Q1.

Using an example you have studied, assess the impact of a river restoration project on urban drainage.

[9 marks]

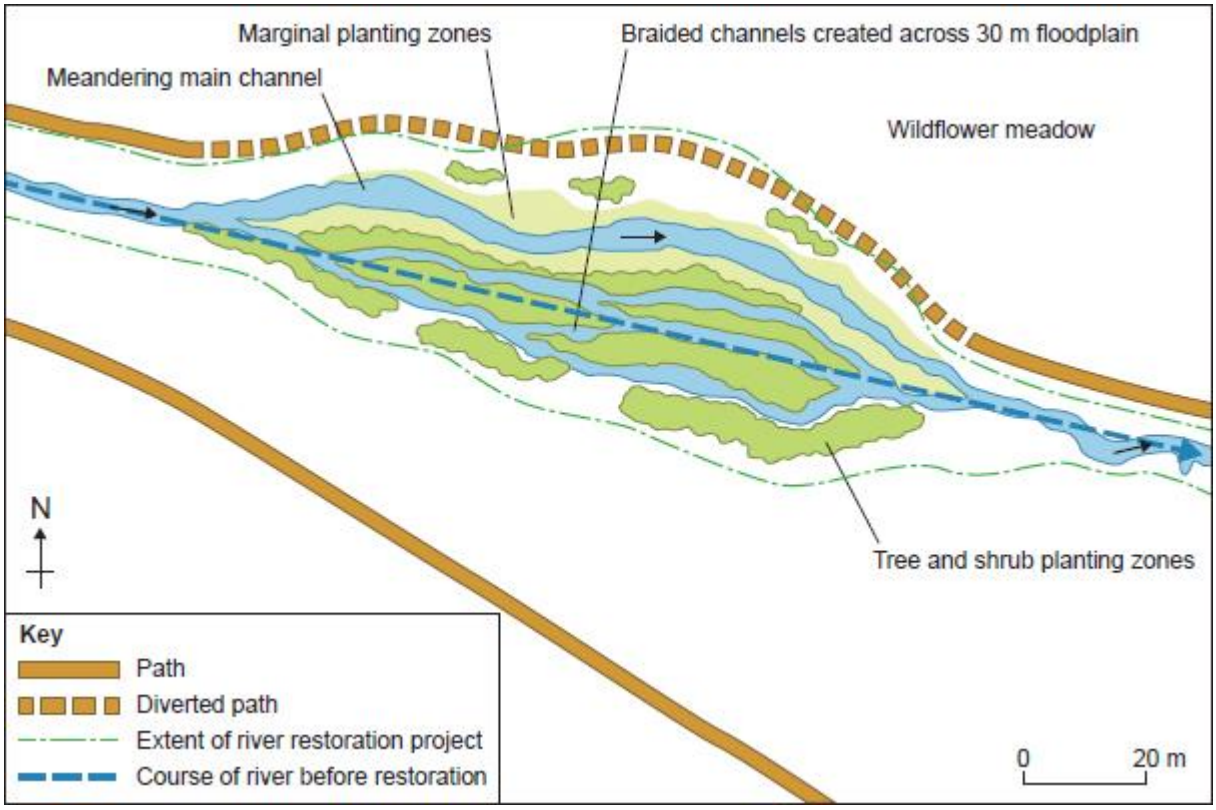
Q2.

Outline benefits of sustainable urban drainage systems (SUDS).

[3 marks]

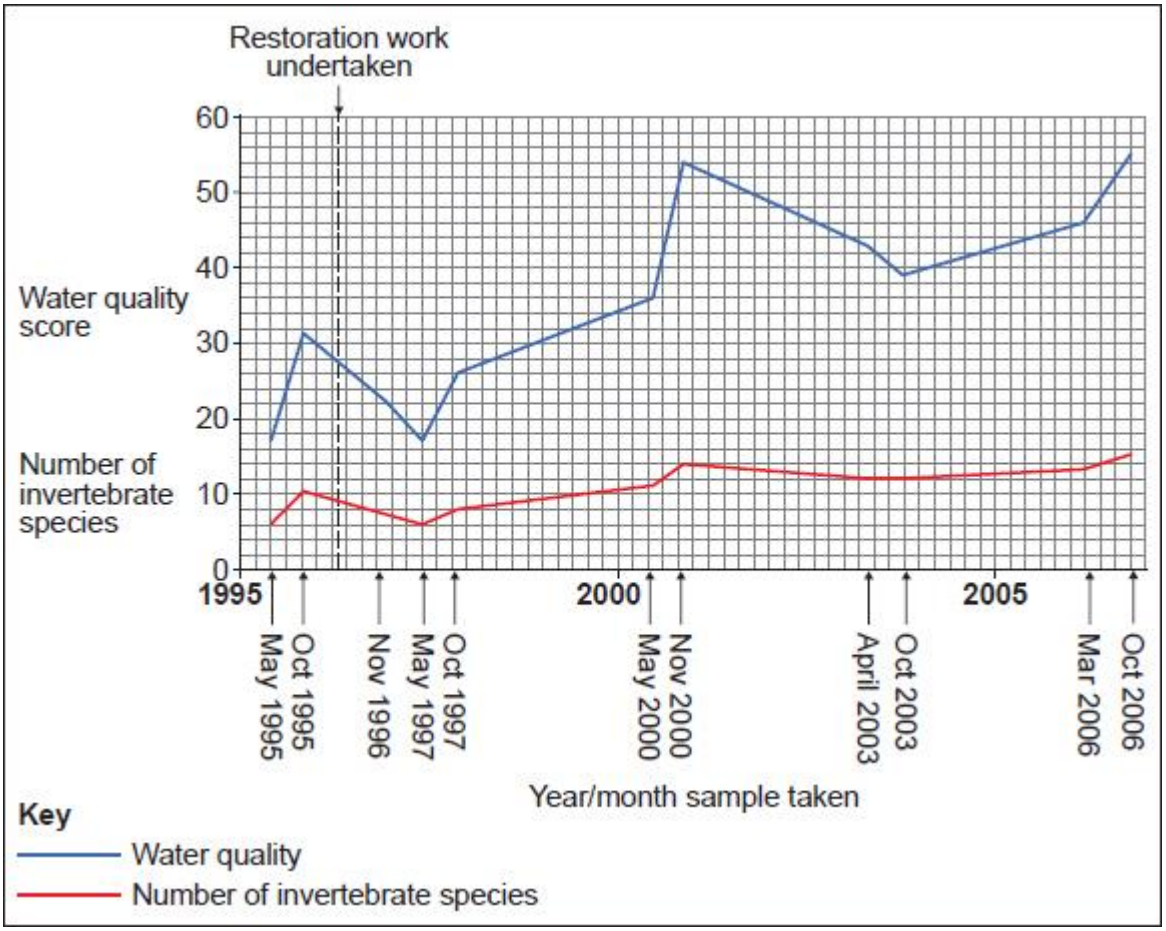
Q3.

Figure a
Information about a river restoration project on the River Alt in Knowsley, Merseyside which took place in 1996



Note: Marginal plants are plants that grow on the edge of water areas such as rivers and ponds.
They are tolerant to water-logged soils.
Braided channels occur where a main channel splits into several smaller channels. These channels are often narrower and shallower than the main channel, encouraging a diverse ecology.

Figure b
Water quality and biodiversity in the River Alt between 1995 and 2006



Note: The higher the water quality score, the cleaner the water. The score is based on the actual number of large invertebrates found in a water sample.
Invertebrates are organisms without a backbone, for example worms and insects.

Analyse the changes brought about by river restoration shown in **Figure a** and **Figure b**.

[6 marks]

Q6.

Assess the impact on the character of a place of a river restoration and conservation project in a damaged urban catchment.

[9 marks]

Q7.

To what extent do you agree that urban drainage presents more opportunities than challenges in developing more sustainable cities?

[20 marks]

Q8.

What are SUDS?

[1 mark]

A Artificial drainage systems that are installed in urban areas to rapidly transfer surface water so reducing lag time and decreasing flood risk. ⬭

B River channels are dredged in urban areas to increase channel capacity, so decreasing flood risk in the area. ⬭

C Strategies that reduce flood risk in urban areas by straightening rivers to increase flow rates through the area. ⬭

D Strategies using natural approaches in the landscape to reduce flood risk and provide ⬭

amenities for the community in urban areas.

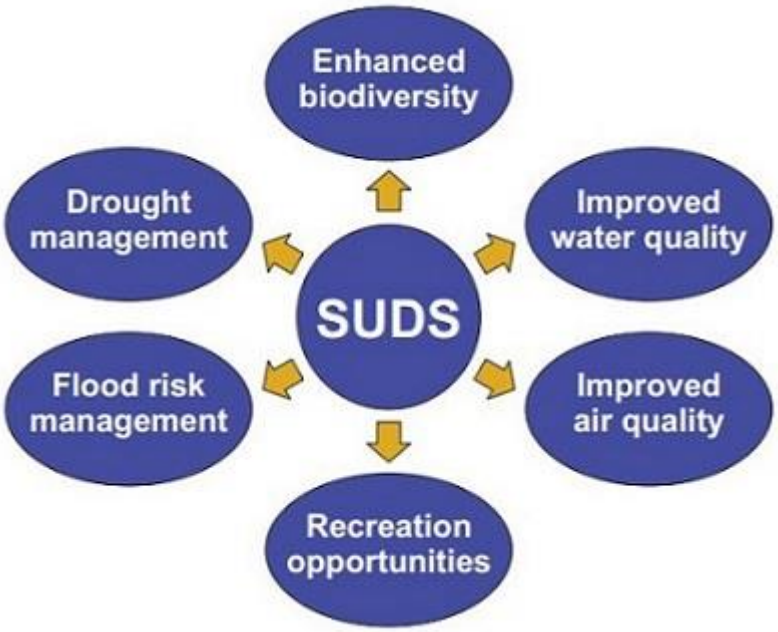
Q9.

Figure 1 shows an example of a sustainable urban drainage system (SUDS) using swales in Upton, Northampton.

Figure 1

Figure 2 shows the possible benefits of SUDS.

Figure 2



Using **Figure 1** and your own knowledge, evaluate the use of SUDS in achieving the benefits shown in **Figure 2**.

[9 marks]

Q1.

AO1 – Knowledge and understanding of urban drainage. Knowledge and understanding of a specified river restoration project.

AO2 − Application of knowledge and understanding to analyse and evaluate the impact of the river restoration scheme on urban drainage.

Mark scheme

Level 3 (7–9 marks)
AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.
AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation is detailed and well supported with appropriate evidence. A well balanced and coherent argument is presented.

Level 2 (4–6 marks)
AO1 – Demonstrates some appropriate knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.
AO2 – Applies some knowledge and understanding appropriately. Connections and relationships between different aspects of study are emerging/evident with some relevance. Analysis and evaluation evident and supported with some appropriate evidence. A clear but partial argument is presented.

Level 1 (1–3 marks)
AO1 – Demonstrates basic/limited knowledge and understanding of concepts, processes, interactions and change. These offer limited relevance with inaccuracy.
AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation basic and supported with limited appropriate evidence. A basic argument is presented.

Notes for answers
This question links two different parts of the specification, namely urban drainage and a specific river restoration project. Students need to link their knowledge of the river restoration project and apply this to their knowledge and understanding of urban drainage. There should be reference to a specific named restoration project. The focus of the question should be the impact of the project on the drainage system rather than environmental improvements. However, water quality could be considered as part of the urban drainage system.

AO1

- Knowledge and understanding of urban drainage systems – altered storage capacity due to urban reservoirs, channelisation, replacement of vegetation by impermeable surfaces, less soil storage capacity.
- Urban water cycles – Reduced evapotranspiration, large surface run-off, reduced infiltration, wastewater discharge.
- Urban flood hydrographs – lower base-flows, short lag times, higher peak discharge, steep falling limb.
- Catchment management in urban areas – flooding, water quality and environmental issues.

- Knowledge and understanding of a specific river restoration project – aims of the project, nature of the project.
- Impacts of the river restoration project not related to urban drainage, for example, recreation opportunities or employment.

AO2

- Analysis of the aims of the project in altering urban drainage – reducing flood risk, improving water quality. For example, the river restoration scheme aimed to reduce flood risk by increasing vegetation, thereby increasing interception.
- Analysis of the project on a flood hydrograph – increased tree planting would increase the lag-time.
- Analysis of the link between the project and the impact on urban drainage. For example, restoration involving restoring meanders from previously straightened channels will slow discharge.
- Evaluation of the restoration project in achieving its aims in relation to urban drainage. The extent to which it was successful in its outcomes.
- Evaluation of the project may consider unintended outcomes on the urban drainage. For example, changes in river discharge as a result of building gravel banks to encourage greater biodiversity.
- The extent to which the restoration project changed urban drainage should be considered.
- Response should incorporate a view on the impact of the project on urban drainage.

Credit any other valid approach.

AO1 = 4, AO2 = 5

[Total 9 marks]

Q2.

Notes for answers

Allow 1 mark per valid point with additional marks for developed points (d).

SUDS:

- Prevent water pollution by encouraging natural processes to purify sewage before it is returned to the local water cycle (1).
- Slow down surface water run-off (1) and therefore reduce the risk of flooding (1)(d).
- Potentially reduce the risk of local sewers flooding during heavy rain (1).
- Recharge groundwater to help prevent drought in areas prone to water shortage (1).
- Provide valuable habitats and a supply of drinking water for wildlife in urban areas (1).
- Create potential green spaces for people in urban areas, allow for recreation and leisure activity, depending upon the scale of the project (1).
- There may be reference to management of grey water.

AO1 = 3

[Total 3 marks]

Q3.

AO3 – Analysis of the changes brought about by river changes shown in **Figure a** and **b**. Analysis of the connections between the project and improvements in water quality.

Mark scheme

Level 2 (4–6 marks)

AO3 – Clear analysis of the qualitative and quantitative evidence provided which makes

appropriate use of data to support. Clear connections between different aspects of the data.

Level 1 (1–3 marks)
AO3 – Basic analysis of the qualitative and quantitative evidence provided which makes limited use of data to support. Basic or limited connections between different aspects of the data.

Notes for answers
The question requires analysis of the river restoration project shown in **Figure a**. Connections may be made both within the data sets and between the map and the graph.

AO3

- The river restoration project has changed a straight channel into one that meanders and is also braided now covering an area that is about 30m wide rather than one narrow channel.
- In between the braided channels are areas of shrubs and trees. There is also a lot of planting either side of the river extending the whole area to about 40m wide.
- The river path has been diverted and now goes through wildflower meadows and planted areas, providing recreational opportunities.
- The graph shows that water quality has improved since the project started as the water quality score has trebled. This links with the plan above as greater planting will have improved water quality.
- The number of species has also increased as a result of the project as the braided channels and meandering river has increased the number of species by 8.
- The number of species seems to mirror that of the water quality score, because as one increases so does the other, for example, in 2000 both increased and then saw a fall after November 2000. The only exception is in 2003 when the water quality score fell but the number of species stayed the same.
- However, it is difficult to say with certainty that the project achieved its aim and improved water quality as the water quality score rose prior to the works. Also, although there has been an overall rise in both scores, there have also been some falls.
- They may also consider that the data is historical, and we don't know what happened after 2006.

Credit any other valid analysis.

AO3 = 6
[Total 6 marks]
AO1 = 4, AO2 = 5
[Total 9 marks]

Q6.

AO1 − Knowledge and understanding of a river restoration and conservation project in a damaged urban catchment. Knowledge and understanding of the principals associated with understanding factors affecting the character of place.

AO2 − Application of knowledge and understanding to assess the impact of a river restoration and conservation project in a damaged urban catchment on the character of that place.

Level 3 (7−9 marks)
AO1 − Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.
AO2 − Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete

relevance. Analysis and evaluation is detailed and well-supported with appropriate evidence.

Level 2 (4−6 marks)
AO1 − Demonstrates clear knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.
AO2 − Applies clear knowledge and understanding appropriately. Connections and relationships between different aspects of study are evident with some relevance. Analysis and evaluation is evident and supported with clear and appropriate evidence.

Level 1 (1−3 marks)
AO1 − Demonstrates basic knowledge and understanding of concepts, processes, interactions and change. This offers limited relevance with inaccuracy.
AO2 − Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation is basic and supported with limited appropriate evidence.

Notes for answers

AO1

- River restoration and conservation in damaged urban catchments with reference to a specific project. Reasons for and aims of the project; attitudes and contributions of parties involved; project activities and evaluation of project outcome.
- Issues associated with catchment management in urban areas.
- Urban characteristics. Physical and human factors in urban forms.
- How places are known and experienced, how their character is appreciated, the factors and processes which impact upon places and how they change and develop over time.
- Factors contributing to the character of places: Endogenous: location, topography, physical geography, land use, built environment and infrastructure, demographic and economic characteristics.
- The ways in which students' own lives and those of others are affected by continuity and change in the nature of places and our understanding of place.

AO2

Responses are expected to show an understanding of a river restoration and conservation project in a damaged urban catchment on the character of that place. There should be a clear recognition of the learning from the Changing Places unit in assessing the impact of such schemes and how they affect aspects of the character of the place. Reciting learned case study material does not constitute AO2. It is the integration of the place study ideas and concepts which allow access to AO2.

- Assessment − Expect reference to a specific named river restoration project. There is no specification about the location of this project, but it must be in a named urban area.
- Assessment − responses should show understanding and give assessment of the reasons for the named project.
- Assessment − expect responses to give details of and assess activities involved in the project.
- Assessment − expect responses to show understanding and give assessment of the project outcomes.
- Assessment − to move through the upper levels the response must evaluate how the activities of the project and their outcomes specifically affected the character of the place where the project was implemented. There could be assessment of how the project affected different aspects of the character of the place, that could include: location, topography, physical geography, land use, built environment and infrastructure, demographic and economic characteristics.

- Assessment − may seek to assess different categories of impacts of the project on the character of the place, including: positive and negative impacts; economic impacts; social impacts; environmental impacts; Impacts on the built environment.
- Assessment − some may assess how different parties involved in the project may interpret the impacts on the character of the place differently.

Overall **Assessment** − There must be clear linkage between the impact of a river restoration and conservation project in a damaged urban catchment and the character of that place.

AO1 = 4, AO2 = 5

[Total 9 marks]

Q7.

AO1 – Knowledge and understanding of urban drainage – urban precipitation, storage and catchment characteristics, urban water cycle, movement of water through urban areas. Knowledge and understanding of the challenges and opportunities in developing more sustainable cities.

AO2 – Application of knowledge and understanding to analyse and evaluate the extent to which urban drainage presents challenges to sustainable cities. Application of knowledge and understanding to analyse and evaluate the extent to which urban drainage presents opportunities to develop more sustainable cities.

Notes for answers

The question links various aspects of the Contemporary urban environments section of the specification, specifically urban drainage and the challenges and opportunities for developing more sustainable cities. There is no requirement to include specific examples and detail could be included through concepts such as urban catchments as well as place -specific examples.

AO1

- Knowledge and understanding of urban drainage and how it is different from drainage in rural areas.
- Knowledge and understanding of urban precipitation and water movement through the catchment. Higher proportion of precipitation reaching urban river channels and the reduced lag time. The subsequent increase in flood risk. Lack of seasonal variations. Decrease in the base or normal flow of the river.
- Knowledge of storm hydrographs for urban areas.
- Knowledge and understanding of the urban water cycle, for example interruption to the water cycle in urban areas through human activities such as uses in industry.
- Impacts on catchment management – flood management, water pollution, sediment accretion from erosion.
- Knowledge and understanding on the challenges and opportunities for developing sustainable cities. They may consider economic, social and environmental challenges / opportunities in developing sustainable cities.
- Case-study knowledge of the challenges and opportunities in developing sustainable cities for example Copenhagen, Curitiba or Freiburg.

AO2

- Assessment of the link between urban drainage and sustainability on an economic, social or environmental level.
- Evaluation of the link between urban drainage and the challenges in developing sustainable cities, for example increased flood risk, diverts money from sustainable strategies and frequently means that large-scale flood management schemes have to be employed that significantly impact on environmental sustainability. The impact

of flood risk on the concept of liveability.

- Evaluation of the impact of urban catchment and storage on sustainability. Construction of channelised rivers reduces the flood risk but also has a significant impact on natural habitats. For example, the Los Angeles River is almost entirely concreted with very few natural areas.
- The extent to which past urban processes such as industrialisation have impacted on urban drainage may be considered and the resulting challenges. For example, the Sheffield and Tinsley canal fell into disuse following construction of the railway and then even more so following deindustrialisation. This resulted in water contamination and is a challenge to sustainability.
- The extent to which issues associated with urban drainage can be managed through strategies to such as SuDS. For example the lag time can be increased by construction of green roofs and the creation of detention basins.
- Evaluation of schemes such as SuDs in creating opportunities for sustainable urban areas. For example, at Lamb Drove biodiversity and ecology has increased as a result of SuDS and this has also reduced flood risk improving quality of life and social sustainability.
- Evaluation of how attempts to improve urban drainage through schemes such as river restoration might create opportunities for sustainability. For example, the River Don in Sheffield has been restored creating the Blue Loop, this has rejuvenated the area for cyclists and runners increasing liveability and it has also encouraged biodiversity by restoring natural ecosystems. Thereby providing opportunities for both social and environmental sustainability.
- Some students may assess the role of sustainable cities in managing urban drainage. This would be a legitimate response as long as it is linked to the question ie that actually it is the need for sustainable strategies that is impacting on urban drainage. For example Freiburg's sustainability drive has resulted in much of the River Dreisam being unmanaged and subsequent water movement is more natural. Rainwater harvesting is widely employed to protect ground water storage supplies in the city.
- They may also consider alternative futures. Increased precipitation and storm events may make managing urban drainage increasingly challenging. This will have significant impacts on developing more sustainable cities. However, pressure from urban dwellers demanding sustainable strategies may increase the spending on flood risk and recreational areas so improving management of urban drainage.
- An overall judgement of the extent to which urban drainage provides more opportunities than challenges should be addressed. Any conclusion is valid as long as it is supported by the evidence in the response.

Credit any other valid approach.

Level 4 (16–20 marks)

- Detailed evaluative conclusion that is rational and firmly based on knowledge and understanding which is applied to the context of the question (AO2).
- Detailed, coherent and relevant analysis and evaluation in the application of knowledge and understanding throughout (AO2).
- Full evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Detailed, highly relevant and appropriate knowledge and understanding of place(s) and environments used throughout (AO1).
- Full and accurate knowledge and understanding of key concepts and processes throughout (AO1).
- Detailed awareness of scale and temporal change which is well integrated where appropriate (AO1).

Level 3 (11–15 marks)

- Clear evaluative conclusion that is based on knowledge and understanding which is

applied to the context of the question (AO2).
- Generally clear, coherent and relevant analysis and evaluation in the application of knowledge and understanding (AO2).
- Generally clear evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Generally clear and relevant knowledge and understanding of place(s) and environments (AO1).
- Generally clear and accurate knowledge and understanding of key concepts and processes (AO1).
- Generally clear awareness of scale and temporal change which is integrated where appropriate (AO1).

Level 2 (6–10 marks)
- Some sense of an evaluative conclusion partially based upon knowledge and understanding which is applied to the context of the question (AO2).
- Some partially relevant analysis and evaluation in the application of knowledge and understanding (AO2).
- Some evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Some relevant knowledge and understanding of place(s) and environments which is partially relevant (AO1).
- Some knowledge and understanding of key concepts, processes and interactions and change (AO1).
- Some awareness of scale and temporal change which is sometimes integrated where appropriate. There may be a few inaccuracies (AO1).

Level 1 (1–5 marks)
- Very limited and/or unsupported evaluative conclusion that is loosely based upon knowledge and understanding which is applied to the context of the question (AO2).
- Very limited analysis and evaluation in the application of knowledge and understanding. This lacks clarity and coherence (AO2).
- Very limited and rarely logical evidence of links between knowledge and understanding to the application of knowledge and understanding in different contexts (AO2).
- Very limited relevant knowledge and understanding of place(s) and environments (AO1).
- Isolated knowledge and understanding of key concepts and processes (AO1).
- Very limited awareness of scale and temporal change which is rarely integrated where appropriate. There may be a number of inaccuracies (AO1).

Level 0 (0 marks)
- Nothing worthy of credit.

AO1 = 10, AO2 = 10
[Total 20 marks]

Q8.

D

AO1 = 1
[Total 1 mark]

Q9.

AO1 – Knowledge and understanding of the development of SUDS.

AO2 - Application of knowledge and understanding to evaluate the use of SUDS in order

to achieve the benefits shown in **Figure 2**.

Mark scheme

Level 3 (7–9 marks)
AO1 – Demonstrates detailed knowledge and understanding of concepts, processes, interactions and change. These underpin the response throughout.
AO2 – Applies knowledge and understanding appropriately with detail. Connections and relationships between different aspects of study are fully developed with complete relevance. Analysis and evaluation is detailed and well supported with appropriate evidence. A well balanced and coherent argument is presented.

Level 2 (4–6 marks)
AO1 – Demonstrates some appropriate knowledge and understanding of concepts, processes, interactions and change. These are mostly relevant though there may be some minor inaccuracy.
AO2 – Applies some knowledge and understanding appropriately. Connections and relationships between different aspects of study are emerging/evident with some relevance. Analysis and evaluation evident and supported with some appropriate evidence. A clear but partial argument is presented.

Level 1 (1–3 marks)
AO1 – Demonstrates basic / limited knowledge and understanding of concepts, processes, interactions and change. These offer limited relevance with inaccuracy.
AO2 – Applies limited knowledge and understanding. Connections and relationships between different aspects of study are basic with limited relevance. Analysis and evaluation basic and supported with limited appropriate evidence. A basic argument is presented.

Notes for answers
The question requires knowledge of the development of SUDS and different strategies used (including **Figure 1**). This should then be applied to **Figure 2** to evaluate the extent to which these benefits can be achieved.

Whilst there is no requirement within the spec to use specific case- studies, credit specific schemes where used appropriately.

AO1
- Knowledge and understanding of SUDS – environmentally friendly replications of natural drainage systems in the built environment.
- The aims of SUDS, for example, to slow surface run-off and the break- down of water pollution.
- Characteristics of SUDS – easy management, environmentally friendly, require little to no energy to function.
- Different strategies employed to develop SUDS for example swales, green roofs, rain-gardens, permeable road and pavement surfaces, infiltration trenches and detention basins.
- Case-study knowledge of specific SUDS. For example, Lamb Drove in Cambourne is a housing estate which has major flooding concerns. Detention basins were built to store water temporarily and during flood events.

AO2
- Evaluation of SUDS in achieving the benefits shown in **Figure 2**. For example, detention basins can store water so reducing flood risks. These can be very successful as they also look natural and also achieve the benefit of enhancing biodiversity as a range of vegetation can be planted proving habitats for many animals and birds.

- Analysis of different strategies and the degree to which they can achieve the benefits shown in **Figure 2**. Water butts collect roof water slowing down run-off but are fairly small scale in achieving the benefit of flood risk management; however, as residents can store water this helps with drought management.
- Analysis of the scheme shown in **Figure 1**. These are swales (not necessary to name it) which collect excess water and slow down run- off. The water is collected in the vegetation which also cleans it.
- Evaluation of the scheme shown in **Figure 1** in relation to the possible benefits. For example, the swales will help with flood risk management, but they will also improve water quality and recreation opportunities as it provides a nice environment to walk in.
- Evaluation of the success of SUDS. They may refer to specific schemes such as the Lamb Drove scheme which is a proven success. Costs are estimated to be 10% lower than conventional schemes. Biodiversity has increased. It has achieved many of the benefits shown in **Figure 2**.
- The challenges and problems with SUDS. There have been concerns about the detention ponds being a hazard in residential areas and on school sites. Many of the schemes are very small and only benefit very localised areas.
- Students may consider other benefits not listed in **Figure 2**. This would be a legitimate AO2 evaluation as long as they are comparing to **Figure 2**.
- Overall evaluation may conclude that SUDS schemes provide a range of benefits and it depends on the type and scale of the scheme. They may also conclude that as SUDS is relatively new, evaluation is quite limited and in fact there may be more long-term benefits that we are unable to assess yet.

Credit any other valid approach.

AO1 = 4
AO2 = 5
[Total 9 marks]

Q2.

14% failed to secure any credit on this question. There were a number of approaches that students could have taken but many appeared to be guessing. Those that had clearly studied this concept scored three marks. Most made reference to SUDS being used to control flooding. Few went further to consider the reduction in pollution, creation of habitats and leisure opportunities for people.

Q3.

Over half of all students were able to access L2 on this question. Answers generally focused on Figure a, using the data to support analysis of changes in water quality and invertebrate species. The best students were able to use this data to make connections with the changes that had taken place in Figure a. Some students only saw an overall improvement in water quality and/or number of invertebrate species. More sophisticated responses acknowledged that there wasn't a consistent improvement over time and thus used the data from Figure b more effectively. Some students read data in Figure b inaccurately, which impacted the accuracy of their response. This shows the importance of practising all the skills listed in the skills section and ensuring students can read simple graphs as well as more complex ones.

Q6.

The requirements of this question crossed specification units. It is important to remind centres that every series there will be one question which crosses specification units at both AS and A-level. In this case, the link was to Changing Places. The concept (from that unit) of the character of place, was integrated into this contemporary urban environments question. It is an Ofqual requirement that such questions are set every series so that students can demonstrate understanding and learning from across the breadth of study. The nature of impacts on the character of places depended on the choice of river restoration and conservation project. A significant number of responses did not move beyond outlining the nature of the chosen project, often with little more than a summary of the positive and negative achievements. Better responses needed to clearly engage with how the project impacted on the character of the place. Where this was done well there was reference, not just to the physical character of the place, i.e. aspects of the built environment and land use, but also to other aspects of the character of the place. These could have included the cultural and social character of the place, i.e. how different people engaged with, or felt differently about the place following the project. Others referred to improvements in the economic character of a place, with improved opportunities for tourism or increased property values, and the subsequent impacts on character that these would have had. Some engaged with this cross specification link well, however many struggled. The average mark was for this question was 3.69. 52% of responses reached Level 2 or above, but only 14% achieved Level 3. Surprisingly, 4.47% did not attempt this question and 7.75% scored zero.

Q7.

There were some very good responses to this question. Some of the best responses assessed the opportunities brought about by river restoration projects such as the Cheonggyecheon in Seoul or specific SUDs and then compared this to the challenges of managing flood risk in cities, leading to unsustainable practices. Weaker responses were typified by a lack of specific examples and a reliance on generic knowledge of sustainable cities.

Q8.

A significant number correctly identified option D as the correct answer. Many that got the question wrong chose A as their answer.

Q9.

A full range of responses was seen on this question which discriminated well. Most students were able to access at least level 2 by having some understanding of the concept of SUDs and applying this to the question sources. For example, many were able to explain the benefits of **Figure 1** linked to **2**. Students who did not make reference to their own knowledge of SUDs schemes found it difficult to access marks beyond low level 2, relying on simplistic links between phrases in **Figure 2** and their supposed presence in **Figure 1**. The best answers at level 3 were able to evaluate **Figure 1** and other SUDs schemes (Lamb Drove was very popular) in relation to some of the phrases in **2**. At times, there was confusion with river restoration projects showing the need to learn key concepts accurately. Whilst students were able to score credit with generic relevant ideas, inappropriate aspects featured frequently in responses.