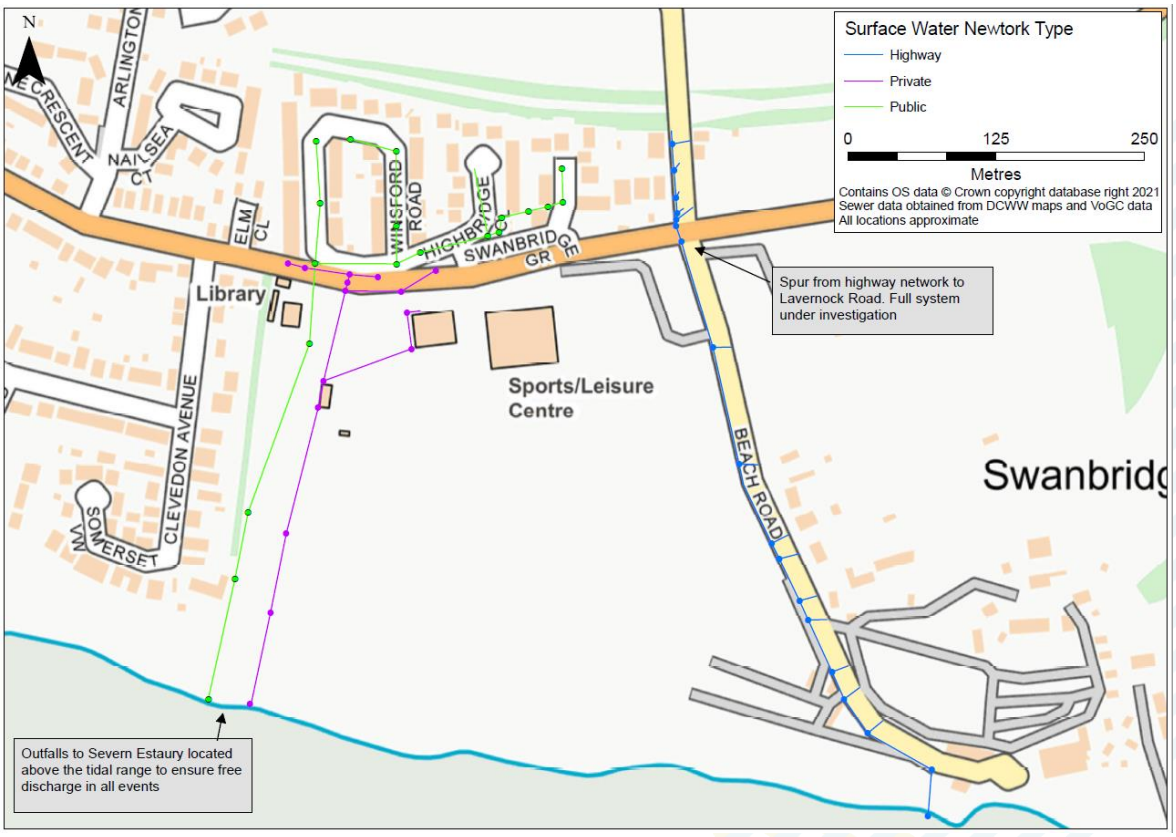


Figure 4-2 Swanbridge Grove Investigation Area Surface Water Network

4.1.1.2 Foul drainage

The foul system servicing Swanbridge Grove and Highbridge Close is still shown as under private sewer transfer on DCWW sewer maps, as shown in Figure 4-1 above. The system connects into the public foul sewer network servicing Winsford

Road, which then flows in a southerly direction under South Road towards the coast and the wider public foul network.

4.1.2 Conybeare Road residential area

4.1.2.1 Surface water

The highway network drainage system extends to the footpath running along the rear of Conybeare Road where this footpath forms part of the adopted highway. A series of four gullies and channel drain receive surface water flows from the footpath and enters the DCWW surface water sewer in the footpath between 71 and 76 Conybeare Road, as shown in Figure 4-3.

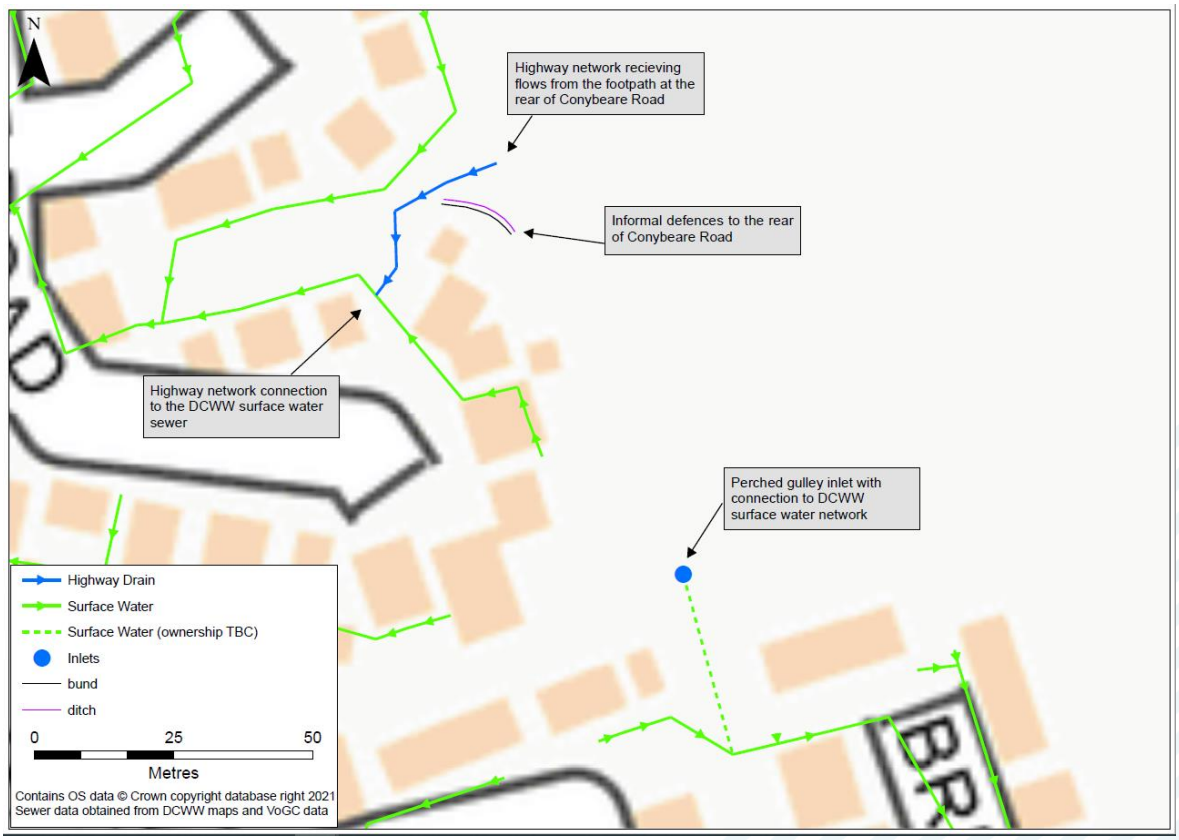


Figure 4-3 Conybeare Road Surface Water Network

The highway drainage system serves the public footpath and is not intended to cope with sheeting overland flows from the adjacent land. The public surface water sewer flows primarily to the rear of the residential properties prior to forming part of the wider Sully public system, as shown in Figure 4-4 and Appendix B.

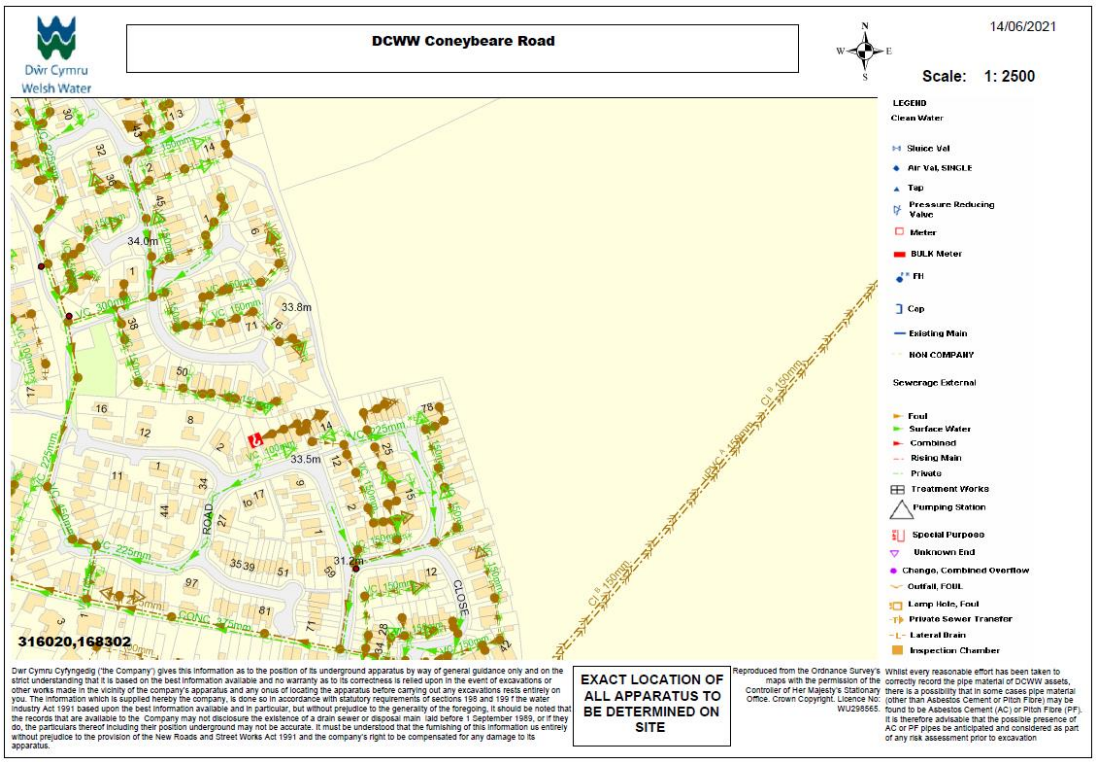


Figure 4-4 DCWW drainage lines Conybeare Road

A perched gully inlet that connects to a DCWW surface water sewer is located at the south-west corner of the Conybeare Road residential area. This asset is designed to allow surface water to pool around it and the sediment contained within to settle. As the level of water surrounding the gulley rises sufficiently to require draining, water free from sediment enters the inlet. Whilst the DCWW sewer maps do not show this inlet, design drawings from the original development in 1984 show this inlet as an original feature which joins to the DCWW surface water sewer to the north of Brean Close (Appendix C). An extract of this plan is shown in Figure 4-5 below, and the DCWW drainage network is shown in Figure 4-4 above. Due to the impact that a blockage of the inlet could have on the adjacent community, adhoc repairs have been undertaken by VoGC on a reactive basis. However, ownership and maintenance responsibilities for this asset remain unconfirmed.

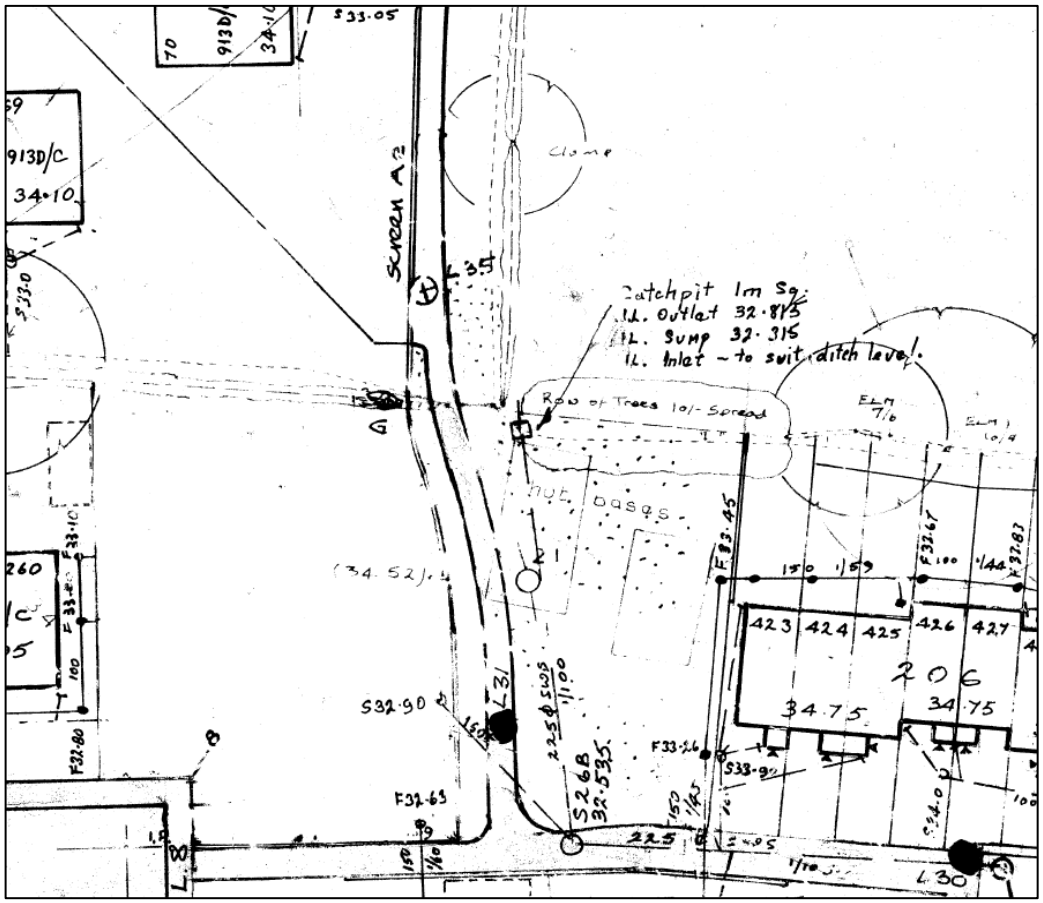


Figure 4-5 Original Sully development plans

The DCWW surface water systems serving Brean Close and Conybeare Road form separate systems which converge east and south of the two areas, respectively.

To the rear of Conybeare Road, is a small informal flood defence installed with the intention of managing surface water. This is comprised of a small bund and ditch to the rear of 76 Conybeare Road, as shown in Figure 4-3 above and Figure 4-6 below.

Figure 4-6 Informal defences to the rear of Conybeare Road (picture provided by VoGC)

4.1.2.2 Foul drainage

The foul system servicing Conybeare Road connects to the public foul sewer network, which serves the wider Sully area.

4.2 Catchment characteristics

High land to the north of the site and at the northern end of the adjoining field acts as a natural watershed for the Cadoxton catchment to the north and for the Sully Coastal catchment to the south. Within the Sully Coastal catchment, surface water runoff is considered the principal flooding mechanism where surface water flows in a southerly direction, across the site area, to the sea.

The Sully Coastal catchment is predominantly underlain by Triassic Rocks comprised of mudstone, siltstone, and sandstone. There are smaller areas of Carboniferous Dinantian Rocks (limestone with subordinate sandstone and argillaceous rocks), and Jurassic Lias Group (mudstone, siltstone, limestone, and sandstone). Superficial deposits of alluvium (clay, silt, and sand) are found along, and in the areas adjacent to, the nearby watercourse. Soils are predominantly loamy and clayey with impeded drainage, with freely draining soils in smaller areas to the north and south of the catchment. Sully is located in an area formed primarily of Sedimentary Bedrock with loamy freely draining soils.

4.2.1 Surface water runoff catchments

2m LiDAR and 0.5m contour lines were used to derive surface water catchments in and around the area of investigation, as shown in Figure 3-6. The key catchments of interest in this area are discussed in more detail below.

4.2.1.1 Catchment C

A slight ridge in the topography east of Conybeare Road creates a steep catchment (C) which channels surface water towards Kingsley Close and Conybeare Road.

The catchment is mainly comprised of agricultural land. However, at the top of the catchment, construction of a residential development site is underway for Taylor Wimpey plc (planning reference 2019/00111/RES). The development is comprised of 325 new homes, areas of public open space and highways infrastructure, with the use of SuDS techniques to manage surface water. At the time of the flood event, construction of the site was not complete. It should be noted that the majority of the Taylor Wimpey development site is located within Catchment A, which naturally drains towards the north east.

4.2.1.2 Catchments E to H

Swanbridge Road forms a boundary between catchments E and F where water is conveyed in a southerly direction towards the disused railway embankment. It is likely that surface water from catchment E pools against this embankment before percolating through the embankment to the properties in Winsford Road, Highbridge Close and Swanbridge Grove.

Within Catchment F water is conveyed in a southerly direction and escapes onto Swanbridge Road flowing in a southerly direction south of the railway bridge. The surface water then combines with water from Catchment G, which has been deflected by the disused railway embankment, flowing in a south-westerly direction towards Swanbridge Road, and subsequently pooling in areas of low ground around Winsford Road and Highbridge Close.

The area will also receive surface water flows from catchment H, further increasing the amount of surface water in this location.

It should be noted that Winsford Road and Highbridge Close have the lowest local ground levels, and this results in surface water from Catchments E, F, G and H pooling in this area. Ground levels of South Road are higher than those across Winsford Road and Highbridge Close, resulting in surface water entering Winsford Road ponding with no means of escape.

The UK SUDS tool has been used to calculate Greenfield runoff rates for each catchment using the FEH Statistical Method, with the results shown in Table 4-1 and the Greenfield runoff volumes shown in Table 4-2. A climate change allowance of 20% and 40% was used for these calculations in line with Welsh Government guidance[1]. The Greenfield runoff volumes were calculated for a 6 hour 100 year storm event from the FEH Web Service[2].

[1] Adapting to Climate Change. https://gov.wales/sites/default/files/publications/2019-06/adapting-to-climate-change-guidance-for-flood-and-coastal-erosion-risk-management-authorities-in-wales.pdf
[2] FEH Web Service. https://fehweb.ceh.ac.uk/

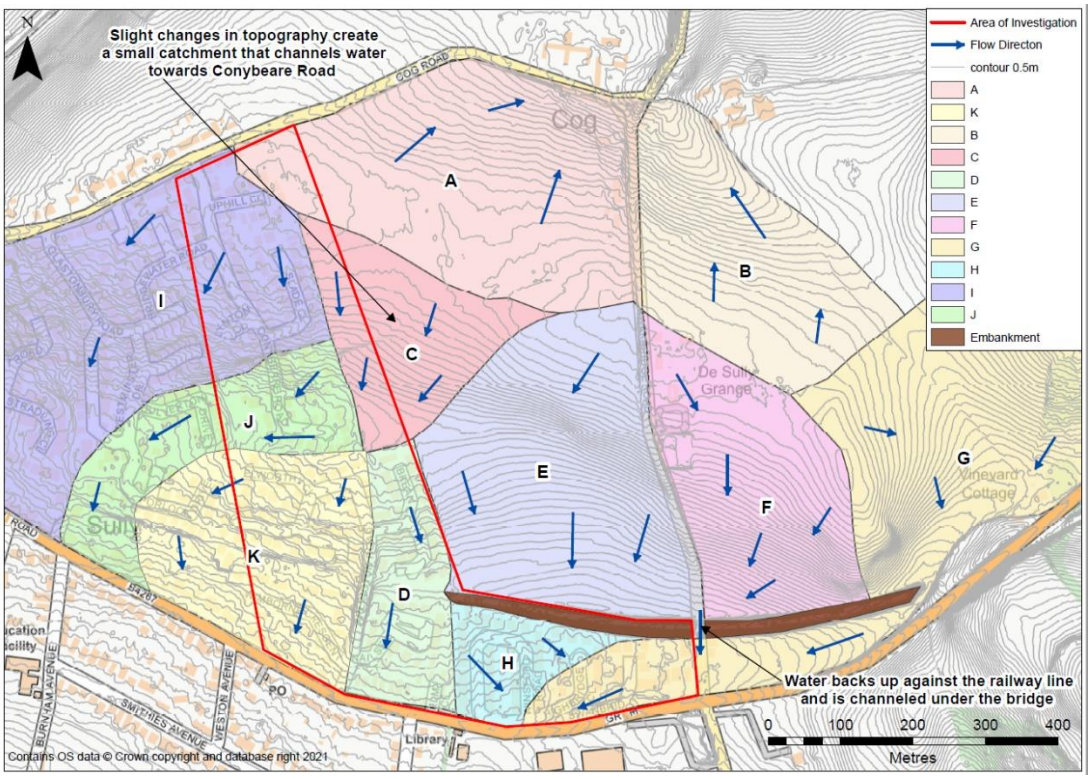


Figure 4-7 Surface water runoff catchments

Table 4-1 Greenfield Runoff Rates

			Greenfield Runoff Rates			
Catchment	**Catchment Area (Ha)**	**QBAR (l/s)**	**3.3% AEP (l/s)**	**1% AEP (l/s)**	**1% AEP with 20% climate change (l/s)**	**1% AEP with 40% climate change (l/s)**
A	13.2	30.4	54.1	66.2	79.4	92.7
B	8.3	19.1	34.0	41.6	49.9	58.2
C	5.2	12.0	21.3	26.1	31.3	36.5
D	4.0	9.2	16.4	20.1	24.1	28.1
E	12.9	29.7	52.8	64.7	77.6	90.6
F	8.7	20.0	35.6	43.6	52.3	61.0
G	16.5	38.0	67.6	82.8	99.4	115.9
H	2.3	5.3	9.4	11.5	13.8	16.1
I	21.1	48.6	86.4	105.8	127.0	148.1
J	5.4	12.4	22.1	27.1	32.5	37.9
K	7.8	18.0	31.9	39.1	46.9	54.7

Table 4-2 Greenfield Runoff Volumes

			Greenfield Runoff Volumes			
Catchment	**Catchment Area (Ha)**	**QBAR (m3)**	**3.3% AEP (m3)**	**1% AEP (m3)**	**1% AEP with 20% climate change (m3)**	**1% AEP with 40% climate change (m3)**
A	13.2	819	1629	2367	3011	3695
B	8.3	515	1024	1488	1893	2324
C	5.2	323	642	933	1186	1455
D	4.0	248	494	717	912	1119
E	12.9	800	1592	2313	2943	3611
F	8.7	540	1074	1560	1985	2436
G	16.5	1024	2036	2959	3764	4619
H	2.3	143	289	412	524	644
I	21.1	1310	2604	3783	4814	5906
J	5.4	335	666	968	1232	1512
K	7.8	484	963	1398	1779	2184

Due to the Greenfield and permeable nature of the catchments (siltstone and sandstone overlain by freely draining slightly acid but base-rich soils as defined by BGS and Soilscapes) surface water runoff from the site would be expected to be low. However, the topography around the area of interest, along with a clayey topsoil as a result of farming practices in the area, creates catchments that channel surface water to specific points and can lead to an increase in runoff. This combined with the number of catchments that lead to one area (e.g water from Catchments E to H all flows towards Winsford Road), causes high levels of surface water runoff that exacerbates flooding in the adjacent residential areas. This is especially true around Conybeare Road and Winsford Road.

5 Information gathering

5.1 Flood risk

5.1.1 Long-term flood risk information

The Natural Resources Wales (NRW) long-term flood risk map from Rivers and from the Sea shows the site is wholly located within Flood Zone 1 for both Rivers and Sea meaning flood risk is Very Low and has a less than 1 in 1,000 (<0.1% AEP) chance of river flooding in any year (Figure 5-1).

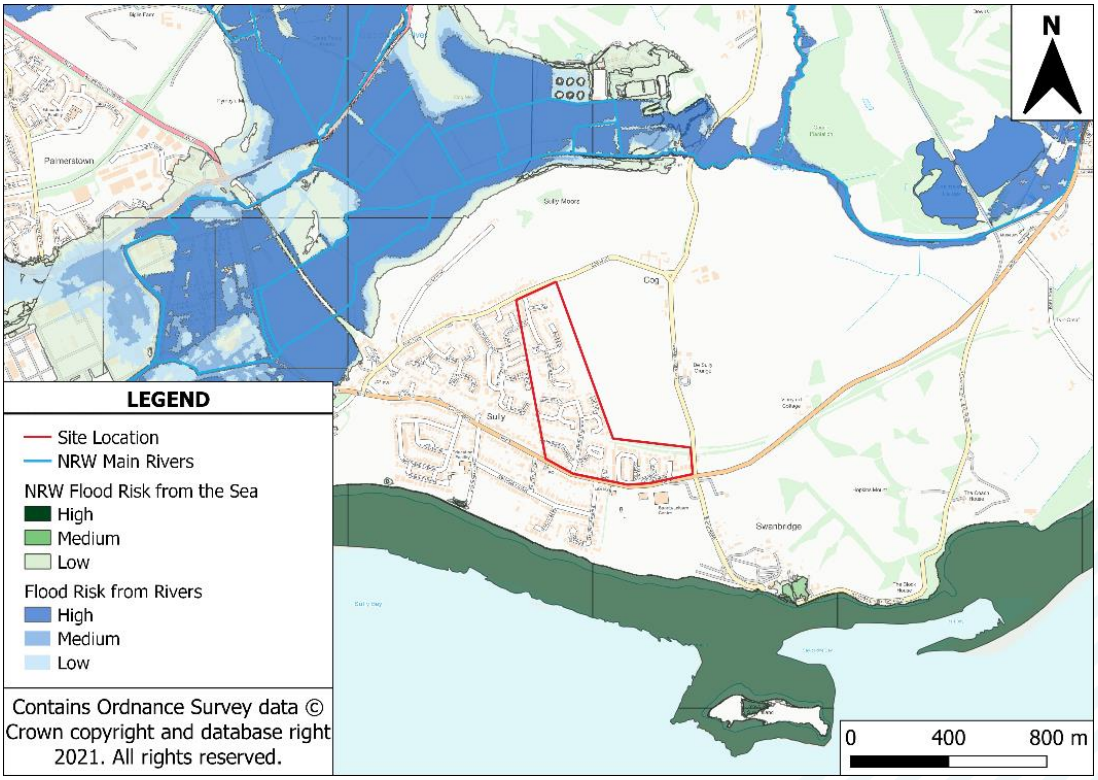


Figure 5-1 Risk of flooding from rivers and the sea

The NRW Flood Map for Surface Water shows the site has a mixed flood risk from surface water. Pooling of surface water on Winsford Road, Highbridge Close and off Conybeare Road to the east and west have resulted in these areas being at high risk of surface water flooding. A high risk of surface water flooding is defined as a greater than 1 in 30 chance of flooding in any year as a result of local rainfall (Figure 5-2).

Similarly, the southern boundary of the adjacent field is also at high risk from surface water flooding as surface water may accumulate along the disused railway embankment.

Additionally, small areas off Elworthy Road and Swanbridge Grove are at low risk, meaning these areas have between a 1 in 1000 (0.1%) and 1 in 100 (1%) chance of flooding in any year as a result of rainfall.

There are no groundwater level measurements available within the vicinity of the site.

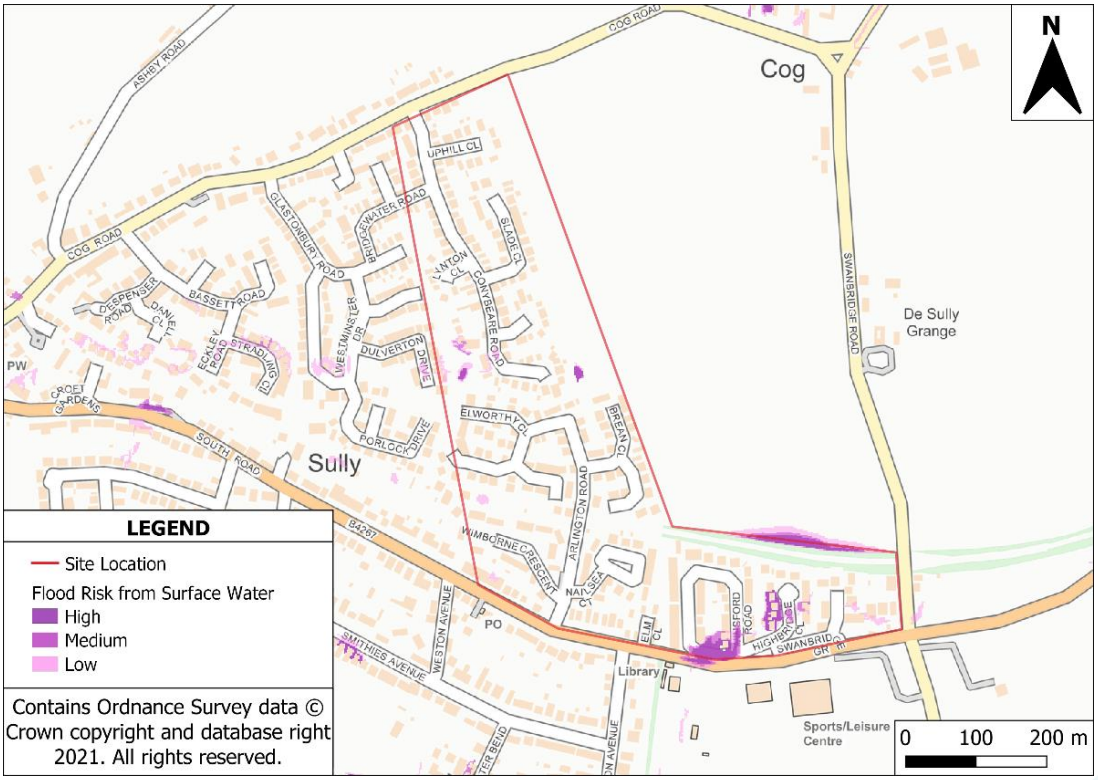


Figure 5-2 Risk of flooding from surface water

5.1.2 Flood history

Table 5.1 details the known flood history of the area of investigation in Sully, South Wales, based on records held by VoGC. Whilst Sully has proven to be prone to surface water flooding it should be noted that the whole area being investigated does not have a history of flooding and with the residents most affected having not experienced flooding during their occupancy.

Table 5-1 Flood history

Date	Source of flooding	Description of impacts
October 1998	Surface water	External flooding gardens, internal flooding to ground floors of 3-5 properties on Conybeare Road. External flooding of one property on Arlington Road.
October 2000	Surface water	External flooding gardens, internal flooding to ground floors of 5 properties on Conybeare Road. External flooding of one property on Arlington Road and flooding of highway.

22/12/2012	Surface water and highway drainage	Heavy rainfall water run off retained behind disused railway embankment percolating through and causing 1 garage to flood and serious external flooding of 7 properties abutting to the south.
31/02/2015	Unconfirmed; likely surface water flooding	Severe Highway Flooding on South Road, Sully and subsequent flooding from Highway to one property causing significant external flooding and internal flooding.
21/11/2016	Surface water	Conybeare Road, Sully. Surface water flooding due to sheeting overland flows from farmland to the rear. 1 property internally flooded and 4 externally flooded.

6 Hydrological analysis of the December 2020 event

6.1 Conditions at the time

The overall rainfall for January to December 2020 was above average across most of the UK, particularly across western regions. December featured a series of cyclonic systems, with successive spells of unsettled weather generating rainfall over saturated ground. Overall, December rainfall was substantially above average with 139% of the long-term average (LTA) for the UK and in a broad portion of Wales rainfall exceeded 150% of the LTA.

Soil moisture deficits (SMD) were near-zero across the whole of the UK, the wettest soils for late December at a national scale since 2012, meaning there was little capacity for the ground to retain additional water. Mean river flows over January to December 2020 were exceptionally high in Wales. As a result of these conditions surface water flooding causing significant disruption was a recurrent characteristic of the month.

6.2 Overview of Event

The flood event on 23rd December 2020 occurred in response to a short and intense storm event. A short sharp period of intense rainfall was observed between 09:00 and 10:00 at Cog Moors Sewage Treatment Works (STW) TBR rain gauge (the closest rain gauge to the site), recording 8.2mm in 1 hour. After a period of no rainfall for 1.5 hours and 1mm between 11.30 and 12.00 a longer period of persistent heavy rainfall between 12:45 and 18:00 occurred. During this 5.25hr period 47.8mm of rain fell with an average intensity of 9.1mm/hr. The maximum rainfall intensity occurred between 14:00 and 15:00 equalling >10mm/hr. Figure 6-1 below shows the rainfall hyetograph of the flood event at the Cog Moors STW TBR, as detailed in the Section 19 Data Analysis report undertaken by JBA Consulting.

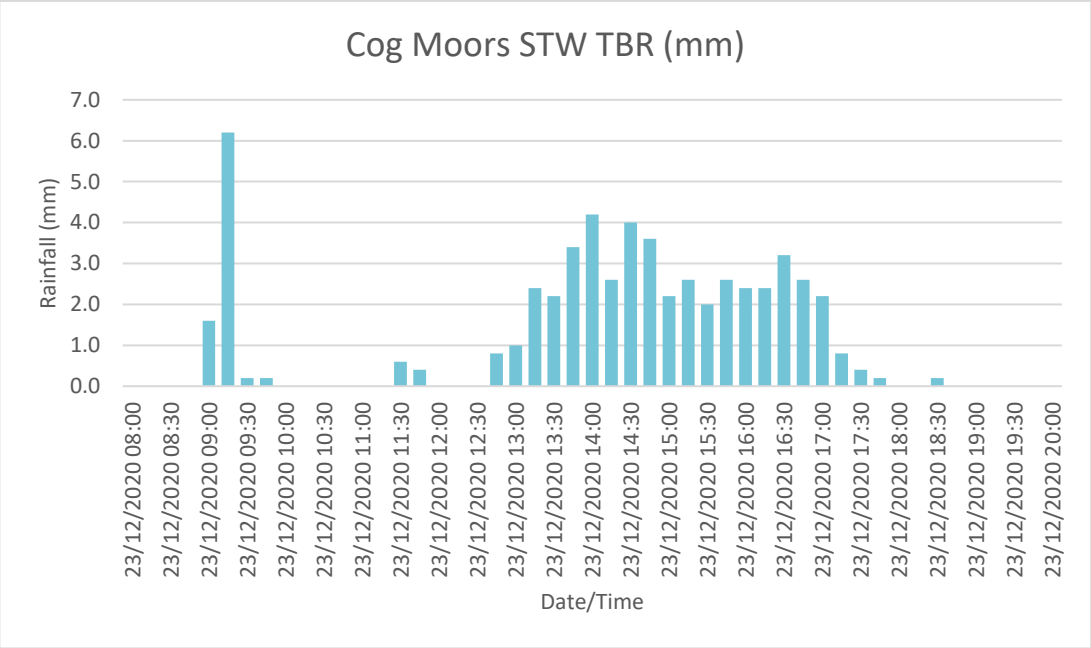


Figure 6-1 Rainfall hyetograph of December 2020 flood event

As described above, prior to the flood there had been a succession of storm events, which had left behind a highly saturated catchment. As a result of this there would have been little capacity for storage within the catchment. The tidal range at Sully was below the river level throughout the storm event, indicating that tides did not have an adverse impact on flood risk.

The outcome of this high volume of rainfall falling on a saturated catchment was rapid flows of surface water run-off across non-permeable urban surfaces and slopes. These flows pooled at lower elevations This also caused problems for the surface water sewer network, which was unable to cope with a large volume of water over this short timeframe.

The days following the event were comparatively dry in the area with short periods of light rainfall on the 24th and 26th December and no impacts resulting from the additional rainfall were reported.

6.3 Timeline of Event

A timeline of the incident response is given Table 6-1.

Table 6-1 Timeline of incident response

Date & time	Activity/event	Agency
23/12/2020 13:45	Received alarm from St Richard Gwyn Gauging Station on the Coldbrook.	VoGC
23/12/2020 15:50	Email received by FCERM Inbox regarding flooding at Millbrook Road, Dinas Powys.	VoGC
23/12/2020	Several reports of Flooding during the evening.	VoGC

	Reports of flooding included: • Highbridge Close, Sully • South Road, Sully • Swanbridge Grove, Sully • Swanbridge Road, Sully • St Marys Well Bay, Sully • Wynsford Road, Sully • Ashby Road, Sully • Sullymoors Road, Sully Emergency room opened.	
23/12/2020	Sully Moors Road closed by Police	Police
24/12/2020	Email received by planning enforcement regarding flows from adjoining field (Taylor Wimpey development site) onto Cog road and flooding of Conybeare Road Sully. Reported that farmer had been in field on 23/12/2021 clearing ditch and inlet. This appears to have been in reference to excavating the perched gully inlet.	VoGC
07/01/2021	Visited Taylor Wimpey site and Conybeare Road outlet structure, undertook inspection and reported to VoGC.	VoGC
17/01/2021	Email received regarding highway gully flooding at Brean Close during storm event. Contacted Welsh Water (DCWW) who reported no issues with system.	VoGC
19/01/2021	VoGC visited Taylor Wimpey site and Conybeare Road outlet structure. Undertook temporary repair, undertook inspection and reported to VoG. VoGC inspected manholes at Brean Close found blockage and arranged for cleansing.	VoGC
04/02/2021	VoGC inspected Taylor Wimpey development site and Conybeare Road outlet structure.	VoGC
05/03/2021	VoGC inspected Taylor Wimpey development site and Conybeare Road outlet structure.	VoGC

7 Source-pathway-receptor analysis

7.1 Source

7.1.1 River and sea

As established in Section 5, the site being investigated is at very low risk of flooding from rivers and the sea and are not considered a source of flooding for this flood event. There are no drainage systems that connect to the river. Highway gullies and public and private sewers discharge at an uncontrolled rate into the sea but the tidal range would not have affected the discharge rate. Additionally, locally impermeable rock formations will have impeded drainage and local soils were saturated.

7.1.2 Extreme rainfall

The primary source of the flood water is the extreme rainfall experienced across South Wales on 23rd December 2020 and in particular around Sully.

This investigation presents Cog Moors STW TBR gauge data due to it being the closest gauge to the site being investigated. Rainfall totals at other local rain gauges were also assessed for the 23rd December 2020 event (detailed in Table 7-1) that provide context for the storm event across South Wales. Note: Rain fell at slightly different times at the gauges, hence the period and duration vary for each.

The findings indicate that the Cog Moors STW TBR gauge recorded substantially larger rainfall totals than at the other gauges within the vicinity of the storm event (see Figure 7-1). NRW have indicated confidence in the Cog Moors STW TBR gauge due to the data being consistent between the primary and secondary gauges that operate independently and after quality checks undertaken on 31st December following the event. Rainfall radar data did not indicate a localised storm around Cog Moors STW TBR, so it is unclear why local rainfall totals differ so substantially from other rain gauges.

The Dinas Powys S19 Data Analysis Report provided an analysis to estimate the flood frequency. The inference of flood rarity from rainfall data is seldom accurate, as treating rainfall rarity as a measure of flood rarity neglects the complex scenarios leading to flood formation. Therefore, a flood frequency specific to the site investigated in this S19 report is not inferred. However, the rainfall frequency estimation suggested Cog Moors STW TBR indicates a frequency of about 5% AEP (20yr return period) and the other rain gauges suggest a frequency of about 70%-20% AEP (1.5yr-5.0yr return period) across the wider area.

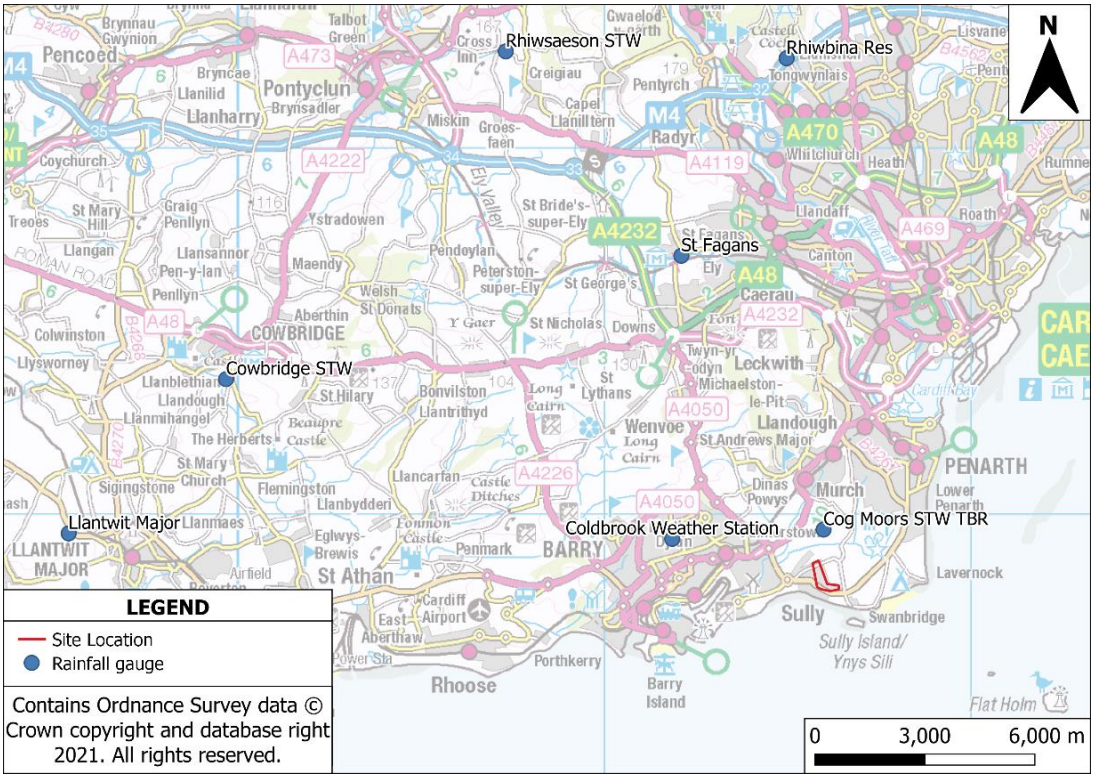


Figure 7-1 Rainfall gauge locations

Table 7-1 Rainfall gauge data

Rain gauge	Distance from site location (km)	Rainfall (mm) on 23/12/2020	Coordinates (XY)
Cog Moor STW TBR	0.86	47.8 in 5.25 hrs	315986,169586
		57.2 in 9.75 hrs	
Cold Brook Weather Station	3.89	29.0 in 5.25 hrs	311853,169334
		37 in 9.75 hrs	
St Fagans TBR	9.13	30.8 in 5.25 hrs	312103,177055
		43.6 in 9.75 hrs	
Rhiwbina Reservoir TBR	13.80	27.6 in 6.00 hrs	314976,182442
		44.4 in 9.75 hrs	
Rhiwsaeson STW TBR	16.34	28.2 in 7.00 hrs	307308,182629
		37.4 in 10.00 hrs	
Cowbridge TBR	16.84	28.8 in 6.75 hrs	299675,173689
		35.2 in 9.25 hrs	
Llantwit Major TBR	20.35	32.6 in 8.50 hrs	295375,169481

7.1.3 Groundwater

There are no groundwater level measurements available within the vicinity of the site. As groundwater levels rise in response to precipitation, groundwater could contribute to an increased level of surface water overland flow and a faster flow of water to river channels. However, flooding as a direct result of groundwater rising was not reported and the rapid onset and short duration of the flood event does not characterise groundwater flooding. Therefore, groundwater is not considered to be a direct source of flooding for this flood event.

7.2 Pathway

7.2.1 Swanbridge Grove residential area

For the residential area south of the adjoining field, surface water accumulated from two areas and travelled in 3 identified flow paths (see Figure 7-2):

1. The first flow path identified was in Catchment E (Figure 4-7) that received water from the fields west of Swanbridge Road and north of the housing estate which pooled at the disused railway embankment before percolating through and flowing into the estate to the south.
2. The second flow path identified originated from Catchment F where water collected from the field east of Swanbridge Road and flowed into the open channel on Swanbridge Road. The open channel eventually overtopped, and surface water continued along Swanbridge Road and into the properties to the west (Figure 7-2). Flood water then flowed in between the gardens of properties on Highbridge Grove where it eventually settled at the lowest ground levels within Swanbridge Grove and Winsford Road.
3. The third flow path recorded water flowing from the bottom field adjacent to Lavernock Road (Catchment G). The water is believed to have flowed along the disused old Lavernock Road route that runs adjacent to the disused railway embankment to the east of Swanbridge Road before tracking south and merging into the southerly section of Swanbridge Grove. Flows also occurred along South Road, where it then also flowed into the cul-de-sac of Swanbridge Grove and Highbridge Close.

Some flows moving west from Swanbridge Grove between properties toward Highbridge Close were reported to have been diverted by residents into a disused pool. Flows were reported to have caused a torrent of water to rush toward properties into Swanbridge Grove.

A further pathway reported by residents was through the drainage network being overwhelmed. It was reported by residents that drains and manholes outside of properties were overflowing.

7.2.2 Conybeare Road residential area

Regarding the flooding to the properties on Conybeare Road, the main flow pathway is reported to have been from the top of the field to the east (Catchment C), tracking west toward Conybeare Road.

It is reported that surface water pools in an area of local low ground level in the south-western corner of the field, north of Brean Close, at the location of the

perched gulley inlet. As water levels increase, this area of ponding increases in a northerly direction adjacent to the footpath to the rear of Conybeare Road, prior to flowing onto the footpath. Once surface water reaches the footpath, water is able to flow into the residential area of Conybeare Road through the gardens of properties and via the public footpath.

It was also reported by residents that drains and manholes by the field adjoining the residential areas were overflowing during the flood event. However, the exact locations of these assets are not clear from the reports.

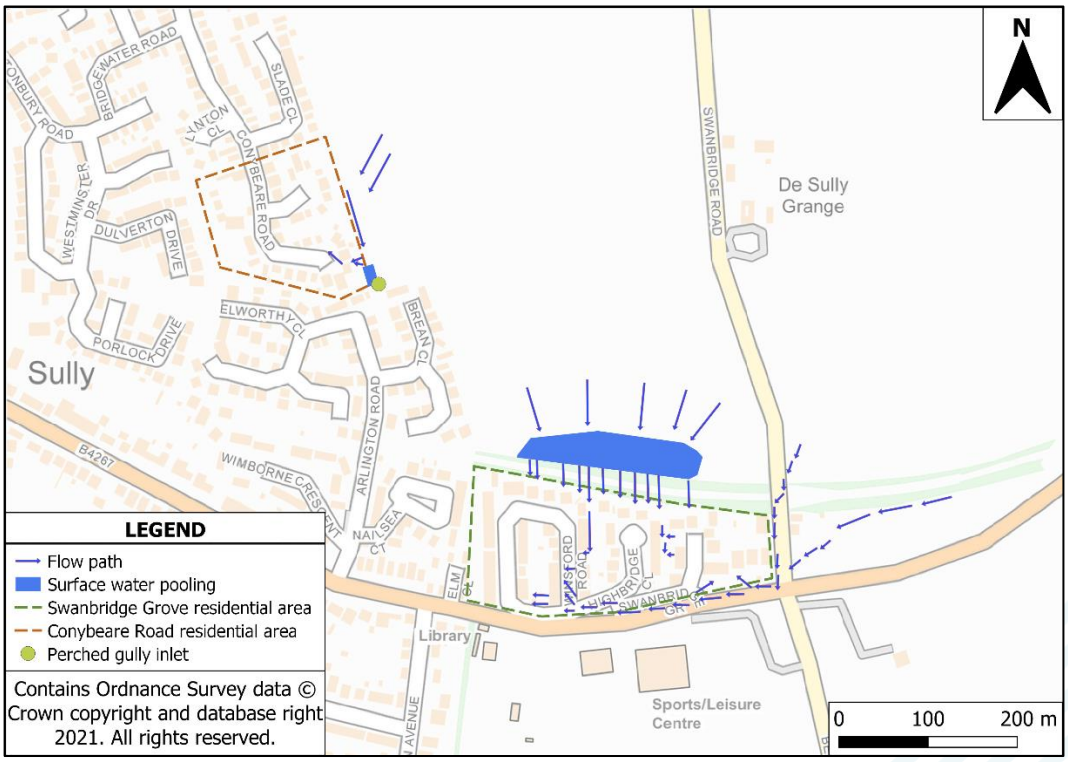


Figure 7-2 Flood water pathways

7.3 Receptor

7.3.1 People

The emotional impact of experiencing flooding and how it can have a harmful impact on mental health is well documented. Multiple reports from residents included concerns about the potential of flooding again and the unrest and anxiety this causes them. Residents also reported loss of personal possessions.

One resident reported they were unblocking a Council drain when the wave of flood water came down the public footpath, knocking them off their feet. The resident was injured and taken to hospital.

7.3.2 Property

The residential areas affected were:

- Swanbridge Road
- South Road
- Swanbridge Grove

- Highbridge Close
- Winsford Road
- Conybeare Road

The 74 returns from the 280 Flood Incident Forms issued by VoGC identified 18 properties that were flooded internally, 7 outbuildings and 19 gardens flooded. Flood water was brown with dirt and was reported to leave behind debris and 'slime' on walls, floors and possessions.

The volume of floodwater within the property varies due to the sloping ground level. The maximum approximate internal flood water depth reported was 1.2m (4ft) on Conybeare Road where 3 properties flooded and upward of 0.9m (3ft) on Winsford Road and 0.6m (2ft) on Swanbridge Grove. In total 15 properties flooded between Swanbridge Road and Winsford Road. Figures 6-4 to 6-6 provide a small representation of the extent of flooding that occurred and the impact it had on the residents.

Residents reported that they undertook measures to prevent property flooding including diverting flows and use of sandbags but did not report having had any temporary or permanent property level flood resilience measures installed prior to the storm event.

Reports of costs of damage to home and possessions from flooding per property varied considerably. Numerous properties reported estimated costs of £100 to £1,000 for properties experiencing internal and external flooding. Exceptional cases that experienced high level of internal flooding reported estimated costs of £10,000 to £50,000 in damages.

Figure 7-3 Image of external property flooding within the Conybeare Road investigation area (image received from resident completed flood report)

Figure 7-4 Image of internal property flooding within the Conybeare Road investigation area (image received from resident completed flood report)

Figure 7-5 Image of external property flood mark within the Swanbridge Grove investigation area (image received from resident completed flood report)

7.3.3 Infrastructure

Road access was prevented into Sully due to flooding of Sully Moors Road causing widespread traffic and some motorists being unable to access their destinations. One elderly resident who attempted to drive home reported being unable to return to their property for a number of hours.

Evidence collected by the VoGC identified a number of areas of highway and footway which were impacted by the flooding. Figure 7-6 below (Appendix D) shows the location of significant water build up within the Swanbridge Grove study area as reported by VoGC following their investigations.

Surface water run-off is reported to have filtered through the disused railway embankment, down Highbridge Close and through the rear gardens of properties situated between Highbridge Close and Winsford Road. It then collected in the low points of Winsford Road and the junction of Highbridge Close and South Road. One resident of Winsford Road reported that the road was impassable for a time due to the depth of water that was ponding in this area. At Swanbridge Grove, water filled the highway from the surrounding area, flowed south and collected in the low point at the entrance to Swanbridge Grove. Additionally, flows from Swanbridge Road were prevented from flowing onto South Road due to the high point on the carriageway, and instead flowed west along the footway and towards the low point at the entrance to Swanbridge Grove.

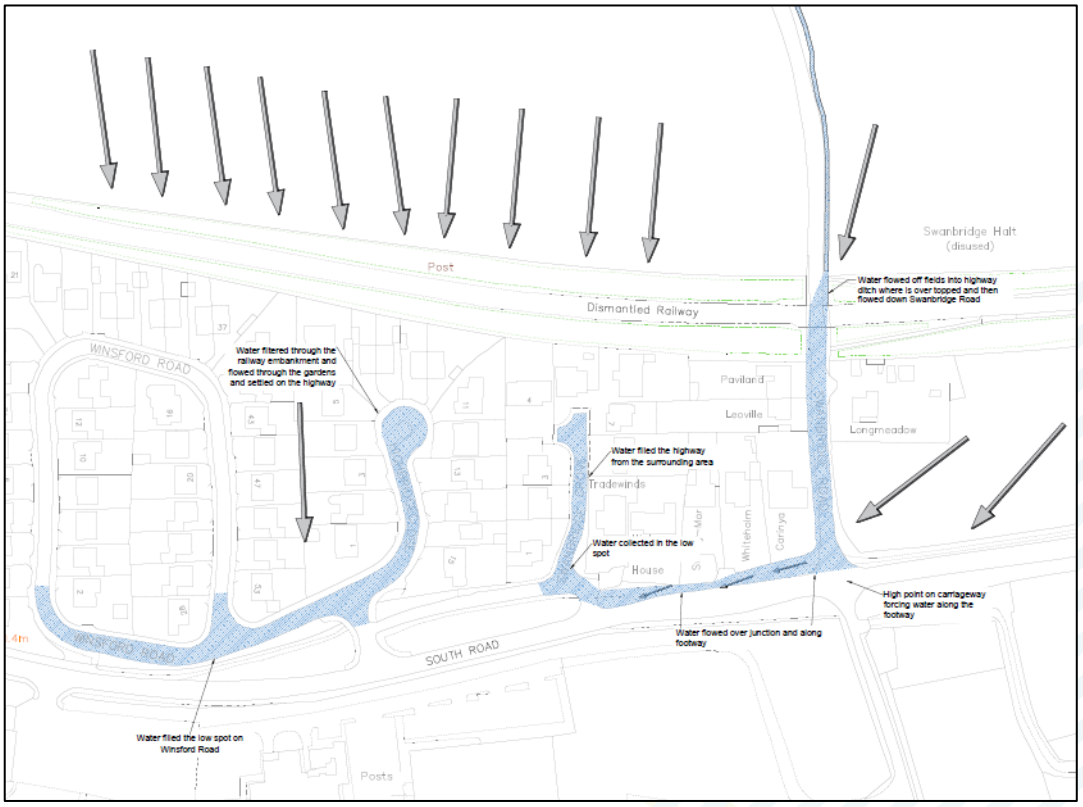


Figure 7-6 - Highway and footway flooding

7.3.4 Services

Flood water was observed around the Sully Sports and Social club and library on South Road, possibly limiting access to these services. The bus service travels along South Road and stopping at The Surgery Bus Stop (CF64 5TL) on South Road would also have been interrupted by the impacts of the flooding on the local roads.

8 Causal factors

8.1 Wider catchment conditions

8.1.1 Catchment C

After the storm event on 23 December 2020, VoGC attended the Taylor Wimpey development site. As identified in Section 4.2.1.1, the majority of the development site is located within Catchment A, with a small section of developed land to the south west of the site located in Catchment C.

During this visit some gullies were noted to be covered in a silty material and to be holding water, but the roads and drainage installed at the time were connected to the main drainage feature in the north eastern corner of the site, which is where the majority of land under development within Catchment A naturally drains (towards the Sully Brook, away from the area of interest at Conybeare and Swanbridge Road). The drainage feature was still under construction at the time, but the drainage pipes from the site were discharging adjacent to the feature. This has since been completed, allowing the runoff from the site to be stored and drain down at an attenuated rate.

An isolated section of drainage in the south west corner of the development which sits in Catchment C, was not connected to the main drainage system at the time of the VoGC visit. This area is bunded to prevent runoff flowing from the Taylor Wimpey site into the field to the south. There was no evidence during the visit that this bund had been overtopped. A short length of newt fencing was installed in the south west corner of the site, from an area of undisturbed ground with a long sward of grass. No evidence was seen of any significant flow from this area.

At the time of the VoGC visit following the December 2020 flooding, the field to the south of the Taylor Wimpey development site, east of Conybeare Road, was planted with what appeared to be winter wheat and so had almost no ground cover, leaving 100% bare earth. These conditions likely contributed to overland surface flows.

Additionally, the ground around the perched gully inlet in the south west corner of the field had been filled in, which will have reduced the storage capacity of surface water runoff in this location. This was later modified by VoGC to reinstate the gully cover and frame.

8.1.2 Catchments E to H

As described above, in Sections 5.1 and 5.2, throughout Catchments E to H soils were highly saturated with little capacity for storage throughout the catchments. The outcome of this high volume of rainfall falling on a saturated catchment was rapid flows of surface water run-off across non-permeable urban surfaces and slopes. These flows pooled at lower elevations This also caused problems for the surface water sewer network, which was unable to cope with a large volume of water over this short timeframe.

8.2 Surface water network

8.2.1 Swanbridge Grove residential area

8.2.1.1 Highway Network

As the Highways Authority, VoGC investigate reports of blocked drains from residents and regularly cleanse the highways surface water drainage network. The current cleansing rotas result in a 15 -18 month average rotation, although this cycle was disrupted by the 23rd December 2020 event.

The Highways Authority have stated that the highway gullies within the Swanbridge Grove residential area were cleansed on the following dates:

- 4th – 10th June 2019
- 2nd – 5th October 2018

The highway gullies along South Road were cleansed on 24th September 2020.

Following the flood event, a CCTV survey investigating the condition of the surface water network was completed by the VoGC for Swanbridge Road on 15th March 2021 and for Winsford Road, Highbridge Close and Swanbridge Grove on 28th April 2021. Additionally, the Highway Authority cleansed the highway network of the Swanbridge Grove residential area between 11th-18th March 2021. VoGC completed clearance of the Swanbridge Road highway network north of South Road on 8th July 2021.

The investigation of the highway network along Swanbridge Road and Beach Road network identified damage just north of the South Road junction and a high level of silt build-up just south of the junction. Low to moderate levels of silt and debris were also reported between the disused railway embankment and the South Road junction.

As detailed in Section 4.1.1.1, the highway network along Swanbridge Road, between the disused railway embankment and the South Road junction, is designed to receive highway flows only and has a full bore capacity of 19.4 l/s. Given the location of the system within Swanbridge Road, the highway network is prone to receiving sheeting overland flow from Catchments F and G. Greenfield runoff rates for Catchments F and G during a 1 in 20 year rainfall event are not known, however rates for the 1 in 2 year rainfall event are 20.0 l/s and 38 l/s respectively. During the 1 in 30 year rainfall event, runoff rates are 35.6 l/s and 67.6 l/s, respectively. Greenfield runoff rates during the flood event greatly exceeded the full bore pipe capacity of the system. It is therefore considered that although this highway system was significantly blocked and damaged at the time of the event, resulting in a reduction in its capacity, the impact of this is considered negligible due to the excessive volume of surface water of more than double the capacity of the Swanbridge Road drainage system during the event.

8.2.1.2 DCWW Network

Investigation of the DCWW surface water network on 28th April 2021 identified low levels of debris build-up on Winsford Road. On Highbridge Close low levels of debris build-up and a number of partial blockages were identified just before connecting with the drains from Swanbridge Grove. The section of drainage on South Road

running parallel to Winsford had a number of blockages within the system. Investigation of the surface water system on Swanbridge Grove identified a low level build-up of silt, debris and roots.

8.2.2 Conybeare Road residential area

No CCTV surveys were completed for the Conybeare Road surface water network. However, numerous residents reported flood water surcharging from manholes and drains being overwhelmed. It is not known whether these manholes and drains relate to the highway or public surface water or foul system. However, VOGC and DCWW have confirmed that there were no reports of foul sewer flooding in this area.

The Highways Authority have stated that the highway gullies within the investigation area were cleansed on the following dates:

- 23rd November 2020
- 4th – 10th June 2019
- 2nd – 5th October 2018

Following the flood event, the Highway Authority cleansed the highway network of the Conybeare Road residential area between 11th-18th March 2021 with an inspection of the system undertaken by VoGC on 6th July 2021. During this inspection, the connection of the highway network to the DCWW network was clear with no sign of blockage.

The highway network gully at the rear of Conybeare Road is not intended to cope with sheeting overland flows from the adjacent land and the system was likely overwhelmed and could not drain at a fast-enough rate.

The risk of flooding to residents was likely heightened due to reported blockage of one or more surface drainage channels at the rear of Conybeare Road. Whilst it is unclear which assets these reports are referring to, it is possible they relate to the ditch and bund informal defence to the rear of Conybeare road, or the highway network that is in close proximity to the residential properties.

Feedback from residents following the event identified a blockage of the perched gully inlet located in the south west corner of the field adjacent to Conybeare Road.

It was reported that VoGC had not addressed reports from residents regarding the blockage at the time of the flooding. The most recent report of blockages received by VoGC prior to 23rd December 2020 relating to this feature were received on 14th November 2019 and 14th February 2020. The perched inlet was inspected by a VoGC LLFA officer on 12th June 2020 and found to be unobstructed. The perched inlet was also inspected and cleared by VoGC contractors in November 2020, in conjunction with cleansing of the highway drainage serving the adjacent footpath, whilst the status of the land drainage connection into a public surface water sewer was being addressed with DCWW. There are also reports that the farmer who owns the adjacent field cleared the perched gulley inlet on 23rd December 2020.

This perched gully inlet flows to the DCWW network to the south of Brean Close that is separate to the highway drainage serving the footpath area to the rear of Conybeare Road. However, blockage of this inlet would result in an increase in surface water volume flowing towards the highway network to the rear of

Conybeare Road due to the reduced capacity of the inlet and volume of surface water able to enter into the DCWW network.

It is unclear who owns the perched gulley inlet and is therefore responsible for its maintenance. Despite this Ad Hoc repairs and cleansings have been undertaken by VoGC on a reactive basis due to the impacts blockage of this inlet have on the adjacent community.

Following the flood event, VoGC cleared the blockage to the inlet on 19th January 2021.

9 Conclusion and recommendations

9.1 Conclusions

This report has detailed the investigation into the flooding of the residential area north of South Road, Sully in the Sully Coastal Catchment on 23rd December 2020. This investigation has reviewed evidence provided by responders and residents and has been informed by a Section 19 data analysis for Dinas Powys produced by JBA Consulting.

Within the area of investigation, the impacts from the storm event primarily occurred in two areas: the residential area north of South Road from Swanbridge Grove to Winsford Road; and Conybeare Road.

The evidence gathered in this report demonstrates that for both areas the cause of flooding was due to heavy rainfall resulting in rapid surface water flows in the adjoining fields that entered the residential areas. This was likely exacerbated by poorly functioning surface water drainage.

In the Swanbridge Grove residential area, three surface water flow paths into the residential area were identified. Firstly, from the field to the north pooling behind and then percolating through the disused railway embankment. Second, from the field east of Swanbridge Road via the highway ditch, and third from the field east of Swanbridge Road via the old Lavernock Road route. These flows resulted in internal flooding and widespread external flooding of residential properties and transport links being affected. This flooding was likely exacerbated by the highway drainage system being overwhelmed that led to increased flows from around the corner of Swanbridge Road toward South Road.

Flooding at Conybeare Road occurred from surface water flows from the adjoining field flowing down the footpath and entering the residential area. This resulted in internal flooding and widespread external flooding of residential properties. The was likely exacerbated by the highway drainage system being overwhelmed at the rear of Conybeare Road and the perched gully inlet in the south-west of the field being blocked.

The below actions are recommended in response to these findings.

9.2 Recommendations

Risk Management Authority/Stakeholder	Recommended actions
LLFA (VoGC)	Assess viability of Flood Risk Management Schemes to manage surface water flood risk for the Swanbridge Grove residential area.
LLFA (VoGC)	Assess viability of Flood Risk Management Schemes to manage surface water flood risk for Conybeare Road.
LLFA (VoGC) and DCWW	Confirm ownership and maintenance responsibilities of perched gully inlet at the south-west corner of adjoining field draining towards Brean Close.
Highways Authority (VoGC)	Model capacity of existing highway surface water network and consider improvements to Swanbridge Road Highway Drainage; investigate options for upgrading highway culverts and drains where required.
Highways Authority (VoGC)	Model capacity of existing highway surface water network and consider enhancing maintenance schedule for the South Road surface water drainage system and for the rear of Conybeare Road.
Highways Authority (VoGC)	Prioritise cleansing of the Swanbridge Road surface water drainage system due to the flood risk posed by surface water run-off from Swanbridge Road.
DCWW	Model capacity of existing public surface water drainage capacity and consider enhancing maintenance schedule for Winsford Road, Highbridge Close and Conybeare Road.
VoGC / Property Owners	Consider flood risk to own properties; to install property flood resilience (PFR) where necessary in liaison with the appropriate RMA's.

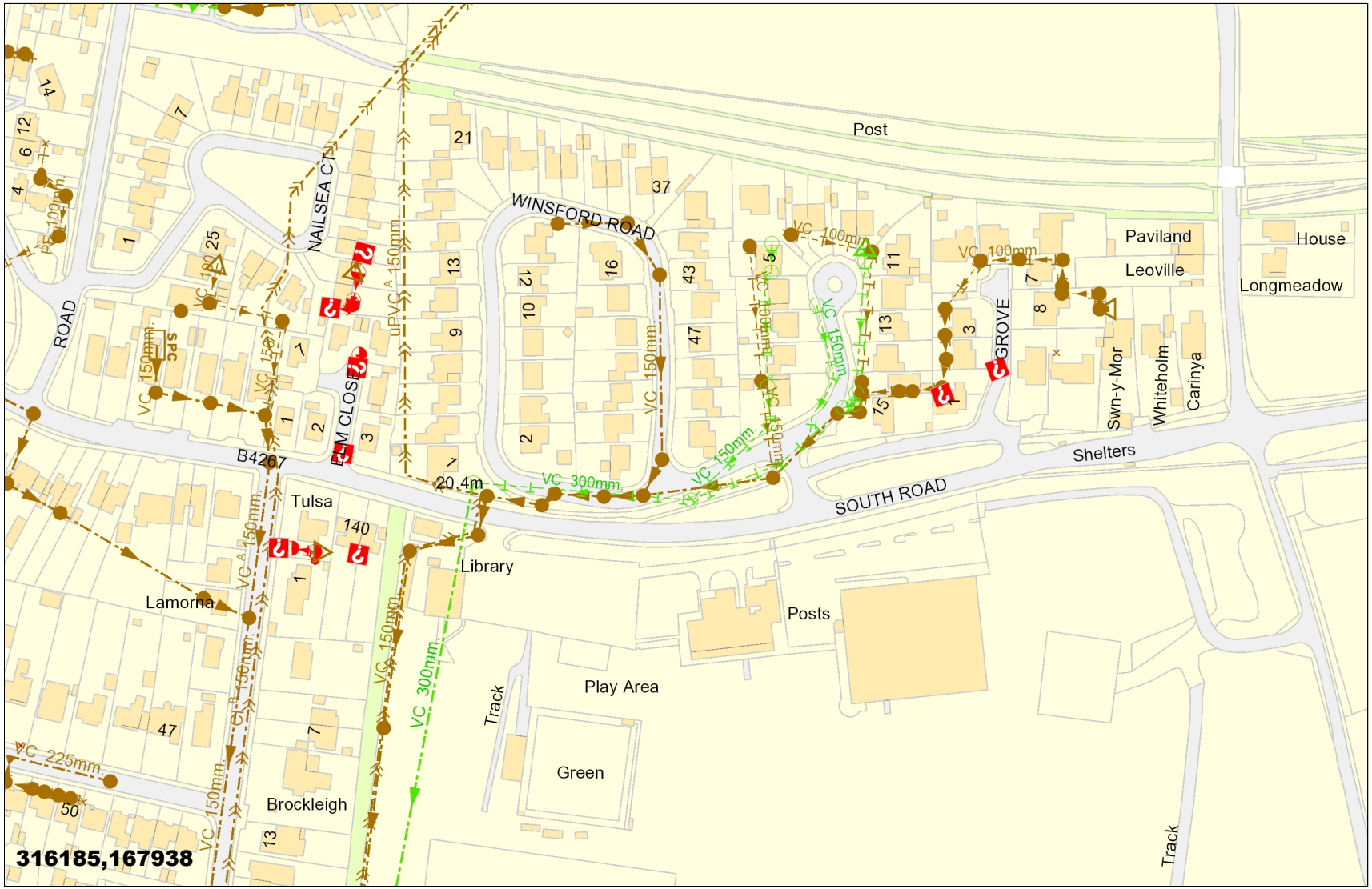
APPENDIX A – Swanbridge Grove Investigation Area DCWW Sewer Maps

Dŵr Cymru
Welsh Water

DCWW Winsford Road

14/06/2021

Scale: 1: 2500



LEGEND

Clean Water

- Sluice Val
- Air Val, SINGLE
- Tap
- Pressure Reducing Valve
- Meter
- BULK Meter
- FH
- Cap
- Existing Main
- NON COMPANY

Sewerage External

- Foul
- Surface Water
- Combined
- Rising Main
- Private
- Treatment Works
- Pumping Station
- Special Purpose
- Unknown End
- Change, Combined Overflow
- Outfall, FOUL
- Lamp Hole, Foul
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be Asbestos Cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

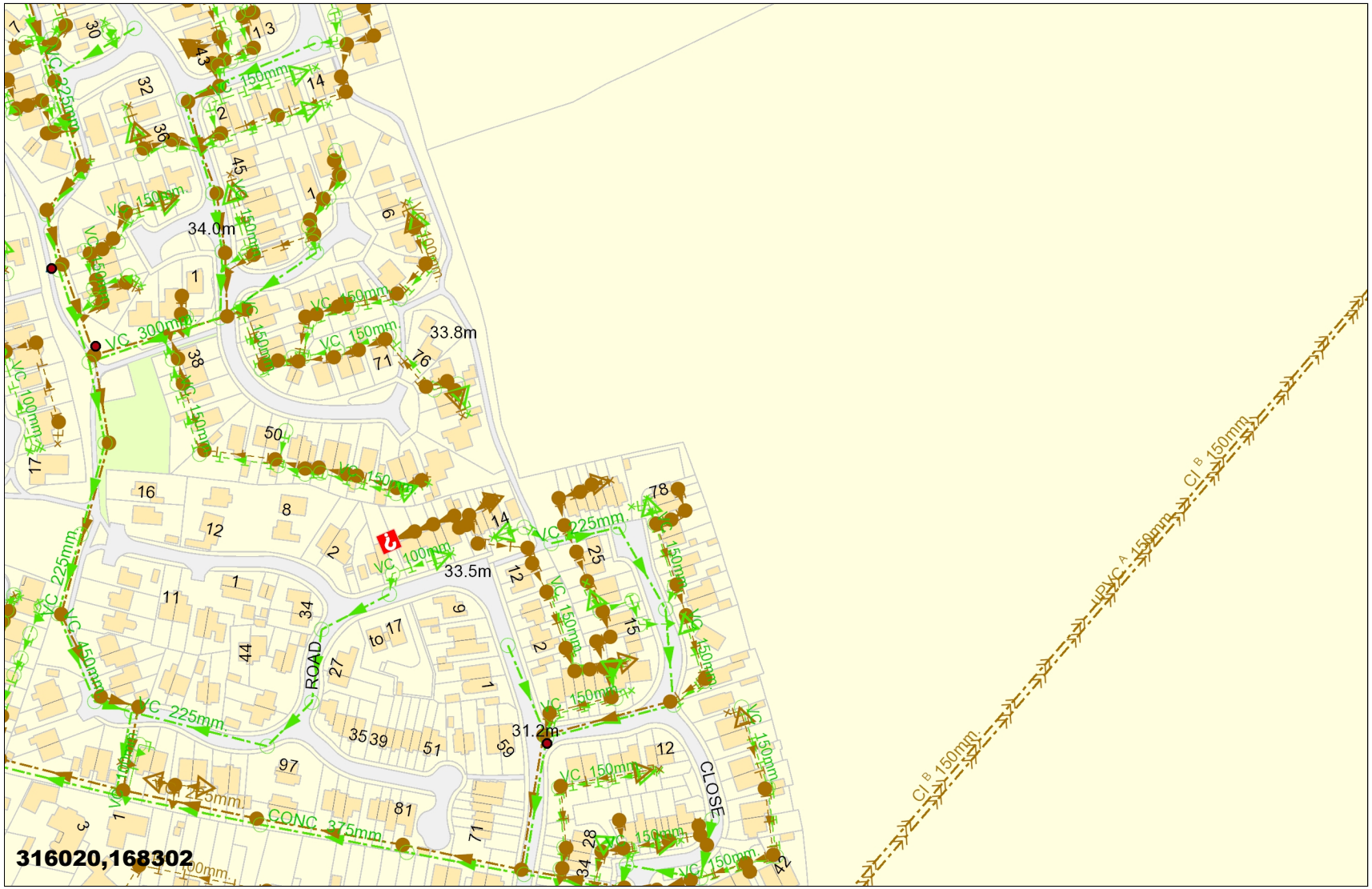
APPENDIX B – Conybeare Road Investigation Area DCWW Sewer Maps

Dŵr Cymru
Welsh Water

DCWW Coneybeare Road

14/06/2021

Scale: 1: 2500



LEGEND

Clean Water

- Sluice Val
- Air Val, SINGLE
- Tap
- Pressure Reducing Valve
- Meter
- BULK Meter
- FH
- Cap
- Existing Main
- NON COMPANY

Sewerage External

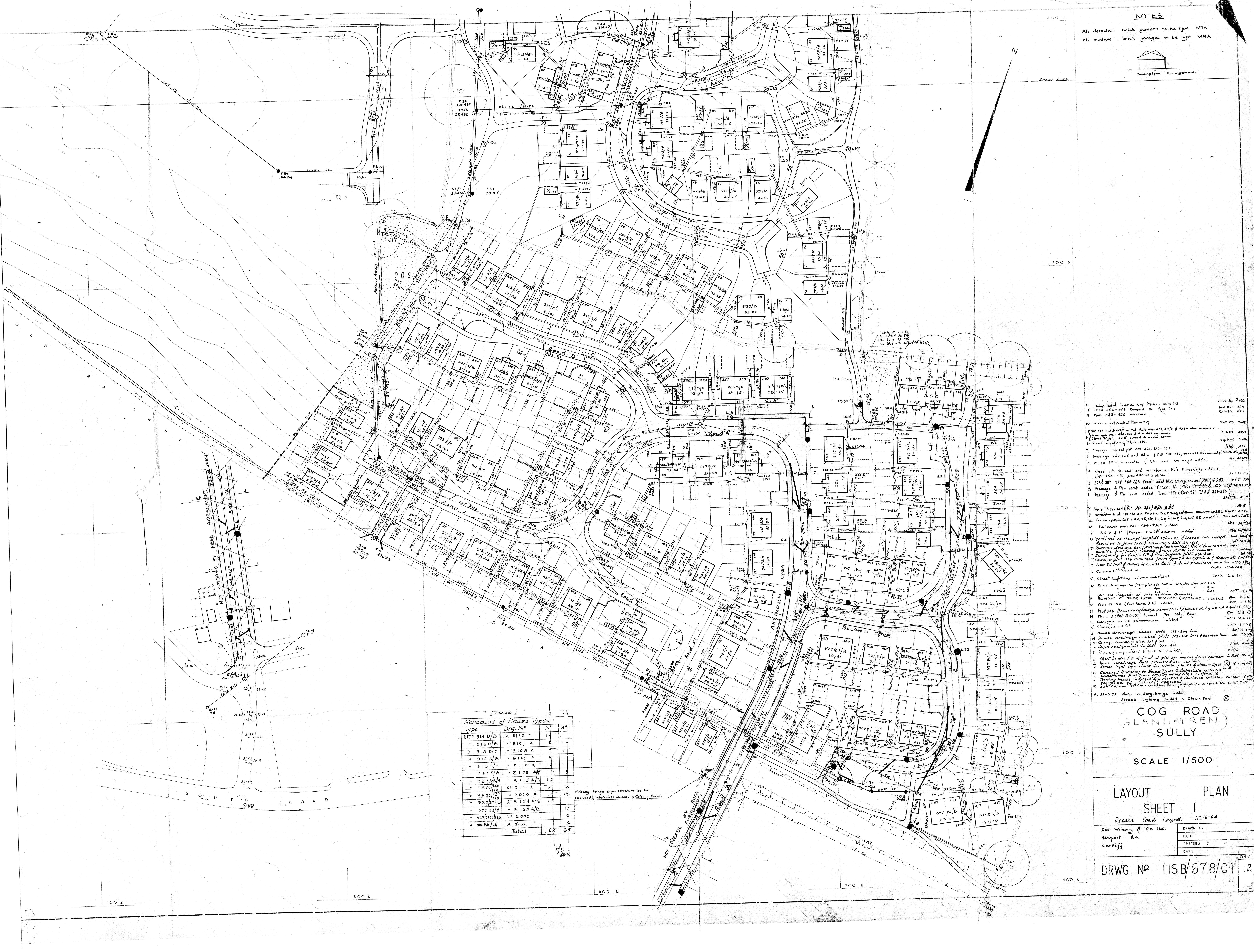
- Foul
- Surface Water
- Combined
- Rising Main
- Private
- Treatment Works
- Pumping Station
- Special Purpose
- Unknown End
- Change, Combined Overflow
- Outfall, FOUL
- Lamp Hole, Foul
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

Dwr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon In the event of excavations or other works made in the vicinity of the company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. The information which is supplied hereby the company, is done so in accordance with statutory requirements of sections 198 and 199 f the water industry Act 1991 based upon the best Information available and in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclosure the existence of a drain sewer or disposal main laid before 1 September 1989, or if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information us entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the company's right to be compensated for any damage to its apparatus.

EXACT LOCATION OF ALL APPARATUS TO BE DETERMINED ON SITE

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be Asbestos Cement (AC) or Pitch Fibre (PF). It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

APPENDIX C – Brean Close Development Plans


NOTES
All detached brick garages to be type M7A
All multiple brick garages to be type MBA
Downpipes Arrangement
COG ROAD
GLANHAFREN
SULLY
SCALE 1/500
LAYOUT PLAN
SHEET 1
Revised Road Layout 30-8-84
Geo. Wimpey & Co. Ltd.
Newport Rd.
Cardiff
DRAWN BY :
DATE :
CHECKED :
DATE :
DRWG Nº 11SB/678/01
ARLINGTON ROAD
BREAN CLOSE
SOUTH ROAD
OLD RAILWAY
P.O.S.
NOT COVERED BY ROAD AGREEMENT
Phase 1
Schedule of House Types
Total

Offices at

Coleshill
Doncaster
Dublin
Edinburgh
Exeter
Haywards Heath
Isle of Man
Limerick
Newcastle upon Tyne
Newport
Peterborough
Saltaire
Skipton
Tadcaster
Thirsk
Wallingford
Warrington

Registered Office
1 Broughton Park
Old Lane North
Broughton
SKIPTON
North Yorkshire
BD23 3FD
United Kingdom

+44(0)1756 799919
info@jbaconsulting.com
www.jbaconsulting.com
Follow us:

Jeremy Benn Associates Limited

Registered in England 3246693

JBA Group Ltd is certified to:
ISO 9001:2015
ISO 14001:2015
ISO 27001:2013
ISO 45001:2018