ENVIRONMENTAL STATEMENT CHAPTER 10: WATER ENVIRONMENT

Land South of Rover Way, Cardiff, CF24 5PH

Harsco Metals Group Limited

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CONTENTS

DOCUMENT REFERENCES

TABLES

APPENDICES

10.1.0 Introduction

10.1.1 This chapter of the Environmental Statement (ES) considers the impact of the proposed development on the water resources (including both groundwater and surface water), flood risk and drainage at the site of the proposed development and the surrounding area. It also identifies possible hydrogeological and hydrological impacts associated with the proposed development during both the construction and operational phases.

10.1.2 It should be noted that, as an impact assessment, this chapter does not explicitly consider the risk of flooding to the proposed development, but does consider implications with regard to the existing water environment and surrounding sensitive users.

10.1.3 Flood risk to the proposed development is considered separately in a Flood Consequences Assessment (FCA) which is enclosed at Appendix 10-1.

10.2.0 Methodology

Legislation and Planning Policy

10.2.1 Reference has been made to relevant legislation, planning policy, technical guidance and other codes of best practice in the design of the proposed development to limit the potential for contamination of ground and surface waters, the potential for flooding to be caused by the proposed development, and other potential impacts on the water environment. The proposed development would therefore be in accordance with the following legislation, guidance and planning policies.

Legislation

10.2.2 Water within the local area of the proposed development is currently regulated according to the following key European Commission (EC) Directives.

Water Framework Directive

10.2.3 The Water Framework Directive (2000/60/EC) (the "WFD") provides the foundation for the protection of the UK's water environment. The WFD seeks to protect all elements of the water cycle and to enhance the quality of groundwater, surface waters, estuaries and coastal waters. The Directive is transposed and implemented within England and Wales through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017.

Groundwater Directive

10.2.4 The Groundwater Directive (2006/118/EC, including amendments to Annex II detailed under Directive 2014/80/EU) (the "GWD") is designed to combat groundwater pollution and sets out procedures for assessing quality of groundwater. Aspects of the GWD are transposed and implemented through the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, the Environmental Permitting (England and Wales) Regulations 2016 and the Groundwater (England and Wales) Regulations 2009;

Floods Directive

10.2.5 The Floods Directive (2007/60/EC) which requires assessment of all watercourses and coastlines to determine risk of flooding and action to take adequate and coordinated measures to reduce this flood risk. The Flood Risk Regulations 2009 transpose the EU Floods Directive into law in England and Wales

Freshwater Fish Directive

10.2.6 The Freshwater Fish Directive (78/659/EEC) (recodified 2006/44/EC) was originally adopted on 18th July 1978 but consolidated in 2006. The Directive seeks to protect fresh water bodies identified as waters suitable for sustaining fish populations. For those waters identified, physical and chemical water quality objectives are set for salmonid waters and cyprinid waters. Waters protected under the Directive are formally designated through the issue of a notice. In Wales the notice is issued by the Department for Environment, Food and Rural Affairs (DEFRA) and it places an obligation on the Natural Resources Wales (NRW) to ensure that designated waters meet their objectives.

Nitrates Directive

10.2.7 The Nitrates Directive (91/676/EEC) aims to reduce water pollution by nitrate from agricultural sources and to prevent such pollution occurring in the future. The directive requires DEFRA and the Welsh Assembly Government to identify surface or groundwaters that are, or could be, high in nitrate from agricultural sources. Nitrogen is one of the nutrients that can affect plant growth. Surface waters also have to be identified if too much nitrogen has caused a change in plant growth which affects existing plants and animals and the use of the water. Once a water body has been identified, all land draining to that water is designated as a Nitrate Vulnerable Zone.

Planning Policy

Planning Policy Wales

10.2.8 Planning Policy Wales (PPW) sets out the Government's planning policies for Wales and how they are expected to be applied. PPW, Technical Advice Notes (TAN's), circulars and policy clarification letters comprise national planning policy. The PPW states that:

- Planning policies, decisions and proposals should promote resource-efficient and climate change resilient settlement patterns that minimise land-take (and especially extensions to the area of impermeable surfaces) and urban sprawl, especially through preference for the re-use of suitable previously developed land and buildings, wherever possible avoiding development on greenfield sites;

- When drawing up policies and proposals for their area local planning authorities must acknowledge that government resources for flood and coastal defence projects are directed at protecting 'existing' developments and are not available to provide defences in anticipation of future development. A sustainable approach to flooding will therefore involve the avoidance of development in flood hazard areas and, where possible or practical, the encouragement of managed retreat, the creation of wash-lands and flood plain restoration;

- Development plans should take water-related issues into account from an early stage in the process of identifying land for development and redevelopment. New development should be located and its implementation planned in such a way as to allow for sustainable provision of water services, in particular minimising vulnerability to the impacts of climate change. Design approaches and techniques that improve water efficiency and minimise adverse impacts on water resources, surface water quality, the ecology of rivers and groundwater should be encouraged;

- Development proposals should also include features that provide effective adaptation to, and resilience against, the current and predicted future effects of climate change, for example by incorporating green space to provide shading and sustainable drainage systems to reduce run-off, and are designed to prevent overheating and to avoid the need for artificial cooling of buildings;

- The adequacy of water supply and the sewage infrastructure are material in considering planning applications and appeals. The need to balance the growing demand for water with the needs of the environment is crucial;

- Even where there is theoretical capacity, timely investment in infrastructure is required to ensure that new development does not adversely affect water supplies, water quality or

sewerage. These issues require early identification when locating future development. Local planning authorities should therefore encourage the use of sites where existing water supply and/or drainage provision problems can be solved and seek to avoid the use of sites where adequate water supply and/or drainage provision is unlikely to be achieved;

- Development proposals in sewered areas must connect to the main sewer, and it will be necessary for developers to demonstrate to local planning authorities that their proposal site can connect to the nearest main sewer. To ensure consistency of design and facilitate long-term maintenance, sewers should be built to an adoptable standard, and developers should consult sewerage undertakers in the early stages of design and planning.

Technical Advice Note – TAN15

10.2.9 Technical Advice Note (TAN) 15 provides technical guidance which supplements the policy set out in Planning Policy Wales in relation to development and flooding.

10.2.10 National Assembly for Wales produced the 'Technical Advice Note (TAN15)' in July 2004. The proposed development is located in Zone B, as defined by the Development Advice Maps[1].

10.2.11 In relation to new development within Zone B, it states that:

"When considering allocations in Zone B, local planning authorities should consult the Environment Agency to ascertain whether flooding raises a significant constraint in terms of land use. It is not expected that an assessment of the consequences be undertaken at the plan preparation stage but should flooding be considered an issue then policies outlining the appropriate requirements should be included in the plan, in accordance with Sections 6 and 7, and Appendix 1."

10.2.12 TAN15 also requires new developments to reduce the causes and impacts of surface water flooding by implementing the Sustainable Drainage System (SuDS)

10.2.13 With respect to surface water run off from new development, TAN15 states that:

"SuDS can perform an important role in managing run-off from a site and should be implemented, wherever they will be effective, in all new development proposals, irrespective of the zone in which they are located.

Development in one part of a catchment may increase run-off and hence flood risk elsewhere, therefore, the aim should be for new development not to create additional run-off when compared with the undeveloped situation, and for redevelopment to reduce run-off where possible. It is accepted that there may be practical difficulties in achieving this aim."

National Strategy for Flood and Coastal Erosion Risk Management in Wales

10.2.14 In accordance with the Flood and Water Management Act, 2010, the Welsh Government has prepared the 'National Strategy for Flood and Coastal Erosion Risk Management in Wales' in November 2011.

10.2.15 In relation to flood defences, it states that:

1 Natural Resources Wales, Development Advice Map (Accessed June 2019) https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en

"Most of Wales' cities, like Cardiff, Swansea and Newport, have been protected from flooding by a combination of river defences in the form of embankments and walls and local piped drainage systems."

10.2.16 In relation to flood risk management, it states that:

"Drainage and defence still have a place within a flood and coastal erosion system based on the principles of risk management, but we also need to consider other options that could reduce both the likelihood of an event occurring and the consequences of those events."

10.2.17 Other options could include:

- *deploying sustainable drainage systems much more widely;*
- *incorporating greater resilience into the design of developments;*
- *ensuring wider awareness of individual risk to increase levels of preparedness and planning for flood events*

10.2.18 It is also required that Development of Local Development Plans to include adequate provisions in respect of flood and coastal erosion risk in compliance with the requirements of Planning Policy Wales and relevant Technical Advice Note (TAN15)

Strategic Flood Consequences Assessment

10.2.19 A Strategic Flood Consequences Assessment (SFCA) for Cardiff Council was carried out by Atkins in November 2011. The aim of the SFCA was to inform the revision of flooding policies, including the allocation of land for future development and to guide the production of individual FCA's by developers as part of the development control process.

Cardiff Local Development Plan (LDP)

10.2.20 The Cardiff Local Development Plan 2006-2026 was adopted in January 2016.

10.2.21 In relation to flood risk and drainage, the following are included within the objectives of the LDP:

"Objective 3 – To deliver economic and social needs in a coordinated way that respects Cardiff's environment and responds to the challenges of climate change

- *To protect, manage and enhance Cardiff's natural environmental assets, including geodiversity, the best soils, water and air quality including, the reduction of pollution*
- *To have full regard to flood risk when considering the acceptability of development proposals and considering mitigation and adaptation measures."*

"Objective 4 – To create sustainable neighbourhoods that form part of a sustainable city

- *Minimise water usage and maximise sustainable drainage – to carefully manage the consumption and drainage of water to avoid unnecessary wastage and minimise rapid run-off. To seek opportunities to maximise the positive amenity and biodiversity benefits that sustainable drainage solutions can offer."*

10.2.22 In relation to new development, Policy KP5: 'High Quality and Sustainable Design' states that:

"To help support the development of Cardiff as a world-class European Capital City, all new development will be required to be of a high quality, sustainable design and make a positive contribution to the creation of distinctive communities, places and spaces by:

- *Using innovative approached to achieve a resource efficient and climate responsive design that provides sustainable water and waste management solutions."*

10.2.23 In relation to long term sustainable development of Cardiff, Policy KP18: 'Natural Resources' states that:

"In the interests of the long-term sustainable development of Cardiff, development proposals must take full account of the need to minimise impacts on the city's natural resources and minimise pollution."

10.2.24 This is further explained by:

"Cardiff's rivers, lakes, ponds and water bodies are important for a wide range of uses and users. Development has the potential to affect water quality and quantity. It is important that development is only allowed where there would be no unacceptable harm to the quality or quantity of water resources and where provision can be made for any infrastructure required to safeguard water quality and quantity. New developments should have an adequate water supply and sewerage system to serve the development. This policy, which is aimed in part at improving water resource use efficiency, will ensure adequate water supply without adverse impacts on the River Usk and River Wye SACs, thereby helping to avoid the likelihood that this LDP will have a significant effect upon European designated sites"

10.2.25 In relation to planning and design, Policy EN10: 'Innovative water solutions' states that:

"Developments should demonstrate the incorporation of water sensitive urban design solutions (the process of integrating water cycle management with the built environment through planning and urban design). To include the management of:

- *Waste water and pollution;*
- *Rainfall and runoff;*
- *Watercourses and water resource;*
- *Flooding; and*
- *Water pathways."*

10.2.26 The above is further explained by:

''There is a need for an approach where the whole urban water cycle is incorporated into a holistic system. Water sensitive design focuses on managing water locally and reducing demands on the strategic network.

Such examples of integrated water cycle management include Sustainable Urban Drainage Systems (SUDS); water recycling; and the holistic integration of surface water systems designed into the

development layout, as well as into networks of green spaces applicable at a range of spatial scales, such as gardens, green roofs, streets, car parks and river corridors."

10.2.27 In relation to permitted developments, Policy EN11: 'Protection of water resources' states that:

"Development will only be allowed where provision is made for the necessary infrastructure to protect water quality and quantity. Planning permission may be granted subject to conditions to secure the necessary measures, or developers may be required to enter into planning obligations. Applications that cannot provide adequate protection of watercourses, ground and surface water will be refused. New development that:

- *Poses an unacceptable risk to ground water or water courses;*
- *Poses an unacceptable risk to ground water pollution, depletion or obstruction; and*
- *Incorporates inappropriate measures to prevent pollution*

will be refused planning permission, unless appropriate measures to prevent pollution can be incorporated into the development proposal."

"Planning permission will not be granted for development that, in the opinion of the Council, following consultation with NRW and the Caldicot and Wentlooge Levels Internal Drainage Board, would adversely affect the quality, quantity or supply of surface water or groundwater as a result of:

- *The nature of the surface or waste water discharge; or*
- *Unsatisfactory agreements for the disposal of foul sewerage, trade effluent or surface water; or*
- *The spillage or leakage of stored oil or chemicals*

Developments that improve the quality of the water environment or help to prevent water pollution or flooding will be favoured."

10.2.28 According to Policy EN14: 'Flood Risk', development will not be permitted:

- *"Within tidal or fluvial flood plains unless existing or proposed flood prevention and/or protection measures are acceptable; or*
- *Where it would increase the risk of flooding; or*
- *Where it would hinder future maintenance or improvement schemes of flood defences and watercourses; or*
- *Where it would cause adverse effects on the integrity of tidal or fluvial defences; or*
- *Where ground floor bedrooms are proposed in areas at high risk of flooding."*

Supplementary Planning Guidance

10.2.29 There are no current Supplementary Planning Guidance documents adopted by Cardiff Council which are of relevance to this Water Environment chapter.

Guidance

10.2.30 Relevant UK guidance on good practice for construction projects is detailed in the following documents.

- Control of Water Pollution from Construction Sites (C532), Construction Industry Research and Information Association (CIRIA) 2001;
- Environmental Good Practice on Site (C741), CIRIA 2015.
- NRW have adopted the Environment Agency's approach to protecting groundwater set out in their guidance note *Protect groundwater and prevent groundwater* pollution[2]
- The SuDS Manual (C753), CIRIA 2015

10.2.31 The CIRIA guidance provides help on environmental good practice for the control of water pollution arising from construction activities. It focuses on the potential sources of water pollution from within construction sites and the effective methods of preventing its occurrence.

10.2.32 The EA guidance is part of a wider suite of documents and guidance relating to groundwater protection which sets out principles for assessing risk, protecting groundwater and permitting of abstractions and discharges from groundwater.

10.2.33 The SuDS Manual incorporates the latest research, industry practice and guidance for design, delivery and maintenance of Sustainable Drainage Systems (SuDS).

Information Sources

10.2.34 Detailed desk studies and site surveys were undertaken to determine the baseline conditions of the site using the following sources:

- Terrafirma Envirocheck Report produced December 2018. Reference Number: 188504369_1_1 (Appendix 8-1);
- British Geological Survey (BGS) Onshore GeoIndex online maps for details of geology and borehole logs (http://mapapps2.bgs.ac.uk/geoindex/home.html);
- EA website and open source data for details on aquifer classification, source protection zones, groundwater vulnerability, flood risk and Water Framework Directive classifications for groundwater and rivers;
- NRW information provided in May 2019 in response to an information request by SLR;
- Topographic Survey completed by Alpine Land Surveyors Ltd in April 2019;
- Appendix 10-1 – Flood Consequences Assessment, prepared by SLR Consulting Ltd, June 2019; and

2 https://www.gov.uk/government/publications/protect-groundwater-and-prevent-groundwater-pollution/protect-groundwater-and-prevent-groundwater-pollution

- Aerial Imagery available on Google Earth.

Scoping Opinion

10.2.35 A Scoping Opinion was sought from Cardiff City Council by way of a Scoping Request Report submitted on 4th April 2019. A formal Scoping Opinion, reference SC/19/00005/MJR, was adopted by Cardiff Council on 17th May 2019. A copy of the Scoping Opinion is provided within Appendix 5-4.

10.2.36 In respect of the Water Environment, the Council relied on the consultation response from National Resources Wales (NRW). NRW's consultation response reference CAS-84284-S9Q8 was dated 26th April 2019.

Table 10-1: Scoping Opinion

Page & Paragraph No.	Scoping Opinion	Comments	Outcome	Reference within ES
Page 4, Section 3, NRW Comments & Page 5, Section 4	FCA required	Site lies within Flood Zone B	Further analysis based on data provided by NRW confirms the Site is at low risk of flooding	Appendix 10-1
Page 4, Section 3, NRW Comments & Page 5, Section 4	Designated sites	The application site lies approximately 200m from the Severn Estuary Special Area of Conservation (SAC), Special Protection Area (SPA), Ramsar Site and Site of Special Scientific Interest (SSSI).	Proposed drainage strategy will ensure the development will have no impact on designated sites arising from surface water runoff.	Appendix 10-1

Additional Consultation

10.2.37 Flood risk data has been obtained by a data request to NRW. Full details of the NRW data response received are contained within the Flood Consequences Assessment at Appendix 10-1.

Assessment Methodology

10.2.38 The assessment has involved the following:

- detailed desk study to establish current baseline hydrological and hydrogeological conditions;
- site visit completed on 20 March 2019;
- identification of potential adverse changes (impacts) resulting from the proposed

construction and operation of the development;

- specification of proposed measures to avoid or mitigate these impacts; and
- evaluation of the residual significance of these impacts following mitigation.

10.2.39 The desk study and site visit were undertaken to:

- describe the hydrological and hydrogeological setting;
- describe any surface water hydrology within and adjacent to the Site;
- describe existing drainage arrangements on and around the Site;
- identify flooding risks; and
- identify sensitive hydrogeological and hydrological features which may potentially be impacted by the proposed development.

10.2.40 The extent of the desk study and site visits was based on professional judgment and is based on both proximity and the direction of flow pathways leading to and from the proposed development.

Study Area

10.2.41 The study area encompassed the Site of the proposed development and immediate environs but was extended to include the designated sites associated with the Severn Estuary approximately 200m to the south east of the eastern site boundary at its closest point

Predicting Effects

10.2.42 A qualitative risk assessment methodology has been used to assess the significance of the potential effects associated with the proposed development. Two factors have been considered using this approach: the sensitivity of the receiving environment and the potential magnitude of impact, should that potential impact occur.

10.2.43 This approach provides a mechanism for identifying the areas where site specific mitigation measures are required and for identifying mitigation measures appropriate to the risk presented by the proposed development. This approach also allows effort to be focused on reducing risk where the greatest benefit may result.

10.2.44 Criteria for determining the significance of effects are provided in Table 10-2 to Table 10-4 below. Effects of ‘major’ and ‘moderate’ significance are considered to be ‘significant’ in terms of the EIA Regulations.

Sensitivity Criteria

10.2.45 The sensitivity of the receiving environment (i.e. the baseline quality of the receiving environment as well as its ability to absorb the impact without perceptible change) is defined in Table 10-2.

Table 10-2: Value/sensitivity assessment

Sensitivity	Definition
High	• International importance. • Receptor with a high quality and rarity, regional or national scale and limited potential for substitution / replacement.
Medium	• National importance. • Receptor with a high quality, local scale and limited potential for substitution / replacement; or • Receptor with a medium quality and rarity, regional or national scale and limited potential for substitution / replacement.
Low	• Regional importance. • Receptor with a medium quality and rarity, local scale and limited potential for substitution / replacement; or • Receptor with a low quality and rarity, regional or national scale and limited potential for substitution / replacement.
Negligible	• Local importance. • Receptor with a low quality and rarity, local scale. • Environmental equilibrium is stable and is resilient to changes that are greater than natural fluctuations, without detriment to its present character.

Magnitude of Change (Impact)

10.2.46 The criteria that have been used to assess the magnitude of potential impacts (i.e. the potential scale of change) to the hydrological and hydrogeological environment are defined in Table 10-3.

Table 10-3: Magnitude of change (impact)

Magnitude	Criteria	Definition
High	Results in loss of attribute	Fundamental (long term or permanent) changes to hydrology, hydrogeology or water quality, such as: • Wholesale changes to watercourse channel, route, hydrology or hydrodynamics. • Changes to the application site resulting in an increase in runoff with flood potential and also significant changes to erosion and sedimentation patterns. • Major changes to the water chemistry or hydro-ecology. • Major changes to groundwater levels, flow regime and risk of groundwater flooding.
Medium	Results in impact on integrity of attribute or loss of part of attribute	Material but non-fundamental and short to medium term changes to hydrology, hydrogeology or water quality, such as: • Some measurable changes to watercourses, hydrology or hydrodynamics. Changes to land cover within the application site resulting in an increase in runoff within system capacity. • Moderate changes to erosion and sedimentation patterns. • Moderate changes to the water chemistry of surface runoff and groundwater.

Magnitude	Criteria	Definition
		• Moderate changes to groundwater levels, flow regime and risk of groundwater flooding.
Low	Results in minor impact on attribute	Detectable but non-material and transitory changes to hydrology, hydrogeology or water quality, such as: • Minor or slight changes to the watercourse, hydrology or hydrodynamics. • Changes to application site resulting in slight increase in runoff well within the drainage system capacity. • Minor changes to erosion and sedimentation patterns. • Minor changes to the water chemistry of surface runoff and groundwater. • Minor changes to groundwater levels, flow regime and risk of groundwater flooding.
Negligible	Results in an impact on attribute but of insufficient magnitude to affect the use/integrity.	No perceptible changes to geology, hydrology, hydrogeology or water quality, such as: • No impact or alteration to existing important geological environs. • No alteration or very minor changes with no impact to watercourses, hydrology, hydrodynamics, erosion and sedimentation patterns. • No pollution or change in water chemistry to either groundwater or surface water. • No alterations to groundwater recharge or flow mechanisms.

10.2.47 It should be noted that many potential hydrological and hydrogeological impacts are probabilistic in nature. This type of impact is clearly different from one that has a higher probability to occur and as such where appropriate, and with justification, professional judgement would be used to adjust the stated magnitude of an impact for low probability impacts.

Significance of Effect

10.2.48 The sensitivity of the receiving environment together with the magnitude of the impact defines the significance of the potential effect, as identified within Table 10-4. Effects of 'major' and 'moderate' significance are considered to be 'significant' in terms of the EIA Regulations.

Table 10-4: Significance of effect

		Sensitivity of Receptor			
Magnitude of Effect		**High**	**Medium**	**Low**	**Negligible**
	High	Substantial / Major	Substantial / Major	Moderate	Neutral / Negligible
	Medium	Substantial / Major	Moderate	Minor	Neutral / Negligible
	Low	Moderate	Minor	Minor	Neutral / Negligible
	Negligible	Neutral / Negligible	Neutral / Negligible	Neutral / Negligible	Neutral / Negligible

10.2.49 The characteristics of the impacts are described in terms of direct/indirect, secondary, cumulative, transboundary, temporary (reversible) / permanent (irreversible), together with timescales (short, medium, long term). The considerations of effects are contained within Section 10.4.0 of this Chapter.

Mitigation Hierarchy

Flooding

10.2.50 The general approach of the Planning Policy for Wales, supported by TAN15, is to advise caution in respect of new development in areas at high risk of flooding by setting out a precautionary framework to guide planning decisions. The overarching aim of the precautionary framework is, in order of preference, to:

- Direct new development away from those areas which are at high risk of flooding.
- Where development has to be considered in high risk areas only those developments which can be justified on the basis of the Justification Tests set out in TAN15 will be permitted.

Drainage

10.2.51 Current best practice guidance, The SuDS Manual (CIRIA Report C753), promotes sustainable water management (SuDS) as a means of mitigating the impact of development. The SuDS Manual identifies a hierarchy of SuDS for managing runoff, commonly referred to as a '*management train*', which summarised below:

- **Prevention** – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- **Source Control** – control of runoff at or very near its source (such as the use of rainwater harvesting).
- **Site Control** – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole site).
- **Regional Control** – management of runoff from several sites, typically in a retention pond or wetland.

Effects Not Requiring Further Assessment

10.2.52 There are no effects not requiring further assessment relating to the Water Environment contained in the Scoping Opinion Report

10.3.0 Baseline Conditions

Current Baseline

Topography and Land Cover

10.3.1 The proposed development comprises an Asphalt Batching Plant and associated internal haul roads within the southern parcel of the wider Celsa Steel Works site. The proposed development is shown within Drawing O1994-00-01-07.05 Rev2 (Proposed Site Layout Plan) submitted in support of the planning application.

10.3.2 A topographic site survey is enclosed at Appendix 02 of the FCA which itself is provided within Appendix 10-1. The survey indicates that there is very little topographic variation across the location of the proposed asphalt plant, with levels varying between approximately 9.1m AOD to 9.6m AOD.

10.3.3 The Aggregate Production Area is currently laid mainly to concrete, however, in places the concrete has deteriorated significantly.

Geology and Hydrogeology

10.3.4 A detailed description of the geology beneath the proposed development, including commentary on groundwater is provided in Chapter 8 Land Quality. A summary of this reporting is provided below.

10.3.5 Land beneath the proposed development comprises of Made Ground, overlying superficial deposits comprising Alluvium. These are underlain by Weathered Marl of the Mercia Mudstone Group.

10.3.6 The Site formerly comprised of a tip, and as such the presence of Made Ground/fill was found at the Site comprising of concrete over Made Ground recovered as predominately black to grey to black granular material with traces of clay. Brick and concrete fragments were also apparent. Depths of Made Ground varied in depth, between approximately 7.3 to 7.7m beneath the Site.

10.3.7 The superficial deposits of Alluvium comprised of very soft to soft Alluvial Clay, at a depths between approximately 15.0 to 16.4m beneath the Site.

10.3.8 The solid bedrock geology of the Mercia Mudstone comprised of Weathered Marl and was observed at depths up to 21.0m.

10.3.9 A monitoring visit carried out on the 16th April 2019 identified perched groundwater within the Made Ground at depths of between 4.59m and 4.65m below ground level. Sub-artesian groundwater was encountered beneath the Alluvium. This was noted to rise up the boreholes and was measured at depths of between 7.52m and 7.62 below ground level.

Aquifer Characteristics

10.3.10 The superficial Alluvium deposits has been designated by NRW as a Secondary (Undifferentiated) Aquifer meaning it has not been possible to attribute the deposits to either category 'Secondary A' or 'Secondary B' aquifers as the deposits have variable characteristics.

10.3.11 The local Mercia Mudstone bedrock has been designated by NRW as a ‘Secondary B Aquifer’ which

are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering.

10.3.12 No Source Protection Zones (SPZs) were identified within a 2km radius of the Site.

10.3.13 The Site overlies the SE Valleys Southern Devonian Old Red Sandstone and Triassic Mercia Mudstone operational groundwater catchment (GB40902G201500). With reference to NRW's Water Watch website[3] the overall classification status for the groundwater body defined by the Water Framework Directive (WFD) is 'Good' with an objective to achieve an Overall and Chemical 'Good' status by 2015 (effectively achieved)

10.3.14 The underlying groundwater body has therefore been assessed to be of '*Medium*' Sensitivity

Hydrology

Surface Water and Drainage

10.3.15 The closest main watercourse to the proposed development is the River Rhymney, located approximately 1.0km north of the proposed development, where it outfalls into the Severn Estuary. The mouth of the River Taff is located approximately 3.2km to the south west of the Site.

10.3.16 The eastern boundary of the Site is some 200m to the west of the tidal River Severn.

10.3.17 There are no watercourses or drains within the Interim Asphalt Plant Area or the wider Celsa Steel Works Site to the south of Rover Way.

10.3.18 The Asphalt Batching Plant Area is currently laid mainly to concrete, however, in places the concrete has deteriorated. There is evidence that some parts of the concrete hardstanding may have been formally drained, however, there are no records of the former drainage system. In the absence of any watercourses, or drains, in the vicinity of the site, it is likely that the any drainage system that may have existed discharged to soakaways rather than to the large diameter combined sewer the runs beneath the eastern boundary of the Asphalt Batching Plant Area.

Surface Water Quality

10.3.19 The EA and NRW survey and samples all Main Rivers in England and Wales routinely to classify and identify pressures on water bodies against the Water Framework Directive objectives set out for them. The Directive requires all water bodies to maintain or improve their classification status, preventing any decline in classification.

10.3.20 For surface waters, Good status is a statement of 'overall status', which in turn consists of a chemical and ecological component. Chemical status measures priority substances that present a significant risk to the water environment. Chemical status is classified as 'good' or 'fail'. Ecological status is measured on a scale of 'high', 'good', 'moderate', 'poor' and 'bad'. The ecological status takes into account physico-chemical elements, biological elements, specific pollutants and hydromorphology. To achieve good ecological status or potential, good chemical status or good groundwater status every single element assessed must be at good status or better. If one element is below its threshold for good status, then the whole water body's status is classed as less than good.

10.3.21 The lower reaches of the Severn Estuary (EA ID GB530905415401) currently has Moderate ecological

[3] https://drive.google.com/file/d/0B2hsDbbdxz1tcUdGV1c5U0dXMkk/view

status and Good chemical status based on 2016 reporting, which represents the latest EA reporting detailed on the EA Catchment Data Explorer[4] . Good ecological potential is expected to be met for the Lower Severn Estuary by 2021.

10.3.22 As the Severn Estuary benefits from a number of designations and the water quality will be a component part of those designation, the sensitivity of this water body is considered in the *Designations* sections below.

Flood Risk

10.3.23 Under the guidance in TAN15, Development Advice Maps (DAMs) are used to determine whether the consequences of a particular frequency flood event are acceptable for the location of a specific type of development or land use.

10.3.24 The Flood Consequences Assessment (FCA) provided in Appendix 10-1 confirms that the proposed development is located in Zone B, which is defined as land known to have flooded in the past, as evidenced by sedimentary deposits. There is also a low risk of surface water flooding within the Site.

10.3.25 The FCA concluded the proposed development will not currently be subject to significant flood risk from any of the flood sources or mechanisms considered. This includes fluvial and tidal flooding, surface water flooding, as well as flooding from sewers, groundwater, other artificial sources and infrastructure failure.

10.3.26 However, with the advent of climate change, the lower-lying parts of the Site may be at risk of tidal flooding over the lifetime of the development.

10.3.27 The impact of development on the flood risk elsewhere can be significant through the obstruction of flood flows, reduction of floodplain storage and increased rate and volume of surface water runoff. However, as the proposed development is in Flood Zone B and not currently at risk of flooding from the 0.1% (1 in 1,000) AEP tidal flood event, any potential effects with respect to the obstruction of flood flows and/or reduction of floodplain storage are assessed to be '*Negligible'* and have not been assessed.

10.3.28 Whilst the Asphalt Plan Area is currently laid to hardstanding it is not formally drained. The proposed drainage strategy will not increase the impermeable area, however, it will positively drain this area thereby altering existing drainage patterns. Given the setting of the site, the only potential receptor on which the altered drainage patterns could have an effect would be groundwaters.

Other Users

10.3.29 The influence of any activity on the groundwater environment can have an effect over large distances. To ensure that all potential receptors are afforded appropriate assessment, all recorded abstraction points within 2km of the application site have been considered. There are 7 active groundwater uses recorded within 2km of the proposed development. These users relate to 4 Groundwater Abstraction Licence numbers. Table 10-5 shows the details of these licenced ground water abstractions, including location details. These abstractors are considered as potential receptors to impacts that might arise from the proposed development.

10.3.30 As these abstractions are drawing on the underlying groundwater body, any effects have not been

[4] https://environment.data.gov.uk/catchment-planning/

considered separately from those that might impact on the groundwater body itself discussed in the *Aquifer Characteristic* section above.

Table 10-5: Active Groundwater Abstraction Licences within 2km of the Site

Operator	License Number	Location	Grid Reference	Abstraction Use
Celsa Manufacturing (UK) Ltd	21/57/25/0078	359m SW of the Site	321323 176141	Mineral Products: Dust Suppression
Celsa Manufacturing (UK) Ltd	21/57/25/0078	656m SW of the Site	321040 176020	Mineral Products: Dust Suppression
Cardiff City Council	21/57/12/0039	1775m W of the Site	319920 177020	General Industrial
Freeline Electro Plating Ltd	21/57/12/0074	1788 NW of the Site	320800 178000	Other Industrial/Commercial/Public Services: General Washing/ Process Washing

Pollution Incidents

10.3.31 Detail of all pollution incidents reported to the EA are held on the National Incident Recording System. Each incident is assessed and assigned an environmental impact categorisation which defines the likely environmental impact with regard to air, water and land. Incidents are classified as Category 1 (major, serious, persistent and/or extensive impact or effect on the environment), Category 2 (significant impact or effect on the environment), Category 3 (minor or minimal impact on the environment) or Category 4 (substantiated incident with no impact).

10.3.32 Reference to the Envirocheck reporting (Reference Number: 188504369_1_1), which is included within the Geotechnical and Geo-Environmental Report (Appendix 8-1), indicates that there have been no recorded pollution incidents within the red line boundaries or within the wider Celsa Steel Works Site to the south of Rover Way. The Envirocheck report details four Category 3 (minor) pollution incidents within 500m of the Site that historically have had the potential to affect water quality. The principal pollution incidents for water quality are summarised in Table 10-6.

Table 10-6: Recorded water pollution incidents within 500m of the Site

Type of Discharge	Location	Grid Reference	Category of Incident	Date of Incident
Crude Sewage	Rover Way, Foreshore 351m SE of the Site	321900 176250	Category 3 (minor)	4th August 1997
Smoke	386m NE of the Site	321825 176689	Category 3 (minor)	13th April 2013
Mud/Clay/Soil	Seawall Road 417m NW of the Site	321300 176700	Category 3 (minor)	23rd April 1996
Algae	A Plant Units, 4, 5 and 6, Eastmoors Road 495m NW of the Site	321300 176800	Category 3 (minor)	6th September 1995

10.3.33 It is highly unlikely that the pollution incidents summarised in Table 10-6 affected baseline water quality for the proposed development, given the minor category of the incidences and the time elapsed since the incidences.

Designations

10.3.34 The influence of any activity on the water environment can have an effect over large distances, either through direct impact to surface water runoff volumes or water quality altering down-gradient hydrological regimes or through changes to groundwater regimes. To ensure that all potential receptors are afforded appropriate assessment, all recorded designated areas within 2km of the application boundary have been considered. Land within 2km of the Site designated for its nature conservation value relative to marginal and aquatic habitats and associated species are listed in Table 10-7.

Table 10-7: Sites designated for hydrological interest

Site Name	Designation	Distance and Direction	Linkage
Severn Estuary	• Ramsar Site • Site of Special Scientific Interest (SSSI) • Special Area of Conservation (SAC) • Special Protection Area (SPA)	200m SE	No direct surface water linkage, however, groundwaters underlying the site may be in hydraulic contact with the Severn Estuary.

10.3.35 The only designated feature in the vicinity of the proposed development is the Severn Estuary, which is designated as a Ramsar Site, SSSI, SAC and SPA. Any changes to flow regimes, or water quality in shallow groundwater underlying the proposed development could potentially affect water quality in the Severn Estuary.

10.3.36 The environmental designations for the Severn Estuary are considered significant and have therefore been assessed as '*Medium*' sensitivity.

Future Baseline

10.3.37 It is expected that should the proposed development not to proceed, the baseline conditions on Site in relation to existing hydrology or hydrogeology would likely remain unchanged. There is potential that some change in the flood risk could occur over time due to the potential of climate change on sea levels in the Severn Estuary.

10.4.0 Assessment of Effects

10.4.1 This section provides a summary of the potential effects of the proposed development on the water environment. The summary does not consider the risk of flooding posed to the proposed development but does consider flood risk implications with regard to the existing water environment and surrounding sensitive users. The assessment is based on a review of actives that will occur during the construction and operation. It also assesses the magnitude of each identified impact and the significance of the associated effect on local hydrological receptors.

10.4.2 In this assessment the sensitivity of the potential receptors is designated as follows, based on the review of baseline conditions in Section 10.3:

- Flood risk – Low sensitivity
- Groundwater – Medium sensitivity
- Severn Estuary – Medium sensitivity

10.4.3 It should be noted that the magnitude of the impact has been assessed as described in Table 10-3. The significance of any potential effect has then been assessed (based on the sensitivity of the receptor) as described in Table 10-4.

Construction Phase Effects

10.4.4 Potential effects during the construction phase are shown in Table 10-8 below. These can be summarised as:

- Upgrading of existing concrete hardstanding in the Asphalt Plant Area;
- material export and import;
- temporary stockpiling of materials;
- groundwork for foundations and services;
- construction of hardstanding and drainage facilities;
- erection of the Asphalt Plant and associated infrastructure; and
- vehicle movements (with the potential to track-out material from site).

Table 10-8: Potential impacts during construction phase

Receptor	Nature of Potential Impact	Sensitivity of Receptor	Magnitude of Potential Impact	Evaluation of Significance	Comment
Temporary stockpiling of materials					
Severn Estuary	Loose stockpiled materials could generate turbid run off.	Medium	Negligible	Negligible (Not significant)	No direct flow path from the Site to the Severn Estuary.
Groundwater		Medium	Low	Minor Any significant impact would potentially be indirect (through infiltration), adverse, temporary and short to medium term.	Significant thickness of made ground overlying aquifer. Analysis (see Section 9.0 of FCA Appendix 10-1) suggests water infiltrating through made ground will not mobilise contaminants
Groundwork for foundations, concrete hardstanding and services					
Severn Estuary	Generation of turbid run off from groundworks	Medium	Negligible	Negligible (Not Significant)	No direct flow path from the Site to the Severn Estuary.
Groundwater	Excavations and foundations (piling) could open preferred pathways to bedrock groundwater	Medium	Low	Minor Any significant impact would potentially be direct (if piling to bedrock) or indirect (through infiltration), adverse, temporary and short to medium term	Significant thickness of made ground overlying aquifer. Analysis (see Section 9.0 of FCA Appendix 10-1) suggests water infiltrating through made ground will not mobilise contaminants

Receptor	Nature of Potential Impact	Sensitivity of Receptor	Magnitude of Potential Impact	Evaluation of Significance	Comment
Vehicle movements					
Severn Estuary	Spills of fuels, oils or other polluting substances	Medium	Negligible	Negligible	No direct flow path from the Site to the Severn Estuary.
Groundwater		Medium	Low	Minor Any significant impact would potentially be indirect (through infiltration) adverse, temporary and short to medium term.	Significant thickness of made ground overlying aquifer. Analysis (see Section 9.0 of FCA Appendix 10-1) suggests water infiltrating through made ground will not mobilise contaminants.

Operational Phase Effects

10.4.5 Potential effects from the operation of the Site are shown in Table 10-9 below. These relate to operational site activities which include operation and regular maintenance of the Asphalt Batching Plant and management of surface water runoff.

Table 10-9: Potential impacts during operational phase

Receptor	Nature of Potential Impact	Sensitivity of Receptor	Magnitude of Potential Impact	Evaluation of Significance	Comment
Operational site activities					
Severn Estuary	Spills of fuels, oils or other polluting substances	Medium	Negligible	Negligible	No direct flow path from the Site to the Severn Estuary.
Groundwater		Medium	Low	Minor Any significant impact would be indirect (through infiltration via the proposed soakaway), adverse and permanent (for the lifetime of the facility)..	Significant thickness of made ground overlying aquifer. Analysis (see Section 9.0 of FCA Appendix 10-1) suggests water infiltrating through made ground will not mobilise contaminants.
Management of surface water runoff					
Flood Risk Elsewhere	Alteration of drainage regime	Low	Low	Minor Any significant impact would be direct, adverse and temporary (short term) for the duration extreme storm events.	Surface water drainage strategy proposed to manage surface water runoff (See FCA enclosed at Appendix 10-1)
Groundwater	Surface water runoff to drain to a soakaway	Medium	Low	Minor Any significant impact	Significant thickness of made ground overlying aquifer. Analysis (see

Receptor	Nature of Potential Impact	Sensitivity of Receptor	Magnitude of Potential Impact	Evaluation of Significance	Comment
	founded in made ground			would be indirect (through infiltration), adverse and permanent (for the lifetime of the facility).	Section 9.0 of FCA Appendix 10-1) suggests water infiltrating through made ground will not mobilise contaminants. Proposed settlement lagoon will remove suspended solids, hydrocarbons and metal from surface water runoff.

Cumulative Effects

10.4.6 A description of committed development in the vicinity of the proposed Asphalt Plant is provided in Chapter 7.

10.4.7 These developments have been considered in the content of any potential cumulative effects on the Water Environment, and specifically on the key receptor described in Section 10.3, i.e.:

- Flood risk – Low sensitivity
- Groundwater – Medium sensitivity
- Severn Estuary – Medium sensitivity

Land at Rover Way, Pengam (The Cardiff Motocross Centre MX)

10.4.8 Land at Rover Way, Pengam extends to a site area of approximately 16.6 Ha (41 acres) and is located immediately to the east of the planning application site, predominantly consisting of the Cardiff Motocross Centre MX and adjoining land.

10.4.9 The FCA submitted with the application confirms that the site is not at risk of flooding and that surface water runoff is to be discharged to the Severn Estuary.

10.4.10 As the proposed biomass plant and industrial accommodation will not increase the risk of flooding elsewhere, there is no potential for any cumulative effect on flood risk.

10.4.11 No significant effect on the Severn Estuary arising from the Asphalt Plant has been identifed and therefore there is there is no potential for any cumulative effect on this key receptor.

SIMS Metal UK Metal Recovery Plant, Rover Way, Pengam

10.4.12 The Metal Recovery Plant is located within the Celsa Steel Works site, immediately to the north of the current application site.

10.4.13 It is understood that runoff from the roof of the facility is collected for reuse within the plant with excess runoff discharged to a soakaway into made ground which will be of similar composition to that underlying the proposed Asphalt Plant.

10.4.14 The facility lies with Flood Zone C2, however, the FCA submitted with the application confirms that the site is defended and concludes that there would be no loss of flood storage volume associated with a breach of the defences. As discussed above, surface water runoff is to be managed with a soakaway.

10.4.15 As neither the proposed Asphalt Plant, nor the Metal Recovery Plant will have an impact on the flood risk elsewhere, there is no significant cumulative effect on flood risk.

10.4.16 For the reasons set out in Section 10 and in the FCA at Appendix 10.1, the impact on the groundwater from Asphalt Plant, or the Metal Recovery Plant, is unlikely to be significant and therefore there is no significant cumulative effect on groundwater.

10.4.17 As for the Asphalt Plant, there is no direct hydraulic connection to the Severn Estuary from the Metal

Recovery Plant and therefore neither facility will have a significant impact on this key receptor singly or in combination.

10.5.0 Mitigation

10.5.1 There are a number of mitigation measures that can be employed to reduce the effects identified in the Assessment of Effects set out above.

Construction Phase

10.5.2 To manage the potential effects of the construction works on the water environment a range of mitigation measures are suggested which may form part of a site-specific Construction and Environmental Management Plan (CEMP).

10.5.3 The CIRIA publications '*Control of Water Pollution from Construction Sites*' provides a range of measures to control ground and water pollution impacts from construction that would form part of the CEMP. These can be summarised as:

- Management of construction works so as to comply with the necessary standards and consent conditions to be identified by Natural Resources Wales (NRW) and Cardiff Council;
- Consideration will be given to the appropriate storage of materials in wet weather and certain site activities may be postponed during heavy rainfall to prevent pollution entering surface water runoff;
- Any oil, fuel lubrication and other potential pollutants shall be handled on the site in such a manner as to prevent pollution of any watercourse or aquifer. For any liquid other than uncontaminated water, this shall include storage in suitable, bunded tanks;
- No extraction, tipping or temporary storage of materials shall take place within an agreed distance of any gully or other surface water drainage component unless part of the approved works. Under no circumstances shall tipped material enter any drain without prior consent;
- Effective wheel/body washing facilities to be provided and used as necessary;
- A road sweeper to be available whenever the need for road cleaning arises; and
- Vehicles carrying waste material off-site to be sheeted.

10.5.4 All contractors and sub-contractors will also be required to go beyond best practice site management principles, as defined by the Considerate Constructors scheme.

10.5.5 The site does not currently benefit from a formal surface water drainage system; incident rainfall infiltrates into the underlying ground or ponds on areas of hardstanding. Nevertheless, the contractor should where practical manage surface water runoff within the working area by creating a local sump (or sumps) and grips to prevent ponding. Trafficking areas of ponded runoff, particularly on made ground, has the potential to generate fine silts that can be difficult to manage and are easily transported off site. This also has the potential to increase the mobility of any contaminants in the made ground.

Operational Phase

10.5.6 Section 9.0 of the FCA enclosed at Appendix 10-1 describes the proposed surface water

management scheme. Surface water runoff from the Asphalt Plant Area will drain to a settlement lagoon before being discharged to a soakaway. The settlement lagoon will remove fine silts and metals from the runoff. A baffle arrangement at the outlet from the settlement lagoon will retain any hydrocarbons.

10.5.7 Any oil, fuel lubrication and other potential pollutants shall be handled and stored on the site in such a manner as to prevent them being released into the drainage system. For any liquid other than uncontaminated water, this shall include storage in suitable tanks with bunding as required.

10.6.0 Residual Effects

10.6.1 When taking into account the mitigation measures identified above (Section 10.5.0), the effects for the construction and operation of the proposed development will all have been reduced to negligible and therefore ensures that all effects are not significant. Furthermore, when taking into account the likelihood of such effects occurring, which in all cases is low or unlikely, the associated risks are low or very low.

10.6.2 Notwithstanding, with regard to groundwater, it is duly recognised that there is a potential indirect adverse long term (for the duration of the operation of the plant) effect due to infiltration of surface water runoff into made ground overlying the aquifer. However, the magnitude of effect is likely to be low to negligible based on an analysis of the leaching tests completed on the made ground. On this basis, it is considered that this residual effect also represents a negligible effect and a low risk.

10.6.3 Given the above, there are no residual effects associated with the development following the incorporation of the proposed mitigation measures.

10.7.0 Summary of Effects

10.7.1 The principal water environment receptors that could potentially be affected by the proposed development have been identified as the Severn Estuary, which is subject to a number of designations, and the groundwater body underlying the site.

10.7.2 The potential impact on the flood risk to non-specific receptors (generically referred to as 'elsewhere') has also been considered as this is a specific requirement of PPW and TAN15.

10.7.3 As there is no direct identified hydraulic pathway to the Severn Estuary the potential effects during the construction and operational phases are considered 'negligible'

10.7.4 The potential effect of the proposed development on groundwater arises from infiltration of runoff through a considerable thickness of made ground during both the construction and operational phase. However, analysis shows that the leaching potential of the made ground is low and therefore the residual effect following implementation of the mitigation measures is likely to be low to negligible.

10.7.5 The Site is not at significant risk of flooding and sustainable drainage measures are proposed to manage surface water runoff.

10.8.0 Conclusions

10.8.1 Reference has been made to relevant legislation, planning policy, technical guidance and other codes of best practice in the design of the proposed development to limit the potential for contamination of ground and surface waters, the potential for flooding to be caused by the proposed development, and other potential impacts on the water environment.

10.8.2 A qualitative risk assessment methodology has been used to assess the significance of the potential effects associated with the proposed development. Two factors have been considered using this approach: the sensitivity of the receiving environment and the potential magnitude of impact, should that potential impact occur.

10.8.3 This approach provides a mechanism for identifying the areas where site specific mitigation measures are required and for identifying mitigation measures appropriate to the risk presented by the proposed development. This approach also allows effort to be focused on reducing risk where the greatest benefit may result

10.8.4 An assessment the sensitivity of the potential receptors based on a review of baseline conditions identified the following key receptors:

- Flood risk – Low sensitivity
- Groundwater – Medium sensitivity
- Severn Estuary – Medium sensitivity

10.8.5 It is notable that these were also identified by the Scoping Opinion Report prepared by the Local Planning Authority.

10.8.6 As there is no direct identified hydraulic pathway to the Severn Estuary the potential effects during the construction and operational phases are considered to be 'negligible' and not significant.

10.8.7 The potential effect of the proposed development on groundwater arises from infiltration of runoff through a considerable thickness of made ground during both the construction and operational phase. However, analysis shows that the leaching potential of the made ground is low and therefore the residual effect following implementation of the mitigation measures is likely to be low to negligible and not significant.

10.8.8 The Site is not at significant risk of flooding and sustainable drainage measures are proposed to manage surface water runoff.

10.8.9 No cumulative effects arising from committed development in the vicinity of the proposed development have been identified.

REFERENCES

- Water Framework Directive (2000/60/EC) (European Commission, 2000)
- Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (The Stationery Office Limited, 2017)
- Groundwater Directive (2006/118/EC, including amendments to Annex II detailed under Directive 2014/80/EU) (European Commission, 2006)
- Environmental Permitting (England and Wales) Regulations 2016 (The Stationery Office Limited, 2016)
- Groundwater (England and Wales) Regulations 2009 (The Stationery Office Limited, 2009)
- Floods Directive (2007/60/EC) (European Commission, 2006)
- The Flood Risk Regulations 2009 (The Stationery Office Limited, 2009)
- Freshwater Fish Directive (78/659/EEC) (recodified 2006/44/EC) (European Commission, 2006)
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- Planning Policy Wales, Edition 10 (Welsh Government, 2018)
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- Cardiff Strategic Flood Consequences Assessment (Atkins, 2009)
- Cardiff Local Development Plan 2006-2026 (Cardiff Council, 2016)
- Control of Water Pollution from Construction Sites (C532) (CIRIA, 2000)
- Environmental Good Practice on Site (C741) (CIRIA, 2015)
- The SuDS Manual (C753) (CIRIA, 2015)
- Geotechnical and Geo-Environmental Report (Terra Firma, 2019)
- Envirocheck Report Reference 188504369_1_1, December (Envirocheck, 2018)
- British Geological Survey (BGS) Onshore GeoIndex online maps (http://mapapps2.bgs.ac.uk/geoindex/home.html)

- Topographic Survey (Alpine Land Surveyors Ltd ,2019)
- Water Watch Website (https://drive.google.com/file/d/0B2hsDbbdxz1tcUdGV1c5U0dXMkk/view)
- Catchment Data Explorer (https://environment.data.gov.uk/catchment-planning/)

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