AGENDA ITEM NO 6

REPORT NO 238/23

ANGUS COUNCIL

DEVELOPMENT MANAGEMENT REVIEW COMMITTEE – 4 SEPTEMBER 2023

SMUGGLERS TAVERN, 65 LADYBRIDGE STREET, ARBROATH

REPORT BY THE DIRECTOR OF LEGAL AND DEMOCRATIC SERVICES

ABSTRACT:

The Committee is asked to consider an application for a review of the decision taken by the planning authority in respect of the refusal of planning permission for change of use from public house to flat and dormer extension to attic of existing flat, application No 22/00221/FULL, at Smugglers Tavern, 65 Ladybridge Street, Arbroath

1. RECOMMENDATIONS

It is recommended that the Committee:-

(i) review the case submitted by the Planning Authority **(Appendix 1)**; and

(ii) review the case submitted by the Applicant **(Appendix 2)**.

2. ALIGNMENT TO THE ANGUS LOCAL OUTCOMES IMPROVEMENT PLAN

This Report contributes to the following local outcomes contained within the Angus Council Plan:

- Safe, secure, vibrant and sustainable communities
- A reduced carbon footprint
- An enhanced, protected and enjoyed natural and built environment

3. CURRENT POSITION

The Development Management Review Committee is required to determine if they have sufficient information to determine the Review without further procedure. If members do not determine the review without further procedure, the Review Committee must determine the manner in which the review is to be conducted. The procedures available in terms of the regulations are: written submissions, hearing sessions or inspection of the land to which the review relates.

4. FINANCIAL IMPLICATIONS

There are no financial implications arising directly from the recommendations in the Report.

5. EQUALITY IMPACT ASSESSMENT

An equality impact assessment is not required.

6. CONSULTATION

In accordance with Standing Order 48(4), this Report falls within an approved category that has been confirmed as exempt from the consultation process.

NOTE: No background papers, as defined by Section 50D of the Local Government (Scotland) Act 1973, (other than any containing confidential or exempt information) were relied on to any material extent in preparing the above Report.

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List of Appendices:
Appendix 1 – Submission by Planning Authority
Appendix 2 – Submission by Applicant

ANGUS COUNCIL'S SUBMISSION ON GROUNDS OF REFUSAL

APPLICATION NUMBER – 22/00221/FULL

APPLICANT - H & CO LEISURE LTD

PROPOSAL & ADDRESS – CHANGE OF USE FROM PUBLIC HOUSE TO FLAT AND DORMER EXTENSION TO ATTIC OF EXISTING FLAT AT SMUGGLERS TAVERN 65 LADYBRIDGE STREET ARBROATH

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Angus Council

Application Number:	22/00221/FULL
Description of Development:	Change of use from public house to flat and dormer extension to attic of existing flat
Site Address:	Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX
Grid Ref:	364219 : 740673
Applicant Name:	H & Co Leisure Ltd

Report of Handling

Proposal

The application proposes change of use and alterations to the two-storey building to create a flat at ground floor level, and extend an existing flat at first floor level into the roof space, including the installation of two new splayed dormer windows on the south facing roof slope of the building.

The building, which is located within the conservation area, currently contains a vacant public house at ground floor level and a flatted dwelling at first floor level. The flat is accessed via a door on East Grimsby to the west. To the immediate east of the site is the Brothock Water, which has been subject to various recent interventions to increase flood protection in the area. Operations 36 and 37 of the Arbroath Flood Protection Scheme (FPS) affect the east gable of the application property and the property on the opposite side of the river channel, which included the blocking up of a window and the relocation of an air conditioning unit on the eastern gable wall of the application property.

The plans submitted show the ground floor would be altered to create a two-bedroom flat. The roof space above the first floor flat would be altered to create two additional bedrooms. The proposed plans indicate that three windows on the ground floor would be removed and replaced with new one over one timber sash and case double glazed units coloured dark grey. The door on that elevation would also be replaced with a new timber dark grey coloured door. The roof space dormers proposed would contain timber double glazed windows and the dormers would have a slate cheeks. On the East Grimsby elevation (west), a window would be replaced by a new one over one timber sash and case double glazed unit coloured dark grey. Replacement windows would also be installed on the ground floor rear elevation of the building (north).

The application has not been subject of variation.

Publicity

The application was subject to normal neighbour notification procedures.

The application was advertised in the Dundee Courier on 22 April 2022 for the following reasons:

- Conservation Area

A site notice was posted for Conservation Area Development.

Planning History

None.

Applicant's Case

Design Statement indicates that the public house has been empty, on and off for over 5 years, and like

many pubs in Arbroath it is an unsustainable business and there has been no interest in the property, which has been up for lease for 3 years. The existing curved glass window is a feature of the building which shall be retained. To provide suitable insulated external fabric of the building it is proposed to fit secondary glazing behind the curved glass which will not alter the external appearance of the building. The new ground floor flat can be accessed from Ladybridge Street with level access and can be also accessed from the rear amenity space. The amenity space has a brick outbuilding which will provide space for bicycle storage and external store, there is also a drying area and bin stores so refuse collection can be easily accessed from the pavement at East Grimsby. The applicant considers the proposed development to be a vast improvement of an empty prominent building in the harbour area and would regenerate a building that is falling into a state of disrepair. The applicant considers the alterations to be sympathetic to the conservation area and would maintain the original character of the building.

No other reports on the impact or potential impact of the proposed development were submitted in support of the application.

Consultations

Community Council - There was no response from this consultee at the time of report preparation.

Roads (Traffic) – no objection.

Scottish Water - no objection.

Environmental Health (Arbroath) - no objection.

Scottish Environment Protection Agency – **objects in principle** and recommends that planning permission should be refused. SEPA has indicated that this is because the proposed development is expected to put people or property at risk of flooding.

SEPA states that the site is shown to be at flood risk from fluvial, coastal and surface water sources on SEPA flood maps. They also hold data which gives accounts of flood events in the area, including historic floods in October 1976 and February 1977. The 1977 event flooded the area around the pub as well as many other places.

SEPA has considered the protection afforded to the site from both the existing flood protection scheme and the protection that will be provided as a result of the flood protection scheme currently under construction (*completed in December 2022*) in Arbroath. SEPA has indicated that the new flood protection scheme will provide a level of protection which is the equivalent of a one in 200-year event.

SEPA considers an appropriate standard of flood protection for a residential development (a highly vulnerable use) to be a one in 200-year event *with an additional allowance for climate change.* SEPA therefore objects to the proposal.

SEPA raises additional concerns about the gable end of the Smugglers Tavern, which is acting as a *de facto* flood wall/ part of the existing flood protection scheme. The plan for the flood protection scheme currently under construction proposes no change to this – the only change under Scheme Operation 37, is to brick up a window in the gable end of the pub, to prevent flood water getting in. There is then an obvious risk of potential collapse of that gable end during a flood (through scour) as was witnessed on the banks of the River Teviot in Hawick a few years ago, where an older building right on the river edge collapsed into the river.

SEPA has commented that if the planning authority proposes to grant planning permission contrary to their advice on flood risk, the Town and Country Planning (Notification of Applications) (Scotland) Direction 2009 provides criteria for the referral to the Scottish Ministers of such cases.

Roads (Flood Prevention Authority) – **objects to the proposal** on the grounds of flood risk.

Roads indicate that while modelling data shows that the area around the site does not flood in a 200-year event with the new flood protection scheme in place, it does flood in a 200-year event when an allowance

for climate change is added. Roads indicate that the relevant climate change allowance is 53% for the Brothock Water.

Roads indicate that the conversion of the public house on the ground floor to residential accommodation will increase land use vulnerability at the site from a “least vulnerable” use to a “highly vulnerable” use (as defined within SEPA’s Land Use Vulnerability Guidance). They therefore consider the proposal to be contrary to Scottish Planning Policy. Roads also note that under the new flood protection scheme, the wall of the building adjacent to the Brothock Water is acting as a flood wall.

Representations

There were no letters of representation.

Development Plan Policies

NPF4 – national planning policies

Policy 1 Tackling the climate and nature crises
Policy 2 Climate mitigation and adaptation
Policy 3 Biodiversity
Policy 4 Natural places
Policy 7 Historic assets and places
Policy 9 Brownfield, vacant and derelict land and empty buildings
Policy 10 Coastal development
Policy 13 Sustainable transport
Policy 14 Design, quality and place
Policy 15 Local living and 20 minute neighbourhoods
Policy 16 Quality homes
Policy 18 Infrastructure first
Policy 22 Flood risk and water management
Policy 23 Health and safety

Angus Local Development Plan 2016

Policy DS1 : Development Boundaries and Priorities
Policy DS2 : Accessible Development
Policy DS3 : Design Quality and Placemaking
Policy DS4 : Amenity
Policy TC2 : Residential Development
Policy PV8 : Built and Cultural Heritage
Policy PV12 : Managing Flood Risk
Policy PV13 : Resilience and Adaptation
Policy PV15 : Drainage Infrastructure
Policy PV18 : Waste Management in New Development

The full text of the relevant development plan policies can be viewed at Appendix 1 to this report.

Assessment

Sections 25 and 37(2) of the Town and Country Planning (Scotland) Act 1997 require that planning decisions be made in accordance with the development plan unless material considerations indicate otherwise.

Section 59 of the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 requires the planning authority, in considering whether to grant planning permission for development which affects a listed building or its setting, to have special regard to the desirability of preserving the building or its setting or any features of special architectural or historic interest which it possesses.

Section 64 of the Planning (Listed Buildings and Conservation Areas) (Scotland) Act 1997 requires the

council to pay special attention to the desirability of preserving or enhancing the character or appearance of the conservation area in determining this planning application.

In this case the development plan comprises: -

- National Planning Framework 4 (NPF4) (Adopted 2023)
- Angus Local Development Plan (ALDP) (Adopted 2016)

The development plan policies relevant to the determination of the planning application are reproduced at Appendix 1 and have been taken into account in preparing this report.

The ALDP was adopted in September 2016 while NPF4 was adopted in February 2023. Planning legislation indicates that where there is any incompatibility between the provision of the national planning framework and the provision of a local development plan, whichever of them is the later in date is to prevail.

The site is located in the development boundary and is not allocated or otherwise identified for development in the ALDP. ALDP Policy DS1 states that proposals on sites not allocated or otherwise identified for development within development boundaries will be supported where they are of an appropriate scale and nature and are in accordance with relevant policies of the ALDP. NPF4 Policy 1 indicates that when considering all development proposals significant weight will be given to the global climate and nature crises. Both NPF4 and the ALDP seek to encourage the reuse of brownfield land and buildings to help reduce the need for greenfield development. NPF4 Policy 9 indicates that development proposals for the reuse of existing buildings will be supported, taking into account their suitability for conversion to other uses.

NPF4 Policy 16 *quality homes* seeks to encourage, promote and facilitate the delivery of more high quality, affordable and sustainable homes, in the right locations. It indicates that development proposals for new homes on land not allocated for housing in the local development plan will only be supported in limited circumstances where the proposal is supported by an agreed timescale for build-out; the proposal is otherwise consistent with the plan spatial strategy and other relevant policies including local living and 20 minute neighbourhoods; and where (amongst other things) the proposal is for smaller scale opportunities within an existing settlement boundary.

ALDP Policy TC2 supports proposals for new residential development within development boundaries where the site is not allocated or protected for another use; and the proposal is consistent with the character and pattern of development in the surrounding area. Policy TC2 also requires proposals be compatible with neighbouring land uses, provide a satisfactory residential environment, not unacceptably impact on the built or natural environment, surrounding amenity, access and infrastructure, and to include a mix of house sizes, types and tenures and provision for affordable housing in accordance with Policy TC3.

The principle of reusing the ground floor of a vacant building within the conservation area of an established settlement attracts some support from the development plan, and it would desirable to see the vacant ground floor brought back into a purposeful and suitable new use. Development plan support is however qualified, and policy requires development to be of an appropriate scale and nature, requires consideration of the suitability of the proposed use, seeks to achieve sustainable new homes, requires consideration of how the proposal will help to address the global climate and nature crises, and requires proposals to accord with other relevant policies of the development plan.

Flood risk

The application site is located directly adjacent to the Brothock Water in an area the SEPA flood maps identify as being of high risk of river, surface water and coastal flooding.

NPF4 Policy 22 *flood risk and water management* seeks to strengthen resilience to flood risk by promoting avoidance as a first principle and reducing the vulnerability of existing and future development to flooding. The policy indicates that development proposals at risk of flooding or in a flood risk area will only be supported if they are for (amongst other things) redevelopment of an existing building or site for

an equal or less vulnerable use. The policy indicates that the protection offered by an existing formal flood protection scheme or one under construction can be taken into account when determining flood risk. In those circumstances, the applicant is required to demonstrate all risks of flooding are understood and addressed; there is no reduction in floodplain capacity, increased risk for others, or a need for future flood protection schemes; the development remains safe and operational during floods; flood resistant and resilient materials and construction methods are used; and future adaptations can be made to accommodate the effects of climate change.

NPF4 Policy 2 *climate mitigation and adaptation* seeks to encourage, promote and facilitate development that adapts to the current and future impacts of climate change. Part (b) of that policy indicates that development proposals will be sited and designed to adapt to current and future risks from climate change. NPF4 Policy 10 *coastal development* indicates that development proposals in developed coastal areas will only be supported where the proposal does not result in (amongst other things) an increase in the risk to people of coastal flooding; and is anticipated to be supportable in the long-term, taking into account projected climate change. NPF4 Policy 23 *health and safety* indicates (amongst other things) that any advice from the Scottish Environment Protection Agency that planning permission should be refused should not be overridden by the decision maker without the most careful consideration.

The ALDP indicates that in assessing proposals, reference will be made to the Flood Risk Framework, Flood Risk Maps and land use vulnerability guidance published by SEPA. ALDP Policy PV12 indicates that to reduce potential risk from flooding there will be a general presumption against built development proposals on the functional floodplain; which involve land raising resulting in the loss of the functional flood plain; or which would materially increase the probability of flooding to existing or planned development. It indicates that flood risk assessments may be required for development in areas known or suspected to be at risk of flooding, and requires that assessment to demonstrate that (amongst other things) flood risk can be adequately managed both within and outwith the site; that a freeboard allowance of at least 500-600mm in all circumstances can be provided; access and egress to the site can be provided that is free of flood risk; and where appropriate that water-resistant materials and construction will be utilised.

As noted above, the proposal lies within an area which is identified as being subject to flood risk from river, surface water and coastal flooding according to SEPA flood maps. While the upper floor of the property is currently in residential use, the ground floor was last used as a public house. SEPAs Flood Risk and Land Use Vulnerability Guidance categorises a drinking establishment as a *least vulnerable use* and buildings used as dwelling houses as a *highly vulnerable use.* The proposal would change the use of the ground floor of the property into a use which is more vulnerable to flood risk, as defined by SEPA guidance.

The SEPA consultation response to the application indicates that an appropriate standard of flood protection for a *highly vulnerable use* of this nature is a one in 200-year event with an additional allowance for climate change. The council's roads - flood prevention authority indicate that a suitable level of flood protection would be a one in 200-year event plus an allowance for climate change. Roads – flooding has indicated that the allowance for climate change should be 53% for the Brothock Water.

Works have recently been completed in and around the Brothock Water as part of the Arbroath Flood Protection Scheme (FPS). That scheme was designed to provide flood protection from the Brothock Water to provide a one in 200-year standard of protection. A flood modelling report was prepared for Angus Council in 2017 in support of the FPS. While it indicates that the application site would be protected during a one in 200-year event following completion of the FPS works, information contained in the report suggests that it would continue to flood in a one in 200-year event when a 20% allowance for climate change is added. As such, available evidence suggests that the site would flood in a one in 200-year event when the necessary 53% allowance for climate change is applied.

Both SEPA and the council's roads – flood prevention authority have objected to the proposal on the basis of flood risk, noting that the proposal would introduce a more vulnerable use into the ground floor of the building. They acknowledge that while an level of increased protection for the building will be provided as a result of the FPS, that scheme would not provide a sufficient protection for use of the ground floor as a dwelling. No technical information (such as a site-specific detailed flood risk assessment) has been submitted by the applicant to consider flood risk associated with the proposal, and as such there is no

evidence to suggest that the proposal would not be subject to an unacceptable level of flood risk. On the contrary, available evidence suggests that the proposal would be subject to an unacceptable level of flood risk.

The proposal is therefore contrary to NPF4 policies 2, 10 and 22 and ALDP Policy PV12 because the proposal is for redevelopment of an existing building in a manner which would introduce a more vulnerable use on the ground floor in an area at risk of flooding from coastal, river and surface water flooding; because the applicant has not demonstrated that all risks of flooding are understood and addressed; and because there is insufficient evidence to suggest that the proposal has been designed to adapt to future risks from flooding as a result of climate change. In circumstances where available evidence suggests that the proposed development would be subject to an unacceptable level of flood risk, and no site-specific evidence has been submitted to demonstrate otherwise – there are no reasonable grounds to override SEPA advice.

While development plan policy may support reuse of the ground floor of the building for an equal or less vulnerable use (as defined by SEPAs Flood Risk and Land Use Vulnerability Guidance), residential use of the ground floor in the manner proposed does not comply with the development plan approach to development in areas subject to flood risk.

Other development plan considerations

Matters relating to flood risk excepted, it is considered that the proposal could create a reasonable residential environment for a would-be householder. There are no neighbouring land uses which are likely to render residential use of the site unsuitable. Environmental health has been consulted on the proposal and has offered no objection, having regard to neighbouring uses including the nearby hot food takeaway use. There would be space within the rear curtilage for bin and recycling storage and space for the storage of bicycles. The reuse of the ground floor and alterations to the upper floor of the property would not result in any significant or unacceptable privacy or amenity issues on neighbouring property.

The site is not subject to any designation for natural heritage reasons and the proposed works are unlikely to result in any direct or indirect impacts on biodiversity, protected sites or species.

The building is located within the conservation area and the proposal has the potential to affect the conservation area both in terms of impacts on the character of the area (resulting from the change in use of the ground floor from a public house to residential) and impacts on the appearance of the area (as a result of the physical alterations to the building). The proposal alterations would safeguard some of the features that contribute to the character of the building and conservation area (e.g. the curved and inscribed ground floor window on the southwest ground floor corner of the building, and the decoration on the blinded window opening at first floor level). Precise details of the proposed ground floor windows onto Ladybridge Street and East Grimsby could be secured by planning condition were the proposal otherwise acceptable. A condition could be used to secure an appropriate external colour finish and window glazing configuration. The detail of the first-floor dormers is broadly acceptable having regard to the use of a similar style of dormer on similar property in the surrounding area. The removal of the public house use of the ground floor of the property would potentially result in some change to the character of activity in the area, particularly activity in the evening. However, the area would continue to have uses which attract activity both in the daytime and evening. Impacts on the building and conservation area resulting from the proposal are not significant and could be mitigated. There are listed buildings nearby on The Shore to the west and at Ladybridge House to the southeast. Indirect/setting impacts resulting from the proposal would also be insignificant.

There is no provision for car parking associated with the proposal. However, this is a location in town where access to sustainable travel options is good for walking, wheeling, cycling and public transport. There is also on street parking in the surrounding area. The application form indicates that existing water supply and drainage arrangements would be utilised. Scottish Water has no objection to the proposal, but has suggested that the developer submit a pre-development enquiry prior to any formal technical application being submitted to them. There are no other known infrastructure issues, and the development is not of a scale where it would require a developer contribution or affordable housing provision.

Returning to ALDP Policy 1 and NPF4 policies 1, 9 and 16; while it would be desirable to see the vacant ground floor of the building brought back into a purposeful new use, that use must be suitable for the location. In this case, the site lies directly adjacent to the Brothock Water and is within an area identified as being at risk from coastal, river and surface water flooding. SEPA and the council's roads – flood prevention authority have objected to the proposal on that basis, and the applicant has submitted no information to demonstrate that all risks of flooding are understood and addressed. Introducing a *highly vulnerable use* in an area subject to flood risk is not a development which gives significant weight to the global climate crisis. The proposal is contrary to ALDP Policy 1, NPF4 policies 1, 9 and 16 because the application proposes development which is not of an appropriate nature for this location due to flood risk; it does not represent a sustainable home in the right location due to flood risk; the ground floor of the building is not suitable for conversion to residential use due to flood risk; and the proposal not consistent with relevant policies of the development plan (NPF4 policies 2, 10 and 22 and ALDP Policy PV12).

While reuse of a vacant building in the conservation area to an appropriate new use would be highly desirable, any new use must be for an equal or less vulnerable use as defined by SEPA guidance. The proposal is contrary to the development plan. There are no material considerations which justify approval of the proposal contrary to the provisions of the development plan.

SEPA has objected to the proposal on the grounds of flood risk. Any decision to grant planning permission for the development proposed would require consideration of the Town and Country Planning (Notification of Applications) (Scotland) Direction 2009 and is likely to require to be notified to Scottish Ministers.

Human Rights Implications

The decision to refuse this application has potential implications for the applicant in terms of his entitlement to peaceful enjoyment of his possessions (First Protocol, Article 1). For the reasons referred to elsewhere in this report justifying the decision in planning terms, it is considered that any actual or apprehended infringement of such Convention Rights, is justified. Any interference with the applicant's right to peaceful enjoyment of his possessions by refusal of the present application is in compliance with the Council's legal duties to determine this planning application under the Planning Acts and such refusal constitutes a justified and proportionate control of the use of property in accordance with the general interest and is necessary in the public interest with reference to the Development Plan and other material planning considerations as referred to in the report.

Decision

The application is refused

Reason(s) for Decision:

1. The proposal is contrary to National Planning Framework 4 (2023) policies 2, 10 and 22 and Angus Local Development Plan (2016) Policy PV12 because the proposal is for redevelopment of an existing building which would introduce a more vulnerable land use on the ground floor in an location which is identified as being at risk of coastal, river and surface water flooding on SEPA flood maps; because the applicant has not demonstrated that all risks of flooding are understood and addressed; and because there is insufficient evidence to suggest that the proposal has been designed to adapt to future risks from flooding as a result of climate change.

2. The proposal is contrary to National Planning Framework 4 (2023) policies 1, 9 and 16 and Angus Local Development Plan (2016) Policy DS1 because the application proposes development which is not of an appropriate nature for this location due to flood risk; it does not represent a sustainable home in the right location due to flood risk; the ground floor of the building is not suitable for conversion to residential use due to flood risk; allowing a *highly vulnerable use* in an area subject to flood risk is not a development which gives significant weight to the global climate crises; and because the proposal is not consistent with relevant policies of the development plan (namely NPF4 policies 2, 10 and 22 and ALDP Policy PV12).

Notes:

Case Officer: Damian Brennan
Date: 15 March 2023

Appendix 1 - Development Plan Policies

NPF4 – national planning policies

Policy 1 Tackling the climate and nature crises
When considering all development proposals significant weight will be given to the global climate and nature crises.

Policy 2 Climate mitigation and adaptation
a) Development proposals will be sited and designed to minimise lifecycle greenhouse gas emissions as far as possible.
b) Development proposals will be sited and designed to adapt to current and future risks from climate change.
c) Development proposals to retrofit measures to existing developments that reduce emissions or support adaptation to climate change will be supported.

Policy 3 Biodiversity
a) Development proposals will contribute to the enhancement of biodiversity, including where relevant, restoring degraded habitats and building and strengthening nature networks and the connections between them. Proposals should also integrate nature-based solutions, where possible.

b) Development proposals for national or major development, or for development that requires an Environmental Impact Assessment will only be supported where it can be demonstrated that the proposal will conserve, restore and enhance biodiversity, including nature networks so they are in a demonstrably better state than without intervention. This will include future management. To inform this, best practice assessment methods should be used. Proposals within these categories will demonstrate how they have met all of the following criteria:
i. the proposal is based on an understanding of the existing characteristics of the site and its local, regional and national ecological context prior to development, including the presence of any irreplaceable habitats;
ii. wherever feasible, nature-based solutions have been integrated and made best use of;
iii. an assessment of potential negative effects which should be fully mitigated in line with the mitigation hierarchy prior to identifying enhancements;
iv. significant biodiversity enhancements are provided, in addition to any proposed mitigation. This should include nature networks, linking to and strengthening habitat connectivity within and beyond the development, secured within a reasonable timescale and with reasonable certainty. Management arrangements for their long- term retention and monitoring should be included, wherever appropriate; and
v. local community benefits of the biodiversity and/or nature networks have been considered.

c) Proposals for local development will include appropriate measures to conserve, restore and enhance biodiversity, in accordance with national and local guidance. Measures should be proportionate to the nature and scale of development. Applications for individual householder development, or which fall within scope of (b) above, are excluded from this requirement.

d) Any potential adverse impacts, including cumulative impacts, of development proposals on biodiversity, nature networks and the natural environment will be minimised through careful planning and design. This will take into account the need to reverse biodiversity loss, safeguard the ecosystem services that the natural environment provides, and build resilience by enhancing nature networks and maximising the potential for restoration.

Policy 4 Natural places
a) Development proposals which by virtue of type, location or scale will have an unacceptable impact on the natural environment, will not be supported.

b) Development proposals that are likely to have a significant effect on an existing or proposed European

site (Special Area of Conservation or Special Protection Areas) and are not directly connected with or necessary to their conservation management are required to be subject to an "appropriate assessment" of the implications for the conservation objectives.

c) Development proposals that will affect a National Park, National Scenic Area, Site of Special Scientific Interest or a National Nature Reserve will only be supported where:
i. The objectives of designation and the overall integrity of the areas will not be compromised; or
ii. Any significant adverse effects on the qualities for which the area has been designated are clearly outweighed by social, environmental or economic benefits of national importance.

All Ramsar sites are also European sites and/ or Sites of Special Scientific Interest and
are extended protection under the relevant statutory regimes.

d) Development proposals that affect a site designated as a local nature conservation site or landscape area in the LDP will only be supported where:
i. Development will not have significant adverse effects on the integrity of the area or the qualities for which it has been identified; or
ii. Any significant adverse effects on the integrity of the area are clearly outweighed by social, environmental or economic benefits of at least local importance.

e) The precautionary principle will be applied in accordance with relevant legislation and Scottish Government guidance.

f) Development proposals that are likely to have an adverse effect on species protected by legislation will only be supported where the proposal meets the relevant statutory tests. If there is reasonable evidence to suggest that a protected species is present on a site or may be affected by a proposed development, steps must be taken to establish its presence. The level of protection required by legislation must be factored into the planning and design of development, and potential impacts must be fully considered prior to the determination of any application.

g) Development proposals in areas identified as wild land in the Nature Scot Wild Land Areas map will only be supported where the proposal:
i) will support meeting renewable energy targets; or,
ii) is for small scale development directly linked to a rural business or croft, or is required to support a fragile community in a rural area.

All such proposals must be accompanied by a wild land impact assessment which sets out how design, siting, or other mitigation measures have been and will be used to minimise significant impacts on the qualities of the wild land, as well as any management and monitoring arrangements where appropriate. Buffer zones around wild land will not be applied, and effects of development outwith wild land areas will not be a significant consideration.

Policy 7 Historic assets and places
a) Development proposals with a potentially significant impact on historic assets or places will be accompanied by an assessment which is based on an understanding of the cultural significance of the historic asset and/or place. The assessment should identify the likely visual or physical impact of any proposals for change, including cumulative effects and provide a sound basis for managing the impacts of change.

Proposals should also be informed by national policy and guidance on managing change in the historic environment, and information held within Historic Environment Records.

b) Development proposals for the demolition of listed buildings will not be supported unless it has been demonstrated that there are exceptional circumstances and that all reasonable efforts have been made to retain, reuse and/or adapt the listed building. Considerations include whether the:
i. building is no longer of special interest;
ii. building is incapable of physical repair and re-use as verified through a detailed structural condition survey report;
iii. repair of the building is not economically viable and there has been adequate marketing for

existing and/or new uses at a price reflecting its location and condition for a reasonable period to attract interest from potential restoring purchasers; or
iv. demolition of the building is essential to delivering significant benefits to economic growth or the wider community.

c) Development proposals for the reuse, alteration or extension of a listed building will only be supported where they will preserve its character, special architectural or historic interest and setting. Development proposals affecting the setting of a listed building should preserve its character, and its special architectural or historic interest.

d) Development proposals in or affecting conservation areas will only be supported where the character and appearance of the conservation area and its setting is preserved or enhanced. Relevant considerations include the:
i. architectural and historic character of the area;
ii. existing density, built form and layout; and
iii. context and siting, quality of design and suitable materials.

e) Development proposals in conservation areas will ensure that existing natural and built features which contribute to the character of the conservation area and its setting, including structures, boundary walls, railings, trees and hedges, are retained.

f) Demolition of buildings in a conservation area which make a positive contribution to its character will only be supported where it has been demonstrated that:
i. reasonable efforts have been made to retain, repair and reuse the building;
ii. the building is of little townscape value;
iii. the structural condition of the building prevents its retention at a reasonable cost; or
iv. the form or location of the building makes its reuse extremely difficult.

g) Where demolition within a conservation area is to be followed by redevelopment, consent to demolish will only be supported when an acceptable design, layout and materials are being used for the replacement development.

h) Development proposals affecting scheduled monuments will only be supported where:
i. direct impacts on the scheduled monument are avoided;
ii. significant adverse impacts on the integrity of the setting of a scheduled monument are avoided; or
iii. exceptional circumstances have been demonstrated to justify the impact on a scheduled monument and its setting and impacts on the monument or its setting have been minimised.

i) Development proposals affecting nationally important Gardens and Designed Landscapes will be supported where they protect, preserve or enhance their cultural significance, character and integrity and where proposals will not significantly impact on important views to, from and within the site, or its setting.

j) Development proposals affecting nationally important Historic Battlefields will only be supported where they protect and, where appropriate, enhance their cultural significance, key landscape characteristics, physical remains and special qualities.

k) Development proposals at the coast edge or that extend offshore will only be supported where proposals do not significantly hinder the preservation objectives of Historic Marine Protected Areas.

l) Development proposals affecting a World Heritage Site or its setting will only be supported where their Outstanding Universal Value is protected and preserved.

m) Development proposals which sensitively repair, enhance and bring historic buildings, as identified as being at risk locally or on the national Buildings at Risk Register, back into beneficial use will be supported.

n) Enabling development for historic environment assets or places that would otherwise be unacceptable in planning terms, will only be supported when it has been demonstrated that the enabling

development proposed is:
i. essential to secure the future of an historic environment asset or place which is at risk of serious deterioration or loss; and
ii. the minimum necessary to secure the restoration, adaptation and long-term future of the historic environment asset or place.

The beneficial outcomes for the historic environment asset or place should be secured early in the phasing of the development, and will be ensured through the use of conditions and/or legal agreements.

o) Non-designated historic environment assets, places and their setting should be protected and preserved in situ wherever feasible. Where there is potential for non-designated buried archaeological remains to exist below a site, developers will provide an evaluation of the archaeological resource at an early stage so that planning authorities can assess impacts. Historic buildings may also have archaeological significance which is not understood and may require assessment.

Where impacts cannot be avoided they should be minimised. Where it has been demonstrated that avoidance or retention is not possible, excavation, recording, analysis, archiving, publication and activities to provide public benefit may be required through the use of conditions or legal/planning obligations.

When new archaeological discoveries are made during the course of development works, they must be reported to the planning authority to enable agreement on appropriate inspection, recording and mitigation measures.

Policy 9 Brownfield, vacant and derelict land and empty buildings
a) Development proposals that will result in the sustainable reuse of brownfield land including vacant and derelict land and buildings, whether permanent or temporary, will be supported. In determining whether the reuse is sustainable, the biodiversity value of brownfield land which has naturalised should be taken into account.
b) Proposals on greenfield sites will not be supported unless the site has been allocated for development or the proposal is explicitly supported by policies in the LDP.
c) Where land is known or suspected to be unstable or contaminated, development proposals will demonstrate that the land is, or can be made, safe and suitable for the proposed new use.
d) Development proposals for the reuse of existing buildings will be supported, taking into account their suitability for conversion to other uses. Given the need to conserve
embodied energy, demolition will be regarded as the least preferred option.

Policy 10 Coastal development
a) Development proposals in developed coastal areas will only be supported where the proposal:

i. does not result in the need for further coastal protection measures taking into account future sea level change; or increase the risk to people of coastal flooding or coastal erosion, including through the loss of natural coastal defences including dune systems; and
ii. is anticipated to be supportable in the long- term, taking into account projected climate change.

b) Development proposals in undeveloped coastal areas will only be supported where they:
i. are necessary to support the blue economy, net zero emissions or to contribute to the economy or wellbeing of communities whose livelihood depend on marine or coastal activities, or is for essential infrastructure, where there is a specific locational need and no other suitable site;
ii. do not result in the need for further coastal protection measures taking into account future sea level change; or increase the risk to people of coastal flooding or coastal erosion, including through the loss of natural coastal defences including dune systems; and
iii. are anticipated to be supportable in the long-term, taking into account projected climate change; or
iv. are designed to have a very short lifespan.

c) Development proposals for coastal defence measures will be supported if:
i. they are consistent with relevant coastal or marine plans;
ii. nature-based solutions are utilised and allow for managed future coastal change wherever practical; and

iii. any in-perpetuity hard defence measures can be demonstrated to be necessary to protect essential assets.

d) Where a design statement is submitted with any planning application that may impact on the coast it will take into account, as appropriate, long-term coastal vulnerability and resilience.

Policy 13 Sustainable transport

a) Proposals to improve, enhance or provide active travel infrastructure, public transport infrastructure or multi-modal hubs will be supported. This includes proposals:

i. for electric vehicle charging infrastructure and electric vehicle forecourts, especially where fuelled by renewable energy.

ii. which support a mode shift of freight from road to more sustainable modes, including last-mile delivery.

iii. that build in resilience to the effects of climate change and where appropriate incorporate blue and green infrastructure and nature rich habitats (such as natural planting or water systems).

b) Development proposals will be supported where it can be demonstrated that the transport requirements generated have been considered in line with the sustainable travel and investment hierarchies and where appropriate they:

i. Provide direct, easy, segregated and safe links to local facilities via walking, wheeling and cycling networks before occupation;

ii. Will be accessible by public transport, ideally supporting the use of existing services;

iii. Integrate transport modes;

iv. Provide low or zero-emission vehicle and cycle charging points in safe and convenient locations, in alignment with building standards;

v. Supply safe, secure and convenient cycle parking to meet the needs of users and which is more conveniently located than car parking;

vi. Are designed to incorporate safety measures including safe crossings for walking and wheeling and reducing the number and speed of vehicles;

vii. Have taken into account, at the earliest stage of design, the transport needs of diverse groups including users with protected characteristics to ensure the safety, ease and needs of all users; and

viii. Adequately mitigate any impact on local public access routes.

c) Where a development proposal will generate a significant increase in the number of person trips, a transport assessment will be required to be undertaken in accordance with the relevant guidance.

d) Development proposals for significant travel generating uses will not be supported in locations which would increase reliance on the private car, taking into account the specific characteristics of the area.

e) Development proposals which are ambitious in terms of low/no car parking will be supported, particularly in urban locations that are well-served by sustainable transport modes and where they do not create barriers to access by disabled people.

f) Development proposals for significant travel generating uses, or smaller-scale developments where it is important to monitor travel patterns resulting from the development, will only be supported if they are accompanied by a Travel Plan with supporting planning conditions/obligations. Travel plans should set out clear arrangements for delivering against targets, as well as monitoring and evaluation.

g) Development proposals that have the potential to affect the operation and safety of the Strategic Transport Network will be fully assessed to determine their impact. Where it has been demonstrated that existing infrastructure does not have the capacity to accommodate a development without adverse impacts on safety or unacceptable impacts on operational performance, the cost of the mitigation measures required to ensure the continued safe and effective operation of the network should be met by the developer.

While new junctions on trunk roads are not normally acceptable, the case for a new junction will be considered by Transport Scotland where significant economic or regeneration benefits can be demonstrated. New junctions will only be considered if they are designed in accordance with relevant

guidance and where there will be no adverse impact on road safety or operational performance.

Policy 14 Design, quality and place

a) Development proposals will be designed to improve the quality of an area whether in urban or rural locations and regardless of scale.

b) Development proposals will be supported where they are consistent with the six qualities of successful places:

Healthy: Supporting the prioritisation of women's safety and improving physical and mental health.

Pleasant: Supporting attractive natural and built spaces.

Connected: Supporting well connected networks that make moving around easy and reduce car dependency

Distinctive: Supporting attention to detail of local architectural styles and natural landscapes to be interpreted, literally or creatively, into designs to reinforce identity.

Sustainable: Supporting the efficient use of resources that will allow people to live, play, work and stay in their area, ensuring climate resilience, and integrating nature positive, biodiversity solutions.

Adaptable: Supporting commitment to investing in the long-term value of buildings, streets and spaces by allowing for flexibility so that they can be changed quickly to accommodate different uses as well as maintained over time.

Further details on delivering the six qualities of successful places are set out in Annex D.

c) Development proposals that are poorly designed, detrimental to the amenity of the surrounding area or inconsistent with the six qualities of successful places, will not be supported.

Policy 15 Local living and 20 minute neighbourhoods

a) Development proposals will contribute to local living including, where relevant, 20 minute neighbourhoods. To establish this, consideration will be given to existing settlement pattern, and the level and quality of interconnectivity of the proposed development with the surrounding area, including local access to:

- sustainable modes of transport including local public transport and safe, high quality walking, wheeling and cycling networks;
- employment;
- shopping;
- health and social care facilities;
- childcare, schools and lifelong learning opportunities;
- playgrounds and informal play opportunities, parks, green streets and spaces, community gardens, opportunities for food growth and allotments, sport and recreation facilities;
- publicly accessible toilets;
- affordable and accessible housing options, ability to age in place and housing diversity.

Policy 16 Quality homes

a) Development proposals for new homes on land allocated for housing in LDPs will be supported.

b) Development proposals that include 50 or more homes, and smaller developments if required by local policy or guidance, should be accompanied by a Statement of Community Benefit. The statement will explain the contribution of the proposed development to:

i. meeting local housing requirements, including affordable homes;
ii. providing or enhancing local infrastructure, facilities and services; and
iii. improving the residential amenity of the surrounding area.

c) Development proposals for new homes that improve affordability and choice by being adaptable

to changing and diverse needs, and which address identified gaps in provision, will be supported. This could include:

i. self-provided homes;
ii. accessible, adaptable and wheelchair accessible homes;
iii. build to rent;
iv. affordable homes;
v. a range of size of homes such as those for larger families;
vi. homes for older people, including supported accommodation, care homes and sheltered housing;
vii. homes for people undertaking further and higher education; and
viii. homes for other specialist groups such as service personnel.

d) Development proposals for public or private, permanent or temporary, Gypsy/Travellers sites and family yards and Travelling Showpeople yards, including on land not specifically allocated for this use in the LDP, should be supported where a need is identified and the proposal is otherwise consistent with the plan spatial strategy and other relevant policies, including human rights and equality.

e) Development proposals for new homes will be supported where they make provision for affordable homes to meet an identified need. Proposals for market homes will only be supported where the contribution to the provision of affordable homes on a site will be at least 25% of the total number of homes, unless the LDP sets out locations or circumstances where:

i. a higher contribution is justified by evidence of need, or
ii. a lower contribution is justified, for example, by evidence of impact on viability,

where proposals are small in scale, or to incentivise particular types of homes that are needed to diversify the supply, such as self-build or wheelchair accessible homes.

The contribution is to be provided in accordance with local policy or guidance.

f) Development proposals for new homes on land not allocated for housing in the LDP will only be supported in limited circumstances where:

i. the proposal is supported by an agreed timescale for build-out; and
ii. the proposal is otherwise consistent with the plan spatial strategy and other relevant policies including local living and 20 minute neighbourhoods;
iii. and either:

o delivery of sites is happening earlier than identified in the deliverable housing land pipeline. This will be determined by reference to two consecutive years of the Housing Land Audit evidencing substantial delivery earlier than pipeline timescales and that general trend being sustained; or
o the proposal is consistent with policy on rural homes; or
o the proposal is for smaller scale opportunities within an existing settlement boundary; or
o the proposal is for the delivery of less than 50 affordable homes as part of a local authority supported affordable housing plan.

g) Householder development proposals will be supported where they:

i. do not have a detrimental impact on the character or environmental quality of the home and the surrounding area in terms of size, design and materials; and
ii. do not have a detrimental effect on the neighbouring properties in terms of physical impact, overshadowing or overlooking.

h) Householder development proposals that provide adaptations in response to risks from a changing climate, or relating to people with health conditions that lead to particular accommodation needs will be supported.

Policy 18 Infrastructure first

a) Development proposals which provide (or contribute to) infrastructure in line with that identified as necessary in LDPs and their delivery programmes will be supported.

b) The impacts of development proposals on infrastructure should be mitigated. Development proposals will only be supported where it can be demonstrated that provision is made to address the impacts on infrastructure. Where planning conditions, planning obligations, or other legal agreements are to be used, the relevant tests will apply.

Where planning obligations are entered into, they should meet the following tests:
- be necessary to make the proposed development acceptable in planning terms
- serve a planning purpose
- relate to the impacts of the proposed development
- fairly and reasonably relate in scale and kind to the proposed development
- be reasonable in all other respects

Planning conditions should only be imposed where they meet all of the following tests. They should be:
- necessary
- relevant to planning
- relevant to the development to be permitted
- enforceable
- precise
- reasonable in all other respects

Policy 22 Flood risk and water management
a) Development proposals at risk of flooding or in a flood risk area will only be supported if they are for:
i. essential infrastructure where the location is required for operational reasons;
ii. water compatible uses;
iii. redevelopment of an existing building or site for an equal or less vulnerable use; or.
iv. redevelopment of previously used sites in built up areas where the LDP has identified a need to bring these into positive use and where proposals demonstrate that long- term safety and resilience can be secured in accordance with relevant SEPA advice.

The protection offered by an existing formal flood protection scheme or one under construction can be taken into account when determining flood risk.

In such cases, it will be demonstrated by the applicant that:
o all risks of flooding are understood and addressed;
o there is no reduction in floodplain capacity, increased risk for others, or a need for future flood protection schemes;
o the development remains safe and operational during floods;
o flood resistant and resilient materials and construction methods are used; and
o future adaptations can be made to accommodate the effects of climate change.

Additionally, for development proposals meeting criteria part iv), where flood risk is managed at the site rather than avoided these will also require:
o the first occupied/utilised floor, and the underside of the development if relevant, to be above the flood risk level and have an additional allowance for freeboard; and
o that the proposal does not create an island of development and that safe access/ egress can be achieved.

b) Small scale extensions and alterations to existing buildings will only be supported where they will not significantly increase flood risk.

c) Development proposals will:
i. not increase the risk of surface water flooding to others, or itself be at risk.
ii. manage all rain and surface water through sustainable urban drainage systems (SUDS), which should form part of and integrate with proposed and existing blue- green infrastructure. All proposals should presume no surface water connection to the combined sewer;
iii. seek to minimise the area of impermeable surface.

d) Development proposals will be supported if they can be connected to the public water mains. If connection is not feasible, the applicant will need to demonstrate that water for drinking water purposes will be sourced from a sustainable water source that is resilient to periods of water scarcity.

e) Development proposals which create, expand or enhance opportunities for natural flood risk

management, including blue and green infrastructure, will be supported.

Policy 23 Health and safety

a) Development proposals that will have positive effects on health will be supported. This could include, for example, proposals that incorporate opportunities for exercise, community food growing or allotments.

b) Development proposals which are likely to have a significant adverse effect on health will not be supported. A Health Impact Assessment may be required.

c) Development proposals for health and social care facilities and infrastructure will be supported.

d) Development proposals that are likely to have significant adverse effects on air quality will not be supported. Development proposals will consider opportunities to improve air quality and reduce exposure to poor air quality. An air quality assessment may be required where the nature of the proposal or the air quality in the location suggest significant effects are likely.

e) Development proposals that are likely to raise unacceptable noise issues will not be supported. The agent of change principle applies to noise sensitive development. A Noise Impact Assessment may be required where the nature of the proposal or its location suggests that significant effects are likely.

f) Development proposals will be designed to take into account suicide risk.

g) Development proposals within the vicinity of a major accident hazard site or major accident hazard pipeline (because of the presence of toxic, highly reactive, explosive or inflammable substances) will consider the associated risks and potential impacts of the proposal and the major accident hazard site/pipeline of being located in proximity to one another.

h) Applications for hazardous substances consent will consider the likely potential impacts on surrounding populations and the environment.

i) Any advice from Health and Safety Executive, the Office of Nuclear Regulation or the Scottish Environment Protection Agency that planning permission or hazardous substances consent should be refused, or conditions to be attached to a grant of consent, should not be overridden by the decision maker without the most careful consideration.

j) Similar considerations apply in respect of development proposals either for or near licensed explosive sites (including military explosive storage sites).

Angus Local Development Plan 2016

Policy DS1 : Development Boundaries and Priorities

All proposals will be expected to support delivery of the Development Strategy.

The focus of development will be sites allocated or otherwise identified for development within the Angus Local Development Plan, which will be safeguarded for the use(s) set out. Proposals for alternative uses will only be acceptable if they do not undermine the provision of a range of sites to meet the development needs of the plan area.

Proposals on sites not allocated or otherwise identified for development, but within development boundaries will be supported where they are of an appropriate scale and nature and are in accordance with relevant policies of the ALDP.

Proposals for sites outwith but contiguous* with a development boundary will only be acceptable where it is in the public interest and social, economic, environmental or operational considerations confirm there is a need for the proposed development that cannot be met within a development boundary.

Outwith development boundaries proposals will be supported where they are of a scale and nature appropriate to their location and where they are in accordance with relevant policies of the ALDP.

In all locations, proposals that re-use or make better use of vacant, derelict or under-used brownfield land or buildings will be supported where they are in accordance with relevant policies of the ALDP.

Development of greenfield sites (with the exception of sites allocated, identified or considered appropriate for development by policies in the ALDP) will only be supported where there are no suitable and available brownfield sites capable of accommodating the proposed development.

Development proposals should not result in adverse impacts, either alone or in combination with other proposals or projects, on the integrity of any European designated site, in accordance with Policy PV4 Sites Designated for Natural Heritage and Biodiversity Value.

*Sharing an edge or boundary, neighbouring or adjacent

Policy DS2 : Accessible Development
Development proposals will require to demonstrate, according to scale, type and location, that they:

- are or can be made accessible to existing or proposed public transport networks;
- make provision for suitably located public transport infrastructure such as bus stops, shelters, lay-bys, turning areas which minimise walking distances;
- allow easy access for people with restricted mobility;
- provide and/or enhance safe and pleasant paths for walking and cycling which are suitable for use by all, and link existing and proposed path networks; and
- are located where there is adequate local road network capacity or where capacity can be made available.

Where proposals involve significant travel generation by road, rail, bus, foot and/or cycle, Angus Council will require:

- the submission of a Travel Plan and/or a Transport Assessment.
- appropriate planning obligations in line with Policy DS5 Developer Contributions.

Policy DS3 : Design Quality and Placemaking
Development proposals should deliver a high design standard and draw upon those aspects of landscape or townscape that contribute positively to the character and sense of place of the area in which they are to be located. Development proposals should create buildings and places which are:

- Distinct in Character and Identity: Where development fits with the character and pattern of development in the surrounding area, provides a coherent structure of streets, spaces and buildings and retains and sensitively integrates important townscape and landscape features.
- Safe and Pleasant: Where all buildings, public spaces and routes are designed to be accessible, safe and attractive, where public and private spaces are clearly defined and appropriate new areas of landscaping and open space are incorporated and linked to existing green space wherever possible.
- Well Connected: Where development connects pedestrians, cyclists and vehicles with the surrounding area and public transport, the access and parking requirements of the Roads Authority are met and the principles set out in 'Designing Streets' are addressed.
- Adaptable: Where development is designed to support a mix of compatible uses and accommodate changing needs.
- Resource Efficient: Where development makes good use of existing resources and is sited and designed to minimise environmental impacts and maximise the use of local climate and landform.

Supplementary guidance will set out the principles expected in all development, more detailed guidance on the design aspects of different proposals and how to achieve the qualities set out above. Further details on the type of developments requiring a design statement and the issues that should be addressed will also be set out in supplementary guidance.

Policy DS4 : Amenity
All proposed development must have full regard to opportunities for maintaining and improving environmental quality. Development will not be permitted where there is an unacceptable adverse impact

on the surrounding area or the environment or amenity of existing or future occupiers of adjoining or nearby properties.
Angus Council will consider the impacts of development on:

- Air quality;
- Noise and vibration levels and times when such disturbances are likely to occur;
- Levels of light pollution;
- Levels of odours, fumes and dust;
- Suitable provision for refuse collection / storage and recycling;
- The effect and timing of traffic movement to, from and within the site, car parking and impacts on highway safety; and
- Residential amenity in relation to overlooking and loss of privacy, outlook, sunlight, daylight and overshadowing.

Angus Council may support development which is considered to have an impact on such considerations, if the use of conditions or planning obligations will ensure that appropriate mitigation and / or compensatory measures are secured.

Applicants may be required to submit detailed assessments in relation to any of the above criteria to the Council for consideration.

Where a site is known or suspected to be contaminated, applicants will be required to undertake investigation and, where appropriate, remediation measures relevant to the current or proposed use to prevent unacceptable risks to human health.

Policy TC2 : Residential Development
All proposals for new residential development*, including the conversion of non-residential buildings must:

- be compatible with current and proposed land uses in the surrounding area;
- provide a satisfactory residential environment for the proposed dwelling(s);
- not result in unacceptable impact on the built and natural environment, surrounding amenity, access and infrastructure; and
- include as appropriate a mix of house sizes, types and tenures and provision for affordable housing in accordance with Policy TC3 Affordable Housing.

Within development boundaries Angus Council will support proposals for new residential development where:

- the site is not allocated or protected for another use; and
- the proposal is consistent with the character and pattern of development in the surrounding area.

In countryside locations Angus Council will support proposals for the development of houses which fall into at least one of the following categories:

- retention, renovation or acceptable replacement of existing houses;
- conversion of non-residential buildings;
- regeneration or redevelopment of a brownfield site that delivers significant visual or environmental improvement through the removal of derelict buildings, contamination or an incompatible land use;
- single new houses where development would:
- round off an established building group of 3 or more existing dwellings; or
- meet an essential worker requirement for the management of land or other rural business.
- in Rural Settlement Units (RSUs)**, fill a gap between the curtilages of two houses, or the curtilage of one house and a metalled road, or between the curtilage of one house and an existing substantial building such as a church, a shop or a community facility; and
- in Category 2 Rural Settlement Units (RSUs), as shown on the Proposals Map, gap sites (as defined in the Glossary) may be developed for up to two houses.

Further information and guidance on the detailed application of the policy on new residential development

in countryside locations will be provided in supplementary planning guidance, and will address:

- the types of other buildings which could be considered suitable in identifying appropriate gap sites for the development of single houses in Category 1 Rural Settlement Units, or for the development of up to two houses in Category 2 Rural Settlement Units.
- the restoration or replacement of traditional buildings.
- the development of new large country houses.

*includes houses in multiple occupation, non-mainstream housing for people with particular needs, such as specialist housing for the elderly, people with disabilities, supported housing care and nursing homes.
**Rural Settlement Units are defined in the Glossary and their role is further explained on Page 9.

Policy PV8 : Built and Cultural Heritage
Angus Council will work with partner agencies and developers to protect and enhance areas designated for their built and cultural heritage value. Development proposals which are likely to affect protected sites, their setting or the integrity of their designation will be assessed within the context of the appropriate regulatory regime.

National Sites
Development proposals which affect Scheduled Monuments, Listed Buildings and Inventory Gardens and Designed Landscapes will only be supported where:

- the proposed development will not adversely affect the integrity of the site or the reasons for which it was designated;
- any significant adverse effects on the site or its setting are significantly outweighed by social, environmental and/or economic benefits; and
- appropriate measures are provided to mitigate any identified adverse impacts.

Proposals for enabling development which is necessary to secure the preservation of a listed building may be acceptable where it can be clearly shown to be the only means of preventing its loss and securing its long term future. Any development should be the minimum necessary to achieve these aims. The resultant development should be designed and sited carefully in order to preserve or enhance the character and setting of the listed building.

Regional and Local Sites
Development proposals which affect local historic environment sites as identified by Angus Council (such as Conservation Areas, sites of archaeological interest) will only be permitted where:

- supporting information commensurate with the site's status demonstrates that the integrity of the historic environment value of the site will not be compromised; or
- the economic and social benefits significantly outweigh the historic environment value of the site.

Angus Council will continue to review Conservation Area boundaries and will include Conservation Area Appraisals and further information on planning and the built and cultural heritage in a Planning Advice Note.

Policy PV12 : Managing Flood Risk
To reduce potential risk from flooding there will be a general presumption against built development proposals:
- on the functional floodplain;
- which involve land raising resulting in the loss of the functional flood plain; or
- which would materially increase the probability of flooding to existing or planned development.

Development in areas known or suspected to be at the upper end of low to medium risk or of medium to high flood risk (as defined in Scottish Planning Policy (2014), see Table 4) may be required to undertake a flood risk assessment. This should demonstrate:

- that flood risk can be adequately managed both within and outwith the site;
- that a freeboard allowance of at least 500-600mm in all circumstances can be provided;

- access and egress to the site can be provided that is free of flood risk; and
- where appropriate that water-resistant materials and construction will be utilised.

Where appropriate development proposals will be:

- assessed within the context of the Shoreline Management Plan, Strategic Flood Risk Assessments and Flood Management Plans; and
- considered within the context of SEPA flood maps to assess and mitigate surface water flood potential.

Built development should avoid areas of ground instability (landslip) coastal erosion and storm surges. In areas prone to landslip a geomorphological assessment may be requested in support of a planning application to assess degree of risk and any remediation measures if required to make the site suitable for use.

Policy PV13 : Resilience and Adaptation
Development should not require an increase in the provision and / or maintenance of flood defences.

To increase resilience to the effects of climate change such as flood and drought, extreme weather events and rising sea levels Angus Council may require development proposals to incorporate adaptation measures including:

- use of flood resistant materials and construction techniques;
- removal of culverts and other engineering works where opportunity arises and avoidance of development over or requiring new culverts or other unnecessary engineering works unless there is no practical alternative;
- minimising the area of impermeable surfaces by using permeable surfaces where possible for car parking and hard landscaping and where appropriate, green roofs and green infrastructure; and
- natural flood management measures which reduce water flow and enhance biodiversity and the quality of the water environment. Such schemes can contribute to local green networks, biodiversity and provision of amenity open space and should form an integral part of the design process.

Policy PV15 : Drainage Infrastructure
Development proposals within Development Boundaries will be required to connect to the public sewer where available.

Where there is limited capacity at the treatment works Scottish Water will provide additional wastewater capacity to accommodate development if the Developer can meet the 5 Criteria*. Scottish Water will instigate a growth project upon receipt of the 5 Criteria and will work with the developer, SEPA and Angus Council to identify solutions for the development to proceed.

Outwith areas served by public sewers or where there is no viable connection for economic or technical reasons private provision of waste water treatment must meet the requirements of SEPA and/or The Building Standards (Scotland) Regulations. A private drainage system will only be considered as a means towards achieving connection to the public sewer system, and when it forms part of a specific development proposal which meets the necessary criteria to trigger a Scottish Water growth project.

All new development (except single dwelling and developments that discharge directly to coastal waters) will be required to provide Sustainable Drainage Systems (SUDs) to accommodate surface water drainage and long term maintenance must be agreed with the local authority. SUDs schemes can contribute to local green networks, biodiversity and provision of amenity open space and should form an integral part of the design process.

Drainage Impact Assessment (DIA) will be required for new development where appropriate to identify potential network issues and minimise any reduction in existing levels of service.

*Enabling Development and our 5 Criteria (http://scotland.gov.uk/Resource/0040/00409361.pdf)

Policy PV18 : Waste Management in New Development

AC1

Proposals for new retail, residential, commercial, business and industrial development should seek to minimise the production of demolition and construction waste and incorporate recycled waste into the development.

Where appropriate, Angus Council will require the submission of a Site Waste Management Plan to demonstrate how the generation of waste will be minimised during the construction and operational phases of the development.

Development proposals that are likely to generate waste when operational will be expected to include appropriate facilities for the segregation, storage and collection of waste. This will include provision for the separate collection and storage of recyclates within the curtilage of individual houses.

AC2

ANGUS COUNCIL

PLACE
PLANNING

CONSULTATION SHEET

PLANNING APPLICATION NO	**22/00221/FULL**

Tick boxes as appropriate

ROADS	No Objection	✓	
	Interest		(Comments to follow within 14 days)
	Date	22 / 04 / 22	

PLEASE DO NOT TAKE AWAY THE LAST SET OF PLANS WHERE POSSIBLE COPIES WILL BE PROVIDED ON REQUEST

ELECTRONIC SUBMISSION DRAWINGS TO BE VIEWED VIA IDOX

AC3

Wednesday, 27 April 2022

Local Planner
Planning Service
Angus Council
Forfar
DD8 1AN

Development Operations
The Bridge
Buchanan Gate Business Park
Cumbernauld Road
Stepps
Glasgow
G33 6FB

Development Operations
Freephone Number - 0800 3890379
E-Mail - DevelopmentOperations@scottishwater.co.uk
www.scottishwater.co.uk

Dear Customer,

Smugglers Tavern, 65 Ladybridge Street, Arbroath, DD11 1AX
Planning Ref: 22/00221/FULL
Our Ref: DSCAS-0063402-7ZF
Proposal: Change of use from public house to flat and dormer extension to attic of existing flat

Please quote our reference in all future correspondence

Audit of Proposal

Scottish Water has no objection to this planning application; however, the applicant should be aware that this does not confirm that the proposed development can currently be serviced and would advise the following:

Water Capacity Assessment

Scottish Water has carried out a Capacity review and we can confirm the following:

- There is currently sufficient capacity in the LINTRATHEN WTW NO273538 Water Treatment Works to service your development. However, please note that further investigations may be required to be carried out once a formal application has been submitted to us.

Waste Water Capacity Assessment

- There is currently sufficient capacity for a foul only connection in the HATTON PFI WWTW NO603373 Wastewater Treatment works to service your development. However, please note that further investigations may be required to be carried out once a formal application has been submitted to us.

Please Note

- The applicant should be aware that we are unable to reserve capacity at our water and/or waste water treatment works for their proposed development. Once a formal connection application is submitted to Scottish Water after full planning permission has been granted, we will review the availability of capacity at that time and advise the applicant accordingly.

Drinking Water Protected Areas

A review of our records indicates that there are no Scottish Water drinking water catchments or water abstraction sources, which are designated as Drinking Water Protected Areas under the Water Framework Directive, in the area that may be affected by the proposed activity.

Surface Water

For reasons of sustainability and to protect our customers from potential future sewer flooding, Scottish Water will not accept any surface water connections into our combined sewer system.

There may be limited exceptional circumstances where we would allow such a connection for brownfield sites only, however this will require significant justification from the customer taking account of various factors including legal, physical, and technical challenges.

In order to avoid costs and delays where a surface water discharge to our combined sewer system is anticipated, the developer should contact Scottish Water at the earliest opportunity with strong evidence to support the intended drainage plan prior to making a connection request. We will assess this evidence in a robust manner and provide a decision that reflects the best option from environmental and customer perspectives.

General notes:

- Scottish Water asset plans can be obtained from our appointed asset plan providers:
    - Site Investigation Services (UK) Ltd
    - Tel: 0333 123 1223
    - Email: sw@sisplan.co.uk
    - www.sisplan.co.uk
- Scottish Water's current minimum level of service for water pressure is 1.0 bar or 10m head at the customer's boundary internal outlet. Any property which cannot be adequately serviced from the available pressure may require private pumping arrangements to be installed, subject to compliance with Water Byelaws. If the developer wishes to enquire about Scottish Water's procedure for checking the water pressure in the area, then they should write to the Customer Connections department at the above address.

- If the connection to the public sewer and/or water main requires to be laid through land out-with public ownership, the developer must provide evidence of formal approval from the affected landowner(s) by way of a deed of servitude.

- Scottish Water may only vest new water or waste water infrastructure which is to be laid through land out with public ownership where a Deed of Servitude has been obtained in our favour by the developer.

- The developer should also be aware that Scottish Water requires land title to the area of land where a pumping station and/or SUDS proposed to vest in Scottish Water is constructed.

- Please find information on how to submit application to Scottish Water at our Customer Portal.

Next Steps:

All Proposed Developments

All proposed developments require to submit a Pre-Development Enquiry (PDE) Form to be submitted directly to Scottish Water via our Customer Portal prior to any formal Technical Application being submitted. This will allow us to fully appraise the proposals.

Where it is confirmed through the PDE process that mitigation works are necessary to support a development, the cost of these works is to be met by the developer, which Scottish Water can contribute towards through Reasonable Cost Contribution regulations.

Non Domestic/Commercial Property:

Since the introduction of the Water Services (Scotland) Act 2005 in April 2008 the water industry in Scotland has opened to market competition for non-domestic customers. All Non-domestic Household customers now require a Licensed Provider to act on their behalf for new water and waste water connections. Further details can be obtained at www.scotlandontap.gov.uk

Trade Effluent Discharge from Non Dom Property:

- Certain discharges from non-domestic premises may constitute a trade effluent in terms of the Sewerage (Scotland) Act 1968. Trade effluent arises from activities including; manufacturing, production and engineering; vehicle, plant and equipment washing, waste and leachate management. It covers both large and small premises, including activities such as car washing and launderettes. Activities not covered include hotels, caravan sites or restaurants.
- If you are in any doubt as to whether the discharge from your premises is likely to be trade effluent, please contact us on 0800 778 0778 or email TEQ@scottishwater.co.uk using the subject “Is this Trade Effluent?".

Discharges that are deemed to be trade effluent need to apply separately for permission to discharge to the sewerage system. The forms and application guidance notes can be found here.

- Trade effluent must never be discharged into surface water drainage systems as these are solely for draining rainfall run off.
- For food services establishments, Scottish Water recommends a suitably sized grease trap is fitted within the food preparation areas, so the development complies with Standard 3.7 a) of the Building Standards Technical Handbook and for best management and housekeeping practices to be followed which prevent food waste, fat oil and grease from being disposed into sinks and drains.
- The Waste (Scotland) Regulations which require all non-rural food businesses, producing more than 50kg of food waste per week, to segregate that waste for separate collection. The regulations also ban the use of food waste disposal units that dispose of food waste to the public sewer. Further information can be found at www.resourceefficientscotland.com

I trust the above is acceptable however if you require any further information regarding this matter please contact me on **0800 389 0379** or via the e-mail address below or at planningconsultations@scottishwater.co.uk.

Yours sincerely,

Laura Bunton
Development Operations Analyst
Tel: 0800 389 0379
developmentoperations@scottishwater.co.uk

Scottish Water Disclaimer:

"It is important to note that the information on any such plan provided on Scottish Water's infrastructure, is for indicative purposes only and its accuracy cannot be relied upon. When the exact location and the nature of the infrastructure on the plan is a material requirement then you should undertake an appropriate site investigation to confirm its actual position in the ground and to determine if it is suitable for its intended purpose. By using the plan you agree that Scottish Water will not be liable for any loss, damage or costs caused by relying upon it or from carrying out any such site investigation."

Our Ref: 5015
Your Ref: 22/00221/FULL

Damian Brennan
Angus Council
Angus House
Planning Service
Orchardbank Business Park
Forfar
DD8 1AN

SEPA Email Contact:
planningsoutheast@sepa.org.uk

9 May 2022

By email only to: PLNProcessing@angus.gov.uk

Dear Mr Brennan

Town and Country Planning (Scotland) Acts
22/00221/FULL
Change of use from public house to flat and dormer extension to attic of existing flat
Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Thank you for your consultation which was received by SEPA on 18 April 2022 in relation to the above application. We understand the reason for consultation is flood risk.

Advice for the planning authority

We **object in principle** to this proposal and recommend that planning permission should be refused. This is because the proposed development is expected to put people or property at risk of flooding which is contrary to Scottish Planning Policy.

If the planning authority proposes to grant planning permission contrary to this advice on flood risk, the Town and Country Planning (Notification of Applications) (Scotland) Direction 2009 provides criteria for the referral to the Scottish Ministers of such cases. You may therefore wish to consider if this proposal falls within the scope of this Direction.

1. Flood Risk Technical Report

1.1 The application is for a change of use from a pub to 2 residential apartments (i.e. one 3 bedroom and one 2 bedroom). Within Scottish Planning Policy the appropriate flood probability for different types of development is identified and this is linked to the vulnerability of different land use types. The proposed change of use represents an increase in land use vulnerability at the site from a "least vulnerable" to a "highly vulnerable" use within SEPA's Land Use Vulnerability Guidance, as referenced by Scottish Planning Policy.

Flood risk and past flooding

1.2 The site is shown to be at flood risk from fluvial, coastal and surface water sources on our flood maps. Our Observed Flood Events (OFE) database also gives accounts of historic floods in the

area. We also hold reports regarding the most notable historic floods in October 1976 and February 1977. The 1977 event was larger and flooded the area around the pub as well as many other places.

1.3 The AECOM Fluvial Study (2017) undertaken for Angus Council also provides a useful information on these past events. Furthermore, recent AECOM modelling undertaken for the proposed flood protection scheme (discussed below) shows the Smugglers Tavern to be at flood risk from as little as a 1 in 20-year event and is certainly within the present day 200-year functional floodplain.

Existing Flood Protection Scheme

1.4 A formal flood protection scheme exists in Arbroath, built in 1985 under the 1961 Flood Prevention Act. The original design Standard of Protection (SOP) was 1 in 25 years. The current SOP however (as assessed under SFDAD analysis in 2006) is at best, only 1 in 5 years.

1.5 As referenced in the risk framework within Scottish Planning Policy Paragraph 263, areas at medium to high risk of coastal or watercourse flooding "May be suitable for - residential, institutional, commercial and industrial development within built-up areas provided flood protection measures to the appropriate standard already exist…". Paragraph 264 further states that in applying the risk framework to proposed development, other factors should be taken into account, including the effects of climate change. Based on this we consider that "an appropriate standard" for Highly Vulnerable development including residential must therefore be 1 in 200 year standard of protection with an additional allowance for climate change.

Proposed Flood Protection Scheme

1.6 There is an approved formal flood scheme for Arbroath, that is ongoing in its design and build.

1.7 The proposed scheme is only to a 200-year SOP, and this is achieved mainly by upstream storage in 3 locations (2 of which are formal Cat A reservoirs). This reduces the downstream flow on the Brothock Water for the 200-year event.

1.8 The AECOM modelling results show that the area around the site does not flood in a 200-year event with the scheme in place – however, it does flood at the 200-year plus climate change (CC) event.

1.9 Note that whilst no 200 plus CC flood extent map is shown in the AECOM results, the 500-year event (post scheme) is shown – this shows the area to flood. The AECOM report does provide a level for the 200 plus CC event and it is actually higher than the 500-year event, i.e., 5.016m vs. 5.009m AOD respectively.

1.10 Given the above, the site floods at the 200 plus CC event (with the approved scheme in place) and SEPA therefore considers that the development does not accord with the principles of Scottish Planning Policy. Scottish Planning Policy states (paragraph 255), that "The planning system should promote: … flood avoidance: by … locating development away from functional flood plains and medium to high risk areas" and as the area is not protected by a flood protection scheme giving 1:200 year flood protection plus climate change, then it is not appropriate to locate new vulnerable development at this location.

Other observations

1.11 Additionally, we are also concerned about the fact that the gable end of the Smugglers Tavern is acting as a *de facto* flood wall/ part of the existing scheme. The plan for the proposed scheme

Angus Smith Building
6 Parklands Avenue, Eurocentral,
Holytown, North Lanarkshire ML1 4WQ
tel 01698 839000 fax 01698 738155
www.sepa.org.uk • customer enquiries 03000 99 66 99

proposes no change to this – the only change under Scheme Operation 37, is to brick up a window in the gable end of the pub, to prevent flood water getting in.

1.12 There is then an obvious risk of potential collapse of that gable end during a flood (through scour) as was witnessed on the banks of the River Teviot in Hawick a few years ago, where an older building right on the river edge collapsed into the river.

Caveat

1.13 Due to the ongoing Cyber Attack, our advice is based on the current (limited) information which is accessible to us. Our responses are therefore provided in the absence of some of our historic flood information, flood defence assets, flood studies and site history. We would strongly recommend that your local authority flood officer is contacted with regards to this application as they may hold more detailed information which SEPA is currently unable to access.

2. Other Planning Matters

2.1 For all other planning matters, please see our triage framework and standing advice which are available on our website: www.sepa.org.uk/environment/land/planning/.

Advice for the applicant

3. Regulatory advice

3.1 Details of regulatory requirements and good practice advice, for example in relation to private drainage, can be found on the regulations section of our website. If you are unable to find the advice you need for a specific regulatory matter, please contact a member of the local compliance team at: FAD@sepa.org.uk

If you have queries relating to this letter, please contact planningsoutheast@sepa.org.uk including our reference number in the email subject.

Yours sincerely

Jess Taylor
Planning Officer
Planning Service

Ecopy to: BrennanDG@angus.gov.uk

Disclaimer This advice is given without prejudice to any decision made on elements of the proposal regulated by us, as such a decision may take into account factors not considered at this time. We prefer all the technical information required for any SEPA consents to be submitted at the same time as the planning or similar application. However, we consider it to be at the applicant's commercial risk if any significant changes required during the regulatory stage necessitate a further planning application or similar application and/or neighbour notification or advertising. We have relied on the accuracy and completeness of the information supplied to us in providing the above advice and can take no responsibility for incorrect data or interpretation, or omissions, in such information. If we have not referred to a particular issue in our response, it should not be assumed that there is no impact associated with that issue. For planning applications, if you did not specifically request advice on flood risk, then advice will not have been provided on this issue. Further information on our consultation arrangements generally can be found on our website planning pages - www.sepa.org.uk/environment/land/planning/.

Angus Smith Building
6 Parklands Avenue, Eurocentral,
Holytown, North Lanarkshire ML1 4WQ
tel 01698 839000 fax 01698 738155
www.sepa.org.uk • customer enquiries 03000 99 66 99

AC4

From:	Damian G Brennan
To:	Damian G Brennan
Subject:	FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX
Date:	11 November 2022 18:11:23
Attachments:	image001.jpg ~WRD0000.jpg

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 07 November 2022 12:33
To: gianni@building-design-services.com
Cc: kirsti-mathiesonG@angus.gov.uk; Damian G Brennan <BrennanDG@angus.gov.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

Good afternoon

Thank you for your email. As you will be aware, we have objected **in principle** to the proposals to convert the ground floor to residential accommodation as these proposals represent a change of use to a more vulnerable use within a flood risk area, where no flood free access and egress would be available Our position is based on the best available information, namely the flood maps produced following a detailed flood study, carried out by AECOM on behalf of Angus Council as part of the design work for the new flood scheme. This study clearly demonstrates that the site will flood at the 200 year plus climate change event.

The new flood scheme proposed is only to a 200-year Standard Of Protection, not the 200-year + CC as required by Scottish Planning Policy, and set out in PIN 4, so key principles are not met for us to support the development.

As you will be aware, SEPA are a statutory consultee to the planning process and as such we provide advice to planning authorities and other consulting bodies at their request. Angus Council are the Planning Authority and Flood Risk Management Authority and it is of course they that would determine the planning application. We do not grant permission, nor do we have any powers to enforce conditions or revoke permission. As such, if there are any material considerations that you feel are relevant to the determination of the planning application, please direct these to the Council in the first instance so that they may consult SEPA on specific matters where they deem necessary. Likewise if proposing any design alterations these must be submitted via the Council.

In relation to the two planning applications you have mentioned, SEPA do not appear to have been consulted on 17/00413/FULL and as such we did not comment. In relation to 17/01002/FULL SEPA lodged an objection in principle, however Angus Council determined to approve this application against our advice.

I trust the above helps to clarify our role,

Best wishes

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

OFFICIAL

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 04 November 2022 12:53
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Cc: kirsti-mathiesonG@angus.gov.uk; 'Damian G Brennan' <BrennanDG@angus.gov.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Jess/Georgia,

We are unclear what window you are referring to that requires blocked, please can you clarify. There does not appear to be any window there at present.

We would like to propose building up the boundary wall where its steps down towards the riverbank. We can completely infill this wall in blockwork and concrete which would help the water flow past the building, rather than pressing against that external corner. I think this would

be much more advantageous to the building than blocking up a window, and I think if you really believe water will ever reach that level in the future, it will prevent a lot of erosion to the existing building.

We noticed there has already been flood barriers fitted to the windows of the neighbouring building at 57 to 61 Ladybridge street. These are glazed panels fitted to base of windows. Georgia perhaps you can confirm what height these flood barriers were fitted to as it doesn't have any levels on your drawing. Maybe they are at the required level if this was part of Angus Councils flood prevention scheme. I have attached a sketch of where I see the 5.100 level is based on your drawing, and you can see from the photographs they do not look anywhere near that level.

Now if you are refusing this development, I would say you are not considering the existing first floor flat at our development, as the erosion of this building will still take place whether our building is a pub or a flat, or remains empty. So, if you refuse this application none of those remedial measures will take place, as the client cannot carry out these works as it will not be financially viable. We believe our works will not cause any new issues but will also improve the safety of the existing building by stopping future erosion.

I would also like to ask why the application 17/00413/FULL – conversion of the Ship Inn to convert to 2no. flats, only 70 meters down the road from this building, had no objections from SEPA when the building is 1m lower than this development? Surely this is much more susceptible to flooding than this building. It was approved in August 2017 so surely there were flood measures in place at this time? The report you attached Georgia is dated July 2017 so my client feels very aggrieved that there is no consistency here, especially when that building is at a much greater risk. He purchased this building based on previous approvals knowing there were no issues with previously approved conversions. There was also the conversion of the Baltic Mill 17/01002/FULL, further down this river which was approved on 07.09.2018 which was conversion of an existing building on a flood plain, which I know SEPA had commented on. This created 18 new flats, so surely this is a much more onerous development.

Surely there must be other remedial measures that could take place rather than refusing this application? We would like to hear your thoughts on this please.

We have attached a couple of photographs to clarify the wall we are proposing to build up and also the neighbouring flood barriers to the very low level windows on the neighbouring building. You can see how low the water levels are even after all this rain we have had over the last week

Kind Regards

Gianni

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 09 June 2022 12:47
To: gianni@building-design-services.com
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

As per SPP, development in built up areas protected by an existing or planned flood protection scheme, will only be acceptable where the standard of protection of the scheme is appropriate for the vulnerability of the land use. The ground floor proposals represent a change of use to a highly vulnerable use, in terms of our land use vulnerability guidance. As set out in my formal response, the planned flood protection scheme does not offer a sufficient level of protection for such a use. Even if finished floor levels are raised above the flood level, this proposal still introduces a new unit of accommodation into an area at risk of flooding. In a flood event, the building itself would become an "island" with no safe, dry egress for residents of the flat which is contrary to DM requirement 3 of our Flood Risk Planning Background Paper. We cannot support this residential conversion and as such our position, as submitted to the Council, is one of objection in principle.

I have spoken to the Council and advised them of this. Given the new information on the first floor flat, specifically that it is not linked to the pub, the Council may wish to reconsult us on this aspect of the proposals prior to determination.

I trust this helps to clarify our position.

Kind regards

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

Riaghladh nan Cumhachdan Rannsachaidh 2000, dh'fhaodadh gun tèid an siostam puist-d aig SEPA a sgrùdadh bho àm gu àm.

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 08 June 2022 17:47
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

> CAUTION: This email originated from outside the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi Jess,

No this existing flat on the first floor is not previously connected to the pub

You haven't addressed my issue where I am telling you we are above the flood level though.

Regards

Gianni

signature copy

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 08 June 2022 16:16
To: gianni@building-design-services.com
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

Thank you for your email. I have checked the plans and as far as I can see the ground floor use is currently a pub, and the proposal is to convert this ground floor level to a flat. This would constitute an increase in vulnerability from the current use as it would introduce additional units of residential accommodation, and as per my response letter would not be something we could support (for the reasons I have already set out).

In relation to the existing first floor flat, can you confirm whether this was previously accommodation associated with the pub, or was this a separate flat unconnected to the pub?

Best wishes,

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 07 June 2022 14:43
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Our Ref: 22/00221/FULL
Your Ref: 5015

F.A.O. Jess Taylor

Jess,

We are writing in response to your letter dated 09.05.22 to Mr Damian Brennan of Angus Council planning for the above application.

The existing building has a flat at street level and at first floor level, so we are not changing anything to this existing situation. The conversion of the pub to a flat is the new part. The flat FFL is at least 5.1 above sea level so we are unclear why you are objecting to this when you are stating levels of 5.016 and 5.009. this building has never flooded, but are you maybe talking about the basement type area? This is not part of the flat, this is an external space

You can call me on 01241 435236 or [redacted] to discuss

Thanks

Gianni

signature copy

OFFICIAL

OFFICIAL

From:	Georgia Kirtsi-Mathieson
To:	Alan Hunter
Cc:	Damian G Brennan; Ed Taylor; Peter Morton
Subject:	FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX
Date:	23 September 2022 13:51:06
Attachments:	image001.jpg ~WRD0000.jpg 5015 SEPA Response.pdf Modelling Report.PDF Operation 36, 37.pdf image002.gif image003.jpg

Hi Alan

Further to your consultation request, I have now considered the above planning application and have the following observations with regard to flood risk:

Planning Permission: 22/00221/FULL
Change of Use from Public House to Flat and dormer extension to attic
Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Observations

1. The planning application is for change of use from a public house on the ground floor and residential apartment on the first floor to two residential apartments i.e. one 2 bedroom apartment on the ground floor and one 3 bedroom apartment on the first floor and attic space.

2. There is a new Flood Prevention Scheme (FPS) for the Brothock Water currently in construction stage , which will provide a 200-year standard of protection to the town of Arbroath. Please see details at https://www.angus.gov.uk/the_environment/flooding_and_coastal_erosion/arbroath_brothock_water_flood_protection_scheme

3. Based on the AECOM's Brothock Water FPS Modelling Report, dated 14 July 2017 (attached), the area around the site does not flood in a 200 year event with the scheme in place, however, it does flood at the 200 year plus 20% climate change (CC) event. Level for the 1 in 200 year event is 4.872m AOD and for the 1 n 200 year + 20% CC is 5.016m AOD. Flood map for the 1 in 200 year + CC is not included in the report, however, the flood map for the 1 in 500 year event is included, which has a lower level than the 1 n 200 year + 20% CC of 5.009m AOD, and this is shown to be at risk of flooding.

4. The conversion of the public house on the ground floor to residential accommodation will increase land use vulnerability at the site from a "least vulnerable" to a "highly vulnerable" use as defined within SEPA's Land Use Vulnerability Guidance, which is contradictory to the Scottish Planning Policy. Also, under the new FPS scheme, operation 37 (attached drawing), is proposing to block up the window in cellar of the public house. The wall of the building adjacent to the Brothock Water is acting as a flood wall of the new FPS.

5. The conversion of the residential accommodation on the first floor has its entrance from

the ground floor, which is shown to be at risk of flooding during the 1 n 200 year + 20% CC event, thus indicating that no flood free access and egress can be provided to the first floor residential accommodation.

Requirements

Based on the above, I am unable to support this planning application on the grounds of flood risk and would recommend that it is refused as per SEPA's consultation response. Should you require any further information please contact me.

Regards

Georgia

Georgia Kirtsi-Mathieson | Design Engineer - Flood Risk and Structures | Angus Council | kirtsi-mathiesong@angus.gov.uk | www.angus.gov.uk

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Visit our Facebook page
For information on COVID-19 goto www.NHSInform.scot

From: Alan Hunter <HunterA@angus.gov.uk>
Sent: 16 September 2022 14:01
To: Georgia Kirtsi-Mathieson <Kirtsi-MathiesonG@angus.gov.uk>; Andrew Brown <BrownA@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Hi both

Please see undernoted and attached. I've received communication from a councillor seeking update on this application.

Damian seems to have shared information with Janice previously but we don't seem to have a response from yourselves on file. Damian is currently on leave so I can't check further with him, but do you have record of a response, in which case, can you share it with me please? If it transpires a response hasn't been provided, I'd be grateful if you could review the application and provide an indicative timescale for issue of a response.

Mank thanks

Alan

Alan Hunter | Manager - Development Standards | Angus Council | 01307 492076 | huntera@angus.gov.uk | www.angus.gov.uk

---

From: Damian G Brennan

Sent: 05 July 2022 18:32
To: Janice Corrigan <corriganj@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Janice,

Proposal: Change of use from public house to flat and dormer extension to attic of existing flat
Location: Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX
Reference: 22/00221/FULL

Further to the submission of this application I received the response attached from SEPA which notes that they object in principle to this application.

This position was relayed to the applicant's agent and the further dialogue between SEPA and the agent is contained in the email below.

The applicant's Agent is asking for your details to discuss further.

Prior to providing the agent with your details I wanted to alert you to the discussion that has already taken place in relation to the flooding issues and afford you the opportunity to review the proposal and confirm the Council's position in relation to any flooding issues.

I trust the above is helpful and look forward to your observations in relation to this application.

Many thanks,

Damian.

Damian Brennan | Planning Officer (Development Standards) | Angus Council | 01307 491819 | brennandg@angus.gov.uk | www.angus.gov.uk
(My pronouns are he/him)

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 02 July 2022 10:08
To: Damian G Brennan <BrennanDG@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Damian,

I see you've been copied in on the correspondence with SEPA. Can you forward contact details for floods officer at angus Council please

Regards

Gianni

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 13 June 2022 15:58
To: gianni@building-design-services.com
Cc: Damian G Brennan <BrennanDG@angus.gov.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

Good afternoon,

To clarify, our response is based on the best available information, namely the flood maps produced following a detailed flood study, carried out by AECOM on behalf of Angus Council as part of the design work for the new flood scheme. This study is more detailed than the flood maps produced by SEPA, and the maps clearly demonstrate that the site will flood at the 200 year plus climate change event. If you are of the view that these maps are incorrect and ground levels are higher, then you need to raise this with the Council and their consultants.

Based on the above flood study, and as previously outlined, the ground floor proposals represent a change of use to a more vulnerable use within a flood risk area, where no flood free access and egress would be available. The new flood scheme proposed is only to a 200-year Standard Of Protection, not the 200-year + CC as required by Scottish Planning Policy, and set out in PIN 4, so key principles are not met for us to support the development.

As you are aware, SEPA is a statutory consultee to the planning process, however Angus Council are the determining body. As such, if there are any material considerations that you feel are relevant to the determination of the planning application, please direct these to the Council in the first instance so that they may consult SEPA on specific matters where they deem necessary.

Yours

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

time to time.

Dh'fhaodadh gum bi am fiosrachadh sa phost-d seo agus ceanglachan sam bith a tha na chois dìomhair, agus cha bu chòir am fiosrachadh a bhith air a chleachdadh le neach sam bith ach an luchd-faighinn a bha còir am fiosrachadh fhaighinn. Chan fhaod neach sam bith eile cothrom fhaighinn air an fhiosrachadh a tha sa phost-d no a tha an cois a' phuist-d, chan fhaod iad lethbhreac a dhèanamh dheth no a chleachdadh arithist.
Mura h-ann dhuibhse a tha am post-d seo, feuch gun inns sibh dhuinn sa bhad le bhith cur post-d gu postmaster@sepa.org.uk.
Oifis chlàraichte: Taigh Srath Alain, Pàirc Gnothachais a' Chaisteil, Sruighlea FK9 4TZ. Fo Achd Riaghladh nan Cumhachdan Rannsachaidh 2000, dh'fhaodadh gun tèid an siostam puist-d aig SEPA a sgrùdadh bho àm gu àm.

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 09 June 2022 15:38
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

> CAUTION: This email originated from outside the organisation. Do not click links or open attachments unless you recognise the sender and know the content is safe.

Hi Jess,

I disagree with your statement that this would become an island. You are saying the 200year flood level is 5.016m. The FFL of the flat is 5.1m, the road at East Grimsby is higher than that level also, so you could walk around the street back into the town where it is all above 5.1m.

The roads to the east at Marketgate drop down to 3.9m but the roads to the west are higher. So even in this most extreme of extreme scenarios of the 1 in 200 year flood, taking into account the rising sea levels, we still have a safe route of access.

Can you please look at your maps again and re-assess.

There was a pub converted in Marketgate only 2 or 3 years ago and that was approved even though 1m lower than this building. We really cannot accept this decision as this property was purchased purely for the conversion and knowing that other properties had been given permission so recently it really makes a mockery of the whole planning process.

Kind Regards

Gianni

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 09 June 2022 12:47
To: gianni@building-design-services.com
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

As per SPP, development in built up areas protected by an existing or planned flood protection scheme, will only be acceptable where the standard of protection of the scheme is appropriate for the vulnerability of the land use. The ground floor proposals represent a change of use to a highly vulnerable use, in terms of our land use vulnerability guidance. As set out in my formal response, the planned flood protection scheme does not offer a sufficient level of protection for such a use. Even if finished floor levels are raised above the flood level, this proposal still introduces a new unit of accommodation into an area at risk of flooding. In a flood event, the building itself would become an "island" with no safe, dry egress for residents of the flat which is contrary to DM requirement 3 of our Flood Risk Planning Background Paper. We cannot support this residential conversion and as such our position, as submitted to the Council, is one of objection in principle.

I have spoken to the Council and advised them of this. Given the new information on the first floor flat, specifically that it is not linked to the pub, the Council may wish to reconsult us on this aspect of the proposals prior to determination.

I trust this helps to clarify our position.

Kind regards

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

Riaghladh nan Cumhachdan Rannsachaidh 2000, dh'fhaodadh gun tèid an siostam puist-d aig SEPA a sgrùdadh bho àm gu àm.

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 08 June 2022 17:47
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Hi Jess,

No this existing flat on the first floor is not previously connected to the pub

You haven't addressed my issue where I am telling you we are above the flood level though.

Regards

Gianni

signature copy

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 08 June 2022 16:16
To: gianni@building-design-services.com
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

Thank you for your email. I have checked the plans and as far as I can see the ground floor use is currently a pub, and the proposal is to convert this ground floor level to a flat. This would constitute an increase in vulnerability from the current use as it would introduce additional units of residential accommodation, and as per my response letter would not be something we could support (for the reasons I have already set out).

In relation to the existing first floor flat, can you confirm whether this was previously accommodation associated with the pub, or was this a separate flat unconnected to the pub?

Best wishes,

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 07 June 2022 14:43
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Our Ref: 22/00221/FULL
Your Ref: 5015

F.A.O. Jess Taylor

Jess,

We are writing in response to your letter dated 09.05.22 to Mr Damian Brennan of Angus Council planning for the above application.

The existing building has a flat at street level and at first floor level, so we are not changing anything to this existing situation. The conversion of the pub to a flat is the new part. The flat FFL is at least 5.1 above sea level so we are unclear why you are objecting to this when you are stating levels of 5.016 and 5.009. this building has never flooded, but are you maybe talking about the basement type area? This is not part of the flat, this is an external space

You can call me on 01241 435236 or [redacted] to discuss

Thanks

Gianni

signature copy

OFFICIAL

OFFICIAL

OFFICIAL

From: Georgia Kirtsi-Mathieson
To: Alan Hunter
Cc: Damian G Brennan; Ed Taylor; Peter Morton
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX
Date: 27 September 2022 10:55:11
Attachments: image001.gif
image002.jpg
image003.jpg
image004.jpg

Hi Alan

I got in touch with the team that is looking after the construction of the new FPS and advised that no scouring concerns or works have been identified. Also, the works to block the window have been carried out, the owner should have been contacted regarding the FPS.

Please let me know if you require any further information.

Regards

Georgia

Georgia Kirtsi-Mathieson | Design Engineer - Flood Risk and Structures | Angus Council | kirtsi-mathiesong@angus.gov.uk | www.angus.gov.uk

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Visit our Facebook page
For information on COVID-19 goto www.NHSInform.scot

From: Alan Hunter <HunterA@angus.gov.uk>
Sent: 23 September 2022 14:56
To: Georgia Kirtsi-Mathieson <Kirtsi-MathiesonG@angus.gov.uk>
Cc: Damian G Brennan <BrennanDG@angus.gov.uk>; Ed Taylor <TaylorE@angus.gov.uk>; Peter Morton <MortonP@angus.gov.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

That's great thanks Georgia. I really appreciate you looking at this and providing the response so quickly.

There's some reference in the SEPA response to the potential for scour in relation to the building. Is that a concern that you share and have we looked at that issue in terms of the FPS? Also, do we have statutory powers and/or agreement to block the window in the wall of the building as part of the FPS?

Alan Hunter | Manager - Development Standards | Angus Council | 01307 492076 | huntera@angus.gov.uk | www.angus.gov.uk

From: Georgia Kirtsi-Mathieson <Kirtsi-MathiesonG@angus.gov.uk>
Sent: 23 September 2022 13:51
To: Alan Hunter <HunterA@angus.gov.uk>
Cc: Damian G Brennan <BrennanDG@angus.gov.uk>; Ed Taylor <TaylorE@angus.gov.uk>; Peter Morton <MortonP@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Hi Alan

Further to your consultation request, I have now considered the above planning application and have the following observations with regard to flood risk:

Planning Permission: 22/00221/FULL
Change of Use from Public House to Flat and dormer extension to attic
Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Observations

1. The planning application is for change of use from a public house on the ground floor and residential apartment on the first floor to two residential apartments i.e. one 2 bedroom apartment on the ground floor and one 3 bedroom apartment on the first floor and attic space.

2. There is a new Flood Prevention Scheme (FPS) for the Brothock Water currently in construction stage , which will provide a 200-year standard of protection to the town of Arbroath. Please see details at https://www.angus.gov.uk/the_environment/flooding_and_coastal_erosion/arbroath_brothock_water_flood_protection_scheme

3. Based on the AECOM's Brothock Water FPS Modelling Report, dated 14 July 2017 (attached), the area around the site does not flood in a 200 year event with the scheme in place, however, it does flood at the 200 year plus 20% climate change (CC) event. Level for the 1 in 200 year event is 4.872m AOD and for the 1 n 200 year + 20% CC is 5.016m AOD. Flood map for the 1 in 200 year + CC is not included in the report, however, the flood map for the 1 in 500 year event is included, which has a lower level than the 1 n 200 year + 20% CC of 5.009m AOD, and this is shown to be at risk of flooding.

4. The conversion of the public house on the ground floor to residential accommodation will increase land use vulnerability at the site from a "least vulnerable" to a "highly vulnerable" use as defined within SEPA's Land Use Vulnerability Guidance, which is contradictory to the Scottish Planning Policy. Also, under the new FPS scheme, operation 37 (attached drawing), is proposing to block up the window in cellar of the public house. The wall of the building adjacent to the Brothock Water is acting as a flood wall of the new FPS.

5. The conversion of the residential accommodation on the first floor has its entrance from the ground floor, which is shown to be at risk of flooding during the 1 n 200 year + 20% CC

event, thus indicating that no flood free access and egress can be provided to the first floor residential accommodation.

Requirements

Based on the above, I am unable to support this planning application on the grounds of flood risk and would recommend that it is refused as per SEPA's consultation response. Should you require any further information please contact me.

Regards

Georgia

Georgia Kirtsi-Mathieson | Design Engineer - Flood Risk and Structures | Angus Council | kirtsi-mathiesong@angus.gov.uk | www.angus.gov.uk

---

From: Alan Hunter <HunterA@angus.gov.uk>
Sent: 16 September 2022 14:01
To: Georgia Kirtsi-Mathieson <Kirtsi-MathiesonG@angus.gov.uk>; Andrew Brown <BrownA@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Hi both

Please see undernoted and attached. I've received communication from a councillor seeking update on this application.

Damian seems to have shared information with Janice previously but we don't seem to have a response from yourselves on file. Damian is currently on leave so I can't check further with him, but do you have record of a response, in which case, can you share it with me please? If it transpires a response hasn't been provided, I'd be grateful if you could review the application and provide an indicative timescale for issue of a response.

Mank thanks

Alan

Alan Hunter | Manager - Development Standards | Angus Council | 01307 492076 | huntera@angus.gov.uk | www.angus.gov.uk

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From: Damian G Brennan
Sent: 05 July 2022 18:32

To: Janice Corrigan <corriganj@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Janice,

Proposal: Change of use from public house to flat and dormer extension to attic of existing flat
Location: Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX
Reference: 22/00221/FULL

Further to the submission of this application I received the response attached from SEPA which notes that they object in principle to this application.

This position was relayed to the applicant's agent and the further dialogue between SEPA and the agent is contained in the email below.

The applicant's Agent is asking for your details to discuss further.

Prior to providing the agent with your details I wanted to alert you to the discussion that has already taken place in relation to the flooding issues and afford you the opportunity to review the proposal and confirm the Council's position in relation to any flooding issues.

I trust the above is helpful and look forward to your observations in relation to this application.

Many thanks,

Damian.

Damian Brennan | Planning Officer (Development Standards) | Angus Council | 01307 491819 | brennandg@angus.gov.uk | www.angus.gov.uk
(My pronouns are he/him)

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 02 July 2022 10:08
To: Damian G Brennan <BrennanDG@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Damian,

I see you've been copied in on the correspondence with SEPA. Can you forward contact details for floods officer at angus Council please

Regards

Gianni

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 13 June 2022 15:58
To: gianni@building-design-services.com
Cc: Damian G Brennan <BrennanDG@angus.gov.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

Good afternoon,

To clarify, our response is based on the best available information, namely the flood maps produced following a detailed flood study, carried out by AECOM on behalf of Angus Council as part of the design work for the new flood scheme. This study is more detailed than the flood maps produced by SEPA, and the maps clearly demonstrate that the site will flood at the 200 year plus climate change event. If you are of the view that these maps are incorrect and ground levels are higher, then you need to raise this with the Council and their consultants.

Based on the above flood study, and as previously outlined, the ground floor proposals represent a change of use to a more vulnerable use within a flood risk area, where no flood free access and egress would be available. The new flood scheme proposed is only to a 200-year Standard Of Protection, not the 200-year + CC as required by Scottish Planning Policy, and set out in PIN 4, so key principles are not met for us to support the development.

As you are aware, SEPA is a statutory consultee to the planning process, however Angus Council are the determining body. As such, if there are any material considerations that you feel are relevant to the determination of the planning application, please direct these to the Council in the first instance so that they may consult SEPA on specific matters where they deem necessary.

Yours

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 09 June 2022 15:38
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Hi Jess,

I disagree with your statement that this would become an island. You are saying the 200year flood level is 5.016m. The FFL of the flat is 5.1m, the road at East Grimsby is higher than that level also, so you could walk around the street back into the town where it is all above 5.1m.

The roads to the east at Marketgate drop down to 3.9m but the roads to the west are higher. So even in this most extreme of extreme scenarios of the 1 in 200 year flood, taking into account the rising sea levels, we still have a safe route of access.

Can you please look at your maps again and re-assess.

There was a pub converted in Marketgate only 2 or 3 years ago and that was approved even though 1m lower than this building. We really cannot accept this decision as this property was purchased purely for the conversion and knowing that other properties had been given permission so recently it really makes a mockery of the whole planning process.

Kind Regards

Gianni

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 09 June 2022 12:47
To: gianni@building-design-services.com
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

As per SPP, development in built up areas protected by an existing or planned flood protection scheme, will only be acceptable where the standard of protection of the scheme is appropriate for the vulnerability of the land use. The ground floor proposals represent a change of use to a highly vulnerable use, in terms of our land use vulnerability guidance. As set out in my formal response, the planned flood protection scheme does not offer a sufficient level of protection for such a use. Even if finished floor levels are raised above the flood level, this proposal still introduces a new unit of accommodation into an area at risk of flooding. In a flood event, the building itself would become an "island" with no safe, dry egress for residents of the flat which is contrary to DM requirement 3 of our Flood Risk Planning Background Paper. We cannot support this residential conversion and as such our position, as submitted to the Council, is one of objection in principle.

I have spoken to the Council and advised them of this. Given the new information on the first floor flat, specifically that it is not linked to the pub, the Council may wish to reconsult us on this aspect of the proposals prior to determination.

I trust this helps to clarify our position.

Kind regards

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

SEPA a sgrùdadh bho àm gu àm.

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 08 June 2022 17:47
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Hi Jess,

No this existing flat on the first floor is not previously connected to the pub

You haven't addressed my issue where I am telling you we are above the flood level though.

Regards

Gianni

signature copy

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 08 June 2022 16:16
To: gianni@building-design-services.com
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

Thank you for your email. I have checked the plans and as far as I can see the ground floor use is currently a pub, and the proposal is to convert this ground floor level to a flat. This would constitute an increase in vulnerability from the current use as it would introduce additional units of residential accommodation, and as per my response letter would not be something we could support (for the reasons I have already set out).

In relation to the existing first floor flat, can you confirm whether this was previously

accommodation associated with the pub, or was this a separate flat unconnected to the pub?

Best wishes,

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 07 June 2022 14:43
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Our Ref: 22/00221/FULL
Your Ref: 5015

F.A.O. Jess Taylor

Jess,

We are writing in response to your letter dated 09.05.22 to Mr Damian Brennan of Angus Council planning for the above application.

The existing building has a flat at street level and at first floor level, so we are not changing anything to this existing situation. The conversion of the pub to a flat is the new part. The flat FFL is at least 5.1 above sea level so we are unclear why you are objecting to this when you are stating levels of 5.016 and 5.009. this building has never flooded, but are you maybe talking about the basement type area? This is not part of the flat, this is an external space

You can call me on 01241 435236 or [redacted] to discuss

Thanks

Gianni

signature copy

OFFICIAL

OFFICIAL

OFFICIAL

AC5

From:	Georgia Kirtsi-Mathieson
To:	gianni@building-design-services.com
Cc:	Damian G Brennan; Peter Morton; Alan Hunter; Planning South East; Ed Taylor
Subject:	RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX
Date:	13 March 2023 10:25:17
Attachments:	8200 A.pdf image001.gif image002.jpg image003.jpg

Good morning Gianni

Further to my email below, please find attached drawing with the requested information for operation 36 and 37 of the Brothock Water FPS.

I hope the above provides answers to your queries, however, please let me know if you require any further information.

Regards

Georgia

Georgia Kirtsi-Mathieson | Design Engineer - Flood Risk and Structures | Angus Council | kirtsi-mathiesong@angus.gov.uk | www.angus.gov.uk

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From: Georgia Kirtsi-Mathieson
Sent: 10 March 2023 12:10
To: gianni@building-design-services.com
Cc: Damian G Brennan <BrennanDG@angus.gov.uk>; Peter Morton <MortonP@angus.gov.uk>; Alan Hunter <HunterA@angus.gov.uk>; Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Good afternoon Gianni

Further to your email below (which I received on Friday 03 March 2023) in response to my initial email, dated 23 September 2022, please see comments below in green in relation to the queries raised.

Unfortunately, I am unable to support this planning application on the grounds of flood risk as per my initial consultation response and would recommend that it is refused. However, a new planning application could be considered as suggested in the comments below.

Should you require any further information please contact me.

Regards

Georgia

Georgia Kirtsi-Mathieson | Design Engineer - Flood Risk and Structures | Angus Council | kirtsi-mathiesong@angus.gov.uk | www.angus.gov.uk

---

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 03 March 2023 14:45
To: Georgia Kirtsi-Mathieson <Kirtsi-MathiesonG@angus.gov.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Georgia,

I don't know how that's happened as I would always cut and paste an email address, and how I managed to email you today using the correct one! God knows what's happened but if you haven't received it, that would explain a lot!

Seems strange why the emails would not be bounced back though, saying "recipient cannot be found" or something like that.

Can you please treat this as a matter of urgency now, due to the delays

Thanks

Gianni

From: Georgia Kirtsi-Mathieson <Kirtsi-MathiesonG@angus.gov.uk>
Sent: 03 March 2023 14:33
To: gianni@building-design-services.com
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

My email address on the email below is wrong, I did not received the email, but I have now and will respond to you next week.

Regards

Georgia

Georgia Kirtsi-Mathieson | Design Engineer - Flood Risk and Structures | Angus Council | kirtsi-mathiesong@angus.gov.uk | www.angus.gov.uk

---

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 03 March 2023 14:26
To: Georgia Kirtsi-Mathieson <Kirtsi-MathiesonG@angus.gov.uk>
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

The email that was sent on 04.11.22 which we've still never received a response to

---

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 04 November 2022 12:53
To: 'Planning South East' <PlanningSouthEast@sepa.org.uk>
Cc: 'kirsti-mathiesonG@angus.gov.uk' <kirsti-mathiesonG@angus.gov.uk>; 'Damian G Brennan' <BrennanDG@angus.gov.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Jess/Georgia,

We are unclear what window you are referring to that requires blocked, please can you clarify. There does not appear to be any window there at present. - The window in the cellar of the public house, shown as operation 37 on the attached drawing. From the photo provided, it looks that this has been blocked.

We would like to propose building up the boundary wall where its steps down towards the riverbank. We can completely infill this wall in blockwork and concrete which would help the water flow past the building, rather than pressing against that external corner. I think this would be much more advantageous to the building than blocking up a window, and I think if you really believe water will ever reach that level in the future, it will prevent a lot of erosion to the existing building. – Comment noted. However, based on the AECOM's Brothock Water FPS Modelling Report, dated 14 July 2017, the area around the site does flood at the 200 year plus 20% climate change (CC) event. In addition to this, you are proposing to change and increase the vulnerability category of the ground floor.

We noticed there has already been flood barriers fitted to the windows of the neighbouring building at 57 to 61 Ladybridge street. These are glazed panels fitted to base of windows. Georgia perhaps you can confirm what height these flood barriers were fitted to as it doesn't have any levels on your drawing. Maybe they are at the required level if this was part of Angus Councils flood prevention scheme. I have attached a sketch of where I see the 5.100 level is based on your drawing, and you can see from the photographs they do not look anywhere near that level. – The panels fitted should provide the 200-year standard of protection that the scheme offers. I am waiting on information for the exact level that the panels have been fitted at and will get back to you.

Now if you are refusing this development, I would say you are not considering the existing first floor flat at our development, as the erosion of this building will still take place whether our building is a pub or a flat, or remains empty. So, if you refuse this application none of those

remedial measures will take place, as the client cannot carry out these works as it will not be financially viable. We believe our works will not cause any new issues but will also improve the safety of the existing building by stopping future erosion. Comment noted.

I would also like to ask why the application 17/00413/FULL – conversion of the Ship Inn to convert to 2no. flats, only 70 meters down the road from this building, had no objections from SEPA when the building is 1m lower than this development? Surely this is much more susceptible to flooding than this building. It was approved in August 2017 so surely there were flood measures in place at this time? The report you attached Georgia is dated July 2017 so my client feels very aggrieved that there is no consistency here, especially when that building is at a much greater risk. He purchased this building based on previous approvals knowing there were no issues with previously approved conversions. There was also the conversion of the Baltic Mill 17/01002/FULL, further down this river which was approved on 07.09.2018 which was conversion of an existing building on a flood plain, which I know SEPA had commented on. This created 18 new flats, so surely this is a much more onerous development. – I have not been consulted on either of the two planning applications and can comment no further.

Surely there must be other remedial measures that could take place rather than refusing this application? We would like to hear your thoughts on this please. - Unfortunately, I cannot see any remedial measures for this planning application, which is for change of use from a public house on the ground floor and residential apartment on the first floor to two residential apartments i.e. one 2 bedroom apartment on the ground floor and one 3 bedroom apartment on the first floor and attic space. However, given that the first floor flat, specifically is not linked to the pub, a new planning application could be considered on the basis that it is an existing residential accommodation. Any changes proposed for the ground floor should be in the 'least vulnerable' category of the SEPA's Vulnerability Guidance.

We have attached a couple of photographs to clarify the wall we are proposing to build up and also the neighbouring flood barriers to the very low level windows on the neighbouring building. You can see how low the water levels are even after all this rain we have had over the last week

Kind Regards

Gianni

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 09 June 2022 12:47
To: gianni@building-design-services.com
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

As per SPP, development in built up areas protected by an existing or planned flood protection scheme, will only be acceptable where the standard of protection of the scheme is appropriate for the vulnerability of the land use. The ground floor proposals represent a change of use to a highly vulnerable use, in terms of our land use vulnerability guidance. As set out in my formal response, the planned flood protection scheme does not offer a sufficient level of protection for such a use. Even if finished floor levels are raised above the flood level, this proposal still

introduces a new unit of accommodation into an area at risk of flooding. In a flood event, the building itself would become an "island" with no safe, dry egress for residents of the flat which is contrary to DM requirement 3 of our Flood Risk Planning Background Paper. We cannot support this residential conversion and as such our position, as submitted to the Council, is one of objection in principle.

I have spoken to the Council and advised them of this. Given the new information on the first floor flat, specifically that it is not linked to the pub, the Council may wish to reconsult us on this aspect of the proposals prior to determination.

I trust this helps to clarify our position.

Kind regards

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 08 June 2022 17:47
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: RE: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Hi Jess,

No this existing flat on the first floor is not previously connected to the pub

You haven't addressed my issue where I am telling you we are above the flood level though.

Regards

Gianni

signature copy

From: Planning South East <PlanningSouthEast@sepa.org.uk>
Sent: 08 June 2022 16:16
To: gianni@building-design-services.com
Subject: FW: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

OFFICIAL

Thank you for your email. I have checked the plans and as far as I can see the ground floor use is currently a pub, and the proposal is to convert this ground floor level to a flat. This would constitute an increase in vulnerability from the current use as it would introduce additional units of residential accommodation, and as per my response letter would not be something we could support (for the reasons I have already set out).

In relation to the existing first floor flat, can you confirm whether this was previously accommodation associated with the pub, or was this a separate flat unconnected to the pub?

Best wishes,

Jess Taylor
Planning Officer
Planning Service
SEPA Stirling Office, Strathallan House, Castle Business Park, Stirling FK9 4TZ
email: planningsoutheast@sepa.org.uk

From: gianni@building-design-services.com <gianni@building-design-services.com>
Sent: 07 June 2022 14:43
To: Planning South East <PlanningSouthEast@sepa.org.uk>
Subject: 22/00221/FULL - Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX

Our Ref: 22/00221/FULL
Your Ref: 5015

F.A.O. Jess Taylor

Jess,

We are writing in response to your letter dated 09.05.22 to Mr Damian Brennan of Angus Council planning for the above application.

The existing building has a flat at street level and at first floor level, so we are not changing anything to this existing situation. The conversion of the pub to a flat is the new part. The flat FFL is at least 5.1 above sea level so we are unclear why you are objecting to this when you are stating levels of 5.016 and 5.009. this building has never flooded, but are you maybe talking

about the basement type area? This is not part of the flat, this is an external space

You can call me on 01241 435236 or [redacted] to discuss

Thanks

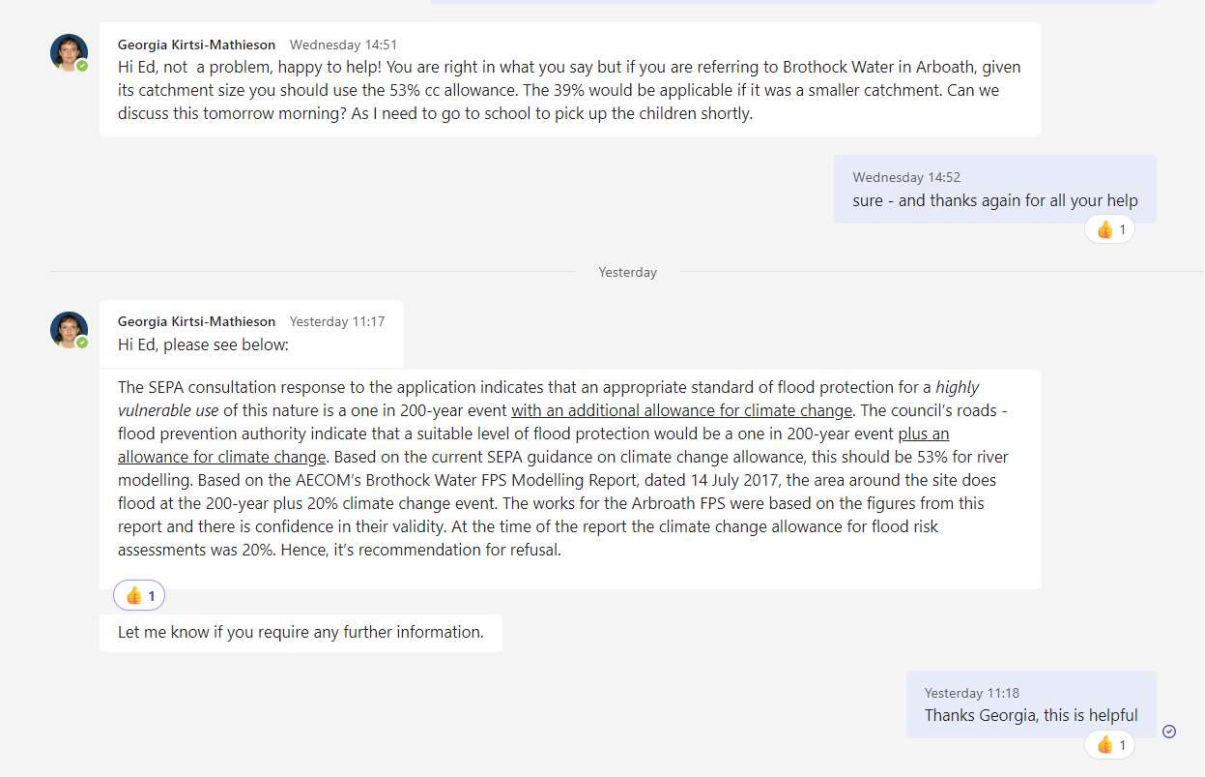
Gianni

signature copy

OFFICIAL

OFFICIAL

Discussions with Roads – Wednesday 15 March to Thursday 16 March 2023 on Teams



Georgia Kirtsi-Mathieson Wednesday 14:51
Hi Ed, not a problem, happy to help! You are right in what you say but if you are referring to Brothock Water in Arboath, given its catchment size you should use the 53% cc allowance. The 39% would be applicable if it was a smaller catchment. Can we discuss this tomorrow morning? As I need to go to school to pick up the children shortly.

Wednesday 14:52
sure - and thanks again for all your help
1

Yesterday

Georgia Kirtsi-Mathieson Yesterday 11:17
Hi Ed, please see below:

The SEPA consultation response to the application indicates that an appropriate standard of flood protection for a *highly vulnerable use* of this nature is a one in 200-year event with an additional allowance for climate change. The council's roads - flood prevention authority indicate that a suitable level of flood protection would be a one in 200-year event plus an allowance for climate change. Based on the current SEPA guidance on climate change allowance, this should be 53% for river modelling. Based on the AECOM's Brothock Water FPS Modelling Report, dated 14 July 2017, the area around the site does flood at the 200-year plus 20% climate change event. The works for the Arbroath FPS were based on the figures from this report and there is confidence in their validity. At the time of the report the climate change allowance for flood risk assessments was 20%. Hence, it's recommendation for refusal.

1

Let me know if you require any further information.

Yesterday 11:18
Thanks Georgia, this is helpful
1

AC6

From: Martin Petrie
To: Damian G Brennan
Cc: Steven D Thomson
Subject: FW: Planning Application Consultation 22/00221/FULL - flare 521169
Date: 12 May 2022 14:58:15
Attachments: ufm9_E-mail_-_Standard_Consultation.pdf

HI Damian
I can now advise that I have had a chance to peruse the documents for this application and my thoughts on this are below.

This application converts an existing pub, which already has an attached flat into 2 flats which includes a conversion of the attic space. There is a takeaway chip shop within the vicinity which could lead to odour and noise complaints at future residents, however there are other receptor at the same height, closer to the chip shop and I am aware of no complaints arising from this shop, therefore I have no objections to this application.

If you have any further queries please do not hesitate to contact me..
kind regards
Martin

-----Original Message-----
From: ACCESSENVArbroath <accessenvarbroath@angus.gov.uk>
Sent: 18 April 2022 15:12
To: Martin Petrie <PetrieM@angus.gov.uk>
Subject: FW: Planning Application Consultation 22/00221/FULL - flare 521169

-----Original Message-----
From: PLNProcessing@angus.gov.uk <PLNProcessing@angus.gov.uk>
Sent: 18 April 2022 15:04
To: ACCESSENVArbroath <accessenvarbroath@angus.gov.uk>
Subject: Planning Application Consultation 22/00221/FULL

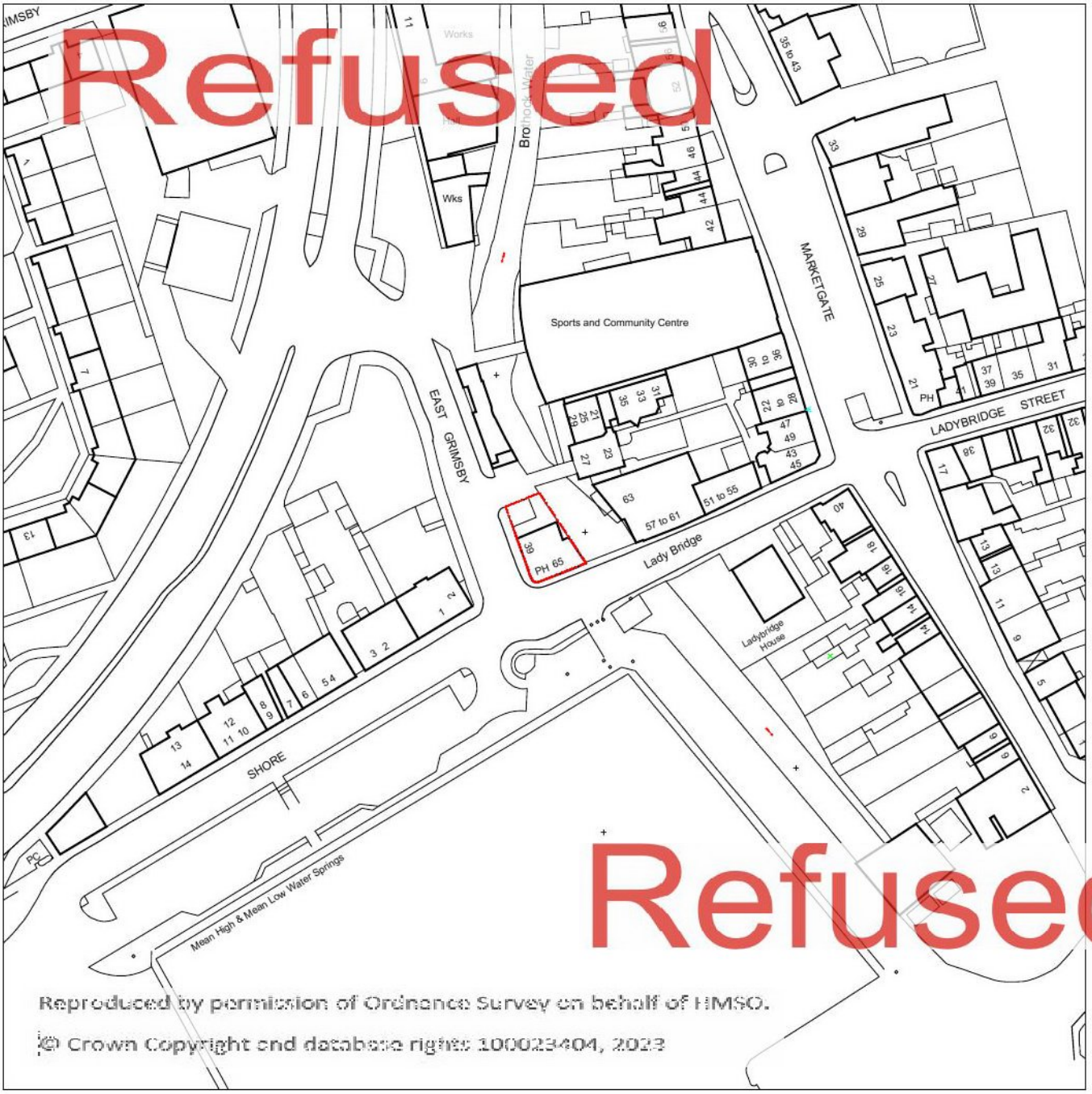
Please see attached document.

Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RD
Tel: 01241 435236
www.building-design-services.com
building design services

project	client	drawing
Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	Mr Mitchell	Existing Location Plan
scale	**date**	**drg no.** / **rev.**
1:250	February 2022	EX-02 / -

AC7

Rev	Date	Description
-	--	----



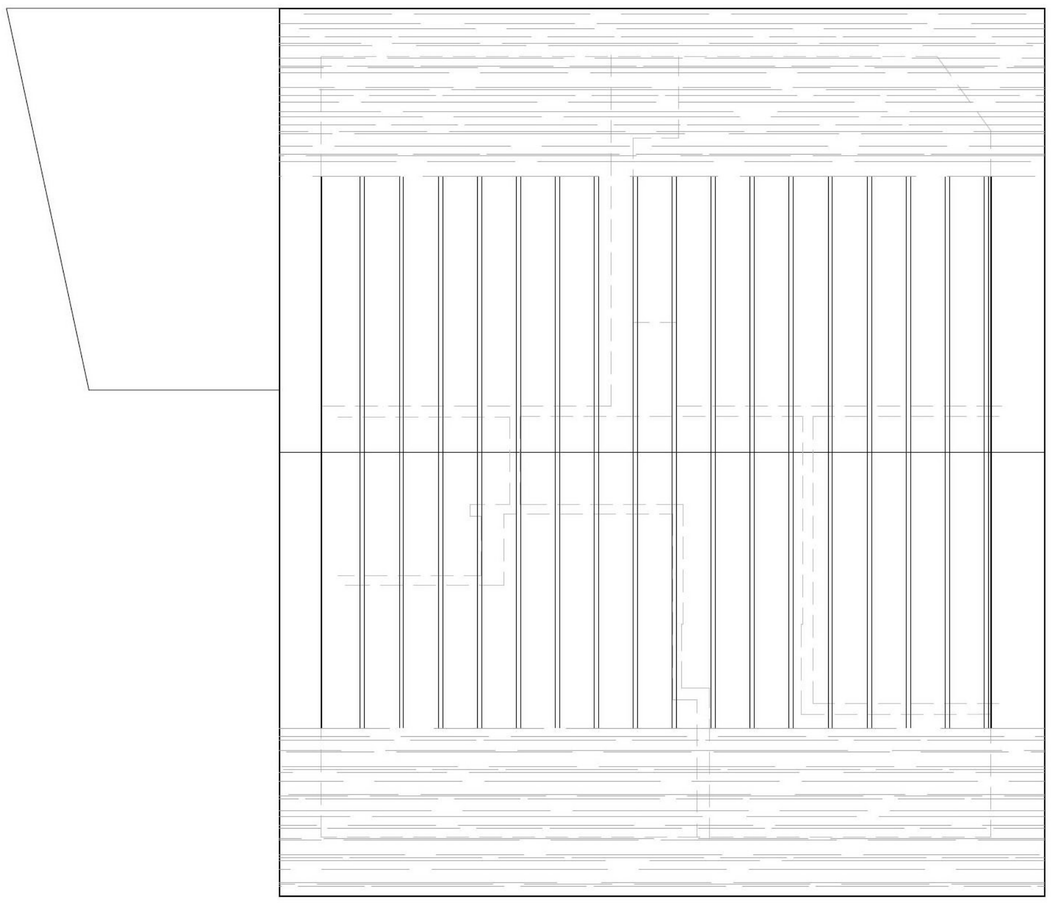
Scale in Meters

0 20 40 60 80 100

N

location plan @ 1:1250

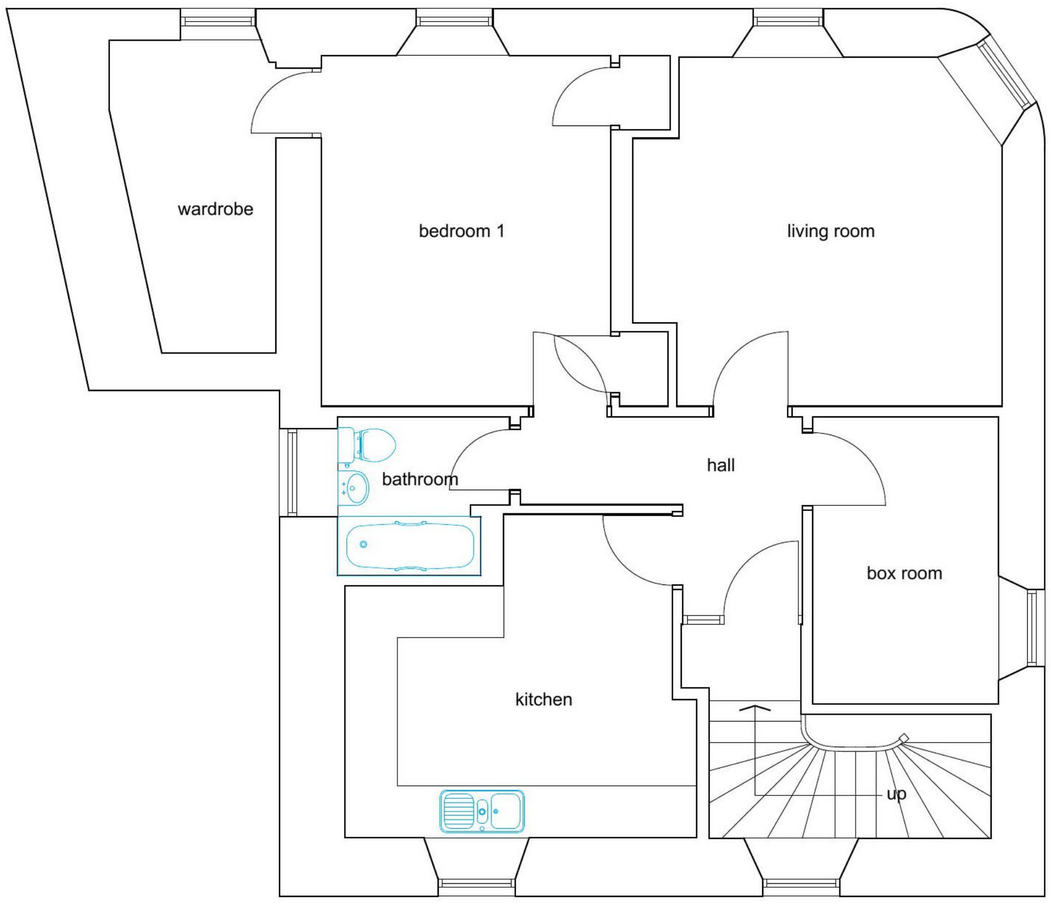
AC8



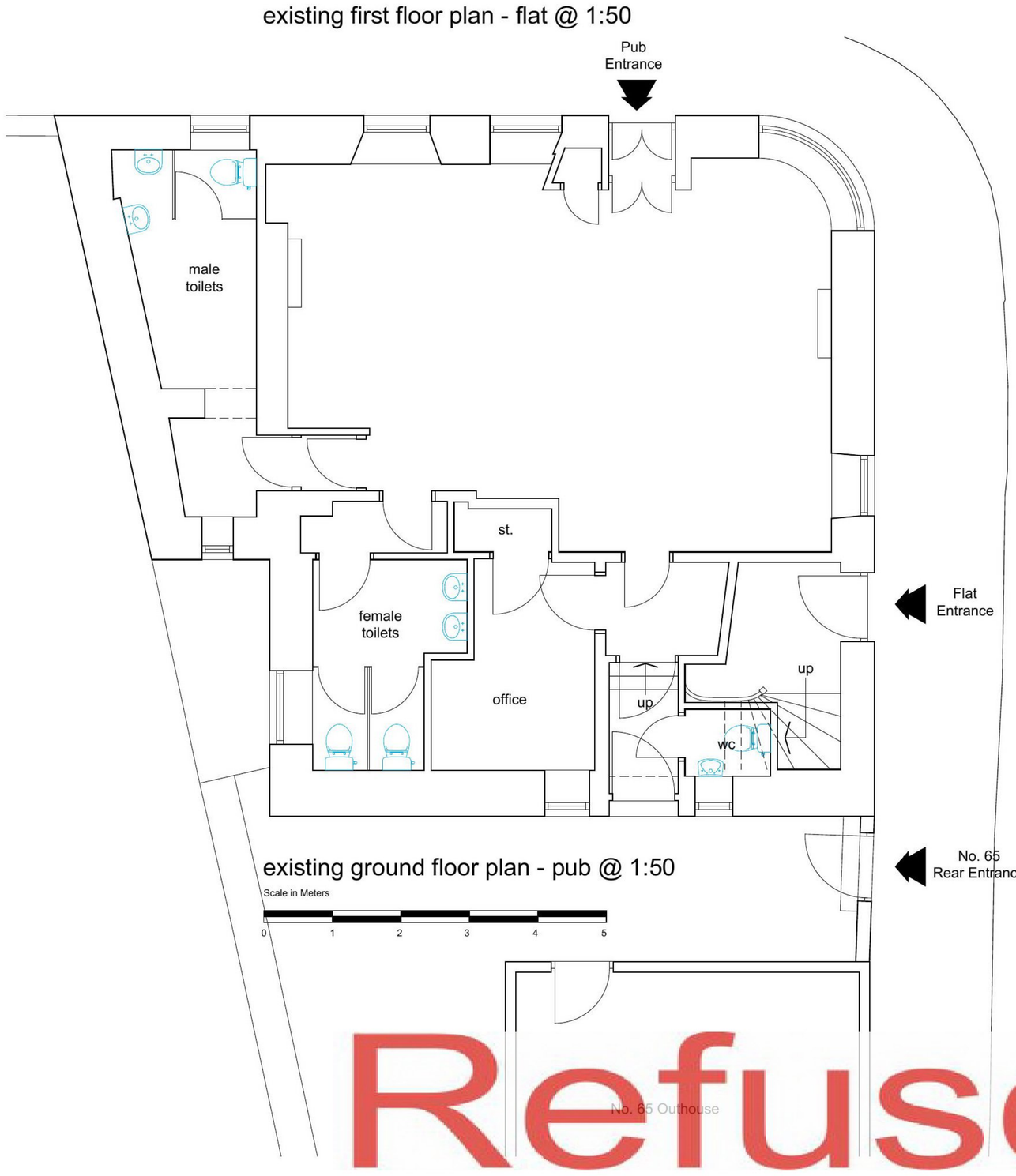
existing attic floor plan - flat @ 1:50

Scale in Meters

0 1 2 3 4 5



existing first floor plan - flat @ 1:50



existing ground floor plan - pub @ 1:50

Scale in Meters

0 1 2 3 4 5

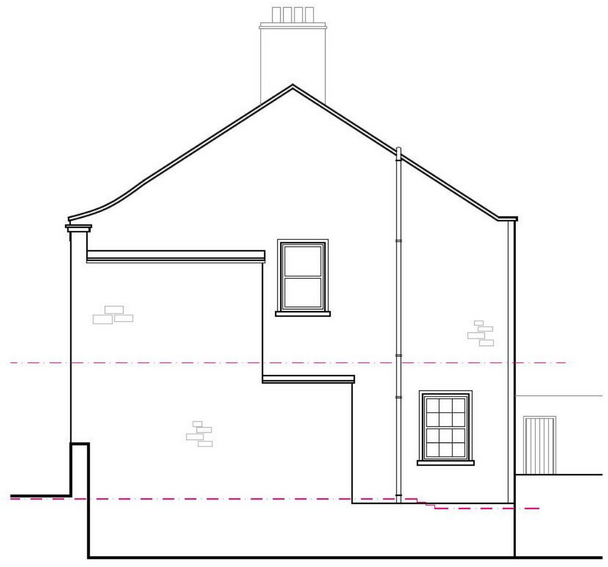
existing south elevation @ 1:100

Scale in Meters

0 1 2 3 4 5

existing west elevation @ 1:100

existing north elevation @ 1:100



existing east elevation @ 1:100

existing site/roof plan @ 1:200

Scale in Meters

0 2 4 6 8 10

Rev	Date	Description
-	--/--/----	----

Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RD
Tel: 01241 435236
www.building-design-services.com
building design services

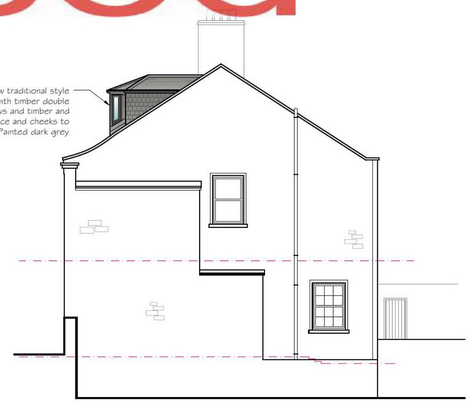
project: Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	client: Mr Mitchell	drawing: Existing Plans & Elevations.	
scale: 1:50, 1:100 & 1:200	date: February 2022	drg no.: EX-01	rev.: -

AC8

proposed south elevation @ 1:100

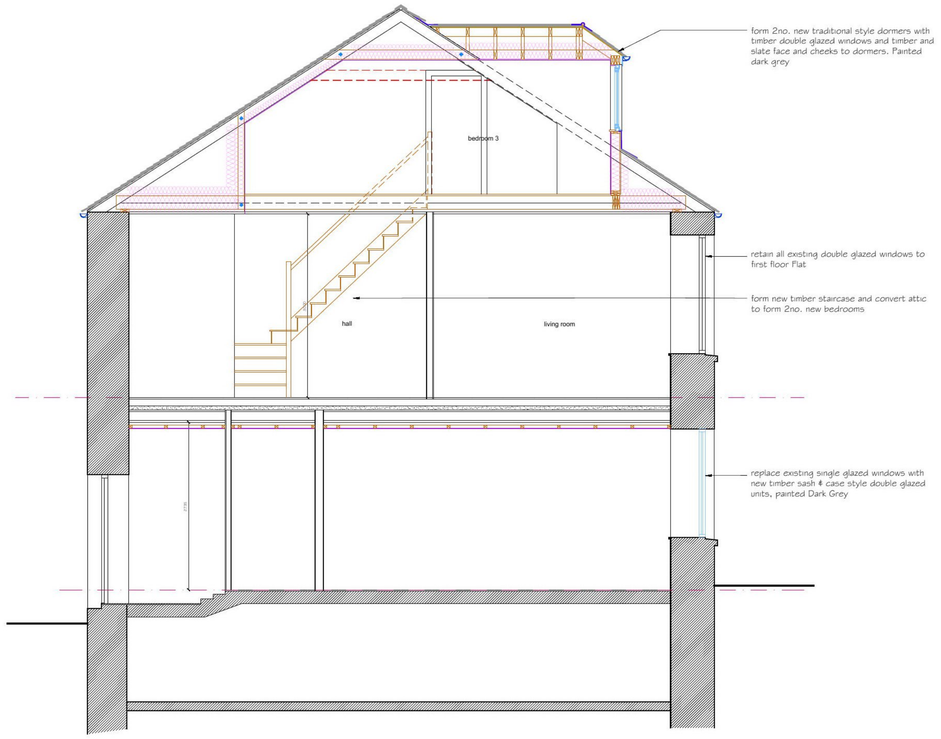
proposed west elevation @ 1:100

proposed north elevation @ 1:100



proposed east elevation @ 1:100

Scale in Meters
0 1 2 3 4 5



section A-A @ 1:50

Scale in Meters
0 1 2 3 4 5

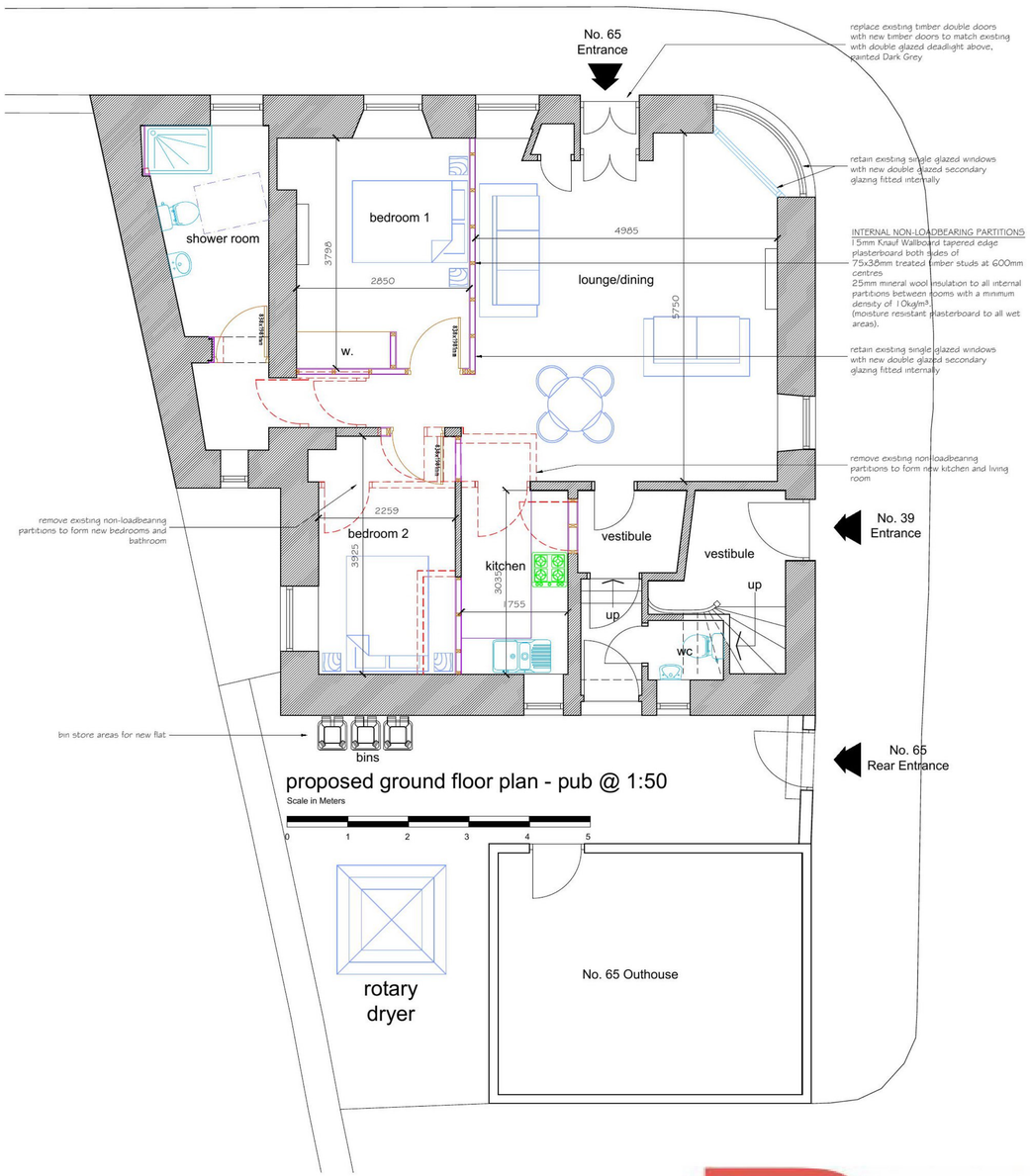
proposed site/roof plan @ 1:200

Scale in Meters
0 2 4 6 8 10

Rev	Date	Description
-	-/-/--	--

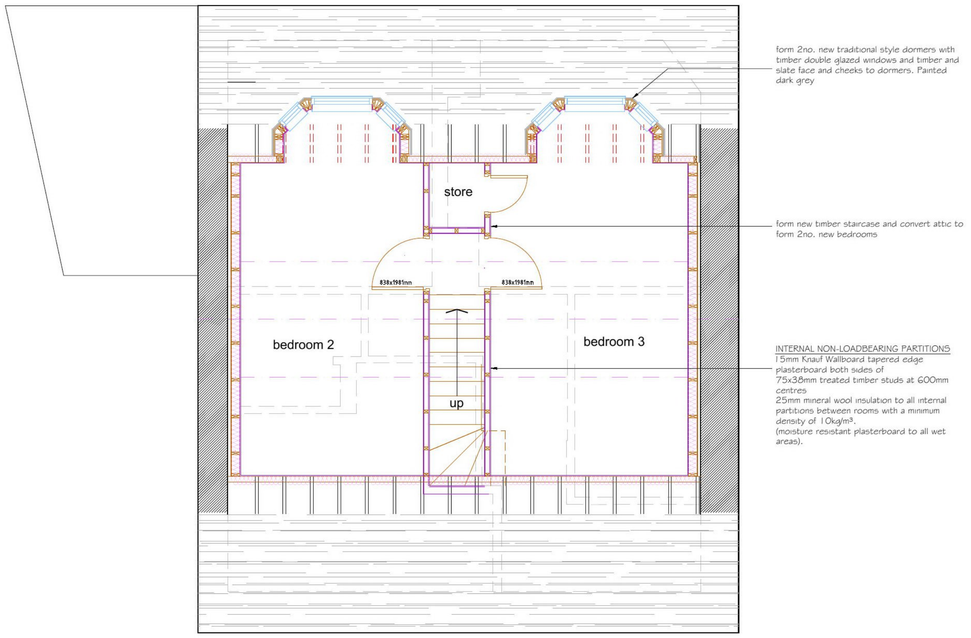
Kirton Enterprise Centre
Bill Williams Smith Road
Kirton Industrial Estate
Arbroath
DD11 3RD
Tel: 01241 435536
www.building-design-services.com
building design services

project: Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	client: Mr Mitchell	drawing: Proposed Site Plan, Section & Elevations.	
scale: 1:50, 1:100 & 1:200	date: February 2022	drg no.: PL-02	rev.: -



proposed ground floor plan - pub @ 1:50

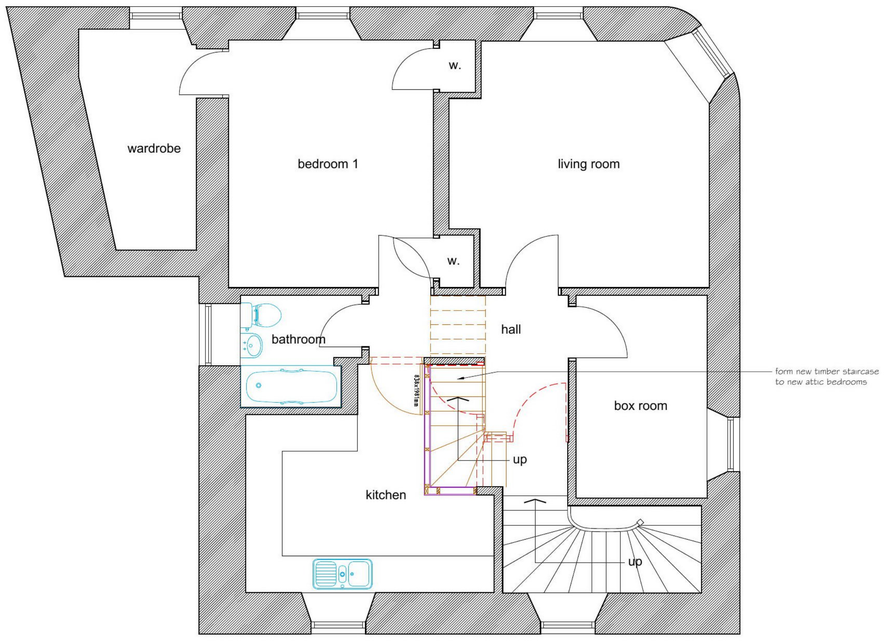
Scale in Meters



proposed attic floor plan - flat @ 1:50

Scale in Meters

0 1 2 3 4 5



proposed first floor plan - flat @ 1:50

Rev	Date	Description
-	----------	----

Kirton Enterprise Centre
Sir William Smith Road
Kirton Industrial Estate
Arbroath
DD11 3RD
Tel: 01241 435236
www.building-design-services.com
building design services

project: Alterations to Smugglers Tavern, 65 Ladybridge Street, Arbroath DD11 1AX	client: Mr Mitchell	drawing: Proposed Plans & Elevations.	
scale: 1:50, 1:100 & 1:200	date: February 2022	drg no.: PL-01	rev.: -

ANGUS COUNCIL

TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997
(AS AMENDED)
TOWN AND COUNTRY PLANNING (DEVELOPMENT MANAGEMENT PROCEDURE) (SCOTLAND)
REGULATIONS 2013

PLANNING PERMISSION REFUSAL
REFERENCE : 22/00221/FULL

To **H & Co Leisure Ltd**
c/o Gianni Giacomini
Building Design Services
Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RD

With reference to your application dated 4 April 2022 for planning permission under the above mentioned Acts and Regulations for the following development, viz.:-

Change of use from public house to flat and dormer extension to attic of existing flat at **Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX** for **H & Co Leisure Ltd**

The Angus Council in exercise of their powers under the above mentioned Acts and Regulations hereby **Refuse Planning Permission (Delegated Decision)** for the said development in accordance with the particulars given in the application and plans docqueted as relative hereto in paper or identified as refused on the Public Access portal.

The reasons for the Council's decision are:-

1 The proposal is contrary to National Planning Framework 4 (2023) policies 2, 10 and 22 and Angus Local Development Plan (2016) Policy PV12 because the proposal is for redevelopment of an existing building which would introduce a more vulnerable land use on the ground floor in an location which is identified as being at risk of coastal, river and surface water flooding on SEPA flood maps; because the applicant has not demonstrated that all risks of flooding are understood and addressed; and because there is insufficient evidence to suggest that the proposal has been designed to adapt to future risks from flooding as a result of climate change.

2 The proposal is contrary to National Planning Framework 4 (2023) policies 1, 9 and 16 and Angus Local Development Plan (2016) Policy DS1 because the application proposes development which is not of an appropriate nature for this location due to flood risk; it does not represent a sustainable home in the right location due to flood risk; the ground floor of the building is not suitable for conversion to residential use due to flood risk; allowing a highly vulnerable use in an area subject to flood risk is not a development which gives significant weight to the global climate crises; and because the proposal is not consistent with relevant policies of the development plan (namely NPF4 policies 2, 10 and 22 and ALDP Policy PV12).

Amendments:

The application has not been subject of variation.

Dated this **20 March 2023**

Jill Paterson
Service Lead
Planning and Sustainable Growth
Angus Council
Angus House
Orchardbank Business Park
Forfar
DD8 1AN

Planning Decisions – Guidance Note

Please retain – this guidance forms part of your Decision Notice

You have now received your Decision Notice. This guidance note sets out important information regarding appealing or reviewing your decision. There are also new requirements in terms of notifications to the Planning Authority and display notices on-site for certain types of application. You will also find details on how to vary or renew your permission.

Please read the notes carefully to ensure effective compliance with the new regulations.

DURATION

The duration of any permission granted is set out in conditions attached to the permission. Where no conditions are attached the duration of the permission will be in accordance with sections 58 and 59 of the Town and Country Planning (Scotland) Act 1997 (as amended).

PLANNING DECISIONS

Decision Types and Appeal/Review Routes

The 'decision type' as specified in your decision letter determines the appeal or review route. The route to do this is dependent on the how the application was determined. Please check your decision letter and choose the appropriate appeal/review route in accordance with the table below. Details of how to do this are included in the guidance.

Determination Type	What does this mean?	Appeal/Review Route
Development Standards Committee/Full Council	National developments, major developments and local developments determined at a meeting of the Development Standards Committee or Full Council whereby relevant parties and the applicant were given the opportunity to present their cases before a decision was reached.	***DPEA (appeal to Scottish Ministers) – See details on attached Form 1***
Delegated Decision	Local developments determined by the Service Manager through delegated powers under the statutory scheme of delegation. These applications may have been subject to less than five representations, minor breaches of policy or may be refusals.	***Local Review Body – See details on attached Form 2***
Other Decision	All decisions other than planning permission or approval of matters specified in condition. These include decisions relating to Listed Building Consent, Advertisement Consent, Conservation Area Consent and Hazardous Substances Consent.	***DPEA (appeal to Scottish Ministers) – See details on attached Form 1***

Notification of initiation of development (NID)

Once planning permission has been granted and the applicant has decided the date they will commence that development they must inform the Planning Authority of that date. The notice must be submitted before development commences – failure to do so would be a breach of planning control. The relevant form is included with this guidance note.

Notification of completion of development (NCD)

Once a development for which planning permission has been given has been completed the applicant must, as soon as practicable, submit a notice of completion to the planning authority. Where development is carried out in phases there is a requirement for a notice to be submitted at the conclusion of each phase. The relevant form is included with this guidance note.

Display of Notice while development is carried out

For national, major or 'bad neighbour' developments (such as public houses, hot food shops or scrap yards), the developer must, for the duration of the development, display a sign or signs containing prescribed information.

The notice must be in the prescribed form and:-

- displayed in a prominent place at or in the vicinity of the site of the development;
- readily visible to the public; and
- printed on durable material.

A display notice is included with this guidance note.

Should you have any queries in relation to any of the above, please contact:

Angus Council
Angus House
Orchardbank Business Park
Forfar
DD8 1AN

Telephone 03452 777 780
E-mail: planning@angus.gov.uk
Website: www.angus.gov.uk

AC9

FORM 1

TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997 (AS AMENDED)

The Town & Country Planning (Development Management Procedure) (Scotland) Regulations 2013 – Schedule to Form 1

Notification to be sent to applicant on refusal of planning permission or on the grant of permission subject to conditions decided by Angus Council

1. If the applicant is aggrieved by the decision of the planning authority-

a) to refuse permission for the proposed development;
b) to refuse approval, consent or agreement required by condition imposed on a grant of planning permission;
c) to grant planning permission or any approval, consent or agreement subject to conditions,

the applicant may appeal to the Scottish Ministers to review the case under section 47 of the Town and Country Planning (Scotland) Act 1997 within three months beginning with the date of this notice. The notice of appeal should be addressed to The Planning and Environmental Appeals Division, Scottish Government, Ground Floor, Hadrian House, Callendar Business Park, Callendar Road, Falkirk, FK1 1XR. Alternatively you can submit your appeal directly to DPEA using the national e-planning web site https://eplanning.scotland.gov.uk.

2. If permission to develop land is refused or granted subject to conditions and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, the owner of the land may serve on the planning authority a purchase notice requiring the purchase of the owner of the land's interest in the land in accordance with Part 5 of the Town and Country Planning (Scotland) Act 1997.

Angus Council

TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997 (AS AMENDED)

The Town & Country Planning (Development Management Procedure) (Scotland) Regulations 2013 – Schedule to Form 2

Notification to be sent to applicant on refusal of planning permission or on the grant of permission subject to conditions decided through Angus Council's Scheme of Delegation

1. If the applicant is aggrieved by the decision of the planning authority-

   a) to refuse permission for the proposed development;
   b) to refuse approval, consent or agreement required by condition imposed on a grant of planning permission;
   c) to grant planning permission or any approval, consent or agreement subject to conditions,

   the applicant may require the planning authority to review the case under section 43A of the Town and Country Planning (Scotland) Act 1997 within three months beginning with the date of this notice. The notice of review should be addressed to Committee Officer, Angus Council, Resources, Legal & Democratic Services, Angus House, Orchardbank Business Park, Forfar, DD8 1AN.

   A Notice of Review Form and guidance can be found on the national e-planning website https://eplanning.scotland.gov.uk. Alternatively you can return your Notice of Review directly to the local planning authority online on the same web site.

2. If permission to develop land is refused or granted subject to conditions and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, the owner of the land may serve on the planning authority a purchase notice requiring the purchase of the owner of the land's interest in the land in accordance with Part 5 of the Town and Country Planning (Scotland) Act 1997.

PLANNING

Your experience with Planning

Please indicate whether you agree or disagree with the following statements about your most recent experience of the Council's handling of the planning application in which you had an interest.

Q.1 I was given the advice and help I needed to submit my application/representation:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.2 The Council kept me informed about the progress of the application that I had an interest in:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.3 The Council dealt promptly with my queries:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.4 The Council dealt helpfully with my queries:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.5 I understand the reasons for the decision made on the application that I had an interest in:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.6 I feel that I was treated fairly and that my view point was listened to:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

OVERALL SATISFACTION: Overall satisfaction with the service: ……

Q.7 Setting aside whether your application was successful or not, and taking everything into account, how satisfied or dissatisfied are you with the service provided by the council in processing your application?

Very satisfied	Fairly satisfied	Neither Satisfied nor Dissatisfied	Fairly Dissatisfied	Very Dissatisfied
☐	☐	☐	☐	☐

OUTCOME: Outcome of the application:

Q.8 Was the application that you had an interest in:-

Granted Permission/Consent ☐ Refused Permission/Consent ☐ Withdrawn ☐

Q.9 Were you the:- Applicant ☐ Agent ☐ Third Party objector who made a representation ☐

Please complete the form and return in the pre-paid envelope provided.
Thank you for taking the time to complete this form.

AC10

Our reference: 2202/GG/SMUG/DS/01

10th March 2022

Angus Council
Planning & Transport
County Buildings
Market Street
FORFAR
DD8 3LG

Dear Sir/Madam

Conversion of Smugglers Tavern to form flat and conversion of Attic of Flat above,
65 Ladybridge Street & 39 East Grimsby, Arbroath. DD11 1AX
DESIGN STATEMENT

We are writing in support of the above Planning Application. The development is proposing to convert the existing Public House back to it's original state of a dwelling house, and convert the attic of the flat above to give additional rooms and form 2no. traditional dormers to give views over the harbour. The Public house has lay empty, on and off for over 5 years, and like many Pubs in Arbroath it is an unsustainable business and there has been no interest in the property, which has been up for lease for 3 years. Our client has purchased both properties with a view to giving them a major refurbishment and create 2 attractive flats which would be highly desirable with views over the harbour.

The property is located within harbour conservation area, on the corner of Ladybridge Street and East Grimsby. The external fabric of the building would remain intact with no new openings formed. The only alterations externally would be forming 2no. traditional dormers in-keeping with the historic dormers which can be seen around the Arbroath Harbour area with splayed windows, slated pitched roof and slated cheeks and face with timber windows and lead flashings. The existing window openings shall be retained, and the ground floor single pane windows shall be replaced with traditional sash & case style windows with new double-glazed units excellent thermal values to comply with domestic u-value requirements. The external doors shall be replaced with like for like replacements, with new timber doors with level access thresholds to comply with disabled access and provide greater thermal resistance. The existing curved glass window which is a main feature of the building shall be retained, but to provide suitable insulated external fabric of the building we propose to fit a secondary glazing behind the curved glass which will not alter the external appearance of the building. The new ground floor flat can be accessed from Ladybridge Street with level access and can be also accessed from the rear amenity space which is accessed from the side via the existing timber gate. The amenity space has a brick-built outbuilding which will provide space for bicycle storage and external store, there is also a drying area and bin stores so refuse collection can be easily accessed from the pavement at East Grimsby.

Although we cannot provide off-street parking, there is a car parking adjacent to the harbour and a vast car park around the corner off Marketgate. This is like many properties in the harbour area that have no private parking, but in the evenings when the offices and shops to the High Street area are closed, there is ample parking for all properties. There is also excellent public transport links from the nearby the bus and train station which are easily accessible on foot by a short 5 minute walk.

Both properties shall be generous 2 and 3 bedroom Flats giving comfortable living space which shall be modernised with a complete refurb including, new energy efficient heating system and new insulated envelope to bring the property into the 21st century.

In summary, we believe the proposed development shall be a vast improvement of an empty prominent building in the harbour area and regenerate a building that is falling into a state of disrepair. We believe the alterations shall be sympathetic to the conservation area and all materials used shall be traditional, maintaining the original character of the building.

Yours faithfully

Gianni Giacomini
Building Design Services

APPENDIX 2

DEVELOPMENT MANAGEMENT REVIEW COMMITTEE

APPLICATION FOR REVIEW – SMUGGLERS TAVERN, 65 LADYBRIDGE STREET, ARBROATH

APPLICATION NO 22/00221/FULL

APPLICANT'S SUBMISSION

Page No

Angus House Orchardbank Business Park Forfar DD8 1AN Tel: 01307 473360 Fax: 01307 461 895 Email: plnprocessing@angus.gov.uk

Applications cannot be validated until all the necessary documentation has been submitted and the required fee has been paid.

Thank you for completing this application form:

ONLINE REFERENCE 100544362-003

The online reference is the unique reference for your online form only. The Planning Authority will allocate an Application Number when your form is validated. Please quote this reference if you need to contact the planning Authority about this application.

Applicant or Agent Details

Are you an applicant or an agent? * (An agent is an architect, consultant or someone else acting on behalf of the applicant in connection with this application) ☐ Applicant ☒ Agent

Agent Details

Please enter Agent details

Company/Organisation:	Building Design Services		
Ref. Number:		You must enter a Building Name or Number, or both: *	
First Name: *	Gianni	Building Name:	Kirkton Enterprise Centre
Last Name: *	Giacomini	Building Number:	
Telephone Number: *	01241435236	Address 1 (Street): *	Sir William Smith Road
Extension Number:		Address 2:	
Mobile Number:		Town/City: *	Arbroath
Fax Number:		Country: *	Scotland
		Postcode: *	DD11 3RD
Email Address: *	gianni@building-design-services.com		

Is the applicant an individual or an organisation/corporate entity? *

☐ Individual ☒ Organisation/Corporate entity

Applicant Details

Please enter Applicant details

Title:		You must enter a Building Name or Number, or both: *	
Other Title:		Building Name:	
First Name: *		Building Number:	14
Last Name: *		Address 1 (Street): *	Applegate
Company/Organisation	H & Co Leisure Ltd	Address 2:	
Telephone Number: *		Town/City: *	Arbroath
Extension Number:		Country: *	Scotland
Mobile Number:		Postcode: *	DD11 1HX
Fax Number:			
Email Address: *	gianni@building-design-services.com		

Site Address Details

Planning Authority:	Angus Council

Full postal address of the site (including postcode where available):

Address 1:	SMUGGLERS TAVERN
Address 2:	65 LADYBRIDGE STREET
Address 3:	
Address 4:	
Address 5:	
Town/City/Settlement:	ARBROATH
Post Code:	DD11 1AX

Please identify/describe the location of the site or sites

Northing	740670	Easting	364221

Description of Proposal

Please provide a description of your proposal to which your review relates. The description should be the same as given in the application form, or as amended with the agreement of the planning authority: *
(Max 500 characters)

Change of use from public house to flat and dormer extension to attic of existing flat

Type of Application

What type of application did you submit to the planning authority? *

☒ Application for planning permission (including householder application but excluding application to work minerals).

☐ Application for planning permission in principle.

☐ Further application.

☐ Application for approval of matters specified in conditions.

What does your review relate to? *

☒ Refusal Notice.

☐ Grant of permission with Conditions imposed.

☐ No decision reached within the prescribed period (two months after validation date or any agreed extension) – deemed refusal.

Statement of reasons for seeking review

You must state in full, why you are a seeking a review of the planning authority's decision (or failure to make a decision). Your statement must set out all matters you consider require to be taken into account in determining your review. If necessary this can be provided as a separate document in the 'Supporting Documents' section: * (Max 500 characters)

Note: you are unlikely to have a further opportunity to add to your statement of appeal at a later date, so it is essential that you produce all of the information you want the decision-maker to take into account.

You should not however raise any new matter which was not before the planning authority at the time it decided your application (or at the time expiry of the period of determination), unless you can demonstrate that the new matter could not have been raised before that time or that it not being raised before that time is a consequence of exceptional circumstances.

Unjust decision based on flood levels, see attached appeal statement

Have you raised any matters which were not before the appointed officer at the time the Determination on your application was made? * ☐ Yes ☒ No

If yes, you should explain in the box below, why you are raising the new matter, why it was not raised with the appointed officer before your application was determined and why you consider it should be considered in your review: * (Max 500 characters)

Please provide a list of all supporting documents, materials and evidence which you wish to submit with your notice of review and intend to rely on in support of your review. You can attach these documents electronically later in the process: * (Max 500 characters)

2202-SMUG - SS - 01 appeal statement AECOM Modelling Report SMUG - EX01A existing plans SMUG - EX02 location plan SMUG - PL01A proposed floor plans SMUG - PL02A site plan & elevations SMUG - PL03 photos 2200221a - planning refusal

Application Details

Please provide the application reference no. given to you by your planning authority for your previous application.

22/00221/FULL

What date was the application submitted to the planning authority? *

22/03/2022

What date was the decision issued by the planning authority? *

20/03/2023

Review Procedure

The Local Review Body will decide on the procedure to be used to determine your review and may at any time during the review process require that further information or representations be made to enable them to determine the review. Further information may be required by one or a combination of procedures, such as: written submissions; the holding of one or more hearing sessions and/or inspecting the land which is the subject of the review case.

Can this review continue to a conclusion, in your opinion, based on a review of the relevant information provided by yourself and other parties only, without any further procedures? For example, written submission, hearing session, site inspection. *

☒ Yes ☐ No

In the event that the Local Review Body appointed to consider your application decides to inspect the site, in your opinion:

Can the site be clearly seen from a road or public land? * ☒ Yes ☐ No

Is it possible for the site to be accessed safely and without barriers to entry? * ☒ Yes ☐ No

Checklist – Application for Notice of Review

Please complete the following checklist to make sure you have provided all the necessary information in support of your appeal. Failure to submit all this information may result in your appeal being deemed invalid.

Have you provided the name and address of the applicant?. * ☒ Yes ☐ No

Have you provided the date and reference number of the application which is the subject of this review? * ☒ Yes ☐ No

If you are the agent, acting on behalf of the applicant, have you provided details of your name and address and indicated whether any notice or correspondence required in connection with the review should be sent to you or the applicant? * ☒ Yes ☐ No ☐ N/A

Have you provided a statement setting out your reasons for requiring a review and by what procedure (or combination of procedures) you wish the review to be conducted? * ☒ Yes ☐ No

Note: You must state, in full, why you are seeking a review on your application. Your statement must set out all matters you consider require to be taken into account in determining your review. You may not have a further opportunity to add to your statement of review at a later date. It is therefore essential that you submit with your notice of review, all necessary information and evidence that you rely on and wish the Local Review Body to consider as part of your review.

Please attach a copy of all documents, material and evidence which you intend to rely on (e.g. plans and Drawings) which are now the subject of this review * ☒ Yes ☐ No

Note: Where the review relates to a further application e.g. renewal of planning permission or modification, variation or removal of a planning condition or where it relates to an application for approval of matters specified in conditions, it is advisable to provide the application reference number, approved plans and decision notice (if any) from the earlier consent.

Declare – Notice of Review

I/We the applicant/agent certify that this is an application for review on the grounds stated.

Declaration Name: Mr Gianni Giacomini

Declaration Date: 31/05/2023

Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RD
Tel: 01241 435236
www.building-design-services.com
building design services

Our reference: 2202/GG/SMUG/SS/01

01st May 2023

Angus Council
Planning & Transport
County Buildings
Market Street
FORFAR
DD8 3LG

Dear Sir/Madam

Conversion of Smugglers Tavern to form flat and conversion of Attic of Flat above,
65 Ladybridge Street & 39 East Grimsby, Arbroath. DD11 1AX
APPEAL STATEMENT

We are writing in support of the above Planning Application appeal. The development is proposing to convert the existing Public House back to it's original state of a dwelling house, and convert the attic of the flat above to give additional rooms and form 2no. traditional dormers to give views over the harbour. The Public house has lay empty, on and off for over 5 years, and like many Pubs in Arbroath it is an unsustainable business and there has been no interest in the property which had been up for lease for 3 years. Our client has purchased both properties with a view to giving them a major refurbishment and create 2 attractive flats which would be highly desirable with views over the harbour, which could be used for Airbnb holiday let accommodation, or similar short let tourist rental.

The property is located within harbour conservation area, on the corner of Ladybridge Street and East Grimsby. The external fabric of the building would remain intact with no new openings formed. The only alterations externally would be forming 2no. traditional dormers in-keeping with the historic dormers which can be seen around the Arbroath Harbour area with splayed windows, slated pitched roof and slated cheeks and face with timber windows and lead flashings. The existing window openings shall be retained, and the ground floor single pane windows shall be replaced with traditional sash & case style windows with new double-glazed units with excellent thermal values to comply with domestic u-value requirements. The external doors shall be replaced with like for like replacements, with new timber doors with level access thresholds to comply with disability access and provide greater thermal resistance. The existing curved glass window which is a main feature of the building shall be retained, but to provide suitable insulated external fabric of the building we propose to fit a secondary glazing behind the curved glass which will not alter the external appearance of the building. The new ground floor flat can be accessed with level from Ladybridge Street and can be also accessed from the rear amenity space which is accessed from the side via the existing timber gate. The amenity space has a brick-built outbuilding which will provide space for bicycle storage and external store, there is also a drying area and bin stores so refuse collection can be easily accessed from the pavement at East Grimsby.

Although we cannot provide off-street parking, there is a car parking adjacent to the harbour and a vast car park around the corner off Marketgate. This is like many properties in the harbour area that have no private parking, but there is ample parking for all properties. There is also excellent public transport links from the nearby the bus and train station which are easily accessible on foot by a short 5-minute walk.

Both properties shall be generous 2 and 3 bedroom Flats giving comfortable living space which shall be modernised with a complete refurb including, new energy efficient heating system and new insulated envelope to bring the property into the 21st century.

In summary, we believe the proposed development shall be a vast improvement of an empty prominent building in the harbour area and regenerate a building that is falling into a state of disrepair. We believe the alterations shall be sympathetic to the conservation area and all materials used shall be traditional, maintaining the original character of the building.

PLANNING REFUSAL

The planning application was refused due to the consultation from SEPA which stated they could not support the application due to increasing the vulnerability of the land use by changing from Public House to Domestic Dwelling. Although SEPA's recommendation must be considered, Angus Council Planning still had the option of accepting or not accepting this recommendation like they have done on many neighbouring applications. We feel very aggrieved that there is not the continuity of their decisions due to similar applications that have been approved before and after our application.

The levels that SEPA have indicated are the 1 in 200 year flood event plus an additional 20% increase for Climate Change, which takes the flood level to 5.016m. We have calculated our FFL being at 5.045m. These events would be unforeseen and half the "Fit o' the Toon" area of Arbroath would be underwater should such an event take place. Even at the highest previous flood levels, have been nowhere near the levels that have been predicted.

We are appealing this decision for the following reasons:-

1. We are above the flood levels stated, also why are we being judged on flood levels some 1m higher than the recently finished £12m flood protection scheme carried out by Angus Council. We do not believe that these flood levels are realistic, and if they are, why is the Flood Protection scheme ignoring the 20% increase for climate change, yet the Planning Dept aren't.
2. This is not a new risk. We are not creating a new problem here. The site already has housing within it, the Flat at 39 East Grimsby is an existing Dwelling Flat, so there is already housing within the site.
3. There have already been applications in this area at higher risk to flooding which have been approved by Angus Council planning.
4. By carrying out our own flood protection measures by building up the gable wall of the building we are improving the overall safety of an existing building.

POINT 1

If the flood levels we are being judged on are the 1 in 200 year flood event plus an additional 20% for climate change which brings us to 5.016m, then we are above that level so we see there being no issue. If this biblical style flood was to happen, then the occupants of the flat would be able to walk out their front door and get their feet wet at worst. The occupier of 39 Ladybridge has the same risk whether this application is approved or not. The main grievance we have is, the new flood protection scheme has been carried out as per the AECOM report (attached), and the level they appear to be protecting the neighbouring buildings to is 3.952m (see page 103 – point B_251 1:200 year level). The report states on Page 81 that 200year +CC is a level of 5.016m. These levels have not changed since the report was carried out. If this is a serious risk, why has the Flood Protection scheme chosen to ignore it? Why is one arm of the council taking on board SEPA's comments and one arm choosing their own level. See Page 109, email from SEPA to Dylan Huws recommending they take into account 20% for CC for the Flood Protection Scheme. If our Client had came along to purchase the property and seen the flood protection scheme raised up to 1m higher and almost at the FFL of the building, he may have thought twice about purchasing the property. The neighbouring building at 63 Ladybridge Street has recently had glass protective barriers fitted which are way below the FFL of the Smuggler's Tavern (see drawing PL-03). Likewise all along the Brothock water behind Marketgate the walls and protective measures are at approx. 3.900m. We would have thought Angus Council flood prevention team, (with their experience and knowledge), would have a much more stringent attitude towards flooding than the Planning Dept, but this does not appear to be the case. Surely the risk of converting this public house to a flat which is 30mm above the flood levels is of insignificant risk compared to all the neighbouring properties 1m below this building.

POINT 2

This is not a new build development. This is a partial conversion of an existing building which already has housing within the site. No. 39 Ladybridge Street is an existing 2-bedroom flat that we are looking to convert to a maisonette. No. 65 was originally a house when it was first built and then converted to a Public House midway through the 20th Century. The Client would like to use the 2 flats as Holiday Let apartments so they would be lower risk than a normal dwelling, because if there were an unprecedented flood, then the flats would not be let out. For flood levels to get that high there would need to be weeks of rain and half the harbour area would be covered in water long before this building floods so there would be plenty of warning time.

POINT 3

There have been many applications of similar conversions from commercial buildings within flood risk areas of Arbroath that have been much more onerous than this application, approved by Angus Council recently. There needs to be some consistency, it is impossible to give Clients advice based on previous approvals.

17/00082/LBC & 10/00188/FULL – Conversion of Baltic Mill, Dens Road, Arbroath to Form 19 Flats
No dwellings within the site, middle of flood plain, Planning granted even though SEPA objected, as the Planning Department believed there would be little risk as floor level above the flood level.

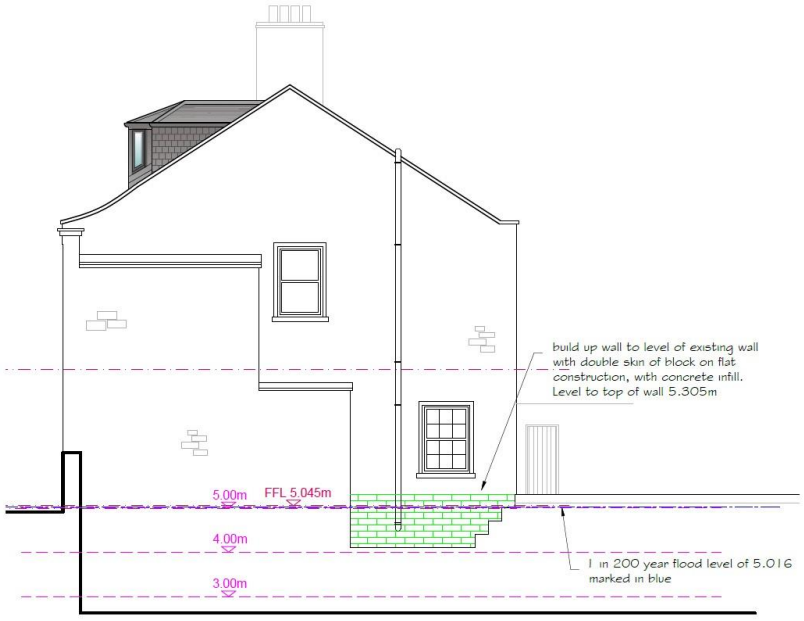
17/00413/FULL & 17/00448/LBC – Conversion of Public House to form 2no. dwelling Flats, Ship Inn, Marketgate, Arbroath. A very similar application although this building is 1m below our current application and only 100yards from our site, the Planners approved this with no qualms. Much higher risk of flooding if the levels are to be believed. Client had purchased the current site on the basis of this approval, and we expected the current application would be viewed similarly. This application was approved after the AECOM report was carried out so there was known risk of flooding when this was approved.

22/00653/FULL – Change of Use from Office to Flat, 9A East Grimsby Arbroath DD11 1NX
This is the most comparable of the applications recently approved, as it was approved AFTER we submitted our application. Again only 100 yards from our site, in the middle of the flood plain, conversion of a commercial premises to a dwelling flat, approved with no issues. When seeing this application approved, really highlighted the inconsistencies of the planning judgements.

17/00306/FULL – Erection of School, Ladyloan Primary School, Millgate Loan, Arbroath
School erected in middle of flood plain, Category 1 of SEPA's Land Use Vulnerability Classification, the highest risk category of all buildings. School moved from out with the flood plain into the middle of the flood plain and flood water being displaced by the new building.

POINT 4

SEPA had commented on the gable wall being a point of erosion and there being a risk of scour. We looked at this detail where the water line would be above this 90-degree check in the wall, and we put forward proposals to build up this wall to allow the water to flow smoothly past. This is a detail we are surprised the flood prevention scheme had no issues with but was picked up in this application. Therefore, we shall be building up this wall if the application is approved to prevent any damage should the water ever rise to this point.



proposed east elevation

PHOTO A – taken in March 2023 after continual heavy rainfall. Water level approx. 3.000m

This shall future proof the building for extreme event flooding. The wall shall be taken up to level of 5.305m to tie in with adjacent wall, taking the wall 300mm above even the 1 in 200 year event with 20% extra for climate change.

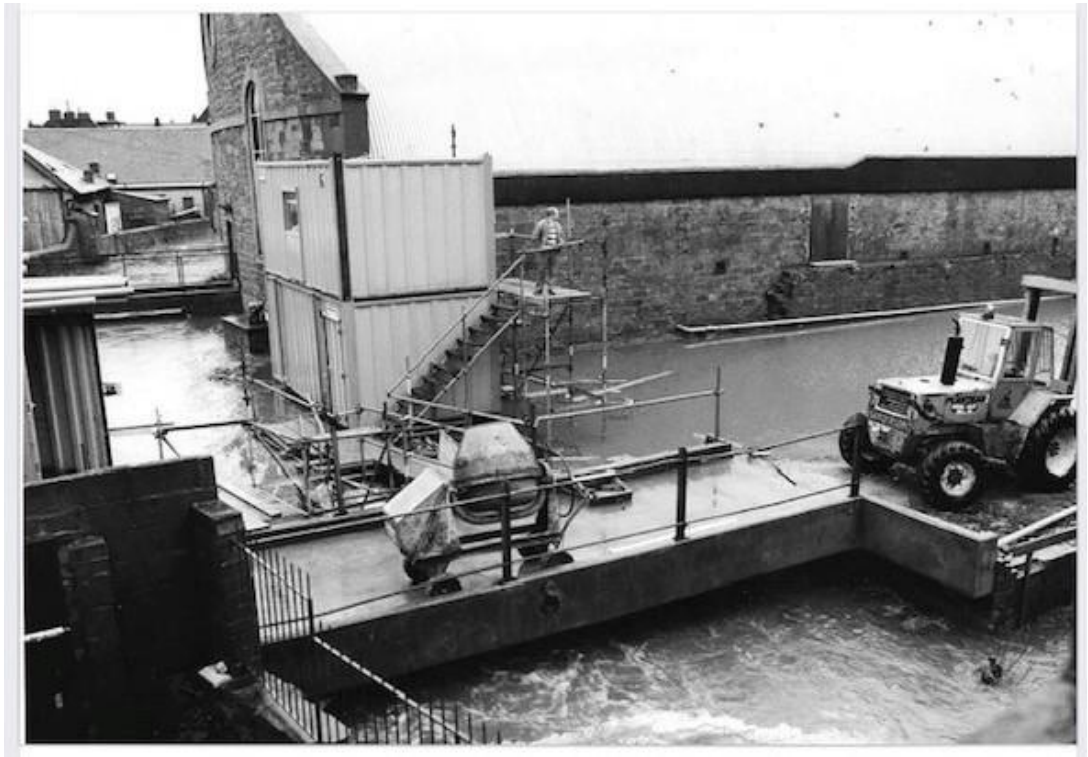


PHOTO B – 1994 extreme flood. Taken from window of Flat at 39 East Grimsby. Water level approx 3.600m.

See above photograph of extreme flood event of 1994, the largest on record. This photo was taken prior to the opening of harbour walls, prior to formation of culvert between Dens Road and Lindsay Street, and prior to the £12m flood protection scheme recently carried out by Angus Council. The water levels have been nowhere near these levels for the last 30 years due to the new works at the estuary of the Brothock where the walls of the riverbank have been substantially widened at the bottom of Marketgate, adjacent to the new flatted development at 1 to 10 Marketgate - 08/01428/FUL. This is the worst flooding on record, and we are still some 1.3m below the FFL of our proposed development.

In summary we believe the application should be approved because we are not creating a new housing site, the works proposed shall improve flood safety and corrosion to the building, this is a site much less susceptible to flooding than previously approved applications, and we are judged on levels 1m higher than the flood protection scheme is work to.

We trust the enclosed information helps with your decision process and look forward to receiving your comments in due course.

Yours faithfully

Gianni Giacomini
Building Design Services

ITEM 3

ANGUS COUNCIL

TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997
(AS AMENDED)
TOWN AND COUNTRY PLANNING (DEVELOPMENT MANAGEMENT PROCEDURE) (SCOTLAND)
REGULATIONS 2013

PLANNING PERMISSION REFUSAL
REFERENCE : 22/00221/FULL

To **H & Co Leisure Ltd**
c/o Gianni Giacomini
Building Design Services
Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RD

With reference to your application dated 4 April 2022 for planning permission under the above mentioned Acts and Regulations for the following development, viz.:-

Change of use from public house to flat and dormer extension to attic of existing flat at **Smugglers Tavern 65 Ladybridge Street Arbroath DD11 1AX** for **H & Co Leisure Ltd**

The Angus Council in exercise of their powers under the above mentioned Acts and Regulations hereby **Refuse Planning Permission (Delegated Decision)** for the said development in accordance with the particulars given in the application and plans docqueted as relative hereto in paper or identified as refused on the Public Access portal.

The reasons for the Council's decision are:-

1 The proposal is contrary to National Planning Framework 4 (2023) policies 2, 10 and 22 and Angus Local Development Plan (2016) Policy PV12 because the proposal is for redevelopment of an existing building which would introduce a more vulnerable land use on the ground floor in an location which is identified as being at risk of coastal, river and surface water flooding on SEPA flood maps; because the applicant has not demonstrated that all risks of flooding are understood and addressed; and because there is insufficient evidence to suggest that the proposal has been designed to adapt to future risks from flooding as a result of climate change.

2 The proposal is contrary to National Planning Framework 4 (2023) policies 1, 9 and 16 and Angus Local Development Plan (2016) Policy DS1 because the application proposes development which is not of an appropriate nature for this location due to flood risk; it does not represent a sustainable home in the right location due to flood risk; the ground floor of the building is not suitable for conversion to residential use due to flood risk; allowing a highly vulnerable use in an area subject to flood risk is not a development which gives significant weight to the global climate crises; and because the proposal is not consistent with relevant policies of the development plan (namely NPF4 policies 2, 10 and 22 and ALDP Policy PV12).

Amendments:

The application has not been subject of variation.

Dated this **20 March 2023**

[redacted]

Jill Paterson
Service Lead
Planning and Sustainable Growth
Angus Council
Angus House
Orchardbank Business Park
Forfar
DD8 1AN

Planning Decisions – Guidance Note

Please retain – this guidance forms part of your Decision Notice

You have now received your Decision Notice. This guidance note sets out important information regarding appealing or reviewing your decision. There are also new requirements in terms of notifications to the Planning Authority and display notices on-site for certain types of application. You will also find details on how to vary or renew your permission.

Please read the notes carefully to ensure effective compliance with the new regulations.

DURATION

The duration of any permission granted is set out in conditions attached to the permission. Where no conditions are attached the duration of the permission will be in accordance with sections 58 and 59 of the Town and Country Planning (Scotland) Act 1997 (as amended).

PLANNING DECISIONS

Decision Types and Appeal/Review Routes

The 'decision type' as specified in your decision letter determines the appeal or review route. The route to do this is dependent on the how the application was determined. Please check your decision letter and choose the appropriate appeal/review route in accordance with the table below. Details of how to do this are included in the guidance.

Determination Type	What does this mean?	Appeal/Review Route
Development Standards Committee/Full Council	National developments, major developments and local developments determined at a meeting of the Development Standards Committee or Full Council whereby relevant parties and the applicant were given the opportunity to present their cases before a decision was reached.	***DPEA (appeal to Scottish Ministers) – See details on attached Form 1***
Delegated Decision	Local developments determined by the Service Manager through delegated powers under the statutory scheme of delegation. These applications may have been subject to less than five representations, minor breaches of policy or may be refusals.	***Local Review Body – See details on attached Form 2***
Other Decision	All decisions other than planning permission or approval of matters specified in condition. These include decisions relating to Listed Building Consent, Advertisement Consent, Conservation Area Consent and Hazardous Substances Consent.	***DPEA (appeal to Scottish Ministers) – See details on attached Form 1***

NOTICES

Notification of initiation of development (NID)

Once planning permission has been granted and the applicant has decided the date they will commence that development they must inform the Planning Authority of that date. The notice must be submitted before development commences – failure to do so would be a breach of planning control. The relevant form is included with this guidance note.

Notification of completion of development (NCD)

Once a development for which planning permission has been given has been completed the applicant must, as soon as practicable, submit a notice of completion to the planning authority. Where development is carried out in phases there is a requirement for a notice to be submitted at the conclusion of each phase. The relevant form is included with this guidance note.

Display of Notice while development is carried out

For national, major or 'bad neighbour' developments (such as public houses, hot food shops or scrap yards), the developer must, for the duration of the development, display a sign or signs containing prescribed information.

The notice must be in the prescribed form and:-

- displayed in a prominent place at or in the vicinity of the site of the development;
- readily visible to the public; and
- printed on durable material.

A display notice is included with this guidance note.

Should you have any queries in relation to any of the above, please contact:

Angus Council
Angus House
Orchardbank Business Park
Forfar
DD8 1AN

Telephone 03452 777 780
E-mail: planning@angus.gov.uk
Website: www.angus.gov.uk

FORM 1

TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997 (AS AMENDED)

The Town & Country Planning (Development Management Procedure) (Scotland) Regulations 2013 – Schedule to Form 1

Notification to be sent to applicant on refusal of planning permission or on the grant of permission subject to conditions decided by Angus Council

1. If the applicant is aggrieved by the decision of the planning authority-

a) to refuse permission for the proposed development;
b) to refuse approval, consent or agreement required by condition imposed on a grant of planning permission;
c) to grant planning permission or any approval, consent or agreement subject to conditions,

the applicant may appeal to the Scottish Ministers to review the case under section 47 of the Town and Country Planning (Scotland) Act 1997 within three months beginning with the date of this notice. The notice of appeal should be addressed to The Planning and Environmental Appeals Division, Scottish Government, Ground Floor, Hadrian House, Callendar Business Park, Callendar Road, Falkirk, FK1 1XR. Alternatively you can submit your appeal directly to DPEA using the national e-planning web site https://eplanning.scotland.gov.uk.

2. If permission to develop land is refused or granted subject to conditions and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, the owner of the land may serve on the planning authority a purchase notice requiring the purchase of the owner of the land's interest in the land in accordance with Part 5 of the Town and Country Planning (Scotland) Act 1997.

TOWN AND COUNTRY PLANNING (SCOTLAND) ACT 1997 (AS AMENDED)

The Town & Country Planning (Development Management Procedure) (Scotland) Regulations 2013 – Schedule to Form 2

Notification to be sent to applicant on refusal of planning permission or on the grant of permission subject to conditions decided through Angus Council's Scheme of Delegation

1. If the applicant is aggrieved by the decision of the planning authority-

   a) to refuse permission for the proposed development;
   b) to refuse approval, consent or agreement required by condition imposed on a grant of planning permission;
   c) to grant planning permission or any approval, consent or agreement subject to conditions,

   the applicant may require the planning authority to review the case under section 43A of the Town and Country Planning (Scotland) Act 1997 within three months beginning with the date of this notice. The notice of review should be addressed to Committee Officer, Angus Council, Resources, Legal & Democratic Services, Angus House, Orchardbank Business Park, Forfar, DD8 1AN.

   A Notice of Review Form and guidance can be found on the national e-planning website https://eplanning.scotland.gov.uk. Alternatively you can return your Notice of Review directly to the local planning authority online on the same web site.

2. If permission to develop land is refused or granted subject to conditions and the owner of the land claims that the land has become incapable of reasonably beneficial use in its existing state and cannot be rendered capable of reasonably beneficial use by the carrying out of any development which has been or would be permitted, the owner of the land may serve on the planning authority a purchase notice requiring the purchase of the owner of the land's interest in the land in accordance with Part 5 of the Town and Country Planning (Scotland) Act 1997.

PLANNING

Your experience with Planning

Please indicate whether you agree or disagree with the following statements about your most recent experience of the Council's handling of the planning application in which you had an interest.

Q.1 I was given the advice and help I needed to submit my application/representation:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.2 The Council kept me informed about the progress of the application that I had an interest in:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.3 The Council dealt promptly with my queries:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.4 The Council dealt helpfully with my queries:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.5 I understand the reasons for the decision made on the application that I had an interest in:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

Q.6 I feel that I was treated fairly and that my view point was listened to:-

Strongly Agree	Agree	Neither Agree nor Disagree	Disagree	Strongly Disagree	It does not apply
☐	☐	☐	☐	☐	☐

OVERALL SATISFACTION: Overall satisfaction with the service: ……

Q.7 Setting aside whether your application was successful or not, and taking everything into account, how satisfied or dissatisfied are you with the service provided by the council in processing your application?

Very satisfied	Fairly satisfied	Neither Satisfied nor Dissatisfied	Fairly Dissatisfied	Very Dissatisfied
☐	☐	☐	☐	☐

OUTCOME: Outcome of the application:

Q.8 Was the application that you had an interest in:-

Granted Permission/Consent ☐ Refused Permission/Consent ☐ Withdrawn ☐

Q.9 Were you the:- Applicant ☐ Agent ☐ Third Party objector who made a representation ☐

Please complete the form and return in the pre-paid envelope provided.
Thank you for taking the time to complete this form.

ITEM 4

AECOM

Brothock Water Flood Protection Scheme

Modelling Report

Angus Council

14 July 2017

Quality information

Prepared by	Checked by	Approved by
Morag Hutton Hydrologist	Laura Dick Engineer	Dylan Huws Associate Director

Revision History

Revision	Revision date	Details	Name	Position
1	27/01/2017	Addition of exceedance events analysis	Dylan Huws	Associate Director
2	10/03/2017	Update with Client Comments	Dylan Huws	Associate Director
3	14/07/2017	Update with SEPA comments	Dylan Huws	Associate Director

Distribution List

# Hard Copies	PDF Required	Association / Company Name

Prepared for: Angus Council

Angus Council

Prepared by: AECOM

Morag Hutton
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EH3 5DA
UK

T: [redacted]
aecom.com

Table of Contents

Figures

Tables

1. Introduction

AECOM (previously URS and Scott Wilson) were commissioned by Angus Council (AC) to develop a hydraulic model of the Brothock Water and its inflowing watercourses to support the development and design of the Arbroath (Brothock Water) Flood Protection Scheme (A(BW)FPS). This Report outlines the hydrological analysis and hydraulic modelling undertaken to support the development of the A(BW)FPS.

2. Hydrological Analysis

2.1 Catchment Description

The catchment area of the Brothock Water to its outfall at Arbroath Harbour is 46.75km^2, and this is slightly adjusted from the FEH catchment (46.82km^2) based on a review of OS mapping and LIDAR data for the catchment (refer to Arbroath Flood Strategy Flood Risk & Management Options Report (March 2012) for further details)(herein referred to as the AFS Report). The catchment is predominantly farmland with some areas of forestry, with the upper reaches of the watercourse channel having been historically canalised as a result of agricultural practices and the construction of the former Arbroath to Forfar railway. Only the southern extremity of the catchment is urbanised where the Brothock Water flows through Arbroath. There is no significant storage (i.e. lochs, reservoirs, etc.) within the catchment.

The contributing area at the Arbroath Gauging Station is stated as being 50.00km^2 on the National River Archive Database and in correspondence with SEPA dated 06/05/2013. Based on detailed analysis based on OS mapping and LIDAR data, the contributing catchment was calculated to be 44.12km^2. The hydrological assessment has therefore been carried out based on an area of 44.12 km^2.

2.2 Design Flows

The detailed hydrological analysis for the Brothock Water derived for the AFS Report has been adopted for the development and design of the A(BW)FPS. The peak flows used for the development and design of the A(BW)FPS have been statistically derived using the FEH Pooling Group Method growth curve factors based on the QMED value estimated for the subject site (Arbroath Harbour). Full details of the derivation of the design flows are described in the AFS Report.

The AFS Report documents the various methods that were used to estimate QMED for the subject site. The final approach adopted comprised of adjusting QMED using the observed Annual Maxima dataset at Arbroath Gauging Station (station 13010). For the development of the A(BW) FPS, a review of the QMED value derived during the AFS Report was undertaken as 2years of additional flow data has become available since this study. This review found that the $QMED_{OBS}$ at the gauge remained unaltered, therefore the $QMED_{ADJ}$ value used in the previous analysis was not affected. The QMED value (11.81m^3/s) and subsequent design flows adopted for this study are therefore unchanged from the AFS Report. The peak flows adopted for the A(BW)FPS are shown in Table 2-1 below, with some values having been interpolated for the purposes of the Flood Damages Assessment.

Table 2-1: Design Flows for A(BW) FPS

Return Period (years)	Peak Flow (m^3/s)
2 (QMED)	11.81
5	17.36
10	21.02
20	24.21*
25	25.39
30	26.22
50	28.58
75	30.47
100	31.65
200	34.72
500	38.47*
1000	41.34

*Flows interpolated

The return period peak flood levels are lower than those stated by SEPA in correspondence of the 6th May 2013based on a pooling group analysis carried out as check. These flows are however based on the lower contributing area. The flow per km^2 based on the AECOM analysis is greater than the SEPA flow and therefore suitable for the purpose of the modelling exercise. Sensitivity simulations have been undertaken as part of the analysis and the findings used to derive appropriate freeboard levels.

2.3 Design Sea Levels

The extreme sea level analysis for the downstream boundary of the Brothock Water derived for the AFS Report has been adopted for the development and design of the A(BW)FPS. The extreme sea levels at Arbroath have been estimated using the method published in the Environment Agency / DEFRA Flood and Coastal Erosion Risk Management R & D project 'SC060064 Coastal flood boundary conditions for UK mainland and islands'. This report was released in 2011 and supersedes the POL Report 112 method. The DEFRA / EA method is based on the statistical analysis of long term data from the 40 class A tide gauge sites within the UK. This method also provides surge curves that represent the tidal hydrograph occurring during an extreme event, and these surge curves were used to derive a tidal hydrograph to represent the downstream boundary of the model, and this is discussed further in Section 2.6. Full details of the derivation of the extreme sea levels are described in the AFS Report.

In this case, the data point immediately offshore of Arbroath (Ch3310) was utilised to derive estimates for this study. Table 2-2 below summarises the results from the DEFRA / EA method. It is noted that all of the results are given with a confidence interval of +/-0.2m for the results up to a 50yr return period, then +/-0.3m for the 100yr & 200yr return periods, and +/-0.4m for the 500yr return period.

Table 2-2: Design Extreme Sea Levels

Return Period (Years)	2	5	10	20	50	100	200	500
Extreme Sea Level (mAOD)	3.26	3.35	3.42	3.49	3.59	3.67	3.75	3.87

2.4 Climate Change Allowance

It is noted that climate change is not being directly considered in the development of the A(BW)FPS, as the scheme is being developed on the basis of a 1:200yr standard of protection. However, it may be necessary to consider climate change in regard to the flood damages assessment, and therefore the appropriate climate changes allowances are noted below for both the fluvial and tidal hydrology.

Fluvial Hydrology

SEPA have confirmed (email 06/05/13) that the proposed uplift of 20% to design peak flows would be appropriate for the scheme design.

Tidal Hydrology

SEPA have confirmed (email 06/05/13) that the guidance within the UKCP09 reports and user interface should be used to estimate any changes in regional sea levels. Table 2-3, below, summarises the data contained in the UKCP09 user interface for regional sea level change for the coastline at Arbroath for the period from 2011 - 2100.

Table 2-3: UKCP09 Regional Sea Level Change Estimates (2011 – 2100)

UKCP09 Scenario (2011 – 2100)	Probability Level	Regional Sea Level Change for Arbroath (m)
Low Emissions Scenario	5%ile	+0.065
	50%ile	+0.238
	95%ile	+0.412
Medium Emissions Scenario	5%ile	+0.079
	50%ile	+0.306
	95%ile	+0.532
High Emissions Scenario	5%ile	+0.100
	50%ile	+0.389
	95%ile	+0.677

Further to discussions with Angus Council it was confirmed that the "High Emissions Scenario 95%ile Probability Level" estimate should be used as the climate change allowance on extreme sea levels for this project i.e. +0.677m.

2.5 Integrated Catchment Hydrological Model

For the purposes of the hydraulic model developed for the Brothock Water and its inflowing watercourses, the Brothock Water catchment has been divided into various sub-catchments to ensure that catchment areas will enter the Brothock Water at the appropriate locations along the river corridor. This is particularly important to ensure that flooding is not represented incorrectly at the storage area sites being considered within the catchment, and to ensure that the flood waters moving downstream towards Arbroath are well represented in the model. Figure 2-1 below shows where the various sub-catchments will inflow to the hydraulic model of the catchment, with the red outline representing the overall Brothock Water catchment. Table 2-4 provides further details of each hydrological input into the hydraulic model.

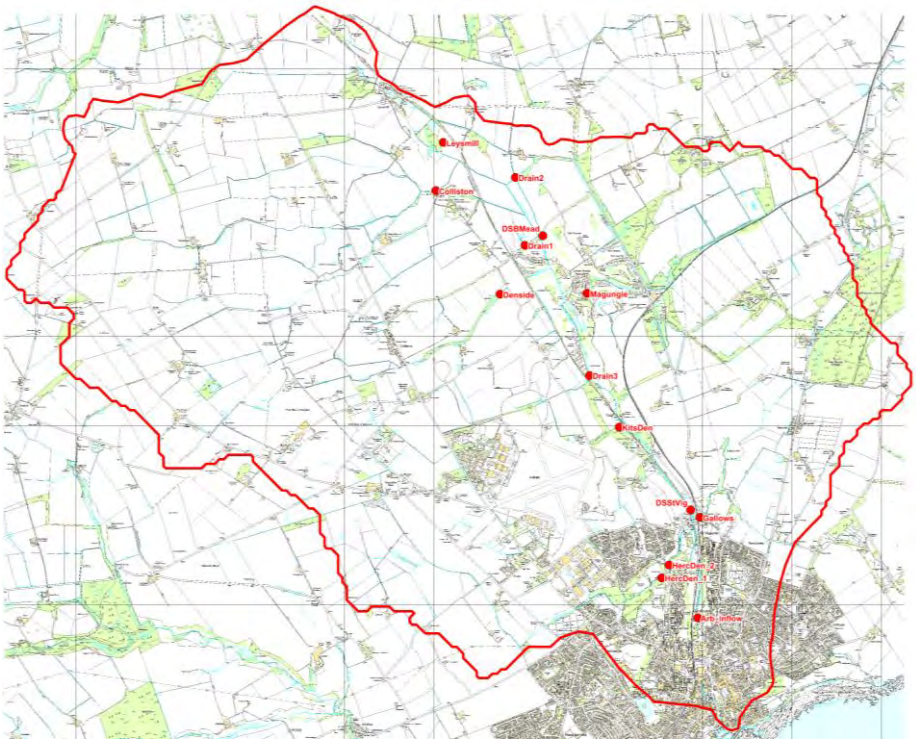


Figure 2-1: Integrated Catchment Hydrological Model

Table 2-4: Integrated Catchment Hydrological Model Inputs

Feature	Details / Location Entering Model	Catchment Characteristics	Catchment Area (km^2)
Watercourse			
Leysmill Burn	Watercourse splits to west of former railway embankment via pond and contributes to two watercourses which flow through Brothock Meadows	Former mine / quarrying works in headwaters, farmland / woodland	3.72
Colliston Burn	Inflows into Brothock Meadows	Farmland / woodland	10.36
Drain 1	Inflows into Brothock Meadows	Very localised catchment - farmland	0.33
Drain 2	Inflows into Brothock Meadows	Farmland / woodland / road drainage	1.15
Denside Burn	Inflows into Brothock Water between the two storage areas	Farmland / woodland	5.21
Magungie Burn	Inflows into Brothock Water between the two storage areas	Farmland / woodland	4.97
Drain 3	Inflows into Brothock Water between the two storage areas	Farmland / woodland	0.58
Kits Den Burn	Inflows into Brothock Water between the two storage areas	Farmland / woodland / partial area of RAF Condor	0.51
Gallows Burn	Inflows into Brothock Water downstream of St Vigeans storage area	Farmland / woodland	3.75
Hercules Den Burn1	Catchment area of watercourse draining to upstream end of Kirkton Road culvert	Farmland / woodland / some urban areas	7.4
Drainage Areas			
DSBMead	Excess catchment area between the storage areas	Farmland / woodland	4.82
DSStVig	Excess catchment area downstream of St Vigeans storage area	Farmland / woodland	0.81
Hercules Den Burn2	Catchment area of watercourse draining downstream of Kirkton Road culvert	Mostly urbanised / some open areas	0.51
Arb_inflow	Catchment area of Arbroath draining to Arbroath	Significantly urbanised / some open areas	2.63

FEH Catchment descriptors for these sub-catchments were obtained from the FEH CD-ROM or derived using area-weighting methods and equations recommended within the FEH.

These sub-catchments were represented as FEH Rainfall-Runoff units in the ISIS hydraulic modelling software being used for the integrated catchment model which automatically produces flow hydrographs for the model. A time-to-peak (Tp) adjustment factor was applied to each of these units to enhance the hydrological model in terms of the Brothock Water catchment's response to a given storm event. This adjustment factor was based on the previous analysis described in the AFS Report, which indicated a Tp of 7.38hrs from catchment descriptors for the whole Brothock Water catchment (46.75km^2) and an observed Tp of 5.93hrs from the gauge data. This approach has been reviewed and deemed appropriate to adopt in the design. As a result, a Tp calibration coefficient of 0.79 was applied to each of the sub-catchment FEH R-R units flowing into the integrated catchment model.

The final stage in completing the hydrological inputs to the model was to scale the flows from catchment descriptors to match the statistically derived flows used in the assessment. This exercise (based on SPR adjustment) is discussed in more detail in Section 3.9.

2.6 Joint Probability Analysis

A detailed joint probability analysis of extreme sea levels versus river flows was completed during the AFS Report in accordance with the guidance in "Use of Joint Probability Methods in Flood Management – A Guide to Best Practice" published by DEFRA / EA (March 2005). Full details of this exercise are provided in the AFS Report.

The AFS Report identified that the worst case flood levels in Arbroath are dominated by river flows with tide levels being relatively insignificant. This is because the river falls at a moderate gradient through Arbroath, its flow capacity is limited by numerous bridges and culverts, and the normal tidal limit is at the very downstream end of the watercourse between Brothock Bridge and Lady Bridge. After a number of model test runs, the AFS Report identified that the worst case scenario for flooding in Arbroath was the highest river flow paired with the lowest extreme sea level. No methods or parameters relating to the joint probability analysis have changed since the AFS Report, and therefore it is considered appropriate to adopt the high river flow / low extreme sea level scenario as the design scenario for all baseline and with scheme model runs for the development of the A(BW)FPS. The following table summarises the joint probability scenarios to be used in the baseline and with scheme model.

Table 2-5: Final Joint Probability Combinations for Extreme Sea Levels versus River Flows for all Joint Exceedance Return Periods

Return Period	River Flow and Extreme Sea Level return period combinations for a Joint Exceedance Return Periods		Results in terms of values for present day scenario (2013)	
	Extreme Sea Level (Yrs) [a]	River Flow (Yrs)[a]	Extreme Sea Level (mAOD)	River Flow (m^3/s)
2	0.005	2	2.44	11.81
5	0.008	5	2.51	17.36
10	0.008	10	2.51	21.02
20	0.025	20	2.66	24.21
50	0.025	50	2.66	28.58
100	0.1	100	2.85	31.65
200	0.2	200	2.93	34.72
500	0.5	500	3.04	38.47

3. Baseline Integrated Catchment Model

3.1 Overview

The hydraulic model for the Brothock Water catchment was constructed using the following hydraulic modelling software packages: -

- ISIS v3.6 (1D modelling),
- TUFLOW.2012-05-AB-w32 (2D modelling)

The existing ISIS-TUFLOW hydraulic model of the Brothock Water used for the Arbroath Flood Strategy (i.e. extending from the trash screen just upstream of the gauging station to the outflow into the sea) was adopted and extended upstream to include reaches of the catchment relevant to the development of the A(BW)FPS (see Section 3.3).

The hydraulic model is set up such that the Brothock Water channel and its tributary channels are modelled in 1D and linked with TUFLOW (2D) to represent the complex flow patterns and interactions in the flood plain in more detail. TUFLOW was used to represent the natural floodplain through the catchment and floodplain through urbanised areas of Arbroath, where 1D hydraulic modelling alone does not allow for sufficient representation of the flooding processes and mechanisms. TUFLOW is a fully hydrodynamic 2D model and solves depth averaged 2D shallow water equations. Another powerful feature of TUFLOW is that as well as defining the extent of flood inundation, TUFLOW outputs depth and velocity data for the 2D domain, enabling flood hazard mapping of the floodplain to be readily produced.

Both ISIS and TUFLOW packages have their advantages with regards to the online flood storage proposals being designed, whereby ISIS is appropriate for modelling complex in-channel control structures for restricting flows and TUFLOW is suitable for accurately modelling the impact of out-of-bank impoundment structures.

3.2 Data Sources

The following data sources have been utilised to develop the baseline integrated catchment model in addition to the data gathered during the AFS Report and watercourse walkover surveys carried out by hydraulic modellers: -

- Maltby Land Surveys Ltd (2004) survey
- Angus Council (2007) survey
- Douglas Land Surveys (2011) survey
- Douglas Land Surveys (2013) survey
- Aspect Surveys Ltd (2013) survey
- LiDAR DTM data provided by Angus Council (2013)
- Angus Council As-Built Drawings of Arbroath Flood Wall Improvements (2013)

3.3 Hydraulic Model Boundaries / Model Extension

The reach of the Brothock Water modelled as part of the AFS study extends from the trash screen at Demondale to its outfall at the harbour over a distance of approximately 1.7km. For the development and design of the FPS, the model was extended upstream by approximately 11.4km to capture all major tributaries of the Brothock Water (refer to Section 2.5 for key hydrological inputs considered). The total reach modelled is therefore approximately 13.1km, and is shown in Figure 1 in Appendix A.

The overall reach modelled is considered to be sufficient to adequately represent the baseline flooding conditions through the catchment and capture the full potential effects of the proposed FPS works on the flooding regime along these reaches. The model extents are such that a full understanding can be attained of the potential effects of the on-line flood storage proposals on channel and out-of-bank (floodplain) flow regimes. The extents of tributaries included in the model

have been based on site inspections and the professional judgement of the hydraulic modellers, in regard to the extent of baseline and with scheme flood effects within the catchment.

Inflow hydrographs for the integrated catchment model were created using the FEH Rainfall Runoff Method (refer to Section 2.5 for further details), and the downstream boundary was set as a time-varying water level to represent the derived extreme sea level curves as defined in the coastal boundary method (report "SC060064 Coastal flood boundary conditions for UK mainland and islands")(refer to Section 2.3 for further details).

In the 2D domain (refer to Figure 1 in Appendix A for model extents) the extreme sea levels were represented as a Head / Time (HT) boundary to represent the time-varying extreme-sea levels at the southern edge of the model and to control the flow spilling out of the 2D domain at the harbour. A Head / Discharge (HQ) boundary was used to the far northwest of the model to draw water out of the 2D domain at 'normal depth' where the floodplain flow (via overtopping of the Colliston Burn) exits via overland flow routes.

A 2D initial water level was applied to the Letham Grange Estate ponds to provide appropriate antecedent conditions for these features within the floodplain prior to inundation from the Brothock Water system. A water level of 20.6mAOD was surveyed by Douglas Land Surveys in Spring 2013 and this was considered to be an appropriate typical water level.

3.4 River Channel Representation

3.4.1 ISIS

Across the entire hydraulic model, the main Brothock Water channel and its inflowing channels were represented in the 1D (ISIS) element of the model (Figures 3 & 4 in Appendix A). Through Arbroath, open channel cross sections in the hydraulic model are mainly unchanged since the AFS study. The ISIS sections have been updated through Arbroath where the harbour culvert has been opened up as a result of a recent residential development at this location. The new reach of channel and upstream face of the shortened harbour culvert have been surveyed and represented in the integrated catchment model as a result. As part of this commission a repeat survey was undertaken at five model cross-section locations through Arbroath to determine if there had been any significant changes to the bed geometry since the 2005 survey by Maltby Land Surveys Ltd. This exercise confirmed that there were no significant differences to the bed geometry through Arbroath and the existing model sections were therefore considered as a suitable representation of the channel for the development and design of the FPS.

Upstream of Arbroath, survey sections by Douglas Land Surveys (2013) were used to define the Brothock Water channel, Hercules Den Burn, Gallows Burn, Magungie Burn, Denside Burn, Colliston Burn, and Drain 2 (refer to Figure 1 in Appendix A).

The Manning's Equation is used in ISIS to estimate flow depths in river reaches assuming normal flow conditions. Manning's 'n' values are used in this equation to reflect the roughness of the flow channels. Large Manning's 'n' values imply higher degrees of roughness and consequently higher flood levels. Manning's 'n' values selected for this hydraulic study varied as follows: -

- Generally, 0.035 - 0.045 for the various watercourse channels including the Brothock Water, and this was based on an assessment of channel roughness from the modelling site visits. In one location on the Brothock Water channel for a length of approximately 300m just upstream of the proposed St Vigeans storage area a higher manning's value of 0.06 has been assigned to represent the poorly maintained nature of this section of channel,
- 0.10 for densely vegetated land along the banks of the Brothock Water,
- 0.05 for medium grassed and bushed areas along the banks of the Brothock Water,
- 0.02 for the concreted / brick walled defences adjacent to the channel.

These values are within the range recommended in the Conveyance Estimation System's Roughness Advisor module as well as in other standard references, and are considered appropriate. These values have also been reviewed through the verification of the 1D ISIS model (see Section 3.10).

3.4.2 Estry (1D) Channels

A ditch is noted to the south of the proposed St Vigeans Storage Area, and this discharges into the Gallows Burn (refer to Figure 2 in Appendix A). This channel was considered as important to the performance / drainage of the St Vigeans floodplain mechanisms and therefore a short reach of it (some 110m) was represented in Estry (TUFLOW's 1D solution scheme) and configured to dynamically link to ISIS where it discharges into the Gallows Burn. Estry was used in this instance as it runs in a stable manner for small channels with limited gradient within floodplain systems.

3.4.3 Non Modelled Watercourses

There are various ditches and drains that could not be modelled due to the scale of these features in relation to the 2D domain cell size (5m) being used for the integrated catchment model, i.e. less than 5m in width. This is particularly the case through the Letham Grange Estate where there are a number of local drains and ditches which serve to drain the low lying areas of the golf course. These were mostly considered to be relatively insignificant to the routing of the flood hydrograph through the catchment and therefore are represented coarsely in the 2D domain (refer to Figure 2 in Appendix A)

Drain 1 which flows adjacent to the road at Brothock Meadows is a more substantial drainage ditch, however it could not be modelled in ISIS due to its very flat gradient and the limited size of the structures on it. As a result, the surveyed bed levels were stamped onto the 2D domain as a series of z_lines where it flows through Brothock Meadows and into the golf course.

3.5 Structure Representation

3.5.1 ISIS

Across the entire hydraulic model, structures on the river channels were represented in the 1D (ISIS) element of the model. The ISIS element of the model contains 43 bridges / culverts, the weir through Arbroath, the trash screen at Demondale (north of Wardmill Bridge), and the drop structure to the north of St Vigeans, and these are represented using the topographic survey information gathered for the AFS study and this stage of the FPS development. Various As-Built drawings were made available during the AFS study to determine the geometry of the Morrison's Culvert in Arbroath.

It should be noted that there is a degree of uncertainty with the representation of the Morrison's Culvert, due to discrepancies between the levels from the 2004 topographic survey and the as-built drawings provided, due to lack of data. However, the balance in water level through this structure has been verified as described in Section 3.10, therefore counteracting some of the uncertainty associated with the changes in shape and invert levels along its length.

Inlet and outlet energy losses associated with all the structures have also been included within the model using the guidance contained within the 'Culvert Design and Operation Guide' (CIRIA, 2010). The values adopted have been reviewed through the verification of the 1D ISIS model through Arbroath (see Section 3.10).

3.5.2 Estry (1D) Culverts

A number of key culverts which pass through various embankments within the floodplain have been included in the 2D domain as Estry (1D) culverts, including: -

- The culvert through the former railway embankment to the north of the Brothock Meadows to allow the floodwater which has escaped from the Colliston Burn channel to enter Brothock Meadows;
- The two culverts on Drain 1 which run under the road at Brothock Meadows and the local access through the Letham Grange Estate;
- The lade culvert under the road to the north of St Vigeans;
- The railway underpass at Denside.

All these structures were considered as important to the routing of the hydrograph along the watercourse floodplain and therefore have been included in the hydraulic model (refer to Figure 2 in Appendix A).

3.6 Floodplain Representation

3.6.1 1D Domain

Due to complex out-of-bank urbanised flow patterns in Arbroath and through rural areas in the catchment upstream of the town, the majority of the floodplain is modelled in the 2D (TUFLOW) component of the model. However, some steeper valley sections have been modelled in 1D, including part of the left (eastern) over-bank from the ACROP yard to the trash screen at Demondale, the right overbank just upstream of the St Vigeans storage area, and the left bank just south of the golf course (refer to Figure 1 in Appendix A). This is because the out-of-bank flow along these reaches would be essentially one dimensional, and therefore does not require TUFLOW to be utilised.

3.6.2 2D Domain

Figure 1 in Appendix A defines the portions of the model represented in ISIS and TUFLOW respectively.

Along the modelled 13.1km reach of the hydraulic model, a 2D domain was created in TUFLOW based on a 5m grid size. Appropriate cut off points were used to determine the extent of the 2D domain, with a Head / Discharge (HQ) boundary used to draw water out of the 2D domain at 'normal depth' where floodplain flow seeks to exit the study area towards the northwest of Brothock Meadows, and a Head / Time (HT) boundary used to represent the time-varying extreme-sea levels at the southern edge of the model to control the flow spilling out of the 2D domain at the harbour.

The grid was then populated with ground elevation data from the (filtered) LiDAR data, via a point inspection using Mapinfo Vertical Mapper. The LiDAR data has been spot checked in relation to available topographic survey data and this showed a relatively close match in all areas. This showed that the LiDAR data is of sufficient accuracy to use for the 2D domain. A composite grid check was also undertaken to review the detail of the 5m grid against the raw LiDAR DTM data which is of a 1m grid size. This check is necessary to review if the resolution is detailed enough, and to ensure that the 5m grid captures all the important overland flow paths within the floodplain. The results showed that there was little difference between the levels captured at a 5m grid (as in the model) and those of the raw 1m LiDAR DTM data. Therefore, the 5m grid size was deemed appropriate for use in development and design of the FPS.

Various topographic features were stamped onto the grid throughout the hydraulic model using topographic survey data, including bridge decks, threshold levels for all the properties within Arbroath, embankment data filtered out by the LiDAR data, ditch bed levels, and top of bank elevations.

3.6.3 Floodplain Roughness

Manning's values within the 2D element of the hydraulic model are represented via GIS polygons, which link to a 'look-up' text file (TUFLOW materials file). These values are within the range recommended in the Conveyance Estimation System's Roughness Advisor module as well as in other standard references, and are considered appropriate. Table 3-1 lists the range of Manning's values used within the 2D domain. A sensitivity analysis (Section 4.4) describes the effects of varying the Manning's values in the 2D domain.

Table 3-1: 2D Domain Manning's Values, by Land Use Classification

Classification	Land use	Manning's n value
0	Default value	0.04
1	Roads and paths	0.02
2	Pavements and hard standing	0.025
3	Fields and gardens	0.04
4	Short grass / turf	0.03
5	Long grass	0.05
6	Scrapyards	0.10
7	Rail	0.025
8	Deciduous tree cover & shrubs (dense woodland)	0.10
9	Pine woodland (sparse woodland)	0.075
10	Water	0.03
11	Buildings	0.50

3.7 Linkage between 1D and 2D Domains

Through the reach where the 1D ISIS model has been converted to the hybrid 1D / 2D ISIS-TUFLOW model, the existing cross sections in the 1D ISIS model were trimmed back to the top of banks / walls and floodwater interfaces (level transfer – HX lines) were created along the bank tops to allow floodwater to pass between the 1D and 2D domains.

For the baseline scenario the onset of flooding is modelled as the condition where the floodwater overtops flood defences or reaches top of bank, i.e. once the flood level in the Brothock Water reaches top of wall / bank level floodwater is transferred to the 2D domain.

3.8 Determination of Critical Storm Duration

The 200yr event was run using the raw FEH descriptors (i.e. no adjustment of SPR at this stage to match the statistical peak at the gauge) across a range of storm durations to find the critical storm duration (i.e. that which produces the highest flow) for the entire catchment to the Arbroath Gauging Station. This exercise excluded the Arbroath contributing catchment, i.e. Arb_inflow, as described in Section 2.5. This is because the main aim was to determine the critical storm duration for the catchment upstream of the gauging station, for the purpose of quantifying the critical baseline flooding conditions for the upstream storage sites and determining the maximum flow at the upstream end of Arbroath.

The model was run for the 200yr return period for a range of critical storm durations to determine the critical storm duration for the catchment and the peak flow was analysed at Section B_1599 (i.e. the Arbroath Gauging Station). The critical storm duration for the catchment was found to be 17hrs (refer to Figure A below, showing the final set of model run results). It is noted that between a 14hr and 18hr storm duration the difference in peak flow is only 0.49m^3/s, which is less than a 1.5% difference. It is noted that both higher and lower durations were also tested to ensure that the peak flows fell away outside the range shown in Figure 3-1. During the AFS study a critical storm duration of 10hrs was calculated for the catchment, however this was based on FEH equations and not a detailed hydraulic model. The 17hr storm duration has been adopted for all other return period runs for the baseline modelling on the basis that the catchment will respond in a similar manner for all events with the same storages being utilised.

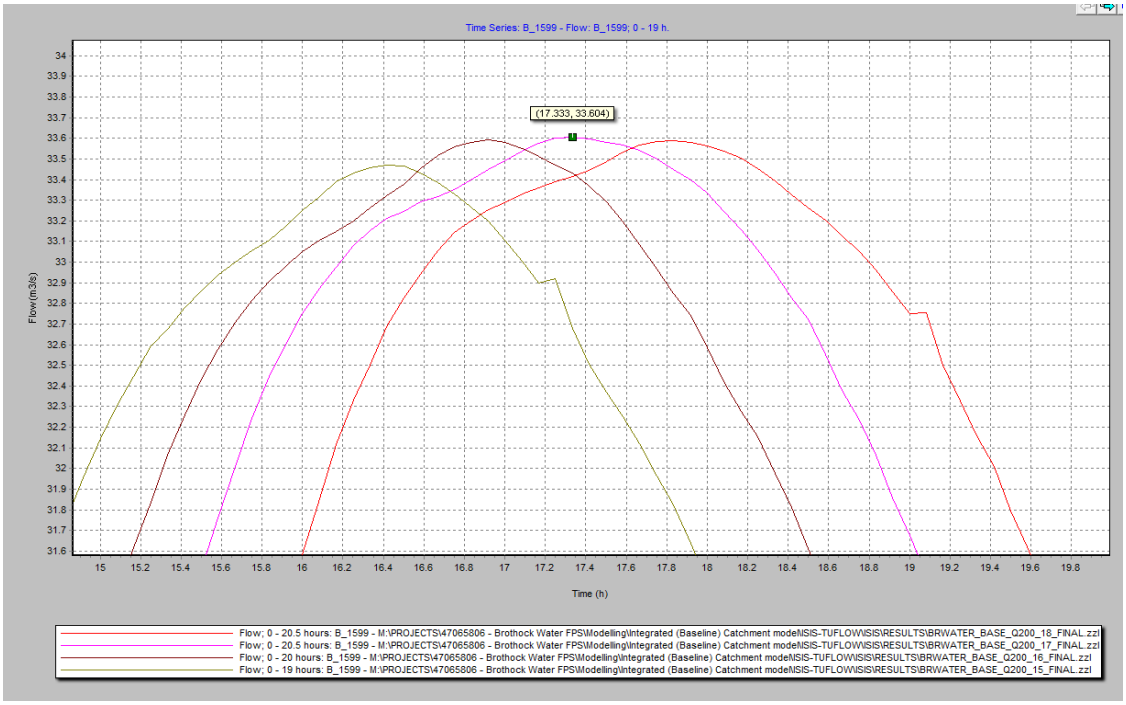


Figure 3-1: Final Model Run Results for Critical Storm Duration

3.9 SPR Adjustment Exercise & Results

Since the hydrological model being used for the design is statistically derived using the FEH Pooling Group Method, the next step was to calibrate the hydrological model (i.e. the ISIS FEH R-R inflow units) in order for the model to produce and match the design peak flows being used. A similar approach to that used in the AFS study was used, and this involved globally adjusting the SPRHOST value across the FEH R-R inflow units for each return period.

The model was then run iteratively across the design return periods for a number of SPR adjustment factors to determine the required adjustment for each return period to match the respective peak flows at the Gauging Station (Section B_1578 in the model).

Table 3-2 below shows the results of this analysis, and the aim of the exercise was to match the predicted flow at the Gauging Station to within +/-2.5% of the target peak flow from the statistical analysis as this is considered a sufficiently close match to the target flows.

Table 3-2: Summary of Results for SPR Adjustment Exercise

Return Period (years)	Target Peak Flow (m3/s)	SPR Adjustment Required (%)	Predicted Flow at Gauge (B_1578) (m3/s)	Difference (m3/s)	Difference (%)
2	11.81	-22.5	11.82	0.01	0.1%
5	17.36	22.0	17.63	0.27	1.6%
10	21.02	18.0	21.39	0.37	1.8%
20	24.21	17.0	24.69	0.48	2.0%
50	28.58	11.0	28.81	0.23	0.8%
100	31.65	7.0	31.52	-0.13	-0.4%
200	34.72	1.3	34.66	-0.06	-0.2%
500	38.47	6.0	38.16	-0.31	-0.8%
1000	41.34	3.0	40.91	-0.43	-1.1%

Figure 3-2 shows the difference in the flow hydrograph at the Arbroath Gauging Station between the AFS study and for the updated modelling for the Arbroath (Brothock Water) FPS design. This is based on the developed catchment model, and therefore the derived hydrograph now better represents the flooding processes (such as flood storage, etc.) within the catchment.

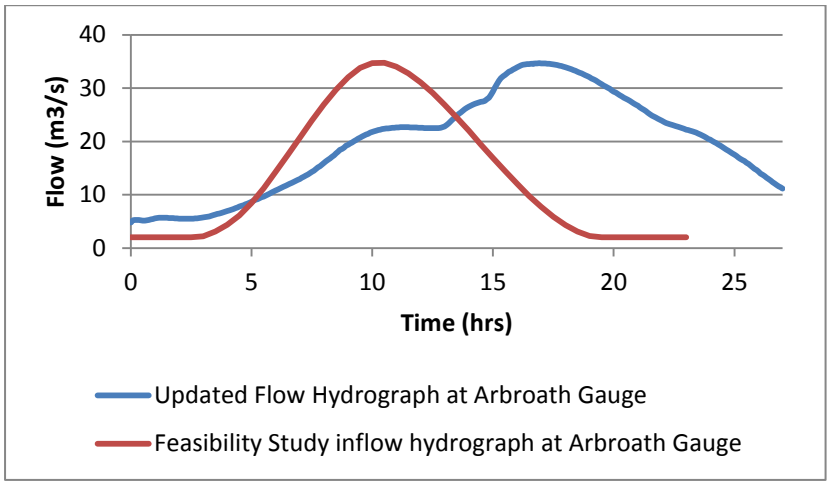


Figure 3-2: Difference Between Flow Hydrographs for AFS Study and A(BW) FPS Design

Since the model was run for a particular joint probability scenario (refer to Section 2.6), the tidal boundary at the downstream end of the model was also adjusted to ensure that the peak of the tidal surge wave would match the peak flow in the river. The downstream boundary conditions for the baseline model runs are a time varying boundary, with the peak of the boundary being the design sea level noted in the joint probability analysis and the shape of the boundary condition being based on standard surge shapes from the coastal flood boundary method (refer to Section 2.3 & 2.6).

3.10 Model Verification

3.10.1 Hydrograph shape

Limited rainfall data is available within and near the Brothock Water catchment, with many of the gauging stations recording only daily flow. The gauges at Auchterhouse and Lethame Grange were also deemed unsuitable based on either distance from catchment or that they were flooded during the 2009 event. A rainfall hyetograph could therefore not be produced to run a rainfall runoff model.

A review of the 2009 event recorded hydrograph at Arbroath gauging station shows a similar shape to the design hydrograph used in this study. The catchment model shows a good representation of the response of the catchment to rainfall as well as a vast improvement on the generated shape from the feasibility study (Figure 3-3).

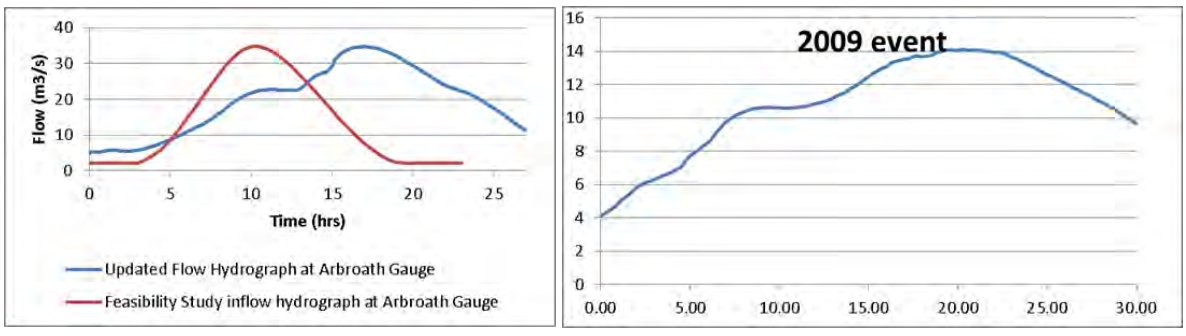


Figure 3-3: Comparison of hydrograph shape for the 2009 event

3.10.2 Hydraulic model verification

There was limited data available to verify the model as there have not been any fully documented flood events since the Gauging Station has been in operation. Previously during the AFS study the original model was verified for two events (a low flow event and the highest event on record) using available photos for these events. This showed that the model results through Arbroath compared relatively well to actual conditions. It has not been possible to fully repeat this exercise during this stage, as the only actual events with photos have occurred prior to the Harbour Culvert being removed (circa. 2012), and the modelling has determined that this has introduced a significant change to the flood levels within certain reaches within Arbroath and therefore it is not fully valid to do a verification exercise based on pre Harbour Culvert removal events.

However, the verification exercise completed during the AFS study was repeated for comparison purposes (see Table 3-3 & Table 2-1 below for results). It is noted that Environment Agency guidance (2009) given in 'Requirements for Completing Computer River Modelling for Flood Risk Assessments' advises that three separate events should be used to calibrate a hydraulic model. For this study, as was the case previously, it was not possible to attain sufficient details for three separate events to calibrate the 1D hydraulic model, and therefore it has only been possible to 'verify' the model.

As per the previous AFS study, photographs and flow data were available for two observed events (04/09/09 and 14/03/11). The 04/09/09 event is approximately a 1:3yr event (14.06m3/s) where some of the structures through Arbroath are starting to surcharge and some upstream backwatering is occurring. The 14/03/11 event is a typical winter flow (2.28m3/s). Both events are considered suitable to use in the verification of the model as one event will verify the energy losses associated with the various structures at near bank-full conditions and the lower flow event will verify the modelled reach under low flow conditions. However, it is noted that for better accuracy, a larger flood of say 1:10 would be preferred.

As per the previous AFS study, it has not been possible to verify / calibrate the model for out-of-bank flooding through the town of Arbroath since no observed data was available. The last recorded flooding incident in the town is believed to be in 1977. However, given that the geometry of the watercourse has changed substantially since 1977 (i.e. construction of the Guthrie Port to Hume Street culvert, construction of flood defence walls, and modifications to the weir), it is still considered inappropriate to attempt to verify the model to an event that occurred in a distinctly different flooding regime.

The verification comparison process for this study was as follows for the two events: -

1. Estimation of observed flood levels from photographs at model cross-section locations along the Brothock Water (based on previous AFS study),

2. Interrogation of observed 15 minute flow data at Arbroath Gauging Station received from SEPA (based on previous AFS study),

3. Simulation of the hydraulic model for observed flow data & summarisation of results

Table 3-3: Summary of Model Verification Exercise for 04/09/09 Event

River Section	Location	Observed Water Level (mAOD)	Predicted Water Level from AFS Model (2010) (mAOD)	Difference (mm)	Predicted Water Level from A(BW)FPS Model (2013) (mAOD)	Difference (mm)
1557	Upstream Wardmill Rd Bridge	8.06	8.09	+30	8.09	+25
1544	Downstream Wardmill Rd Bridge	8.1	8.03	-70	8.02	-80
717	Upstream	5.31	5.23	-80	5.21	-104

	Catherine St Bridge					
607	Upstream weir	4.52	4.58	+60	4.58	+63
592	Upstream Burnside Dr Bridge	4.26	4.19	-70	4.18	-81
555	D/S of Burnside Dr Bridge	4.18	4.09	-90	4.09	-94
520		4.02	3.91	-110	3.90	-116
470	Upstream Brothock Bridge	3.9	3.87	-30	3.86	-41
309		3.7	3.64	-60	3.63	-72
281		3.55	3.52	-30	3.50	-42
263	Upstream Lady Bridge	3.55	3.61	+60	3.59	+46
251	Downstream Lady Bridge	3.48	3.55	+70	3.54	+55
228		3.35	3.48	+130	3.46	+107
181	Upstream Harbour culvert	3.34	3.46	+120	3.44	+96
125	Downstream Harbour culvert	2.90	2.82	-80	2.82	-86

Table 3-4: Summary of Model Verification Exercise for 14/03/11 Event

River Section	Location	Observed Water Level (mAOD)	Predicted Water Level from AFS Model (2010) (mAOD)	Difference (mm)	Predicted Water Level from A(BW)FPS Model (2013) (mAOD)	Difference (mm)
1544	Downstream Wardmill Rd Bridge	7.29	7.23	-60	7.23	-57
1341	Adjacent to Business Centre	6.30	6.28	-20	6.28	-18
1275		6.07	6.12	+50	6.12	+51
1157	Upstream Morrisons culvert	5.96	5.81	-150	5.85	-112
931	Downstream Morrisons culvert	5.11	4.96	-150	4.96	-150
717	Upstream Catherine St Bridge	4.55	4.48	-70	4.49	-65
607	Upstream weir	3.76	3.81	+50	3.81	+48
592	Upstream Burnside Dr Bridge	3.16	3.16	0	3.16	0
555	D/S of	3.04	3.15	+110	3.15	+107

	Burnside Dr Bridge					
520		3.02	3.09	+70	3.09	+65
470	Upstream Brothock Bridge	2.89	2.95	+60	2.95	+58
309		2.59	2.66	+70	2.66	+68
263	Upstream of Lady Bridge	2.52	2.50	-20	2.51	-13
181	Upstream Harbour culvert	2.36	2.38	+20	2.39	+31

This exercise coupled with the verification exercise carried out during the AFS study gives reasonable confidence in the representation of flood levels in the model. To mitigate the remaining uncertainty a detailed sensitivity analysis on the base case model has been undertaken and this is reported in Section 3.11.

The previous text has been extract from the AFS study report to highlight some of the difficulties experienced with verifying the model through Arbroath: -

"*It was challenging to attain a close match between predicted and observed flood levels at some locations, i.e. upstream and downstream of the Morrisons culvert, downstream of Burnside Drive Bridge and upstream of the Harbour culvert. At the Morrisons culvert this is due to the limited information regarding the internal geometry of the culvert (i.e. there are possibly up to 5 locations within the culvert where the culvert geometry changes). In relation to downstream of Burnside Drive Bridge and upstream of the Harbour Culvert, the verification was challenging in achieving a balance between appropriate culvert inlet / outlet loss coefficients and Manning's n values in the adjacent channel sections. In addition, the 1D representation of the Harbour Culvert (which contains some bends) may also limit the accuracy of the model at this location.*

Elsewhere along the modelled reach, there is a reasonable match between predicted and observed flood levels (+/-70mm). On this basis the 1D hydraulic model is considered appropriate to use for the integrated hydraulic baseline flood model to produce flood levels for this study."

In regard to the verification of the model in the wider catchment (i.e. outwith Arbroath), there were only a limited number of photographs around the peak of the 2009 event and no other information. It is not possible to derive accurate flood levels from these photos. Therefore, the only exercise that could be completed was simply to check that the model predicted similar flooding at these locations during the verification runs, and if the flooding in the photos was significant that the flooding in the model was also significant in these areas. The following table identifies the locations that were reviewed: -

Table 3-5: Summary of Catchment Flooding Review

Location	Flooding in 2009 Photos?	Flooding in Model?	Similar Extents of Flooding in Both Photos and Model?
Hercules Den Burn at Kirkton Road	Y	Y	Y
Fields at the proposed Brothock Meadows Storage Area	Y	Y	Y
Road immediately downstream of Brothock Meadows	Y	Y	Y
Stone Arch Bridge at St Vigeans	Y	Y	Y
Trash Screen Upstream of Arbroath	Y	Y	Y

4. Baseline Modelling Results

4.1 Model Runs

Based on the model derived, as described in Section 3, a number of model runs were carried out to determine the predicted flood extents and depths at all return periods of interest. The following bullet points briefly describe the suite of model runs carried out: -

- 2, 5, 10, 20, 50, 100, 200, 500, & 1000yr return period events for the integrated ISIS – TUFLOW model, with the joint probability scenarios described in Section 4.2 and the critical duration and SPR adjustments described in Sections 3.8 & 3.9 respectively,
- 2, 5, 10, 20, 50, 100, 200, 500, & 1000yr return period events including climate change allowance on both fluvial flows and extreme sea levels for the integrated ISIS – TUFLOW model, with the joint probability scenarios described in Section 4.2 and the critical duration and SPR adjustments described in Sections 3.8 & 3.9 respectively,
- Sensitivity runs covering variations in manning's n values, downstream boundary conditions, structure blockages at key locations, and flow (refer to Section 4.4 for full details of the runs carried out)

4.2 Joint Probability Analysis Combinations

As discussed in Section 2.6, the integrated catchment model is run for each return period based on the worst case joint probability scenario of river flow and sea level (i.e. the scenario that gives the worst flood levels, flood extents, and flood depths in Arbroath). The previous AFS study identified that the worst case flood levels in Arbroath are dominated by river flows with tide levels being relatively insignificant. Based on various joint probability model runs undertaken during the AFS study the worst case scenario for flooding in Arbroath was definitively identified as the highest river flow paired with the lowest extreme sea level. The details of these scenarios are identified in Section 2.6, and these have been used for the baseline model runs carried out.

4.3 Model Results

4.3.1 Fluvial Flooding

The output from the 1D domain (ISIS model), i.e. the modelled flood levels along the Brothock Water, are shown in Appendix B – 1 for 2, 5, 10, 20, 50, 100, 200, 500, & 1000yr events and Appendix B – 2 for the same suite of events with an allowance for climate change for the main watercourse cross sections within the model (including the various tributaries of the Brothock Water).

Maximum flood depths and extents throughout the 2D domain are shown in Figures 5 – 13 in Appendix A for the modelled events. No flooding in Arbroath is observed during the 2, 5, and 10yr events i.e. existing walls are not predicted to overtop. The baseline modelling shows that the existing flood walls along the Brothock Water would start to overtop between a 1:10 and 1:20yr event. However, the effective current standard of protection of the existing defences would be lower than this, as a freeboard allowance would need to be applied to the existing defences. The event at which the existing walls begin to overtop is slightly higher than that reported in the AFS study (reported at around a 1:5 - 1:10yr event), and this is because the Harbour Culvert has now been removed, which has increased the channel capacity through Arbroath slightly, the gate gaps at Marketgate have been filled, which prevents premature escape of flood water from the channel.

Maximum flood depths throughout the 2D domain are shown on Figure 12 in Appendix A for the 200yr + climate change event. Whilst all with climate change events have been modelled only the 1:200yr + climate change event mapping has been included in the report.

The key points of the baseline modelling results can be summarised as follows: -

- 1:2yr return period event – some limited flooding in the fields at Brothock Meadows, but mainly associated with the drainage ditch to the east of the main channel. Some flooding of the Golf Course in the middle of the Letham Grange Estate. Some flooding in an area of low lying woodland just upstream of the proposed St Vigeans Storage Area. Flooding of the low lying part of the west side of the proposed St Vigeans Storage Area. No flooding in Arbroath.

- 1:5yr return period event – more widespread flooding of the low lying fields either side of the main channel at Brothock Meadows. Extensive flooding of the Golf Course in the middle of the Letham Grange Estate, and flooding in the northern part of the estate just downstream of Brothock Meadows. Flooding in an area of low lying woodland just upstream of the proposed St Vigeans Storage Area. Shallow flooding of the both the east and west sides of the proposed St Vigeans Storage Area. No flooding in Arbroath.

- 1:10yr return period event – only slightly increased flood extents and depths compared to the 1:5yr event for Brothock Meadows, the Golf Course in the middle of the Letham Grange Estate, the northern part of the Letham Grange Estate, and the proposed St Vigeans Storage Area. No flooding in Arbroath.

- 1:20yr return period event - only slightly increased flood extents and depths compared to the 1:10yr event for Brothock Meadows, the Golf Course in the middle of the Letham Grange Estate, the northern part of the Letham Grange Estate, and the proposed St Vigeans Storage Area. Widespread flooding would begin to occur in Arbroath, including extensive flooding of the industrial area between Dens Road and Wardmill Road, with these flood waters overtopping at the low point at Guthrie Port and along the railway line and into the area around the Morrison's Supermarket. These out of channel flows would continue to cascade through Arbroath to flood areas around Lindsay Street, Hume Street, and West John Street. Further out of channel flows would occur downstream of Burnside Drive causing extensive flooding in the central part of Marketgate, Ladybridge Street, across Burnside Drive, and affecting properties in Grimsby Place and East Mary Street.

- 1:50yr return period event - only slightly increased flood extents and depths compared to the 1:20yr event for Brothock Meadows, the Golf Course in the middle of the Letham Grange Estate, the northern part of the Letham Grange Estate, and the proposed St Vigeans Storage Area. Widespread flooding would be occurring in Arbroath, including extensive flooding of the industrial area between Dens Road and Wardmill Road, with these flood levels being around 100 – 150mm above the 1:20yr levels. These flood waters would overtop the low point at Guthrie Port and along the railway line and into the area around the Morrison's Supermarket and the Supermarket building itself. These out of channel flows would continue to cascade through Arbroath to flood areas around Lindsay Street, Hume Street, and West John Street, and would combine with direct out of channel flows from these areas. Further out of channel flows would occur downstream of Catherine Street Bridge causing more extensive flooding than the 1:20yr event, and causing flooding in the Bus Station, Gravesend, the east end of Millgate, Brothock Mill Place, Chalmers Street, the Shore, and more extensive flooding in Marketgate and Ladybridge Street, in addition to the flooding noted above for the 1:20yr event.

- 1:100 & 1:200yr return period events – are similar to the 1:50yr return period event with slightly increased flood extents and increasing flood depths in all areas

4.3.2 Coastal Flooding Local to the Brothock Water Channel

There is limited coastal flooding due to direct inundation from extreme sea levels in Arbroath due to the relative height of the land along the coast. There is some relatively minor flood inundation of the quaysides at the Harbour from a 1:5yr event or greater, but this floodwater does not move inland away from the low level quaysides. There is also a short length of road at the far end of Victoria Park ((this area is a 150m section of Kings Drive centred around the access road between Cliffburn Road and Kings Drive), which starts to inundate at a 1:100yr + climate change extreme sea level, but again the land immediately behind this area gradually rises so the inundation is limited to the road immediately behind the seawall. Therefore, the main potential flood risk along the coast is due to

wave overtopping, which is not the subject of the Arbroath BWFPS and has been reported previously in the AFS study

4.4 Sensitivity Analysis

A sensitivity analysis was undertaken to determine the impact of variations in model parameters on predicted flood levels throughout the study area. There can be some uncertainty associated with hydraulic modelling, particularly for a study where a combined 1D-2D modelling approach is being used to predict flood levels. Although the main component of the model (1D ISIS model) has been verified (refer to Section 3.10) and is considered to be relatively representative of free flow and surcharged flow conditions within the Brothock Water channel in Arbroath, it is still considered important to assess the potential uncertainties involved with the hydraulic model. The main controlling factors on a hydraulic model are: -

- Inflows (tests on +10% and + 20% on inflows),
- Downstream Boundary (test on +0.5m on downstream boundary condition),
- Manning's Roughness Coefficients (tests on + / -20% on Manning's n values),
- Structure Blockages (tests on 50% blockage at key bridges / culverts on the Brothock Water including: - Brothock Meadows Road Bridge, St Vigeans Stone Arch Bridge, Whittons Carpets Culvert, Morrisons Culvert, & Catherine Street Bridge).

All sensitivity tests were completed on the 1:200yr return period baseline model as this is the design event for the FPS. The full results of the sensitivity analysis are given in Appendix B-3, and a summary of these results is provided below.

4.4.1 Inflows

The flow estimates for the Brothock Water are based on a comprehensive hydrological analysis (refer to Section 2.2) and therefore it is considered that an appropriate level of confidence can be placed on the design flows used for this study. However, it was considered prudent to test the model for inflows of +10% and +20% to see what affect this had on flood levels. This latter test (+20%) also represents the potential effects of climate change, as this is the climate change allowance figure discussed with SEPA for fluvial flows.

The results (refer to Appendix B - 3) for the +10% inflow show that the model is slightly sensitive to the change in inflow, showing an average change in predicted flood levels in the order of +65mm with an overall range of +0 – 280mm. At the proposed Brothock Meadows Storage Area the average change in predicted flood level is +60mm, whilst at the proposed St Vigeans Storage Area the average change in predicted flood level is +40mm. The average change in the predicted flood level between the storage areas in the upper part of the Letham Grange Estate (incl. the Golf Course) is +60mm. The average change in the predicted flood level between the storage areas in the lower part of the Letham Grange Estate is +170mm, and this seems to be due to additional storage being used up in this area. The average change in the predicted flood level within Arbroath (i.e. from the Gauging Station to the outlet to the sea) is +50mm with an overall range of +10 – 90mm. The changes in the flood extents in the 2D domain are very slight throughout the catchment, with the flood levels in the 2D domain increasing by similar amounts to those described above for the 1D results.

The results (refer to Appendix B - 3) for the +20% inflow show that the model is moderately sensitive to the change in inflow, showing an average change in predicted flood levels in the order of +120mm with an overall range of +0 – 500mm. At the proposed Brothock Meadows Storage Area the average change in predicted flood level is +105mm, whilst at the proposed St Vigeans Storage Area the average change in predicted flood level is +75mm. The average change in the predicted flood level between the storage areas in the upper part of the Letham Grange Estate (incl. the Golf Course) is +120mm. The average change in the predicted flood level between the storage areas in the lower part of the Letham Grange Estate is +305mm, and this seems to be due to additional storage being used up in this area. The average change in the predicted flood level within Arbroath (i.e. from the Gauging Station to the outlet to the sea) is +90mm with an overall range of +10 – 165mm. The changes in the flood extents in the 2D domain are very slight throughout the catchment, with the flood levels in the 2D domain increasing by similar amounts to those described above for the 1D results.

4.4.2 Downstream Boundary

The downstream boundary was initially set as a stage hydrograph (time variant wave) in the model, to represent the variation of the extreme sea level component with time. The sensitivity of the predicted model results to the downstream boundary has been considered by using a time variant wave with a level +0.5m on the level required by the joint probability analysis at the downstream end of the model.

The results (refer to Appendix B - 3) for the +0.5m on the downstream boundary show that the model is relatively insensitive to this change in most of the reaches, showing an average change in predicted flood levels in the order of +6mm with an overall range of -150 - +500mm (with the +500mm being at the very downstream end of Arbroath). At the proposed Brothock Meadows Storage Area the average change in predicted flood level is 0mm, whilst at the proposed St Vigeans Storage Area the average change in predicted flood level is +1mm. The average change in the predicted flood level between the storage areas in the upper part of the Letham Grange Estate (incl. the Golf Course) is +1mm. The average change in the predicted flood level between the storage areas in the lower part of the Letham Grange Estate is +5mm. These very minor changes are likely to be caused by "modelling noise" in response to a change in a parameter. The average change in the predicted flood level within Arbroath (i.e. from the Gauging Station to the outlet to the sea) is +35mm, with no effects between the Gauging Station to the end of the old Harbour Culvert and a gradually increasing effect from +100 – 500mm from the end of the old Harbour Culvert to the outlet to the sea. The changes in the flood extents in the 2D domain are negligible throughout the catchment, with the flood levels in the 2D domain in Arbroath increasing by similar amounts to those described above for the 1D results.

4.4.3 Manning's Roughness Coefficients

The Manning's n values used in the modelling for the channel have been validated through the verification of the ISIS 1D model (Section 3.10). However, there is always a degree of uncertainty in terms of adopted values under flooding conditions, i.e. when 1-dimensional (ISIS) and 2-dimensional (TUFLOW) flooding processes are interacting. This is particularly true with the 2D (TUFLOW) domain of the model since the Manning's n values selected (refer to Table 16) are a best estimate and have not been subject to model verification. As a result a sensitivity analysis has been undertaken to consider a +/-20% change in Manning's n values for the 1D domain and for the 2D domain / floodplain.

The results (refer to Appendix B - 3) for the -20% on the manning's n values show that the model is slightly sensitive to this change in most of the reaches, showing an average change in predicted flood levels in the order of -80mm with an overall range of -375 - +190mm. At the proposed Brothock Meadows Storage Area the average change in predicted flood level is -70mm, whilst at the proposed St Vigeans Storage Area the average change in predicted flood level is -60mm. The average change in the predicted flood level between the storage areas in the upper part of the Letham Grange Estate (incl. the Golf Course) is -70mm. The average change in the predicted flood level between the storage areas in the lower part of the Letham Grange Estate is -240mm. The average change in the predicted flood level within Arbroath (i.e. from the Gauging Station to the outlet to the sea) is -50mm, with an overall range of -160 - + 10mm. The changes in the flood extents in the 2D domain are very slight throughout the catchment, with the flood levels in the 2D domain decreasing by similar amounts to those described above for the 1D results (on average 40-80mm).

The results (refer to Appendix B - 3) for the +20% on the manning's n values show that the model is slightly sensitive to this change in most of the reaches, showing an average change in predicted flood levels in the order of +65mm with an overall range of -22 - +280mm. At the proposed Brothock Meadows Storage Area the average change in predicted flood level is +60mm, whilst at the proposed St Vigeans Storage Area the average change in predicted flood level is +50mm. The average change in the predicted flood level between the storage areas in the upper part of the Letham Grange Estate (incl. the Golf Course) is +60mm. The average change in the predicted flood level between the storage areas in the lower part of the Letham Grange Estate is +160mm. The average change in the predicted flood level within Arbroath (i.e. from the Gauging Station to the outlet to the sea) is +40mm, with an overall range of 0 - + 120mm. The changes in the flood extents in the 2D domain are very slight throughout the catchment, with the flood levels in the 2D domain increasing by similar amounts to those described above for the 1D results.

4.4.4 Structure Blockages

There is a possibility of inlet blockage at some of the key bridges and culverts on the Brothock Water within the catchment and through Arbroath. Although it is acknowledged that there is a trash screen upstream of Arbroath (installed as part of the 1985 FPS), which would be expected to trap large woody debris from the upper catchment, there is still a possibility of some of the smaller structures blocking during high flows.

Since blockage at hydraulic structures would be an additional mechanism of fluvial flooding and has the potential to change predicted flood levels, the sensitivity of the baseline modelling to this parameter has been considered. Blockages have been considered at six structures (Brothock Meadows Road Bridge, St Vigeans Stone Arch Bridge, Whittons Carpets Culvert, Morrisons Culvert, Catherine Street Bridge and Hercules Den) where, based on site inspections and photographs, there is considered to be the greatest likelihood of blocking from trash or woody debris during high flows and these are at key points of interest within the catchment in relation to the development of flood storage areas.

50% Blockage at Brothock Meadows Road Bridge

The 1D & 2D results predict that for a 50% blockage of the Brothock Meadows Road Bridge there would be almost no effects on the catchment flooding regime with only a 5 – 10mm reduction in flood levels being experienced on average along the Brothock Water channel. This is because at the 1:200yr event tested the main flood flows are already bypassing this bridge and flowing over a significant length of the adjacent road into the Letham Grange Estate. The model is therefore not sensitive to this effect at the 1:200yr event.

50% Blockage at St Vigeans Stone Arch Bridge

The results predict that for a 50% blockage of the St Vigeans Stone Arch Bridge there would be no effect on the predicted flood levels at Brothock Meadows, a very minor effect on the predicted flood levels in the Letham Grange Estate (in the order of +3 – 12mm), a slightly more significant effect on the predicted flood levels at the proposed St Vigean's Storage Area (0mm at the upper end increasing to + 170mm at the lower end), and very minor effect on the predicted flood levels through Arbroath of + 0 – 10mm. The model is therefore slightly sensitive to this effect at the 1:200yr event, but only for the proposed St Vigeans storage area. The changes in the flood extents in the 2D domain are negligible throughout the catchment, with the flood levels in the 2D domain increasing by similar amounts to those described above for the 1D results, but with the model predicting that the increase in flood levels at the proposed St Vigean's Storage Area is restricted to the west side of the old railway embankment.

50% Blockage at Whittons Carpets Culvert

The results predict that for a 50% blockage of the Whittons Carpets Culvert there would be no significant effect on the predicted flood levels at Brothock Meadows, the Letham Grange Estate, or the proposed flood storage area at St Vigeans (i.e. nothing more than + / -10mm). Within Arbroath there is a gradual increase in predicted flood levels in the 1D model from +10 – 110mm from the Gauging Station down to the entrance to the Whittons Carpets Culvert, and then a reduction in predicted flood levels from this point downstream. This indicates slightly more flood water would exit into the 2D domain between Dens Road and Wardmill Road increasing flood levels slightly in this area. The model is therefore slightly sensitive to this effect at the 1:200yr event, but only for the upper part of Arbroath. The changes in the flood extents in the 2D domain are negligible throughout the catchment, with the flood levels in the 2D domain increasing in Arbroath by around 20 – 140mm.

50% Blockage at Morrisons Culvert

The results predict that for a 50% blockage of the Morrison's Culvert there would be no significant effect on the predicted flood levels at Brothock Meadows, the Letham Grange Estate, or the proposed flood storage area at St Vigeans (i.e. nothing more than + / -10mm). Within Arbroath there is a gradual increase in predicted flood levels in the 1D model from +10 – 300mm from the Gauging Station down to the entrance to the Morrison's Culvert, and then a reduction in predicted flood levels from this point downstream. This indicates slightly more flood water would exit into the 2D domain between Dens Road and Wardmill Road increasing flood levels slightly in this area. The model is therefore slightly sensitive to this effect at the 1:200yr event, but only for the upper part of Arbroath.

The changes in the flood extents in the 2D domain are negligible throughout the catchment, with the flood levels in the 2D domain increasing by around 20 – 100mm in Arbroath.

50% Blockage at Catherine Street Bridge

The results predict that for a 50% blockage of the Catherine Street Bridge there would be no significant effect on the predicted flood levels at Brothock Meadows, the Letham Grange Estate, or the proposed flood storage area at St Vigeans (i.e. nothing more than + / -10mm). Within Arbroath there is a gradual increase in predicted flood levels in the 1D model from +0 – 310mm from the Gauging Station down to Catherine Street Bridge, and then a reduction in predicted flood levels from this point downstream. This indicates slightly more flood water would exit into the 2D domain between the downstream end of the Morrison's Culvert and Catherine Street Bridge increasing flood levels slightly in this area. The model is therefore slightly sensitive to this effect at the 1:200yr event, but only for the middle part of Arbroath. The changes in the flood extents in the 2D domain are negligible throughout the catchment, with the flood levels in the 2D domain increasing by 10 - 300mm in Arbroath with the +100 – 300mm values occurring in the area immediately upstream of the Catherine Street Bridge.

50% Blockage at Hercules Den

The results predict that for a 50% blockage of the Hercules Den Culvert there would be no significant effect on the predicted flood levels at Brothock Meadows and the Letham Grange Estate, with only minor increases at the proposed flood storage area at St Vigeans (in the order of 16mm). Water levels are increased immediately downstream of the storage area on the Hercules Burn by approximately 100mm as the storage is used up more quickly, allowing increased flow over Kirkton Road. Within Arbroath, predicted flood levels in the 1D model are increased by between 7mm and 3mm from the Gauging Station down to the tidal outfall. This indicates that slightly more flood water would exit into the 2D domain, increasing flood levels slightly in this area. The model is therefore slightly sensitive to this blockage at the 1:200yr event in Arbroath.

5. With Scheme Modelling

5.1 Overview

To create the with scheme model, a version of the baseline model was updated with the proposed storage areas and walls in Arbroath. Further details of the representation of these features of the proposed FPS are provided in Section 5.2 below and Figure 15 in Appendix A.

The preliminary with scheme model was then subject to several tests and analysis to determine the effects of various features of the storage areas including the sizes of the flow controls, size, number, and position of the transfer culverts under the existing railway embankment at St Vigeans and embankment elevations. This preliminary scheme model was then modified alongside the engineering development of the FPS to arrive at a final scheme model.

In order to provide protection to the 1:100yr event, storage areas at Brothock Meadows and St. Vigeans are required as well as work to the walls in Arbroath. To increase the level of protection to the 1:200yr event, an additional storage area at Hercules Den is required. Wall levels in Arbroath remain consistent between the two options.

5.2 Representation of FPS in the Model

The following sections detail the modifications made after determining appropriate structure sizing based on the preliminary model. Scheme notification drawings can be found in Appendix C.

5.2.1 Proposed Brothock Meadows Storage Area

A z-line was used to represent the storage area embankment running parallel to the existing road at Letham Grange, and this was placed along the exact alignment displayed in the Outline Design drawings. The z-line is vertical and was placed at the upstream toe of the embankment slope, and is therefore slightly conservative as it ignores the very small amount of storage available against the slope of this embankment. This loss is not considered significant as this would be a small fraction of the overall storage volume. For the scheme design runs, the z-line was set at an elevation of 30mAOD, a height above which flood levels would not reach as the lowest spillway would be set at the 1 in 200yr peak level. A variety of spillway elevations and lengths were run to establish the most efficient storage area and these embankment elevations were used in events exceeding the design event i.e. the 1 in 500yr event. The outfall of the storage area was modelled as a rectangular culvert has been introduced in the ISIS 1D model on the main channel and this has been sized to restrict the flows passing downstream and thus create the storage required. A number of model runs were carried out to test the size of culvert required to achieve the desired flood storage / flood level in the storage area, as a balance with the flood storage / flood level at the proposed St Vigeans Storage Area. The size of the rectangular culvert is 0.9m wide x 0.9m high, and 16m in length so that is runs the full width of the storage embankment. The culvert has been reduced from the preliminary design to maximise storage at Brothock Meadows. At the culvert outlet, there is a small section of open channel before the existing road bridge 100m downstream of the storage embankment.

5.2.2 Proposed St. Vigeans Storage Area

A z-line was used to represent the storage area embankment, and this was placed along the alignment selected in the Outline Design drawings at Kirkstyle. The z-line is vertical and was placed at the upstream toe of the embankment slope, and is therefore slightly conservative as it ignores the storage available against the slope of this embankment. This loss is not considered significant as this would be a small fraction of the overall storage volume. The z-line is set at 20mAOD, a height above which flood levels will reach. An orifice has been introduced to the 1D model on the main channel to restrict flows passing downstream and thus create the storage required. Several model runs were carried out to test the size of the orifice required to achieve the desired flood storage / flood level in the storage area. A bore area of 6m^2 was calculated as most efficient. The orifice was set at existing bed level.

In addition to the storage are outfall, a series of culverts have been inserted in the model to transfer flood water through the existing railway embankment to ensure that the two sides of the proposed St Vigeans Storage Area fill and empty in a reasonably equal manner. A variety of culvert sizes, locations, and numbers were tested to achieve equalisation of water levels on either side of the storage area, and the arrangement consists of 6 rectangular culverts at 1.5m wide by 0.75m high located in a group approximately 40m upstream of the orifice.

Defences around the houses at Lauriebank, which were included in the preliminary design, were included to allow St. Vigeans storage area to fill to an increased depth, reducing flow in town. The walls have since been removed from the proposed St. Vigeans scheme. The proximity of the houses to Brothock Water meant that defences would have had to be constructed to the PMF event, making them prohibitively high and unlikely to be granted planning.

5.2.3 Proposed Hercules Den Storage Area

The two storage areas outlined in section 5.2.1 and 5.2.2, along with town wall works in Arbroath protect to the 1:100yr event. In order to provide protection to the 1:200yr event, an additional storage area on Hercules Burn is required.

The recreational ground at Hercules Burn currently floods and could provide a suitable additional storage area. Baseline flooding patterns show that flow is throttled at the culvert underneath Kirkton Road, spilling along Park View and over Kirkton Road before spilling back into the channel. To provide the required level of protection in town, it is proposed that part of the Hercules Burn flow is held back, increasing lag and reducing peak flow.

Two z-lines were used to create a storage area at Hercules Den by blocking the two flow pathways along Park Road and across Kirkton Road. Both z-lines are placed at the upstream toe of the embankment slope, and are therefore slightly conservative. To ensure the embankment along the southern edge of Park Road acted as a total barrier to flow, the z-line was set at 20mAOD (approximately 2m above existing ground level). The second embankment runs perpendicular to the channel across a low lying section where Hercules Burn flows under Kirkton Road. A variety of elevations were applied to the z-line to optimise the volume flowing over Kirkton Road. The optimal elevation to reduce flows in town whilst minimising flood extent at Hercules Den was 19.5mAOD. The ISIS 1D culvert dimension remain as existing, with a 1210mm circular culvert in place.

5.2.4 Arbroath Town Walls

The existing walls in Arbroath have been altered (principally by change in their elevation, where this is required) to ensure the containment of flood water within the channel up to and including the 1:200yr return period event.

5.2.5 2D Domain Review in Storage Areas

Whilst the LIDAR data has generally been found to provide a satisfactory representation of the topography for catchment scale modelling, it was deemed necessary to perform a specific check on the ground levels in each of the storage areas to ensure that the with scheme modelling was accurately representing the storage potential in these areas and thus the pass forward flow would also be accurately modelled. To enable this, a cross check topographic survey was carried out consisting of cross sections across each storage area at regular intervals. This information together with the survey information gathered for the area around the footprint of the embankments was compared to the LIDAR data and a difference grid was generated in MAPINFO. A review of this difference grid was undertaken, and this identified some areas within each storage area where the LIDAR data was not an accurate representation of the ground levels. The LIDAR data in these localised areas was adjusted using the survey data, and the finalised LIDAR data was adopted for the with scheme modelling.

5.3 Critical Storm Check

The 2yr and 200yr events were run for the scheme model across a range of storm durations to find the critical storm duration/s i.e. that which produces the highest flow at the gauge and that which produces the highest levels at the storage areas as this can be different to the critical storm duration

in the baseline scenario. Critical durations are likely to be longer after the introduction of attenuation in the catchment. The following tables summarise the analysis for these two return periods.

Table 5-1: Summary of 2yr Return Period Critical Storm Analysis

Storm Duration (hrs)	Arbroath Gauge Station Peak Flow (m3/s)	Brothock Meadows Peak Level (mAOD)	St Vigean's Peak Level (mAOD)	Hercules Den Peak Level (mAOD)
10	9.711	22.837	12.851	16.84
12	10.001	22.841	12.865	16.83
14	10.058	22.84	12.868	16.782
16	10.064	22.838	12.869	16.734
18	10.028	22.835	12.866	16.683

Table 5-2: Summary of 200yr Return Period

Storm Duration (hrs)	Arbroath Gauge Station Peak Flow (m3/s)	Brothock Meadows Peak Level (mAOD)	St Vigean's Peak Level (mAOD)	Hercules Den Peak Level (mAOD)
17	21.786	24.758	13.789	19.576
19	21.838	24.807	13.792	19.577
21	21.846	24.850	13.796	19.576
23	21.945	24.88	13.798	19.574
25	21.982	24.914	13.797	19.570
27	21.972	24.942	13.793	19.567
29	21.915	24.960	13.789	19.563
31	21.856	24.959	13.784	19.559

The critical storm duration for the catchment was found to vary slightly in the 2yr event between the 10 – 16hr storm duration. The difference between these in terms of peak flow and peak level in the storages is very small, and the 14hr storm can be taken as a suitable critical storm for this return period. The critical storm duration for the catchment was found to also vary in the 200yr event between the 19 – 29hr storm duration. The difference between these in terms of peak flow and peak level in the storages is very small, and the 25hr storm can be taken as a suitable critical storm for this return period.

The variation in flow and stage between the storm events for both events was minimal, demonstrating that the scheme is not sensitive to changes in critical duration, For this reason, a 20h storm duration was selected as the median and applied to all return periods between the 2 and 200yr events.

5.4 Model Results

The output from the 1D domain (ISIS model), i.e. the modelled flood levels along the Brothock Water, are shown in Appendix B – 4 for 2, 5, 10, 20, 50, 100, 200, and 500yr events.

Maximum flood depths and extents throughout the 2D domain are shown in Figures 16– 18 in Appendix A for the 2yr, 200yr, & 500yr events. No flooding is experience in Arbroath up to and including the 200yr design event since the FPS will prevent flooding during these events. The flood walls along the Brothock Water would start to overtop between beyond a 1:200yr event, hence the inclusion of a 500yr event to show above design event flooding for the flood damages assessment.

The key points of the with-scheme modelling results can be summarised as follows: -

- 1:2yr return period event – Brothock Meadows and St Vigeans begin to store water during the 1 in 2yr event, whilst Hercules Den remains largely dry. Flooding is predominately limited to the storage areas in all but a few sections. The areas where flooding is noted out-with the scheme areas are along the Magungie Burn at Letham Grange and an isolated pocked on the Hercules Burn downstream of the proposed embankment. No flooding is observed in Arbroath town centre.

  Compared to the baseline conditions, flooding is only increased in Brothock Meadows storage area and is significantly reduced in the St. Ninian's Hill area with flow now contained in bank. Flood depths in St. Vigeans storage area are also reduced due to increased attenuation upstream. Flooding remains unchanged in Arbroath.

- 1:5yr return period event – All storage areas are utilised in the 1 in 5yr event with increased depths and extents compared to the 1 in 2yr event. Flooding is largely located in the same areas as discussed in the previous return period with the exception of a significant area now flooded at St Ninian's Hill. No flooding is observed in Arbroath town centre.

  Compared to the baseline flooding, depth and extent is increased in Brothock and Hercules Den storage areas, with reductions in flooding seen on the left hand bank of St Vigeans storage area due to the overall reduction in flow as a result of Brothock Meadows storage. Other areas experiencing a reduction in depth and extent are St. Ninian's, the area immediately downstream of Brothock Meadows embankment and properties along Park View. Flooding remains unchanged in Arbroath.

- 1:10yr return period event – Only minor increases to extent are evident when compared to the 1 in 5yr event. There are no notable new areas of flooding. No flooding is observed in Arbroath town centre.

  The 1 in 10yr event displays the same differences between the pre and post scheme simulations as the 1 in 5yr event. Properties along Park View are now protected. Flooding remains unchanged in Arbroath.

- 1:20yr return period event – Significant extents are experienced in all storage areas with other notable flooding occurring in largely the same areas identified in the 1in 10yr event. The left hand side of St.Vigeans storage area is now being utilised and ponding is observed immediately downstream of Brothock Meadows embankment. No flooding is observed in Arbroath town centre.

  Compared with baseline flooding, Brothock Meadows and Hercules Den remain the only two areas where depths have increased, with reductions still present at Letham Grange, St Ninian's, St Vigeans and Park View. Properties along Park View are protected and major flooding observed in Arbroath town centre is eradicated in the post scheme simulation.

- 1:50yr return period event – No significant changes to flooding pattern from the 1 in 20yr event with flood depths in the storage areas increased by approximately 300mm. No flooding is observed in Arbroath town centre.

  Compared with the baseline, increased depths are observed in all storage areas and reduced depths are evident in all other notable areas of flooding. No flow pathways exist across Kirkton Road or parallel to the railway at Warddykes which existed in the baseline scenario. Properties along Park View are protected and major flooding observed in Arbroath town centre is eradicated in the post scheme simulation.

- 1:100yr return period event – No significant changes to flood extents from the 1 in 50yr event with flood depths in the storage areas increased by approximately 250mm. No flooding is observed in Arbroath town centre.

  Compared with the baseline flooding, the scheme is still providing a decrease in depths and extents out-with the storage areas. No flow pathways exist across Kirkton Road or parallel to the railway at Warddykes which existed in the baseline scenario. Properties along Park View are now protected and major flooding observed in Arbroath town centre is eradicated in the post scheme simulation.

- 1:200yr return period event - No significant changes to flood extents from the 1 in 100yr event with the exception of a controlled spill over Kirkton Road from Hercules Den. Flood depths in the storage areas increased by approximately 200mm compared to the 1in 100yr event. No flooding is observed in Arbroath town centre.

  Compared with the baseline flooding, the scheme is still providing a decrease in depths and extents out-with the storage areas. A reduced volume is seen to flow across Kirkton Road and parallel to the railway at Warddykes when compared to the baseline run. Properties along Park View are now protected and major flooding observed in Arbroath town centre is eradicated in the post scheme simulation.

- 1:500yr return period event - Some increases to flood extent are seen around the dismantled railway at Brothock Meadows, with levels increased by approximately 400mm from the 1 in 200yr event. Extents and depths in the St. Vigeans storage area remained comparable to the 1 in 200yr event, with an increase in depth of 150mm. Flooding is increased by 100mm on average in Hercules Den storage area. Given the scheme is designed to the 1 in 200yr event, flooding is observed throughout Arboath, originating primarily from the Demondale area, before spilling onto the A92, Guthrie Drive and the surrounding streets.

  Compared with the baseline flooding, the scheme is still providing a decrease in depths and extents out-with the storage areas. A slight increase in depths exists across Kirkton Road, although properties along Park View are now protected. The flow pathway parallel to the railway at Warddykes which existed in the baseline scenario is reduced and a notable reduction in depths of up to 600mm is observed through the town.

5.5 Structure Blockages

Blockage scenarios were considered at the Borthock Meadows culvert and the Hercules Den culvert. The oversized orifice arrangement at St Vigeans was not considered a significant blockage risk due to the large bore area and blockage sensitivity analysis was not undertaken.

5.5.1 Brothock Meadows Culvert

The results predict that for a 50% blockage of the Brothock Meadows Culvert there would be an increase in predicted flood levels at Brothock Meadows. Levels would be increased by approximately 300mm, where flow is now seen to flow over the lowest spillway. Flood levels in the Letham Grange Estate and St. Vigeans storage area are reduced in the order of 200mm as more floodwater is contained in Brothock Meadows. Within Arbroath, predicted flood levels in the 1D model are decreased by between 65mm and 24mm from the Gauging Station down to the tidal outfall. Water is contained within channel during the 1 in 200yr event so this reduction does not impact 2D flood extent and levels. The model is moderately sensitive to this blockage at the 1:200yr event in Arbroath.

5.5.2 Hercules Den Culvert

The results predict that for a 50% blockage of the Hercules Den Culvert there would be an increase in the predicted flood levels at Hercules Den storage area of approximately 130mm. Water levels are also seen to increase by approximately 20mm in St. Vigeans Storage area as a result of backwater effect from the confluence. Within Arbroath, predicted flood levels in the 1D model are increased by between 350mm and 100mm from the Gauging Station down to the tidal outfall. This rise in flood level

would however be contained within the freeboard allowance of the defences in Arbroath. The model is seen to be sensitive to a blockage at Hercules Den. A screen will therefore be installed at the culvert inlet to reduce any risk of blockage.

5.5.3 Wardmill Road Bridge

The results predict that for a 50% blockage of Wardmill Road Bridge there would be an increase in predicted flood levels of approximately 65mm immediately upstream of the bridge when compared to the no blockage scenario. The increase in channel water level as a result of the blockage is seen to extend approximately 450m upstream. Water levels downstream of Wardmill Bridge are reduced by approximately 4mm. Very minor increases to flood extents as a result of the blockage at Wardmill Road Bridge are observed on the left hand bank in an existing grassland area. The model is not sensitive to blockage at the 1 in 200yr event and this location.

5.5.4 Morrison's Culvert

The results predict that for a 50% blockage of the Morrison's culvert there would be an increase in predicted flood levels of approximately 600mm immediately upstream of the culvert when compared to the no blockage scenario. The increase in channel water level as a result of the blockage is seen to extend 900m to the railway bridge at Warddykes, where an increase of 5mm is observed. Water levels downstream of the Morrison's culvert are reduced by approximately 190mm. During the no blockage scenario, no spill is observed during the 1 in 200yr event. With a 50% blockage of the Morrison's culvert, spill is now observed 200m upstream of the culvert inlet on both banks, with flood waters ponding temporarily behind Guthrie Port. Spill then travels down Burnside Drive, ponding either side of the channel around East Mary Street, Marketgate and Burnside Drive. The model is sensitive to blockage at the 1 in 200yr event and this location. This sensitivity will be built into the freeboard calculations.

5.5.5 Brothock Road Bridge

The results predict that for a 50% blockage of Brothock Bridge there would be an increase in predicted flood levels of approximately 550mm immediately upstream of the bridge when compared to the no blockage scenario. The increase in channel water level as a result of the blockage is seen to extend to Hume Street, where an increase of 18mm is observed. Minor increases in the order of 5-15mm are experienced up to Guthrie Port. Water levels downstream of Brothock Bridge are reduced by approximately 40mm. During the no blockage scenario, no spill is observed during the 1 in 200yr event. With a 50% blockage of the Brothock Bridge, spill is now observed from the upstream face of the Burnside Drive Bridge, with flow travelling down the road and ponding around East Grimsby, Burnside Drive and East Mary Street. Some flow is seen to re-enter the channel upstream of Ladybridge Street. The model is moderately sensitive to blockage at the 1 in 200yr event and this location. This sensitivity will be built into the freeboard calculations.

5.5.6 Old Shore Road Bridge

The results predict that for a 50% blockage of the Old Shore Road bridge there would be an increase in predicted flood levels of approximately 1m immediately upstream of the bridge when compared to the no blockage scenario. The increase in channel water level as a result of the blockage is seen to extend to Hume Street, where an increase of 30mm is observed. Minor increases in the order of 10-20mm are experienced up to the gauge at Wardmill Road. Water levels downstream of Old Shore Road Bridge are reduced by approximately 80mm. During the no blockage scenario, no spill is observed during the 1 in 200yr event. With a 50% blockage of the Old Shore Road Bridge, extensive spill is now observed in the southern areas of Arbroath around Burnside Drive and Margetgate. Defence overtopping is seen to first occur between Old Shore Road and Ladybridge Street on the left hand bank, before then also spilling upstream of Ladybridge Street on the right hand bank and at the Burnside Drive Bridge. The model is sensitive to blockage at the 1 in 200yr event and this location. This sensitivity will be built into the freeboard calculations.

5.6 Reservoir Design Flood Events

A series of exceedance events were run to assess flows and velocities over the spills in an extreme event to inform embankment design and protection requirements. The critical durations for the 10,000yr and PMF events were determined for the Brothock Meadows and St Vigeans storage areas using the spill elevations and widths specified in section 5.6.1 and 5.6.2. The PMF event at St. Vigeans takes into account the routing effect of Brothock Meadows storage area.

The works at Hercules Den do not constitute a reservoir. The embankment at Kirkton Road, creating the storage area at Hercules Den, will not be materially altered from existing levels with relatively minor works being undertaken along the lateral embankment at Park View. An assessment of reservoir design flood events at the Hercules Den storage area is therefore not required.

5.6.1 Brothock Meadows

The spill at Brothock Meadows has been divided into two elevations (upper and lower) in order to provide a more controlled release of water during events exceeding the 1 in 200yr. During the PMF event, both spills are utilised, extending a total width of 175m. Figure 5-1 demonstrates the routing effect of the storage areas at Brothock Meadows during the PMF event.

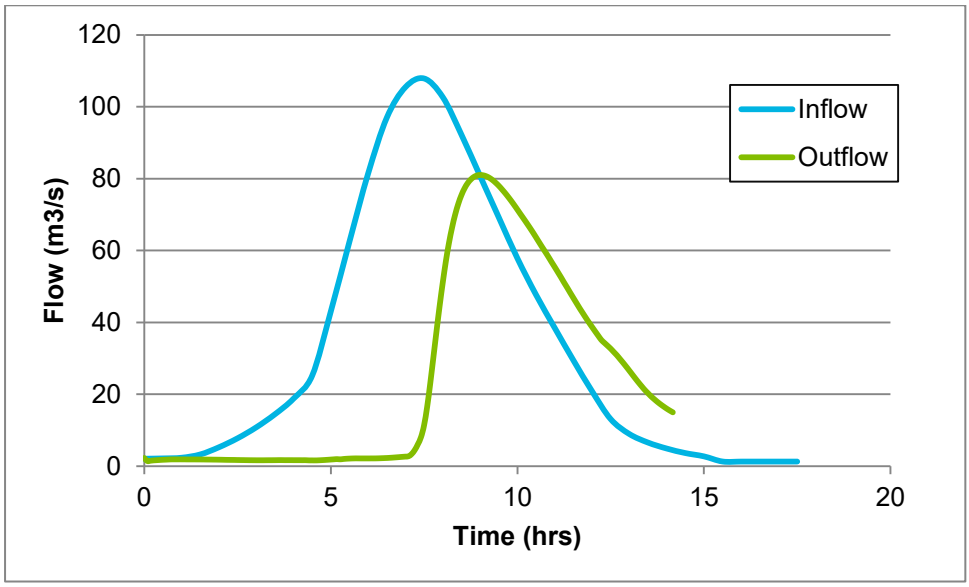


Figure 5-1: Inflow and outflow at Brothock Meadows during the PMF event

Key parameters were extracted from the model for the 1 in 10,000yr and PMF events and are shown in Table 5-3. Both runs utilised the spill arrangement detailed in section 5.6.1 with a critical storm duration calculated iteratively for each. Velocities on the downstream face of the embankments are seen to reach a maximum of 4.25m/s during the PMF event.

Table 5-3: Key flow parameters over the spills at Brothock Meadows

	10,000yr Event (17.5h critical duration)	PMF Event (9.5h Summer critical duration)
Peak Flood Level in Reservoir (mAOD)	25.30	25.59
Peak flow over lower spill (50m at 24.8mAOD) (m^3/s)	13.74	27.97
Flow per m width of lower spill (m^3/s)	0.28	0.56
Velocity on downstream face of spill (50m length) (m/s)	3.20	4.25
Peak flow over upper spill (125m at 25.1mAOD) (m^3/s)	9.96	50.26
Flow per m width of upper spill (m^3/s)	0.08	0.40
Velocity on downstream face of spill (125m length) (m/s)	1.95	3.73

5.6.2 St Vigeans

The spill at St. Vigeans has been divided into three elevations (upper, middle and lower) in order to provide a more controlled release of water during events exceeding the 1 in 200yr. During the PMF event, all three spills are utilised, extending a total width of 100m. Figure 5-2 demonstrates the routing effect of the storage area at St. Vigeans during the PMF event.

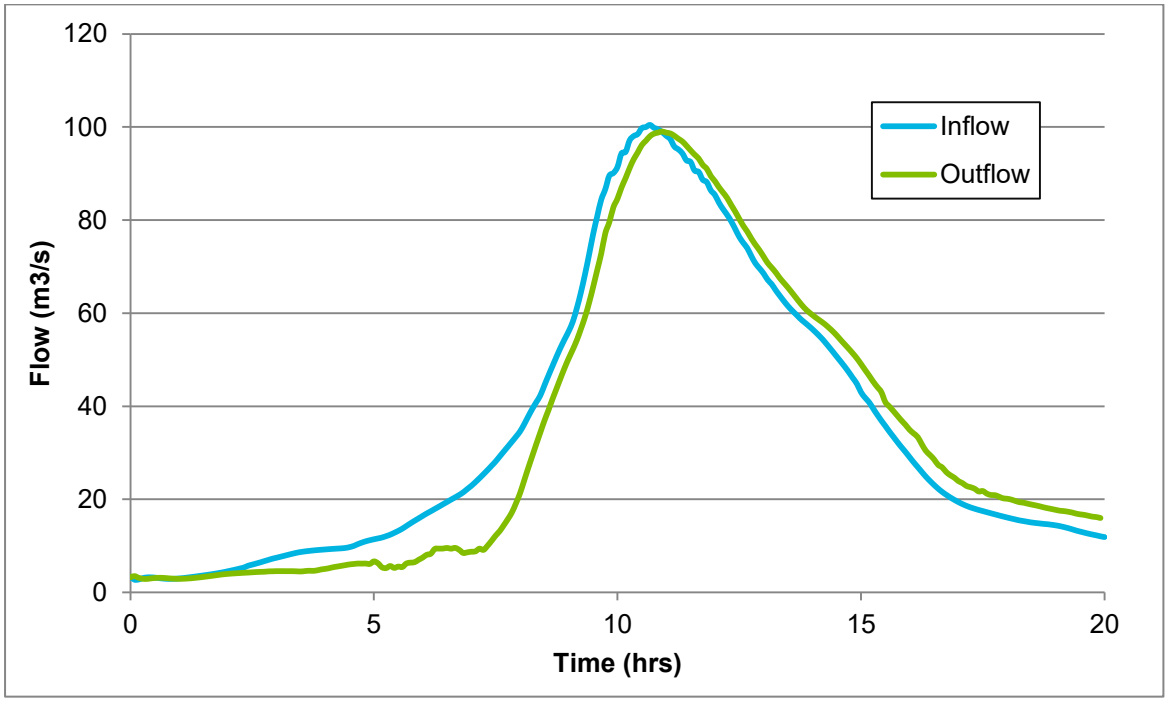


Figure 5-2: Inflow and outflow at St. Vigeans during a PMF event

Key parameters were extracted from the model for the 1 in 10,000yr and PMF events and are shown in Table 5-3. Both runs utilised the spill arrangement detailed in section 5.6.2 with a critical storm duration calculated iteratively for each. Velocities on the downstream face of the embankments are seen to reach a maximum of 5.8m/s during the PMF event.

Table 5-4: Key flow parameters over the spills at St. Vigeans

	10,000yr Event (29.5h critical duration)	PMF Event (10.5h Summer critical duration)
Peak Flood Level in Reservoir (mAOD)	14.394	14.94
Peak flow over lower spill (20m at 13.9mAOD) (m^3/s)	8.83	24.66
Flow per m width of lower spill (m^3/s)	0.44	1.23
Velocity on downstream face of spill (20m length) (m/s)	3.86	5.80
Peak flow over middle spill (40m at 14.2mAOD) (m^3/s)	3.26	23.69
Flow per m width of middle spill (m^3/s)	0.08	0.59
Velocity on downstream face of spill (40m length) (m/s)	1.97	4.35
Peak flow over upper spill (40m at 14.2mAOD) (m^3/s	4.93	41.01
Flow per m width of upper spill (m^3/s)	0.12	1.03
Velocity on downstream face of spill (40m length) (m/s)	2.32	5.41

5.7 Freeboard Allowances on Direct Defences in Town

5.7.1 Physical Processes

The following describes the rationale behind the assessment of the physical processes in the calculation of freeboard. The assessment has been undertaken in accordance with “Fluvial Freeboard Guidance Note, R&D Technical Report W187” by the Environment Agency.

5.7.1.1 Wave Overtopping

Wave surcharge allowance for non-erodible defences (Hard defences)

No allowance for wave surcharge allowance included for hard defences as per guidance.

Wave surcharge allowance for erodible defences (soft defences)

From figure 4.2, wave surcharge allowance estimated as being in the range of 0 to 0.04m. Table 4.3 , worst case factor of 1.13 chosen to give wave surcharge allowance H of 0.0452. From Table 4.4 $0.025 < H < 0.075$ resulting in an actual wave surcharge allowance of 0.05m.

5.7.1.2 Settlement

The assessment of settlement requires some basic information in regard to defence form and ground conditions. At this stage of the project it is not considered reasonable to obtain this information. Therefore, an assessment of settlement has been based on engineering judgement. The following figures could be refined at a later stage once more detailed information on ground conditions and defence form is known.

For non-erodible defences (hard defences) a settlement allowance of 0.05m has been adopted.

For erodible defences (soft defences) a settlement allowance of 0.1m has been adopted.

5.7.1.3 Degradation

The guidance recommends that degradation issues are better dealt with as part of a maintenance regime rather than an additional allowance for freeboard.

Therefore, no allowance has been included for degradation.

5.7.1.4 Cracking and Vermin

Similar to 4.5 Degradation (maintenance regime), and in accordance with the guidance, no allowance has been included for cracking and vermin.

5.7.1.5 Superelevation at Bends

Worst case situation would occur at the rear of the bus station. From Figure 4.5 significance of superelevation falls below curve and hence no allowance for superelevation is necessary. This concurs with JBA's assessment at this location.

5.7.1.6 Boatwash

It is extremely unlikely that boats will be in/on the watercourse.

IN accordance with the guidance no allowance for boatwash adopted.

5.7.1.7 Wind Set-up

The guidance notes that "though these effects can be significant in coastal and tidal situations and in very large lakes and reservoirs, for fluvial rivers their effect is negligible".

Therefore, no allowance has been made for wind set-up.

5.7.1.8 Sedimentation

In accordance with the guidance sedimentation effects should be considered as part of the design flood levels assessment rather than as an arbitrary freeboard allowance. Therefore, no allowance has been made for settlement.

5.7.1.9 Summary

Table 5-5: Summary of physical processes allowances used in the freeboard calculations

Item	Non-erodible (Hard) Defence Freeboard Allowance (m)	Erodible (Soft) Defence Freeboard Allowance (m)
Wave Overtopping	0.00	0.05
Settlement	0.05 *	0.10 *
Degradation	0.00	0.00
Cracking & Vermin	0.00	0.00
Superelevation at bends	0.00	0.00
Boatwash	0.00	0.00
Wind Set-up	0.00	0.00
Sedimentation	0.00	0.00
TOTAL	0.05	0.15

* Figures for settlement could be refined at a later stage when information of defence form and ground conditions is known.

5.7.2 Uncertainty in freeboard calculations

The following describes the method used to determine the uncertainty in the freeboard calculations using the quick method. The assessment has been undertaken in accordance with “Fluvial Freeboard Guidance Note, R&D Technical Report W187” by the Environment Agency.

5.7.2.1 Determining the score for each parameter

The Fluvial Freeboard Guidance Note (Section 5) outlines 6 parameters that need to be considered when assessing the uncertainty in freeboard calculations. A judgement was made about the appropriate score for each parameter based on the descriptions given in the document and used to add an uncertainly allowance to all direct defences throughout Arbroath (Table 5.6).

Table 5-6: Scores for assessing uncertainty in the freeboard calculations

Parameter	Soft Defences Score	Hard Defences Score
Accuracy of hydrological data	1	1
Accuracy of hydrological method	2.5	2.5
Accuracy of hydraulic data	2	2
Accuracy of hydraulic model	1	1
Significance of physical parameters	2	1
Consequence of failure	5	5

5.7.2.2 Freeboard Allowances

Freeboard allowances were calculated at a sample of sections along the urban reach of the Brothock Water, with both physical processes and uncertainty allowances applied. Freeboard allowances for both aspects of the analysis, as well as the total freeboard requirements are shown in Table 5.7.

Table 5-7: Freeboard allowances

Cross Section Number	Operation Number	MAMWL (QMED) (mAOD)	1 in 200yr Water Level (mAOD)	Uncertainty Factor (k)	Physical Processes Allowance (m)		Uncertainty Allowance (m)		Total Allowance (m)	
					Soft Defences	Hard Defences	Soft Defences	Hard Defences	Soft Defences	Hard Defences
1695.6	1	8.37	9.24	0.5	0.15	0.05	0.210	0.196	0.360	0.246
1474	4A, 4B, 5	7.55	8.94	0.5	0.15	0.05	0.336	0.313	0.486	0.363
1232	12	6.60	7.99	0.5	0.15	0.05	0.336	0.313	0.486	0.363
813	16A, 16B	5.19	5.85	0.5	0.15	0.05	0.160	0.149	0.310	0.199
634	19A, 19B	4.57	5.14	0.5	0.15	0.05	0.138	0.128	0.288	0.178
555	20B	3.87	4.73	0.5	0.15	0.05	0.208	0.194	0.358	0.244
361	26, 27	3.41	4.19	0.5	0.15	0.05	0.189	0.176	0.339	0.226
202	33	3.07	3.85	0.5	0.15	0.05	0.189	0.176	0.339	0.226

The total freeboard allowance was added to the 1 in 200yr design event maximum water levels to establish the minimum defence level at each operation. The nearest freeboard allowance was applied to operations where calculations had not been undertaken. These results are displayed in Table 5.8.

Table 5-8: Minimum defence levels

Cross Section Number	Operation Number	1 in 200yr Water Level (mAOD)	Hard Defences Total Freeboard Allowance (m)	Minimum Defence Level (mAOD)
1695.6	1	9.24	0.246	9.486
1599	2	9.13	0.246	9.376
1544	3	9.03	0.246	9.276
1510	4C	8.99	0.363	9.353
1474	4A, 4B, 5	8.94	0.363	9.303
1372	36, 37	8.64	0.363	9.003
1275	6-11	8.04	0.363	8.403
1232	12	7.99	0.363	8.353
898	13,14,15	6.16	0.199	6.359
813	16A, 16B	5.85	0.199	6.049
752	17	5.75	0.199	5.949
634	19A, 19B	5.14	0.178	5.318
555	20B	4.73	0.244	4.974
424	25	4.24	0.226	4.466
361	26,27	4.19	0.226	4.416
281	29, 30, 31	3.97	0.226	4.196
202	32, 33	3.85	0.226	4.076

5.8 Final Scheme Design

The final scheme design to provide protection up to and including the 1 in 200yr event includes four separate elements: storage areas at Brothock Meadows, St. Vigeans and Hercules Den and direct defences through the town. Further details can be found in Appendix C.

5.8.1 Brothock Meadows Storage Area

An embankment running perpendicular to the channel located approximately 50m upstream of the road at Letham Grange provides a block to flow up to the 1 in 200yr event. A 900mm box culvert provides the outflow from Brothock Meadows. In order to provide a controlled release of water in events exceeding the 1 in 200yr event, the two spillways will be set at differing levels. The first at the 1 in 200yr level of 24.82mAOD and extending 50m, with the second set at the 1 in 1000yr level of 25.12mAOD, extending over 125m. The remainder of the embankment is set at the PMF level of 26.12mAOD. Both spills have been located immediately adjacent to the watercourse to divert spill back into the channel during an exceedance event.

An access road runs along the top of the embankment with a turning head at the 90° bend. Access to the existing single carriageway road is available at both ends of the embankment.

5.8.2 St. Vigeans Storage Area

The proposed embankment extends parallel to the existing road north of Kirkton before turning almost 90° connecting in to an existing road to the north of railway line crossing. An orifice with a bore area of 6m^2 controls release from the storage area. In order to provide a controlled release of water in events exceeding the 1 in 200yr event, spillways were set at varying levels. A spillway set at the 1 in 200yr level of 13.9mAOD extends 20m on the right hand bank of the channel, with a further 40m spill set at 14.2mAOD. On the left hand bank, the highest spill set at 14.4mAOD extends 40m. The lowest spill is located immediately adjacent to the watercourse to divert the first spill back into the channel during an exceedance event. The access track located to the west of the middle spill, and the turning head located to the east of the highest spill, are situated on higher ground and further aid the diversion of spill back into the channel.

An access road runs along the top of the embankment with a turning head at the western extent tying in with the existing single carriageway road.

In addition to the storage area outfall, six culverts through the existing railway embankment will allow the 2 sides of the storage area to fill in a reasonably equal manner. Each culvert is 1.5m wide by 0.75m high located in a group approximately 40m upstream of the orifice.

5.8.3 Hercules Den Storage Area

Two separate embankments are proposed to further contain flood waters in the park at Hercules Den. A lateral embankment is located along the route of an existing small embankment at Park View and is set at 19.57mAOD to provide a complete barrier to flow. This will provide protection to the properties on Park View up to the 1 in 200yr event. A flood gate will allow continued access to the park. The second embankment located along Kirkton Road will contain flood waters up to 19.5mAOD before allowing some spill across Kirkton Road and back into the channel. This is to prevent floodwater building to an extreme depth behind Kirkton Road.

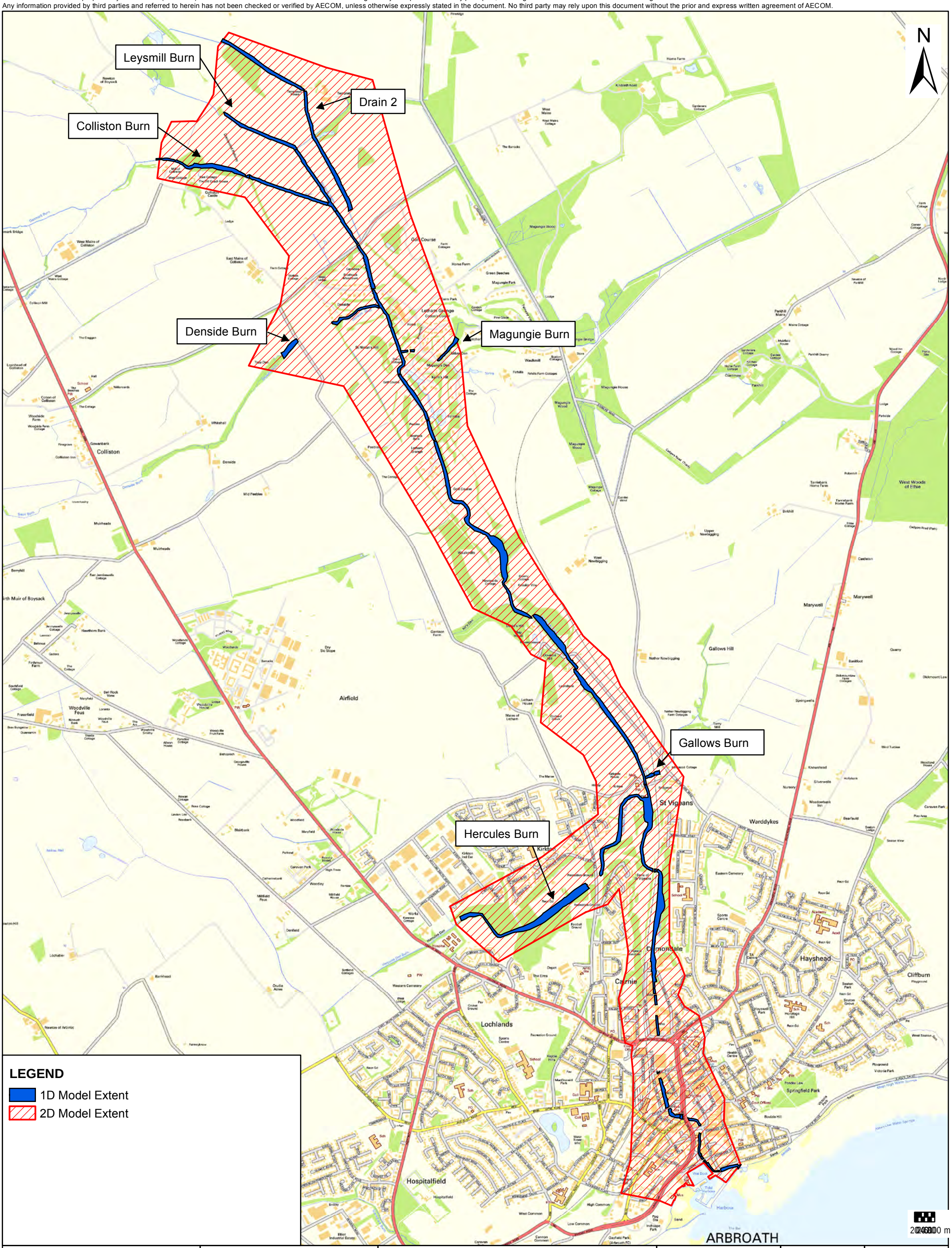
The existing 1210mm circular culvert under Kirkton Road will be left in place to allow controlled release of the storage area.

5.8.4 Arbroath Town Walls

The existing defence walls in Arbroath will require raising as well as inclusion of new sections throughout town to contain flood water within the channel up to and including the 1:200yr return period event. Wall lengths and elevations can be found in the Drawings in Appendix C.

APPENDIX

Appendix A – Figures



Client: Angus Council

Project: BROTHOCK WATER FPS

Title: MODEL SCHEMATISATION

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
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Drawn: MH	Chk'd: DH
App'd: DH	Date: 12/01/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 1	

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: ESTRY ELEMENTS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
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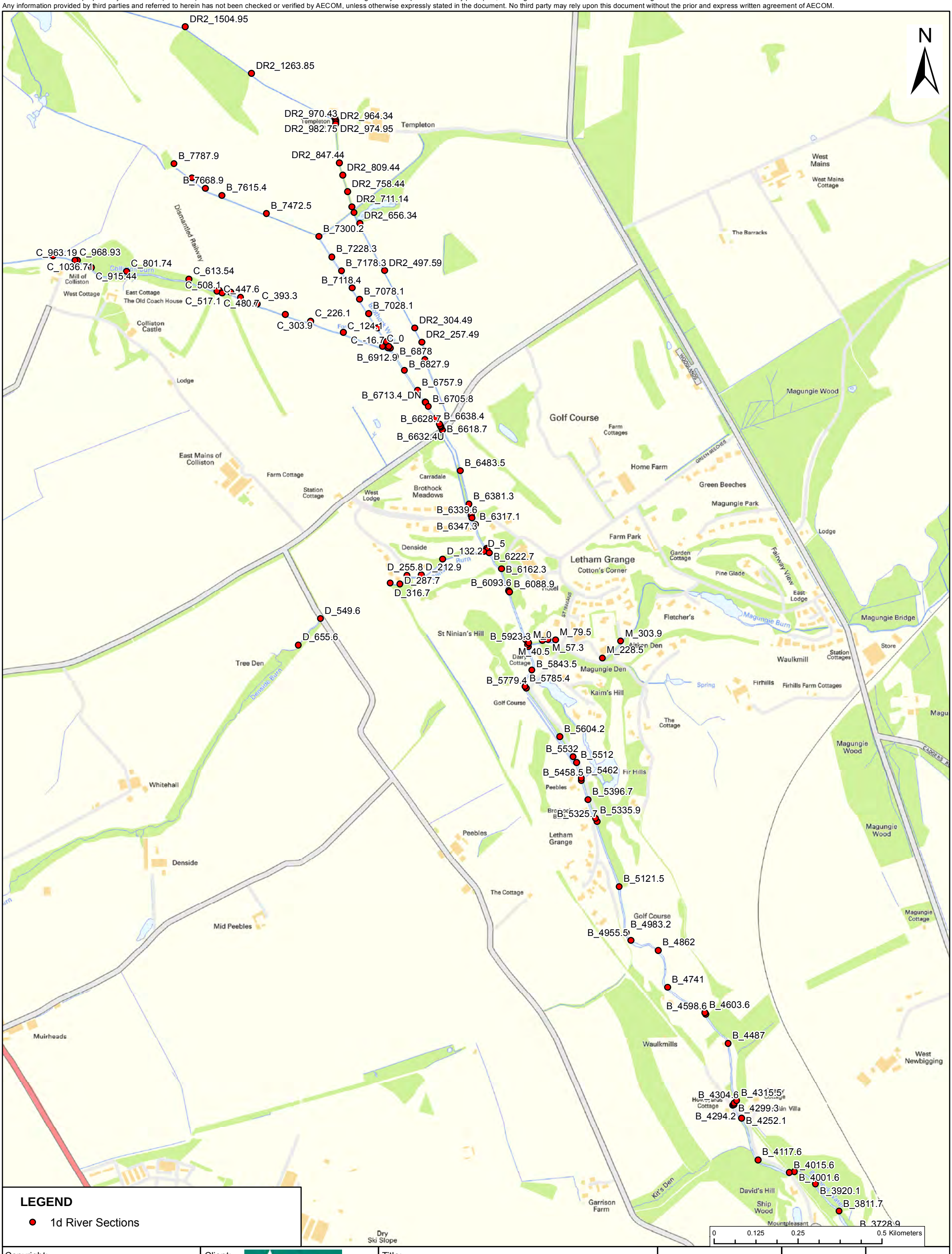
Drawn: MH	Chk'd: DH
App'd: DH	Date: 12/01/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 2	



LEGEND

- 1d River Sections

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1D RIVER SECTIONS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
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Drawn: MH	Chk'd: DH
App'd: DH	Date: 25/05/2017
Scale at A3: 1:10,000	
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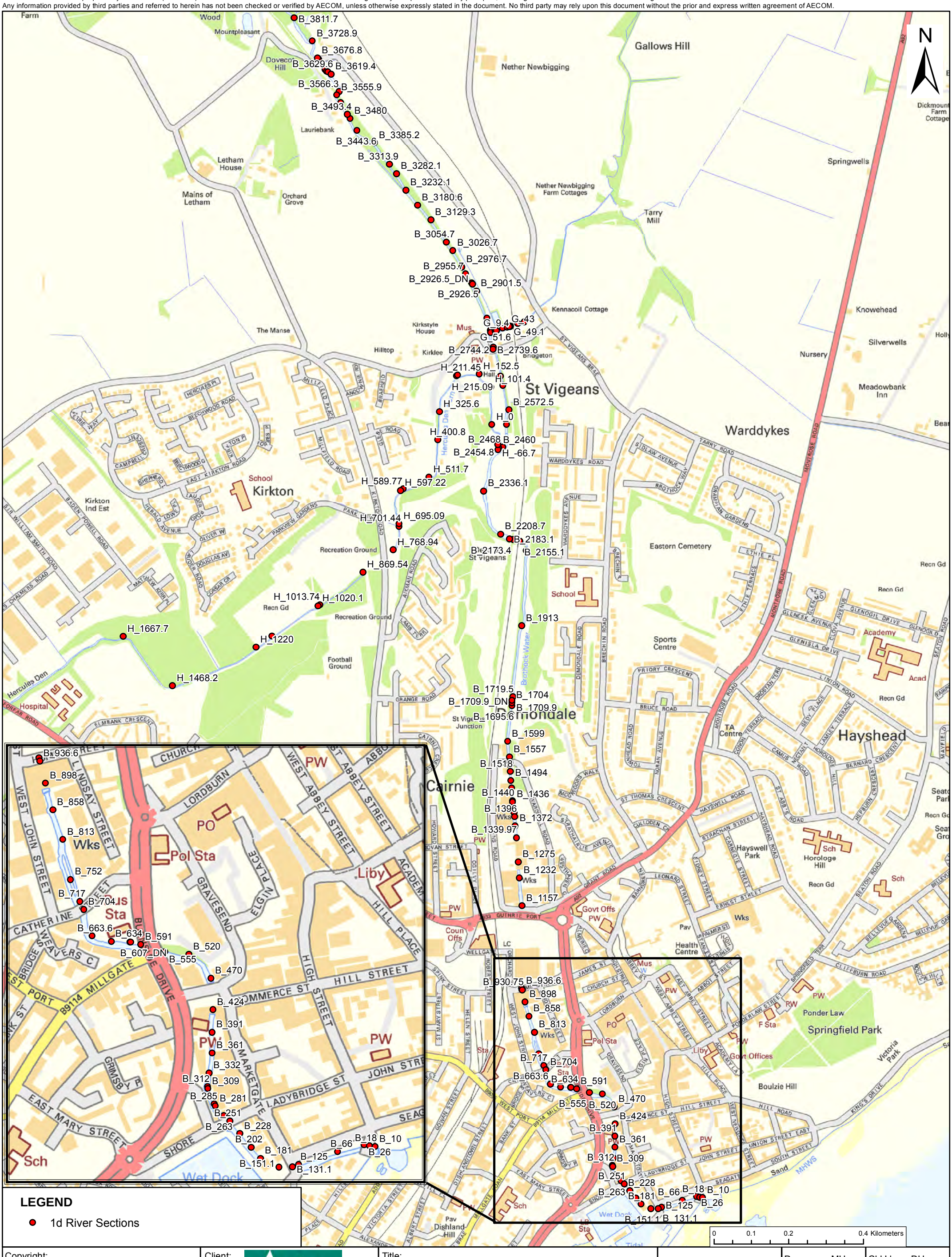

LEGEND

- 1d River Sections

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1D RIVER SECTIONS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
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Drawn: MH	Chk'd: DH
App'd: DH	Date: 25/05/2017
Scale at A3: 1:9,000	
Drawing No: FIGURE 4	

LEGEND

1 in 2yr Baseline Event (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 3.29

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 2YR BASELINE DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
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Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 5	

LEGEND

1 in 5yr Baseline Event (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- 4 - 4.43

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 5YR BASELINE DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 6	

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 10YR BASELINE DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 7	

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 20YR BASELINE DEPTHS

AECOM
1 Tanfield
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EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 8	

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 50YR BASELINE DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 9	

LEGEND

1 in 100yr Baseline Event (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 5.22

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 100YR BASELINE DEPTHS

AECOM
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Tel: +44 (0)131 301 8600
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Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 10	

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 200YR BASELINE DEPTHS

AECOM
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Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 11	

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 500YR BASELINE DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 12	

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 1000YR BASELINE DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 13	

N

LEGEND

1 in 200yr+cc Baseline Event (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 3
- 3 - 4
- 4 - 5
- 5 - 5.33

0 0.25 0.5 1 Kilometers

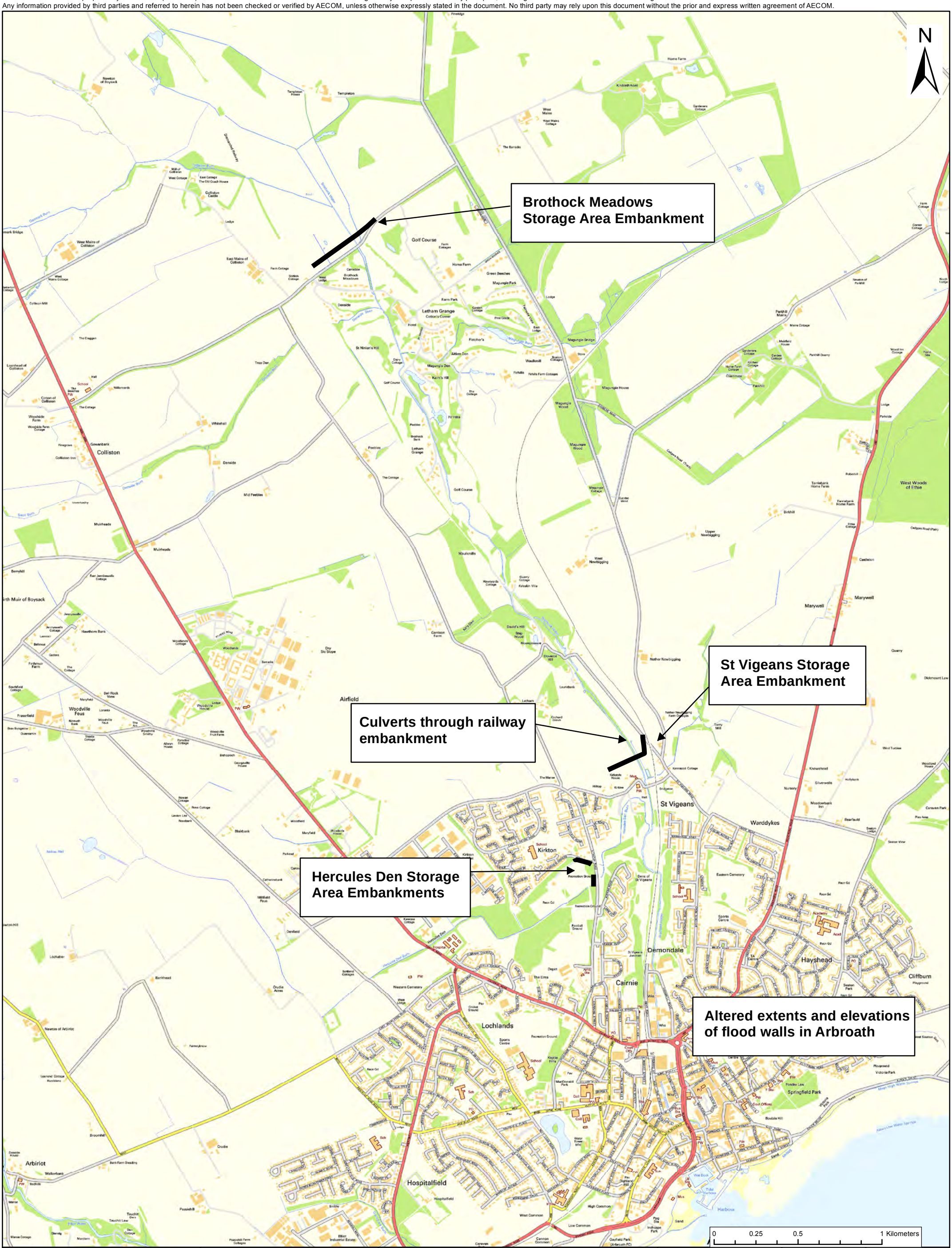
Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 200YR + CC BASELINE DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 14	



Client: Angus Council

Project: BROTHOCK WATER FPS

Title: SCHEME DESIGN

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 15	

LEGEND

1 in 2yr Post-scheme Event (m)

- 0 - 0.25
- 0.25 - 0.5
- 0.5 - 1
- 1 - 1.5
- 1.5 - 2
- 2 - 2.9

Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 2YR POST-SCHEME DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 16	

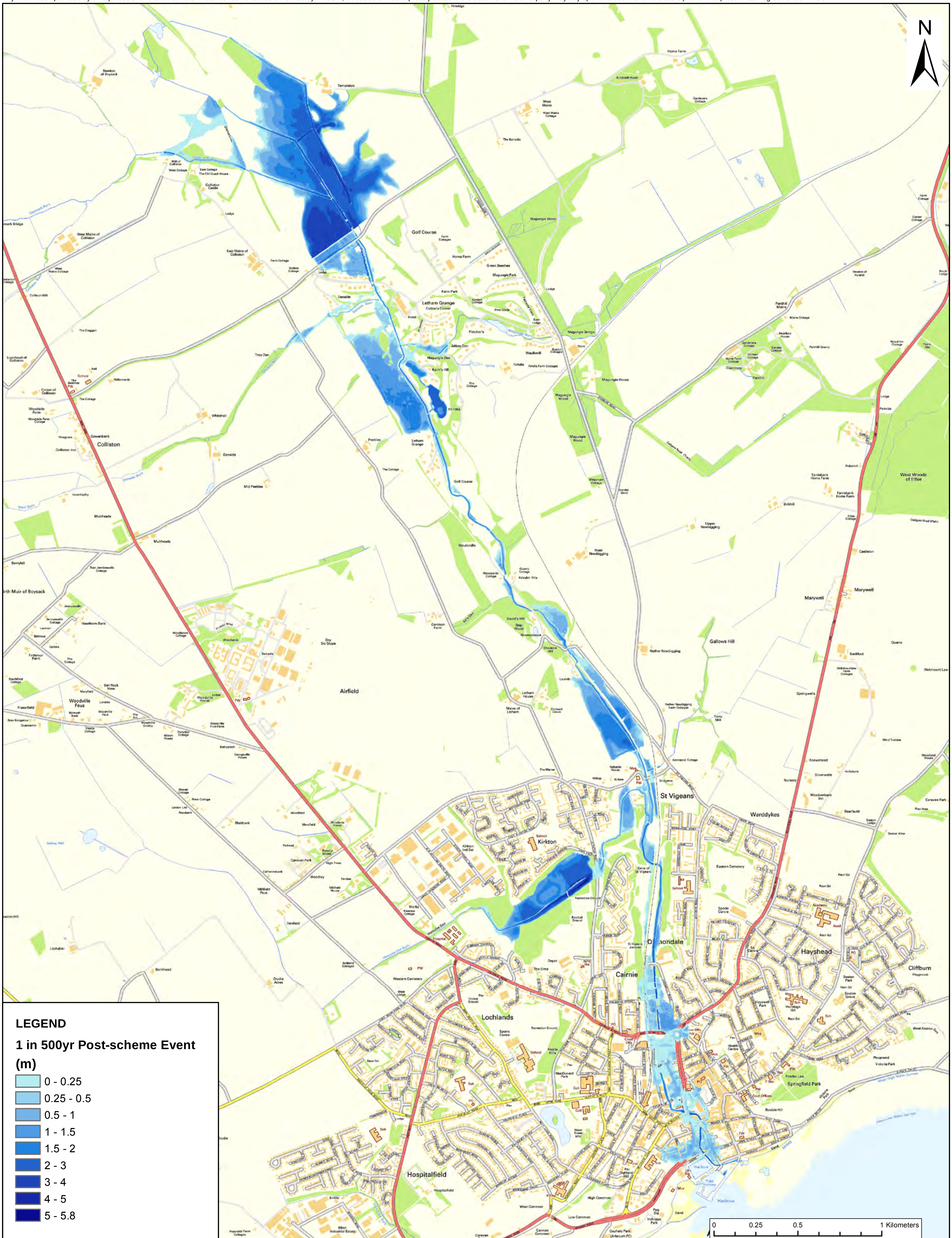
Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 200YR POST-SCHEME DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 17	



Client: Angus Council

Project: BROTHOCK WATER FPS

Title: 1 IN 500YR POST-SCHEME DEPTHS

AECOM
1 Tanfield
Edinburgh
EH3 5DA
Tel: +44 (0)131 301 8600
www.aecom.com

Drawn: MH	Chk'd: DH
App'd: DH	Date: 07/07/2017
Scale at A3: 1:20,000	
Drawing No: FIGURE 18	

Appendix B – Modelling Results

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
B_7787.9	25.345	25.79	25.86	25.972	26.034	26.098	26.197	26.548	26.712
B_7718.9	25.02	25.321	25.37	25.454	25.503	25.555	25.634	25.877	25.994
B_7668.9	24.762	24.934	24.99	25.086	25.141	25.195	25.265	25.485	25.598
B_7615.4	24.602	24.602	24.628	24.732	24.785	24.834	24.882	25.051	25.144
B_7472.5	23.999	23.999	23.999	23.999	23.999	23.999	23.992	24.029	24.122
B_7386.35	23.387	23.387	23.387	23.387	23.391	23.425	23.472	23.579	23.634
B_7300.2	22.787	23.162	23.198	23.249	23.279	23.32	23.369	23.476	23.545
B_7228.3	22.75	23.142	23.172	23.212	23.251	23.294	23.343	23.452	23.529
B_7178.3	22.734	23.132	23.16	23.2	23.241	23.284	23.332	23.442	23.524
B_7118.4	22.719	23.122	23.148	23.188	23.229	23.269	23.316	23.432	23.517
B_7078.1	22.709	23.125	23.153	23.193	23.23	23.268	23.314	23.429	23.515
B_7028.1	22.694	23.124	23.153	23.194	23.234	23.273	23.32	23.428	23.513
B_6978.1	22.671	23.122	23.153	23.194	23.233	23.272	23.319	23.431	23.514
B_6928.9	22.655	23.117	23.153	23.194	23.235	23.274	23.321	23.431	23.512
B_6912.9	22.648	23.116	23.152	23.194	23.237	23.276	23.322	23.431	23.511
B_6905.9	22.643	23.114	23.151	23.195	23.238	23.279	23.324	23.431	23.51
B_6896.6	22.625	23.091	23.129	23.174	23.224	23.268	23.316	23.426	23.506
B_6887.3	22.604	23.064	23.1	23.152	23.212	23.256	23.31	23.424	23.506
B_6878	22.576	23.031	23.066	23.124	23.185	23.236	23.293	23.419	23.504
B_6865.475	22.56	23.015	23.049	23.112	23.174	23.227	23.29	23.417	23.502
B_6852.95	22.547	23.001	23.034	23.101	23.165	23.224	23.288	23.417	23.503
B_6840.425	22.537	22.988	23.021	23.093	23.163	23.224	23.288	23.416	23.501
B_6827.9	22.53	22.977	23.009	23.091	23.164	23.227	23.291	23.418	23.504
B_6810.4	22.515	22.952	22.984	23.077	23.159	23.225	23.29	23.418	23.503
B_6792.9	22.501	22.929	22.96	23.068	23.158	23.224	23.289	23.417	23.502
B_6775.4	22.486	22.907	22.937	23.062	23.155	23.223	23.289	23.417	23.502
B_6757.9	22.472	22.9	22.938	23.063	23.159	23.226	23.291	23.419	23.505
B_6638.4	22.418	22.847	22.888	23.043	23.137	23.21	23.28	23.41	23.496
B_6632.4U	22.417	22.853	22.889	23.045	23.139	23.211	23.282	23.411	23.496
B_6632.4D	22.417	22.853	22.889	23.045	23.139	23.211	23.282	23.411	23.496
B_6628.7	22.414	22.845	22.892	23.061	23.154	23.223	23.29	23.42	23.506
B_6628.7_DS	22.414	22.84	22.889	23.057	23.15	23.218	23.285	23.415	23.501
B_6618.7	22.414	22.841	22.89	23.057	23.15	23.218	23.285	23.415	23.501
B_6551.7	22.357	22.741	22.871	23.042	23.139	23.21	23.277	23.408	23.494
B_6483.5	22.293	22.69	22.869	23.047	23.143	23.213	23.28	23.41	23.495
B_6381.3	22.206	22.625	22.808	23.007	23.113	23.188	23.257	23.389	23.472
B_6347.3	22.149	22.537	22.7	22.897	23.013	23.1	23.182	23.337	23.433
B_6347.3_DS	22.141	22.508	22.63	22.782	22.883	22.963	23.043	23.19	23.287
B_6339.6	22.112	22.469	22.578	22.732	22.839	22.927	23.012	23.173	23.277
B_6317.1	22.123	22.493	22.611	22.747	22.837	22.909	22.985	23.127	23.215
B_6237.6	22.049	22.406	22.503	22.597	22.649	22.681	22.705	22.737	22.855
B_6233.3_DN	22.043	22.398	22.493	22.581	22.63	22.659	22.677	22.69	22.822
B_6222.7	22.01	22.353	22.44	22.501	22.527	22.553	22.591	22.626	22.731
B_6162.3	21.94	22.244	22.319	22.39	22.435	22.466	22.492	22.52	22.615

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
B_6093.6	21.871	22.205	22.286	22.357	22.405	22.44	22.49	22.558	22.713
B_6093.6_DS	21.854	22.154	22.213	22.257	22.28	22.292	22.316	22.351	22.471
B_6088.9	21.834	22.122	22.176	22.213	22.23	22.237	22.254	22.279	22.407
B_5938.1_UP	21.616	21.844	21.9	22	22.058	22.119	22.197	22.269	22.437
B_5938.1_DN	21.616	21.844	21.9	22	22.058	22.119	22.197	22.269	22.437
B_5923.3	21.584	21.802	21.856	21.966	22.033	22.099	22.186	22.266	22.452
B_5915.9	21.568	21.78	21.834	21.949	22.019	22.087	22.178	22.259	22.449
B_5843.5	21.447	21.622	21.697	21.855	21.947	22.03	22.128	22.198	22.378
B_5785.4	21.377	21.65	21.76	21.924	22.011	22.089	22.18	22.259	22.438
B_5779.4	21.187	21.501	21.657	21.849	21.946	22.034	22.135	22.217	22.409
B_5758.3	21.16	21.495	21.658	21.849	21.947	22.034	22.138	22.224	22.422
B_5666	21.054	21.466	21.654	21.849	21.947	22.035	22.144	22.237	22.459
B_5604.2	20.992	21.453	21.651	21.848	21.946	22.034	22.138	22.224	22.437
B_5532	20.896	21.449	21.651	21.848	21.946	22.034	22.133	22.209	22.4
B_5512	20.869	21.445	21.651	21.847	21.945	22.034	22.133	22.212	22.403
B_5462.8	20.828	21.428	21.65	21.849	21.946	22.035	22.134	22.208	22.391
B_5462	20.827	21.427	21.651	21.849	21.947	22.035	22.134	22.208	22.39
B_5462_DS	20.827	21.379	21.629	21.837	21.939	22.03	22.131	22.205	22.39
B_5458.5	20.825	21.38	21.629	21.837	21.939	22.03	22.131	22.206	22.389
B_5396.7	20.757	21.321	21.568	21.761	21.85	21.934	22.033	22.086	22.261
B_5335.9	20.687	21.281	21.563	21.777	21.876	21.967	22.069	22.138	22.32
B_5335.9_DS	20.536	20.83	20.964	21.16	21.264	21.379	21.501	21.704	21.933
B_5325.7	20.545	20.846	20.971	21.164	21.268	21.382	21.504	21.706	21.934
B_5121.5	20.178	20.535	20.688	20.849	20.848	20.924	21.023	21.178	21.381
B_4983.2	19.746	20.113	20.256	20.466	20.619	20.729	20.862	21.066	21.293
B_4955.5	19.633	20.013	20.162	20.411	20.616	20.754	20.887	21.08	21.302
B_4908.75	19.489	19.864	19.995	20.273	20.468	20.629	20.791	21.028	21.272
B_4862	19.372	19.7	19.859	20.116	20.316	20.5	20.689	20.957	21.227
B_4741	19.195	19.623	19.795	20.077	20.287	20.48	20.679	20.953	21.224
B_4603.6	18.845	19.209	19.329	19.53	19.762	19.979	20.225	20.587	20.945
B_4603.6_DS	18.836	19.185	19.297	19.473	19.611	19.732	19.86	20.099	20.524
B_4598.6	18.761	19.096	19.195	19.339	19.45	19.552	19.665	19.947	20.428
B_4542.8	18.475	18.789	18.884	19.049	19.204	19.349	19.514	19.875	20.395
B_4514.9	18.374	18.658	18.75	18.939	19.115	19.284	19.489	19.873	20.395
B_4487	18.231	18.544	18.645	18.849	19.048	19.249	19.479	19.875	20.397
B_4462	18.111	18.418	18.519	18.751	18.984	19.223	19.467	19.869	20.394
B_4438	17.992	18.314	18.444	18.722	18.973	19.218	19.464	19.868	20.393
B_4413.5	17.875	18.246	18.398	18.703	18.966	19.214	19.462	19.866	20.392
B_4389	17.773	18.16	18.349	18.679	18.95	19.202	19.451	19.858	20.387
B_4364.5	17.731	18.14	18.328	18.66	18.934	19.187	19.439	19.846	20.377
B_4340	17.624	17.995	18.165	18.476	18.759	19.019	19.268	19.68	20.233
B_4315.5	17.548	17.903	18.07	18.377	18.665	18.932	19.182	19.586	20.167
B_4315.5_DS	17.526	17.841	17.987	18.243	18.468	18.66	18.792	18.957	19.111
B_4304.6	17.419	17.738	17.891	18.154	18.389	18.59	18.722	18.873	18.997
B_4299.3	17.455	17.782	17.932	18.197	18.435	18.661	18.837	19.111	19.351

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
B_4299.3_DS	17.455	17.765	17.875	18.043	18.175	18.288	18.421	18.691	19.082
B_4294.2	17.436	17.735	17.839	17.992	18.109	18.212	18.34	18.614	19.021
B_4252.1	17.354	17.73	17.858	18.038	18.172	18.286	18.413	18.666	19.046
B_4156	17.047	17.435	17.596	17.84	17.993	18.119	18.249	18.503	19.026
B_4117.6	16.857	17.201	17.348	17.579	17.733	17.857	17.999	18.281	18.959
B_4015.6	16.446	16.755	16.883	17.101	17.221	17.333	17.479	17.777	18.394
B_4015.6_DS	16.433	16.711	16.818	16.985	17.053	17.114	17.194	17.346	17.622
B_4001.6	16.31	16.53	16.595	16.685	16.758	16.823	16.906	17.062	17.332
B_3920.1	15.861	15.998	16.041	16.149	16.257	16.355	16.473	16.661	16.956
B_3893	15.756	15.899	15.952	16.089	16.212	16.319	16.445	16.638	16.942
B_3865.9	15.647	15.829	15.898	16.056	16.187	16.3	16.429	16.624	16.932
B_3838.8	15.529	15.753	15.849	16.031	16.169	16.284	16.414	16.611	16.92
B_3811.7	15.375	15.669	15.79	15.993	16.141	16.261	16.396	16.595	16.906
B_3797.9	15.339	15.637	15.764	15.97	16.124	16.247	16.384	16.584	16.897
B_3784.1	15.323	15.617	15.741	15.947	16.103	16.228	16.367	16.569	16.883
B_3770.3	15.316	15.603	15.724	15.928	16.085	16.21	16.35	16.549	16.862
B_3756.5	15.311	15.595	15.716	15.918	16.071	16.193	16.332	16.525	16.832
B_3742.7	15.309	15.592	15.712	15.914	16.067	16.189	16.325	16.517	16.821
B_3728.9	15.308	15.589	15.709	15.911	16.064	16.186	16.322	16.513	16.817
B_3676.8	14.903	15.216	15.31	15.479	15.615	15.728	15.865	16.064	16.366
B_3676.8_DS	14.87	15.128	15.187	15.28	15.348	15.4	15.462	15.544	15.694
B_3672.2	14.884	15.147	15.2	15.246	15.287	15.33	15.387	15.452	15.583
B_3663.975	14.836	15.078	15.096	15.131	15.171	15.2	15.248	15.268	15.352
B_3655.75	14.788	15.081	15.099	15.106	15.143	15.165	15.23	15.191	15.262
B_3647.525	14.74	15.162	15.227	15.32	15.363	15.406	15.482	15.443	15.443
B_3639.3	14.687	15.179	15.254	15.365	15.421	15.477	15.557	15.528	15.528
B_3636.4	14.546	15.163	15.241	15.356	15.411	15.468	15.553	15.52	15.52
B_3633.5	14.476	15.058	15.153	15.268	15.287	15.331	15.409	15.36	15.407
B_3629.6	14.33	15.029	15.142	15.28	15.3	15.354	15.428	15.39	15.418
B_3626.2	14.228	14.53	14.603	14.773	14.844	14.898	14.962	15.049	15.188
B_3622.8	14.292	14.603	14.677	14.804	14.88	14.931	14.973	14.99	15.114
B_3619.4	14.334	14.663	14.732	14.844	14.921	14.974	15.028	15.101	15.203
B_3606.125	14.304	14.629	14.694	14.798	14.872	14.926	14.982	15.067	15.185
B_3592.85	14.267	14.582	14.636	14.709	14.761	14.799	14.84	14.909	15.007
B_3579.575	14.218	14.53	14.582	14.634	14.664	14.685	14.712	14.743	14.799
B_3566.3	14.148	14.458	14.521	14.615	14.684	14.734	14.789	14.914	15.08
B_3566.3_DS	14.131	14.401	14.453	14.527	14.582	14.618	14.658	14.745	14.85
B_3555.9	14.095	14.354	14.401	14.469	14.52	14.554	14.591	14.674	14.772
B_3542.65	14.039	14.265	14.299	14.35	14.389	14.418	14.451	14.528	14.619
B_3529.4	13.896	14.079	14.121	14.182	14.227	14.261	14.3	14.387	14.486
B_3520.4	13.853	14.033	14.073	14.129	14.17	14.202	14.237	14.316	14.411
B_3511.4	13.819	14.011	14.046	14.092	14.129	14.157	14.188	14.257	14.344
B_3502.4	13.793	14.003	14.041	14.089	14.119	14.14	14.164	14.218	14.29
B_3493.4	13.778	13.986	14.024	14.074	14.105	14.126	14.15	14.201	14.261
B_3480	13.696	13.932	13.969	14.016	14.044	14.063	14.087	14.131	14.179

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
B_3470.9	13.652	13.88	13.914	13.954	13.979	13.998	14.02	14.058	14.092
B_3461.8	13.615	13.836	13.866	13.903	13.927	13.945	13.968	14.003	14.02
B_3452.7	13.581	13.804	13.835	13.872	13.895	13.912	13.935	13.965	13.972
B_3443.6	13.548	13.779	13.813	13.854	13.88	13.9	13.921	13.964	13.978
B_3429	13.518	13.729	13.758	13.797	13.821	13.84	13.86	13.901	13.966
B_3414.4	13.485	13.669	13.696	13.73	13.754	13.775	13.797	13.843	13.93
B_3399.8	13.449	13.618	13.642	13.68	13.713	13.742	13.773	13.843	13.949
B_3385.2	13.405	13.534	13.547	13.575	13.608	13.639	13.672	13.759	13.886
B_3367.375	13.375	13.492	13.513	13.557	13.597	13.63	13.665	13.753	13.883
B_3349.55	13.346	13.451	13.482	13.537	13.583	13.619	13.657	13.748	13.879
B_3331.725	13.319	13.416	13.457	13.525	13.576	13.614	13.654	13.745	13.878
B_3313.9	13.281	13.377	13.431	13.513	13.568	13.608	13.648	13.743	13.876
B_3298	13.267	13.377	13.433	13.51	13.565	13.604	13.645	13.739	13.873
B_3282.1	13.251	13.374	13.436	13.516	13.57	13.61	13.651	13.744	13.877
B_3269.6	13.232	13.367	13.431	13.511	13.566	13.606	13.647	13.742	13.875
B_3257.1	13.214	13.37	13.435	13.515	13.569	13.609	13.649	13.743	13.875
B_3244.6	13.198	13.362	13.43	13.512	13.567	13.607	13.648	13.742	13.874
B_3232.1	13.183	13.36	13.427	13.509	13.564	13.605	13.645	13.74	13.873
B_3219.225	13.173	13.363	13.429	13.51	13.565	13.605	13.646	13.74	13.873
B_3206.35	13.164	13.364	13.429	13.509	13.564	13.604	13.645	13.74	13.873
B_3193.475	13.167	13.37	13.434	13.512	13.566	13.605	13.646	13.739	13.873
B_3180.6	13.166	13.374	13.439	13.517	13.57	13.609	13.649	13.741	13.873
B_3167.775	13.153	13.376	13.442	13.521	13.574	13.613	13.653	13.744	13.874
B_3154.95	13.136	13.373	13.44	13.52	13.574	13.614	13.654	13.745	13.875
B_3142.125	13.116	13.369	13.437	13.517	13.572	13.612	13.652	13.745	13.876
B_3129.3	13.091	13.363	13.431	13.513	13.568	13.608	13.648	13.741	13.873
B_3114.38	13.076	13.36	13.429	13.51	13.565	13.605	13.646	13.739	13.872
B_3099.46	13.063	13.356	13.426	13.508	13.564	13.604	13.645	13.739	13.872
B_3084.54	13.05	13.354	13.425	13.507	13.563	13.604	13.644	13.738	13.871
B_3069.62	13.04	13.354	13.424	13.507	13.563	13.603	13.644	13.738	13.871
B_3054.7	13.034	13.353	13.424	13.507	13.562	13.603	13.644	13.738	13.871
B_3040.7	13.032	13.353	13.424	13.507	13.563	13.603	13.645	13.737	13.872
B_3026.7	13.026	13.352	13.423	13.506	13.562	13.602	13.644	13.738	13.87
B_3014.2	13.026	13.352	13.423	13.506	13.562	13.602	13.644	13.737	13.869
B_3001.7	13.027	13.352	13.423	13.507	13.562	13.602	13.644	13.737	13.87
B_2989.2	13.025	13.351	13.422	13.505	13.561	13.602	13.644	13.737	13.87
B_2976.7	13.027	13.35	13.421	13.504	13.56	13.6	13.641	13.735	13.867
B_2955.7	13.019	13.346	13.417	13.5	13.556	13.596	13.637	13.729	13.864
B_2941.1	13.009	13.341	13.412	13.495	13.551	13.591	13.632	13.725	13.859
B_2926.5	12.961	13.316	13.388	13.473	13.528	13.568	13.608	13.702	13.836
B_2901.5	12.892	13.242	13.315	13.397	13.453	13.493	13.533	13.627	13.766
B_2846.5	12.765	13.063	13.147	13.215	13.265	13.299	13.336	13.434	13.607
B_2823.2	12.623	12.9	13.003	13.124	13.205	13.249	13.298	13.411	13.609
B_2789.2	12.508	12.767	12.868	12.969	13.015	13.041	13.072	13.183	13.362
B_2784.7_UP	12.492	12.747	12.856	12.957	13.003	13.029	13.061	13.171	13.317

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
B_2784.7_DN	12.492	12.747	12.856	12.957	13.003	13.029	13.061	13.171	13.317
B_2744.2	12.465	12.732	12.845	12.953	13.007	13.037	13.073	13.206	13.409
B_2739.6	12.431	12.673	12.753	12.819	12.846	12.857	12.871	12.978	13.106
B_2663.9	12.151	12.331	12.384	12.438	12.478	12.531	12.568	12.748	12.892
B_2638.6	12.061	12.211	12.27	12.327	12.39	12.452	12.5	12.703	12.849
B_2572.5	11.88	12.031	12.105	12.182	12.27	12.354	12.418	12.649	12.798
B_2533.2	11.666	11.858	11.934	12.02	12.158	12.268	12.341	12.585	12.735
B_2516.9	11.546	11.759	11.868	11.981	12.134	12.243	12.315	12.562	12.712
B_2500.6	11.445	11.69	11.81	11.933	12.091	12.201	12.275	12.528	12.681
B_2484.3	11.363	11.637	11.766	11.89	12.052	12.167	12.243	12.498	12.649
B_2468	11.296	11.589	11.719	11.841	12.006	12.124	12.203	12.469	12.623
B_2468_DN	11.235	11.536	11.666	11.784	11.95	12.069	12.147	12.412	12.561
B_2460	11.235	11.536	11.666	11.784	11.95	12.069	12.147	12.412	12.561
B_2454.8	11.228	11.529	11.658	11.775	11.939	12.056	12.135	12.393	12.541
B_2395.45	11.134	11.421	11.542	11.648	11.81	11.924	11.996	12.217	12.349
B_2336.1	11.011	11.293	11.42	11.524	11.703	11.818	11.888	12.099	12.207
B_2272.9	10.865	11.111	11.263	11.436	11.675	11.81	11.89	12.117	12.236
B_2208.7	10.312	10.668	10.826	11.166	11.506	11.63	11.699	11.891	11.965
B_2183.1	10.348	10.688	10.911	11.207	11.525	11.666	11.749	11.997	12.137
B_2183.1_DS	10.258	10.534	10.695	10.9	11.073	11.147	11.19	11.33	11.423
B_2173.4	10.199	10.488	10.656	10.867	11.045	11.122	11.167	11.322	11.414
B_2163.1	10.181	10.478	10.646	10.86	11.04	11.117	11.162	11.297	11.359
B_2155.1	10.073	10.318	10.451	10.613	10.75	10.81	10.845	10.951	11.006
B_2115.8	9.919	10.143	10.264	10.415	10.539	10.595	10.628	10.726	10.782
B_2014.4	9.608	9.854	9.97	10.125	10.239	10.296	10.328	10.425	10.486
B_1913	9.29	9.554	9.696	9.872	9.994	10.056	10.092	10.218	10.299
B_1816.25	8.927	9.126	9.309	9.56	9.684	9.756	9.795	9.975	10.086
B_1719.5	8.645	8.882	9.156	9.477	9.593	9.672	9.734	9.902	10.019
B_1709.9	8.679	8.928	9.196	9.511	9.637	9.717	9.769	9.95	10.066
B_1709.9_DN	8.561	8.811	9.129	9.468	9.59	9.672	9.727	9.909	10.028
B_1704	8.534	8.799	9.126	9.467	9.589	9.671	9.727	9.909	10.028
B_1695.6	8.469	8.754	9.116	9.465	9.589	9.672	9.726	9.911	10.031
B_1599	8.186	8.545	8.985	9.377	9.492	9.566	9.615	9.796	9.919
B_1578	8.117	8.477	8.949	9.35	9.46	9.529	9.576	9.753	9.875
B_1557	7.984	8.394	8.902	9.313	9.416	9.48	9.523	9.695	9.815
B_1557_DS	7.984	8.386	8.893	9.302	9.402	9.463	9.505	9.671	9.789
B_1544	7.912	8.349	8.87	9.283	9.379	9.436	9.477	9.639	9.756
B_1541	7.896	8.338	8.863	9.277	9.372	9.429	9.469	9.631	9.752
B_1541_DS	7.896	8.338	8.863	9.249	9.329	9.36	9.384	9.486	9.57
B_1536	7.891	8.334	8.867	9.256	9.338	9.371	9.395	9.499	9.584
B_1518	7.802	8.275	8.839	9.237	9.316	9.345	9.368	9.47	9.556
B_1510	7.79	8.269	8.835	9.234	9.314	9.346	9.371	9.471	9.555
B_1502	7.782	8.264	8.831	9.233	9.315	9.347	9.373	9.468	9.556
B_1494	7.776	8.258	8.828	9.227	9.311	9.345	9.374	9.474	9.553
B_1474	7.669	8.175	8.777	9.182	9.262	9.291	9.32	9.409	9.483

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
B_1462.67	7.618	8.137	8.755	9.165	9.253	9.286	9.317	9.403	9.487
B_1451.34	7.568	8.098	8.733	9.151	9.253	9.292	9.327	9.368	9.41
B_1440	7.519	8.058	8.707	9.141	9.266	9.34	9.371	9.488	9.566
B_1440_DS	7.519	8.058	8.657	9.02	9.129	9.212	9.23	9.312	9.357
B_1436	7.529	8.066	8.662	9.024	9.133	9.215	9.234	9.315	9.361
B_1407.37	7.5	8.055	8.66	9.035	9.129	9.181	9.207	9.282	9.338
B_1396	7.383	7.939	8.528	8.885	8.963	9.002	9.024	9.058	9.088
B_1372	7.294	7.871	8.491	8.857	8.936	8.975	8.997	9.033	9.063
B_1339.97	7.164	7.753	8.407	8.787	8.879	8.929	8.954	9.015	9.062
B_1275	6.863	7.328	7.912	8.229	8.316	8.37	8.395	8.471	8.533
B_1232	6.689	7.216	7.856	8.189	8.28	8.336	8.362	8.441	8.506
B_1157	6.499	7.167	7.855	8.197	8.289	8.346	8.372	8.452	8.517
B_936.6	5.726	6.062	6.278	6.389	6.483	6.534	6.559	6.688	6.8
B_930.75	5.742	6.093	6.315	6.427	6.517	6.567	6.591	6.716	6.826
B_898	5.647	5.948	6.119	6.206	6.299	6.349	6.374	6.509	6.626
B_858	5.363	5.627	5.83	5.93	6.086	6.171	6.209	6.373	6.5
B_813	5.264	5.587	5.799	5.9	6.045	6.121	6.158	6.315	6.427
B_752	5.118	5.46	5.688	5.802	5.976	6.058	6.098	6.258	6.375
B_717	5.059	5.393	5.618	5.732	5.916	6	6.041	6.2	6.316
B_717_DS	5.02	5.305	5.494	5.587	5.764	5.838	5.873	5.978	6.038
B_710.5	4.986	5.272	5.463	5.556	5.739	5.814	5.85	5.954	6.011
B_704	4.939	5.228	5.423	5.517	5.71	5.786	5.823	5.924	5.979
B_683.7	4.859	5.149	5.352	5.449	5.665	5.748	5.787	5.9	5.966
B_663.6	4.714	5.016	5.235	5.335	5.594	5.672	5.713	5.817	5.897
B_648.7	4.678	4.942	5.154	5.251	5.548	5.623	5.666	5.76	5.826
B_634	4.649	4.868	5.062	5.152	5.465	5.559	5.607	5.685	5.727
B_620.5	4.552	4.832	5.097	5.205	5.55	5.631	5.672	5.746	5.788
B_607_UP	4.473	4.759	5.042	5.21	5.575	5.661	5.702	5.793	5.844
B_607_DN	4.012	4.497	4.835	5.038	5.484	5.573	5.615	5.698	5.743
B_597.5	4.013	4.499	4.836	5.039	5.494	5.588	5.63	5.722	5.776
B_591	4.027	4.51	4.846	5.047	5.497	5.591	5.633	5.724	5.777
B_555	3.966	4.391	4.673	4.845	5.317	5.416	5.452	5.54	5.608
B_520	3.761	4.165	4.46	4.649	5.204	5.302	5.335	5.414	5.462
B_470	3.707	4.132	4.447	4.645	5.216	5.321	5.36	5.464	5.537
B_424	3.597	3.957	4.192	4.348	4.926	5.016	5.052	5.186	5.272
B_391	3.534	3.899	4.139	4.302	4.929	5.003	5.045	5.144	5.232
B_361	3.517	3.893	4.137	4.304	4.963	5.066	5.103	5.223	5.296
B_332	3.486	3.868	4.115	4.287	4.96	5.066	5.103	5.23	5.31
B_312	3.413	3.805	4.066	4.248	4.956	5.064	5.1	5.223	5.304
B_312_DS	3.413	3.796	4.048	4.211	4.888	5.015	5.052	5.181	5.263
B_309	3.411	3.797	4.051	4.213	4.889	5.016	5.052	5.181	5.264
B_285	3.259	3.636	3.869	4.044	4.858	4.998	5.036	5.171	5.256
B_285_DS	3.259	3.636	3.869	4.006	4.75	4.909	4.944	5.079	5.163
B_281	3.247	3.657	3.921	4.066	4.762	4.915	4.95	5.082	5.166
B_263	3.331	3.748	4.009	4.151	4.783	4.929	4.963	5.092	5.174

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
B_263_DS	3.295	3.681	3.91	4.036	4.671	4.841	4.874	5.011	5.088
B_251	3.283	3.668	3.896	4.021	4.667	4.839	4.872	5.009	5.087
B_228	3.188	3.565	3.779	3.906	4.593	4.785	4.818	4.97	5.053
B_202	3.187	3.579	3.801	3.932	4.57	4.743	4.778	4.906	4.986
B_181	3.159	3.545	3.764	3.896	4.55	4.726	4.762	4.889	4.97
B_151.1	3.105	3.479	3.687	3.819	4.487	4.666	4.703	4.817	4.889
B_131.1	3.052	3.412	3.604	3.739	4.399	4.564	4.598	4.735	4.815
B_125	2.713	2.942	3.068	3.133	3.261	3.417	3.466	3.637	3.761
B_95.5	2.575	2.792	2.916	2.988	3.098	3.202	3.233	3.317	3.364
B_66	2.436	2.629	2.739	2.821	2.914	3.042	3.079	3.166	3.209
B_46	2.43	2.534	2.63	2.72	2.8	2.947	2.988	3.078	3.118
B_26	2.451	2.545	2.567	2.702	2.728	2.903	2.973	3.077	3.089
B_25.4	2.451	2.544	2.564	2.7	2.724	2.9	2.97	3.075	3.086
B_18	2.427	2.496	2.531	2.626	2.695	2.863	2.906	3.002	3.044
B_10	2.44	2.51	2.51	2.66	2.66	2.85	2.93	3.04	3.04
H_1667.7	21.174	21.474	21.561	21.67	21.788	21.853	21.9	21.995	22.043
H_1639.2	20.826	21.132	21.22	21.332	21.452	21.52	21.564	21.617	21.627
H_1610.7	20.481	20.79	20.88	20.994	21.116	21.193	21.217	21.305	21.379
H_1582.2	20.128	20.448	20.539	20.656	20.781	20.883	20.978	21.13	21.209
H_1553.7	19.771	20.106	20.199	20.319	20.446	20.539	20.608	20.716	20.785
H_1525.2	19.414	19.765	19.864	19.987	20.115	20.211	20.274	20.357	20.407
H_1496.7	19.062	19.458	19.558	19.673	19.796	19.897	19.94	20.025	20.064
H_1468.2	18.76	19.054	19.146	19.246	19.426	19.55	19.618	19.741	19.777
H_1344.1	17.698	18.33	18.542	18.858	19.027	19.088	19.132	19.216	19.259
H_1220	16.955	18.318	18.541	18.86	19.029	19.091	19.136	19.214	19.259
H_1168.2	16.824	18.317	18.541	18.861	19.034	19.099	19.144	19.225	19.267
H_1094.15	16.783	18.317	18.54	18.861	19.033	19.097	19.143	19.222	19.265
H_1020.1	16.774	18.317	18.54	18.861	19.034	19.099	19.144	19.225	19.267
H_1013.74	16.771	18.316	18.54	18.861	19.034	19.099	19.144	19.225	19.267
H_941.64	16.769	18.316	18.54	18.861	19.034	19.099	19.143	19.224	19.266
H_869.54	16.769	18.316	18.54	18.861	19.034	19.099	19.144	19.225	19.267
H_768.94	14.785	14.918	14.934	14.956	15.241	15.505	15.756	15.899	15.953
H_701.44	14.592	14.67	14.681	14.695	14.844	14.965	14.986	15.308	15.396
H_695.09	14.571	14.661	14.672	14.689	14.873	15.034	15.106	15.29	15.386
H_646.155	14.247	14.355	14.37	14.389	14.587	14.779	14.908	15.122	15.211
H_597.22	13.929	14.048	14.065	14.086	14.309	14.523	14.706	14.878	14.971
H_589.77	13.853	13.978	13.997	14.019	14.217	14.404	14.56	14.817	14.892
H_550.735	13.692	13.847	13.87	13.895	14.063	14.214	14.33	14.481	14.52
H_511.7	13.509	13.681	13.708	13.74	13.869	13.902	13.918	14.116	14.186
H_400.8	12.974	12.988	12.988	12.988	13.066	13.17	13.3	13.88	13.932
H_325.6	12.682	12.78	12.791	12.816	12.922	13.046	13.223	13.934	13.991
H_215.09	12.33	12.462	12.507	12.576	12.752	12.944	13.138	13.708	13.872
H_215.09_DS	12.31	12.426	12.474	12.541	12.66	12.767	12.853	13.109	13.368
H_211.45	12.286	12.397	12.45	12.521	12.625	12.708	12.767	13.02	13.335
H_181.975	12.208	12.323	12.395	12.481	12.57	12.633	12.665	12.837	12.98

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
H_152.5	12.174	12.292	12.359	12.439	12.528	12.605	12.649	12.848	12.997
H_131.3	12.146	12.269	12.334	12.405	12.477	12.536	12.573	12.753	12.895
H_101.4	12.055	12.197	12.26	12.326	12.388	12.449	12.496	12.698	12.844
H_61.8	11.871	12.036	12.108	12.181	12.271	12.356	12.42	12.652	12.802
H_0	11.66	11.844	11.924	12.018	12.153	12.26	12.332	12.575	12.724
H_-16.675	11.623	11.813	11.883	11.972	12.113	12.222	12.296	12.542	12.693
H_-33.35	11.587	11.776	11.846	11.937	12.081	12.194	12.268	12.521	12.672
H_-50.025	11.541	11.719	11.802	11.904	12.056	12.172	12.249	12.503	12.656
H_-66.7	11.319	11.592	11.712	11.829	11.994	12.113	12.192	12.456	12.608
Gallows	13.67	14.122	14.226	14.362	14.502	14.604		15.109	15.409
G_90.3	13.67	14.122	14.226	14.362	14.502	14.604	14.706	15.109	15.409
G_72.8	13.637	14.086	14.197	14.337	14.479	14.583	14.685	15.103	15.406
G_51.6	13.445	13.789	13.86	13.946	14.03	14.11	14.178	14.383	14.515
G_51.6_DN	13.43	13.761	13.834	13.922	14.006	14.107	14.176	14.378	14.502
G_49.1	12.53	12.879	13.161	13.744	13.964	14.092	14.162	14.351	14.465
G_43	12.547	12.939	13.164	13.745	13.965	14.093	14.161	14.353	14.467
G_39.85	12.545	12.935	13.164	13.745	13.964	14.093	14.161	14.352	14.467
G_36.7	12.543	12.931	13.164	13.745	13.965	14.094	14.162	14.352	14.46
G_33.55	12.542	12.927	13.164	13.745	13.965	14.093	14.162	14.351	14.457
G_30.4	12.541	12.927	13.162	13.745	13.965	14.094	14.161	14.353	14.462
G_25.9	12.54	12.922	13.158	13.744	13.965	14.094	14.158	14.351	14.459
G_21.4	12.54	12.92	13.157	13.743	13.965	14.094	14.148	14.35	14.456
G_16.9	12.54	12.919	13.157	13.743	13.965	14.094	14.148	14.348	14.453
G_12.4	12.536	12.917	13.157	13.743	13.965	14.094	14.147	14.349	14.453
G_9.4	12.526	12.881	13.1	13.697	13.926	14.06	14.127	14.334	14.465
DR2_1504.95	26.401	26.575	26.635	26.729	26.765	26.788	26.81	26.904	26.977
DR2_1444.675	25.809	26.001	26.052	26.131	26.166	26.194	26.218	26.262	26.288
DR2_1384.4	25.039	25.2	25.247	25.326	25.371	25.417	25.453	25.519	25.554
DR2_1324.125	24.399	24.595	24.645	24.718	24.752	24.779	24.801	24.849	24.877
DR2_1263.85	24.201	24.408	24.458	24.528	24.554	24.568	24.583	24.606	24.621
DR2_1193.575	24.165	24.352	24.399	24.469	24.497	24.511	24.527	24.548	24.561
DR2_1123.3	24.127	24.283	24.324	24.385	24.412	24.426	24.442	24.462	24.476
DR2_1053.025	24.089	24.196	24.223	24.264	24.28	24.287	24.299	24.307	24.315
DR2_982.75	24.055	24.153	24.179	24.216	24.23	24.236	24.248	24.254	24.26
DR2_974.95	23.364	23.373	23.376	23.379	23.38	23.392	23.413	23.476	23.541
DR2_970.43	23.351	23.361	23.363	23.366	23.368	23.382	23.406	23.474	23.541
DR2_964.34	23.289	23.302	23.303	23.303	23.315	23.342	23.377	23.461	23.535
DR2_935.115	22.987	23.026	23.048	23.117	23.193	23.255	23.316	23.438	23.523
DR2_905.89	22.676	22.933	22.971	23.083	23.176	23.244	23.309	23.435	23.521
DR2_876.665	22.517	22.917	22.959	23.078	23.172	23.242	23.307	23.434	23.52
DR2_847.44	22.477	22.912	22.955	23.075	23.17	23.24	23.306	23.434	23.519
DR2_809.44	22.46	22.91	22.953	23.074	23.169	23.239	23.306	23.434	23.519
DR2_758.44	22.452	22.908	22.951	23.073	23.168	23.238	23.305	23.432	23.518
DR2_711.14	22.447	22.903	22.946	23.071	23.167	23.237	23.304	23.432	23.518
DR2_692.39	22.442	22.897	22.939	23.069	23.166	23.236	23.303	23.431	23.517

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Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
DR2_656.34	22.439	22.892	22.935	23.068	23.165	23.235	23.301	23.429	23.515
DR2_640.465	22.438	22.891	22.934	23.068	23.165	23.235	23.301	23.428	23.515
DR2_624.59	22.437	22.891	22.934	23.068	23.165	23.234	23.301	23.428	23.515
DR2_608.715	22.436	22.891	22.934	23.068	23.165	23.234	23.301	23.428	23.515
DR2_592.84	22.436	22.891	22.934	23.068	23.165	23.234	23.301	23.428	23.515
DR2_576.965	22.435	22.891	22.934	23.068	23.165	23.234	23.301	23.428	23.514
DR2_561.09	22.435	22.891	22.934	23.067	23.165	23.234	23.301	23.428	23.514
DR2_545.215	22.435	22.891	22.934	23.067	23.165	23.234	23.301	23.428	23.515
DR2_529.34	22.435	22.891	22.934	23.067	23.164	23.234	23.301	23.428	23.514
DR2_513.465	22.434	22.891	22.933	23.067	23.164	23.234	23.301	23.428	23.515
DR2_497.59	22.434	22.891	22.933	23.067	23.164	23.234	23.301	23.428	23.515
DR2_478.28	22.434	22.891	22.933	23.067	23.164	23.234	23.301	23.428	23.514
DR2_458.97	22.434	22.89	22.933	23.067	23.164	23.234	23.3	23.428	23.514
DR2_439.66	22.433	22.89	22.933	23.067	23.164	23.234	23.3	23.427	23.513
DR2_420.35	22.433	22.89	22.932	23.067	23.163	23.233	23.299	23.427	23.513
DR2_401.04	22.433	22.89	22.932	23.066	23.163	23.233	23.299	23.426	23.512
DR2_381.73	22.432	22.889	22.931	23.066	23.163	23.232	23.299	23.426	23.512
DR2_362.42	22.432	22.889	22.931	23.066	23.162	23.232	23.298	23.425	23.511
DR2_343.11	22.432	22.889	22.931	23.065	23.162	23.231	23.298	23.425	23.511
DR2_323.8	22.432	22.889	22.93	23.065	23.162	23.231	23.297	23.425	23.51
DR2_304.49	22.432	22.889	22.93	23.065	23.162	23.231	23.297	23.425	23.51
DR2_292.74	22.432	22.888	22.93	23.065	23.162	23.231	23.297	23.424	23.51
DR2_280.99	22.432	22.888	22.93	23.065	23.162	23.231	23.297	23.424	23.51
DR2_269.24	22.432	22.888	22.93	23.065	23.161	23.231	23.297	23.424	23.51
DR2_257.49	22.432	22.888	22.93	23.065	23.161	23.23	23.296	23.424	23.509
DR2_244.24	22.431	22.888	22.929	23.064	23.161	23.23	23.296	23.423	23.509
DR2_230.99	22.431	22.888	22.929	23.064	23.161	23.23	23.296	23.423	23.508
DR2_217.74	22.431	22.888	22.929	23.064	23.16	23.229	23.295	23.423	23.508
DR2_204.49	22.431	22.887	22.929	23.064	23.16	23.229	23.295	23.422	23.508
DR2_189.43	22.43	22.887	22.928	23.063	23.159	23.228	23.293	23.421	23.506
DR2_159.31	22.43	22.887	22.927	23.062	23.158	23.227	23.292	23.42	23.505
DR2_144.25	22.43	22.886	22.927	23.062	23.158	23.226	23.292	23.42	23.505
DR2_129.19	22.43	22.885	22.924	23.059	23.155	23.223	23.289	23.418	23.504
DR2_35.63	22.429	22.885	22.924	23.058	23.153	23.222	23.288	23.416	23.501
DR2_0	22.427	22.884	22.923	23.06	23.155	23.225	23.291	23.42	23.505
D_655.6	31.271	31.523	31.58	31.648	31.709	31.751	31.789	31.691	31.966
D_629.1	30.994	31.235	31.46	31.542	31.594	31.627	31.654	31.579	31.782
D_602.6	30.704	31.101	31.402	31.482	31.525	31.549	31.567	31.513	31.652
D_576.1	30.515	31.01	31.382	31.468	31.502	31.521	31.534	31.493	31.594
D_549.6	30.345	30.934	31.373	31.466	31.507	31.532	31.549	31.496	31.631
D_316.7	25.083	25.282	25.327	25.458	25.522	25.552	25.575	25.508	25.677
D_287.7	24.74	24.949	25	25.076	25.112	25.135	25.166	25.106	25.401
D_279.725	24.58	24.837	24.896	24.968	25.009	25.051	25.107	24.998	25.374
D_271.75	24.422	24.737	24.796	24.866	24.934	24.996	25.063	24.911	25.345
D_263.775	24.273	24.631	24.687	24.772	24.868	24.944	25.018	24.836	25.316

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
D_255.8	24.147	24.493	24.551	24.628	24.697	24.748	24.804	24.676	25.057
D_240.075	24.003	24.329	24.392	24.465	24.522	24.565	24.609	24.505	24.832
D_234.35	23.867	24.185	24.244	24.316	24.371	24.412	24.455	24.355	24.671
D_223.625	23.747	24.068	24.118	24.19	24.246	24.288	24.332	24.23	24.549
D_212.9	23.651	24.002	24.044	24.114	24.173	24.218	24.264	24.156	24.483
D_192.725	23.473	23.84	23.881	23.957	24.027	24.08	24.128	24.005	24.333
D_172.55	23.3	23.678	23.723	23.812	23.891	23.947	23.988	23.867	24.142
D_152.375	23.157	23.537	23.595	23.7	23.79	23.849	23.882	23.764	23.945
D_132.2	22.947	23.305	23.364	23.471	23.56	23.619	23.658	23.534	23.784
D_100.4	22.577	22.936	22.997	23.105	23.193	23.252	23.293	23.168	23.444
D_68.6	22.255	22.673	22.713	22.778	22.841	22.887	22.938	22.829	23.145
D_36.8	22.135	22.559	22.585	22.622	22.626	22.631	22.655	22.638	22.752
D_5	22.105	22.565	22.61	22.67	22.706	22.729	22.752	22.719	22.836
M_303.9	23.628	23.948	23.996	24.048	24.092	24.118	24.14	24.212	24.261
M_285.05	23.627	23.947	23.995	24.047	24.091	24.118	24.141	24.215	24.267
M_266.2	23.626	23.944	23.992	24.044	24.087	24.112	24.134	24.202	24.25
M_247.35	23.626	23.947	23.996	24.049	24.093	24.118	24.142	24.206	24.252
M_228.5	23.625	23.954	24.005	24.062	24.11	24.14	24.166	24.249	24.307
M_79.5	22.079	22.263	22.445	22.681	22.944	23.018	23.055	23.153	23.188
M_57.3	21.985	22.122	22.307	22.552	22.839	22.939	22.992	23.121	23.165
M_40.5	21.675	21.896	21.955	22.042	22.121	22.193	22.274	22.528	22.66
M_20.25	21.64	21.863	21.921	22.016	22.077	22.131	22.199	22.257	22.417
C_1036.71	31.16	31.517	31.666	31.962	32.118	32.212	32.265	32.329	32.356
C_1002.82	30.861	31.351	31.546	31.903	32.086	32.193	32.259	32.331	32.357
C_968.93	30.661	31.217	31.438	31.826	32.009	32.109	32.179	32.286	32.346
C_963.19	30.584	30.903	30.977	31.081	31.132	31.195	31.22	31.238	31.249
C_915.44	30.145	30.41	30.472	30.559	30.589	30.617	30.629	30.644	30.654
C_887.015	29.848	30.12	30.184	30.267	30.294	30.32	30.331	30.345	30.354
C_858.59	29.55	29.828	29.896	29.967	29.995	30.023	30.036	30.051	30.06
C_830.165	29.256	29.553	29.613	29.697	29.744	29.79	29.809	29.817	29.824
C_801.74	29.008	29.292	29.341	29.419	29.461	29.5	29.516	29.546	29.563
C_754.69	28.618	28.879	28.937	29.007	29.048	29.085	29.102	29.121	29.133
C_707.64	28.229	28.47	28.53	28.605	28.643	28.679	28.69	28.713	28.723
C_660.59	27.837	28.066	28.122	28.18	28.209	28.232	28.248	28.254	28.263
C_637.065	27.665	27.888	27.937	27.997	28.024	28.048	28.056	28.068	28.074
C_613.54	27.378	27.612	27.649	27.705	27.73	27.751	27.762	27.771	27.826
C_590.89	27.021	27.266	27.319	27.385	27.419	27.462	27.495	27.54	27.792
C_568.24	26.707	27.019	27.108	27.246	27.342	27.431	27.47	27.525	27.788
C_545.59	26.574	26.949	27.054	27.222	27.322	27.418	27.458	27.514	27.785
C_522.94	26.545	26.898	26.992	27.131	27.216	27.3	27.337	27.387	27.638
C_522.94_DS	26.508	26.767	26.83	26.904	26.946	26.987	27.004	27.027	27.136
C_517.1	26.454	26.672	26.727	26.802	26.846	26.887	26.904	26.927	27.037
C_508.1	26.202	26.365	26.415	26.504	26.553	26.599	26.619	26.644	26.757
C_501.25	25.935	26.12	26.18	26.286	26.339	26.388	26.408	26.435	26.543
C_494.4	25.67	25.933	26.003	26.121	26.174	26.221	26.242	26.268	26.379

APPENDIX B-1

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr	1000yr
	Flood Level (mAOD)								
C_487.55	25.497	25.822	25.893	26.012	26.066	26.114	26.135	26.161	26.283
C_480.7	25.413	25.805	25.871	25.985	26.049	26.108	26.134	26.164	26.312
C_447.6	25.017	25.45	25.515	25.622	25.68	25.733	25.757	25.783	25.919
C_420.45	24.744	25.231	25.314	25.425	25.478	25.524	25.547	25.566	25.675
C_393.3	24.648	25.133	25.222	25.331	25.377	25.416	25.439	25.451	25.535
C_348.6	24.513	24.962	25.051	25.152	25.188	25.214	25.23	25.236	25.283
C_303.9	24.305	24.72	24.803	24.907	24.942	24.964	24.977	24.979	25.012
C_226.1	23.809	24.213	24.309	24.425	24.46	24.486	24.501	24.505	24.544
C_175.1	23.449	23.888	23.991	24.11	24.146	24.172	24.186	24.186	24.219
C_124.1	23.089	23.575	23.67	23.779	23.815	23.839	23.859	23.865	23.896
C_62.05	22.793	23.292	23.351	23.421	23.452	23.474	23.494	23.527	23.572
C_0	22.665	23.145	23.178	23.211	23.261	23.283	23.319	23.418	23.5
C_-16.7	22.643	23.114	23.151	23.195	23.238	23.279	23.324	23.431	23.51

APPENDIX B-2

Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Level (mAOD)							
B_7787.9	25.38	25.876	25.957	26.086	26.2	26.377	26.496	26.753
B_7718.9	25.039	25.382	25.442	25.545	25.636	25.767	25.843	26.029
B_7668.9	24.762	25.004	25.072	25.186	25.267	25.382	25.453	25.636
B_7615.4	24.602	24.643	24.718	24.827	24.884	24.967	25.025	25.177
B_7472.5	23.999	23.999	23.999	23.999	23.999	23.999	24.003	24.154
B_7386.35	23.387	23.387	23.387	23.418	23.473	23.525	23.564	23.655
B_7300.2	22.829	23.206	23.242	23.313	23.37	23.424	23.462	23.577
B_7228.3	22.816	23.179	23.207	23.287	23.343	23.399	23.438	23.562
B_7178.3	22.81	23.166	23.195	23.276	23.332	23.388	23.428	23.557
B_7118.4	22.804	23.154	23.184	23.261	23.317	23.373	23.417	23.551
B_7078.1	22.801	23.16	23.189	23.26	23.315	23.369	23.414	23.549
B_7028.1	22.797	23.16	23.189	23.266	23.321	23.373	23.414	23.547
B_6978.1	22.792	23.16	23.189	23.264	23.32	23.375	23.417	23.548
B_6928.9	22.776	23.16	23.189	23.267	23.321	23.375	23.417	23.545
B_6912.9	22.769	23.16	23.19	23.269	23.323	23.375	23.417	23.544
B_6905.9	22.765	23.16	23.19	23.271	23.325	23.376	23.417	23.542
B_6896.6	22.747	23.137	23.17	23.26	23.317	23.369	23.412	23.539
B_6887.3	22.726	23.108	23.146	23.247	23.311	23.366	23.409	23.539
B_6878	22.694	23.073	23.115	23.224	23.295	23.358	23.404	23.538
B_6865.475	22.677	23.056	23.102	23.216	23.292	23.355	23.402	23.537
B_6852.95	22.665	23.041	23.09	23.211	23.29	23.354	23.401	23.537
B_6840.425	22.656	23.027	23.083	23.211	23.29	23.353	23.4	23.535
B_6827.9	22.649	23.016	23.083	23.213	23.293	23.356	23.403	23.538
B_6810.4	22.633	22.99	23.068	23.211	23.292	23.356	23.402	23.537
B_6792.9	22.617	22.966	23.057	23.21	23.291	23.355	23.402	23.536
B_6775.4	22.601	22.944	23.05	23.208	23.291	23.355	23.401	23.536
B_6757.9	22.584	22.947	23.051	23.211	23.294	23.357	23.404	23.538
B_6638.4	22.521	22.913	23.033	23.195	23.281	23.347	23.394	23.53
B_6632.4U	22.522	22.915	23.035	23.197	23.282	23.348	23.395	23.531
B_6632.4D	22.522	22.915	23.035	23.197	23.282	23.348	23.395	23.531
B_6628.7	22.517	22.92	23.051	23.208	23.292	23.357	23.405	23.54
B_6628.7_DS	22.516	22.917	23.047	23.202	23.287	23.352	23.399	23.535
B_6618.7	22.517	22.917	23.047	23.202	23.286	23.352	23.4	23.535
B_6551.7	22.45	22.9	23.031	23.195	23.28	23.345	23.393	23.527
B_6483.5	22.379	22.901	23.036	23.198	23.282	23.347	23.394	23.529
B_6381.3	22.284	22.842	22.995	23.172	23.259	23.326	23.374	23.504
B_6347.3	22.21	22.733	22.885	23.081	23.185	23.259	23.319	23.475
B_6347.3_DS	22.199	22.655	22.773	22.946	23.046	23.11	23.172	23.34
B_6339.6	22.162	22.602	22.723	22.908	23.015	23.084	23.152	23.33
B_6317.1	22.194	22.633	22.738	22.894	22.986	23.05	23.11	23.247
B_6237.6	22.123	22.52	22.593	22.677	22.701	22.721	22.753	22.85
B_6233.3_DN	22.117	22.509	22.577	22.656	22.671	22.685	22.715	22.808

APPENDIX B-2

Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
B_6222.7	22.085	22.452	22.499	22.546	22.586	22.612	22.642	22.725
B_6162.3	22.014	22.331	22.387	22.457	22.495	22.52	22.544	22.599
B_6093.6	21.946	22.3	22.356	22.43	22.485	22.529	22.58	22.709
B_6093.6_DS	21.926	22.222	22.256	22.291	22.31	22.335	22.367	22.463
B_6088.9	21.905	22.183	22.212	22.238	22.242	22.263	22.295	22.396
B_5938.1_UP	21.67	21.914	22.002	22.099	22.181	22.235	22.293	22.429
B_5938.1_DN	21.67	21.914	22.002	22.099	22.181	22.235	22.293	22.429
B_5923.3	21.635	21.873	21.967	22.075	22.169	22.23	22.293	22.447
B_5915.9	21.618	21.852	21.95	22.063	22.16	22.222	22.287	22.441
B_5843.5	21.488	21.725	21.856	22.001	22.105	22.166	22.23	22.369
B_5785.4	21.426	21.791	21.925	22.062	22.161	22.221	22.284	22.431
B_5779.4	21.228	21.694	21.85	22.004	22.112	22.179	22.25	22.403
B_5758.3	21.201	21.696	21.851	22.004	22.115	22.183	22.259	22.416
B_5666	21.093	21.693	21.851	22.004	22.123	22.195	22.277	22.451
B_5604.2	21.031	21.691	21.85	22.004	22.117	22.186	22.259	22.426
B_5532	20.934	21.69	21.849	22.004	22.11	22.173	22.24	22.39
B_5512	20.907	21.69	21.849	22.003	22.111	22.175	22.243	22.396
B_5462.8	20.866	21.691	21.85	22.004	22.111	22.173	22.237	22.38
B_5462	20.865	21.691	21.85	22.004	22.112	22.173	22.237	22.38
B_5462_DS	20.865	21.671	21.839	21.999	22.108	22.17	22.236	22.38
B_5458.5	20.862	21.671	21.839	21.999	22.107	22.17	22.235	22.382
B_5396.7	20.793	21.608	21.762	21.904	21.999	22.054	22.112	22.249
B_5335.9	20.726	21.608	21.778	21.936	22.042	22.102	22.167	22.311
B_5335.9_DS	20.559	20.999	21.161	21.349	21.521	21.646	21.75	21.922
B_5325.7	20.569	21.006	21.165	21.352	21.524	21.648	21.752	21.923
B_5121.5	20.204	20.729	20.85	20.899	21.032	21.134	21.214	21.371
B_4983.2	19.774	20.29	20.469	20.697	20.891	21.013	21.107	21.281
B_4955.5	19.663	20.194	20.416	20.719	20.913	21.03	21.121	21.29
B_4908.75	19.52	20.035	20.277	20.587	20.825	20.966	21.072	21.261
B_4862	19.399	19.9	20.119	20.447	20.725	20.887	21.007	21.216
B_4741	19.221	19.84	20.081	20.428	20.713	20.881	21.004	21.213
B_4603.6	18.87	19.359	19.533	19.92	20.266	20.481	20.656	20.93
B_4603.6_DS	18.86	19.325	19.475	19.7	19.884	20.016	20.167	20.503
B_4598.6	18.784	19.218	19.341	19.524	19.687	19.855	20.019	20.398
B_4542.8	18.498	18.908	19.052	19.31	19.552	19.763	19.968	20.373
B_4514.9	18.396	18.777	18.942	19.239	19.532	19.758	19.968	20.372
B_4487	18.256	18.674	18.852	19.194	19.526	19.758	19.97	20.374
B_4462	18.137	18.551	18.754	19.158	19.516	19.752	19.965	20.371
B_4438	18.019	18.485	18.726	19.152	19.513	19.75	19.964	20.37
B_4413.5	17.904	18.445	18.708	19.147	19.51	19.748	19.962	20.369
B_4389	17.805	18.403	18.684	19.134	19.5	19.739	19.955	20.363
B_4364.5	17.764	18.382	18.665	19.119	19.487	19.726	19.942	20.353

APPENDIX B-2

Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
B_4340	17.655	18.214	18.481	18.95	19.317	19.553	19.784	20.209
B_4315.5	17.576	18.119	18.382	18.862	19.23	19.462	19.694	20.142
B_4315.5_DS	17.553	18.03	18.247	18.617	18.818	18.914	18.99	19.096
B_4304.6	17.444	17.936	18.158	18.547	18.747	18.835	18.901	18.981
B_4299.3	17.48	17.976	18.201	18.607	18.87	19.035	19.158	19.332
B_4299.3_DS	17.48	17.907	18.045	18.258	18.448	18.614	18.737	19.025
B_4294.2	17.461	17.869	17.995	18.183	18.364	18.534	18.66	18.964
B_4252.1	17.386	17.893	18.04	18.255	18.438	18.592	18.712	19.006
B_4156	17.076	17.635	17.843	18.086	18.274	18.43	18.545	18.932
B_4117.6	16.882	17.384	17.582	17.825	18.028	18.198	18.333	18.814
B_4015.6	16.47	16.919	17.103	17.302	17.507	17.683	17.838	18.329
B_4015.6_DS	16.456	16.847	16.986	17.097	17.209	17.299	17.375	17.595
B_4001.6	16.329	16.612	16.687	16.805	16.921	17.014	17.091	17.301
B_3920.1	15.879	16.055	16.151	16.328	16.495	16.604	16.695	16.92
B_3893	15.772	15.971	16.091	16.29	16.467	16.58	16.673	16.908
B_3865.9	15.666	15.921	16.058	16.269	16.451	16.565	16.659	16.895
B_3838.8	15.553	15.878	16.033	16.252	16.437	16.552	16.647	16.882
B_3811.7	15.415	15.824	15.995	16.229	16.418	16.535	16.631	16.869
B_3797.9	15.379	15.798	15.973	16.214	16.407	16.524	16.62	16.86
B_3784.1	15.362	15.774	15.949	16.195	16.391	16.508	16.605	16.845
B_3770.3	15.354	15.757	15.93	16.176	16.372	16.489	16.584	16.825
B_3756.5	15.349	15.748	15.92	16.16	16.354	16.467	16.56	16.795
B_3742.7	15.347	15.744	15.916	16.156	16.347	16.459	16.551	16.784
B_3728.9	15.345	15.741	15.913	16.153	16.344	16.456	16.547	16.78
B_3676.8	14.949	15.34	15.481	15.698	15.883	16.011	16.097	16.33
B_3676.8_DS	14.911	15.207	15.281	15.388	15.459	15.516	15.56	15.677
B_3672.2	14.927	15.216	15.246	15.319	15.379	15.429	15.465	15.568
B_3663.975	14.881	15.1	15.132	15.194	15.227	15.257	15.274	15.341
B_3655.75	14.835	15.101	15.107	15.163	15.172	15.18	15.187	15.25
B_3647.525	14.788	15.244	15.321	15.394	15.446	15.444	15.445	15.447
B_3639.3	14.736	15.274	15.365	15.461	15.533	15.529	15.531	15.533
B_3636.4	14.589	15.261	15.356	15.451	15.525	15.519	15.523	15.524
B_3633.5	14.52	15.173	15.268	15.32	15.363	15.363	15.362	15.407
B_3629.6	14.373	15.166	15.28	15.341	15.394	15.395	15.392	15.419
B_3626.2	14.272	14.622	14.774	14.883	15.006	15.042	15.053	15.17
B_3622.8	14.345	14.696	14.805	14.918	14.972	14.99	14.99	15.097
B_3619.4	14.389	14.749	14.846	14.96	15.04	15.084	15.111	15.191
B_3606.125	14.358	14.711	14.799	14.912	14.998	15.047	15.079	15.171
B_3592.85	14.32	14.649	14.71	14.788	14.853	14.891	14.92	14.996
B_3579.575	14.272	14.593	14.635	14.679	14.715	14.735	14.748	14.79
B_3566.3	14.203	14.537	14.616	14.72	14.815	14.878	14.937	15.061
B_3566.3_DS	14.181	14.465	14.528	14.608	14.676	14.72	14.76	14.838

APPENDIX B-2

Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
B_3555.9	14.145	14.412	14.47	14.544	14.608	14.65	14.688	14.762
B_3542.65	14.087	14.308	14.351	14.41	14.467	14.506	14.541	14.61
B_3529.4	13.934	14.132	14.183	14.252	14.318	14.362	14.402	14.477
B_3520.4	13.886	14.083	14.129	14.193	14.253	14.293	14.33	14.402
B_3511.4	13.85	14.054	14.092	14.149	14.202	14.237	14.27	14.334
B_3502.4	13.827	14.05	14.089	14.134	14.174	14.201	14.228	14.282
B_3493.4	13.812	14.034	14.075	14.12	14.16	14.187	14.209	14.254
B_3480	13.739	13.978	14.016	14.058	14.096	14.119	14.137	14.174
B_3470.9	13.695	13.922	13.954	13.993	14.027	14.048	14.062	14.087
B_3461.8	13.655	13.873	13.904	13.94	13.973	13.993	14.007	14.02
B_3452.7	13.617	13.842	13.872	13.906	13.937	13.956	13.967	13.971
B_3443.6	13.592	13.821	13.854	13.893	13.93	13.953	13.967	13.972
B_3429	13.557	13.767	13.797	13.834	13.869	13.89	13.905	13.959
B_3414.4	13.521	13.703	13.73	13.769	13.806	13.831	13.853	13.92
B_3399.8	13.481	13.648	13.68	13.733	13.787	13.825	13.857	13.939
B_3385.2	13.431	13.548	13.575	13.63	13.689	13.732	13.775	13.873
B_3367.375	13.397	13.52	13.557	13.62	13.682	13.726	13.77	13.869
B_3349.55	13.365	13.491	13.538	13.609	13.674	13.72	13.766	13.866
B_3331.725	13.337	13.47	13.526	13.603	13.671	13.717	13.763	13.864
B_3313.9	13.298	13.445	13.513	13.597	13.667	13.714	13.761	13.862
B_3298	13.287	13.447	13.511	13.593	13.663	13.71	13.758	13.86
B_3282.1	13.271	13.451	13.517	13.599	13.669	13.715	13.762	13.863
B_3269.6	13.25	13.446	13.512	13.595	13.666	13.713	13.76	13.862
B_3257.1	13.233	13.45	13.515	13.597	13.667	13.714	13.761	13.862
B_3244.6	13.216	13.446	13.513	13.596	13.666	13.712	13.759	13.861
B_3232.1	13.2	13.442	13.51	13.593	13.664	13.711	13.758	13.86
B_3219.225	13.19	13.444	13.51	13.594	13.664	13.711	13.758	13.86
B_3206.35	13.182	13.444	13.51	13.593	13.664	13.711	13.758	13.86
B_3193.475	13.187	13.449	13.513	13.594	13.664	13.71	13.758	13.86
B_3180.6	13.19	13.453	13.517	13.598	13.667	13.712	13.759	13.86
B_3167.775	13.18	13.456	13.521	13.602	13.67	13.715	13.761	13.861
B_3154.95	13.166	13.455	13.521	13.602	13.672	13.717	13.763	13.862
B_3142.125	13.149	13.452	13.518	13.6	13.67	13.716	13.762	13.862
B_3129.3	13.129	13.447	13.514	13.596	13.666	13.712	13.758	13.86
B_3114.38	13.116	13.444	13.511	13.594	13.664	13.71	13.757	13.859
B_3099.46	13.105	13.442	13.509	13.592	13.663	13.71	13.756	13.858
B_3084.54	13.095	13.441	13.508	13.592	13.662	13.709	13.756	13.859
B_3069.62	13.087	13.44	13.508	13.591	13.662	13.709	13.755	13.858
B_3054.7	13.083	13.44	13.508	13.591	13.662	13.709	13.755	13.858
B_3040.7	13.082	13.44	13.508	13.592	13.662	13.709	13.755	13.858
B_3026.7	13.079	13.439	13.507	13.591	13.662	13.709	13.756	13.858
B_3014.2	13.078	13.439	13.507	13.591	13.662	13.708	13.755	13.859

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Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
B_3001.7	13.079	13.438	13.507	13.591	13.661	13.707	13.755	13.857
B_2989.2	13.078	13.439	13.506	13.59	13.66	13.709	13.756	13.857
B_2976.7	13.079	13.437	13.504	13.589	13.659	13.707	13.753	13.855
B_2955.7	13.074	13.433	13.501	13.585	13.655	13.701	13.748	13.851
B_2941.1	13.066	13.428	13.496	13.58	13.65	13.697	13.743	13.847
B_2926.5	13.025	13.404	13.473	13.557	13.627	13.673	13.72	13.824
B_2901.5	12.95	13.328	13.398	13.482	13.552	13.598	13.645	13.753
B_2846.5	12.813	13.16	13.216	13.289	13.353	13.4	13.458	13.593
B_2823.2	12.675	13.026	13.126	13.237	13.313	13.369	13.439	13.594
B_2789.2	12.566	12.891	12.97	13.035	13.086	13.152	13.195	13.353
B_2784.7_UP	12.551	12.879	12.958	13.022	13.076	13.141	13.181	13.312
B_2784.7_DN	12.551	12.879	12.958	13.022	13.076	13.141	13.181	13.312
B_2744.2	12.529	12.868	12.954	13.03	13.089	13.164	13.226	13.398
B_2739.6	12.494	12.768	12.82	12.854	12.881	12.942	12.993	13.105
B_2663.9	12.194	12.395	12.439	12.505	12.599	12.694	12.767	12.891
B_2638.6	12.101	12.282	12.328	12.426	12.541	12.645	12.722	12.849
B_2572.5	11.897	12.121	12.183	12.322	12.47	12.586	12.67	12.798
B_2533.2	11.707	11.948	12.023	12.229	12.399	12.52	12.606	12.736
B_2516.9	11.594	11.888	11.985	12.205	12.372	12.495	12.583	12.712
B_2500.6	11.495	11.832	11.937	12.161	12.333	12.459	12.548	12.681
B_2484.3	11.425	11.788	11.894	12.125	12.301	12.43	12.521	12.649
B_2468	11.366	11.741	11.844	12.082	12.264	12.398	12.49	12.623
B_2468_DN	11.307	11.687	11.788	12.027	12.208	12.34	12.432	12.561
B_2460	11.307	11.687	11.788	12.027	12.208	12.34	12.432	12.561
B_2454.8	11.301	11.678	11.778	12.014	12.193	12.324	12.414	12.541
B_2395.45	11.205	11.56	11.651	11.885	12.047	12.158	12.241	12.349
B_2336.1	11.08	11.437	11.527	11.78	11.937	12.045	12.116	12.207
B_2272.9	10.931	11.29	11.442	11.767	11.944	12.059	12.143	12.236
B_2208.7	10.377	10.871	11.177	11.593	11.738	11.844	11.906	11.965
B_2183.1	10.415	10.96	11.216	11.622	11.803	11.929	12.032	12.137
B_2183.1_DS	10.314	10.731	10.906	11.123	11.218	11.289	11.352	11.423
B_2173.4	10.259	10.693	10.873	11.097	11.196	11.269	11.321	11.414
B_2163.1	10.244	10.683	10.866	11.092	11.19	11.26	11.295	11.359
B_2155.1	10.127	10.479	10.618	10.79	10.868	10.924	10.959	11.006
B_2115.8	9.967	10.289	10.419	10.576	10.65	10.701	10.735	10.782
B_2014.4	9.656	9.996	10.129	10.274	10.35	10.398	10.432	10.486
B_1913	9.346	9.728	9.876	10.034	10.124	10.183	10.228	10.299
B_1816.25	8.966	9.389	9.563	9.733	9.844	9.924	9.987	10.086
B_1719.5	8.694	9.279	9.48	9.644	9.76	9.848	9.916	10.02
B_1709.9	8.728	9.312	9.514	9.69	9.806	9.895	9.962	10.067
B_1709.9_DN	8.607	9.262	9.471	9.643	9.761	9.853	9.922	10.028
B_1704	8.584	9.26	9.47	9.642	9.761	9.852	9.922	10.028

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Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
B_1695.6	8.521	9.256	9.468	9.643	9.763	9.855	9.925	10.031
B_1599	8.253	9.15	9.38	9.541	9.646	9.737	9.809	9.92
B_1578	8.179	9.119	9.353	9.506	9.606	9.695	9.767	9.875
B_1557	8.057	9.08	9.316	9.459	9.55	9.638	9.708	9.816
B_1557_DS	8.055	9.071	9.305	9.443	9.529	9.616	9.685	9.79
B_1544	7.993	9.051	9.286	9.417	9.499	9.584	9.652	9.757
B_1541	7.976	9.044	9.28	9.411	9.49	9.576	9.644	9.752
B_1541_DS	7.976	9.032	9.251	9.351	9.392	9.448	9.495	9.57
B_1536	7.973	9.038	9.258	9.361	9.405	9.462	9.508	9.584
B_1518	7.89	9.016	9.24	9.337	9.376	9.432	9.48	9.556
B_1510	7.879	9.012	9.237	9.337	9.379	9.432	9.48	9.555
B_1502	7.872	9.009	9.235	9.339	9.383	9.433	9.477	9.556
B_1494	7.866	9.006	9.23	9.337	9.387	9.44	9.482	9.553
B_1474	7.761	8.961	9.184	9.287	9.327	9.377	9.417	9.483
B_1462.67	7.71	8.942	9.167	9.282	9.317	9.37	9.411	9.487
B_1451.34	7.662	8.923	9.153	9.291	9.32	9.349	9.372	9.41
B_1440	7.612	8.901	9.144	9.319	9.393	9.451	9.496	9.567
B_1440_DS	7.612	8.825	9.022	9.182	9.253	9.291	9.317	9.357
B_1436	7.622	8.829	9.026	9.186	9.256	9.294	9.321	9.362
B_1407.37	7.595	8.83	9.038	9.166	9.217	9.257	9.288	9.338
B_1396	7.474	8.69	8.888	8.989	9.021	9.044	9.062	9.088
B_1372	7.385	8.657	8.86	8.962	8.995	9.019	9.037	9.064
B_1339.97	7.251	8.58	8.79	8.912	8.958	8.993	9.02	9.062
B_1275	6.937	8.056	8.231	8.351	8.402	8.442	8.478	8.533
B_1232	6.759	8.008	8.191	8.316	8.37	8.412	8.449	8.506
B_1157	6.578	8.012	8.199	8.326	8.38	8.422	8.46	8.517
B_936.6	5.795	6.329	6.39	6.517	6.577	6.636	6.703	6.801
B_930.75	5.815	6.366	6.428	6.55	6.609	6.666	6.731	6.826
B_898	5.708	6.158	6.207	6.333	6.394	6.455	6.525	6.627
B_858	5.415	5.876	5.93	6.143	6.234	6.308	6.392	6.501
B_813	5.327	5.846	5.901	6.096	6.184	6.256	6.33	6.427
B_752	5.185	5.743	5.803	6.031	6.125	6.2	6.274	6.375
B_717	5.124	5.673	5.733	5.972	6.069	6.143	6.215	6.316
B_717_DS	5.078	5.54	5.587	5.814	5.895	5.946	5.986	6.039
B_710.5	5.045	5.509	5.556	5.79	5.872	5.923	5.961	6.012
B_704	4.998	5.47	5.518	5.761	5.845	5.895	5.931	5.979
B_683.7	4.917	5.402	5.45	5.721	5.811	5.866	5.908	5.966
B_663.6	4.775	5.288	5.336	5.647	5.734	5.786	5.824	5.898
B_648.7	4.73	5.207	5.252	5.6	5.684	5.733	5.767	5.828
B_634	4.693	5.114	5.153	5.533	5.623	5.667	5.689	5.727
B_620.5	4.61	5.158	5.205	5.601	5.685	5.726	5.751	5.789
B_607_UP	4.533	5.108	5.211	5.629	5.721	5.768	5.799	5.845

APPENDIX B-2

Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
B_607_DN	4.117	4.914	5.039	5.54	5.633	5.678	5.703	5.743
B_597.5	4.119	4.916	5.041	5.553	5.651	5.698	5.729	5.776
B_591	4.133	4.925	5.049	5.556	5.654	5.7	5.731	5.778
B_555	4.063	4.739	4.846	5.379	5.481	5.516	5.547	5.609
B_520	3.86	4.531	4.651	5.265	5.363	5.398	5.419	5.462
B_470	3.81	4.522	4.647	5.279	5.393	5.438	5.471	5.538
B_424	3.707	4.248	4.35	4.976	5.092	5.151	5.193	5.272
B_391	3.652	4.197	4.304	4.973	5.06	5.108	5.151	5.233
B_361	3.641	4.196	4.306	5.025	5.138	5.193	5.229	5.297
B_332	3.616	4.175	4.288	5.026	5.139	5.198	5.237	5.311
B_312	3.554	4.13	4.25	5.022	5.136	5.191	5.231	5.304
B_312_DS	3.554	4.109	4.212	4.969	5.089	5.147	5.188	5.264
B_309	3.552	4.111	4.214	4.97	5.09	5.148	5.188	5.264
B_285	3.424	3.931	4.045	4.948	5.076	5.136	5.178	5.257
B_285_DS	3.424	3.931	4.007	4.859	4.982	5.043	5.086	5.163
B_281	3.422	3.986	4.068	4.867	4.988	5.048	5.089	5.166
B_263	3.497	4.073	4.152	4.883	5	5.058	5.099	5.175
B_263_DS	3.456	3.967	4.037	4.793	4.916	4.976	5.018	5.089
B_251	3.445	3.952	4.022	4.79	4.914	4.974	5.016	5.087
B_228	3.366	3.836	3.907	4.729	4.866	4.932	4.977	5.053
B_202	3.372	3.86	3.933	4.693	4.812	4.871	4.913	4.986
B_181	3.348	3.823	3.897	4.675	4.795	4.855	4.896	4.971
B_151.1	3.302	3.746	3.82	4.612	4.733	4.79	4.823	4.89
B_131.1	3.258	3.665	3.74	4.517	4.639	4.699	4.742	4.815
B_125	3.065	3.198	3.226	3.462	3.587	3.733	3.783	3.92
B_95.5	3.057	3.101	3.125	3.317	3.351	3.459	3.499	3.58
B_66	3.053	3.021	3.037	3.209	3.228	3.358	3.409	3.493
B_46	3.093	3.103	3.093	3.187	3.159	3.367	3.461	3.586
B_26	3.116	3.178	3.177	3.32	3.323	3.501	3.579	3.686
B_25.4	3.115	3.177	3.176	3.319	3.322	3.5	3.578	3.686
B_18	3.081	3.061	3.045	3.095	3.084	3.268	3.372	3.484
B_10	3.12	3.19	3.19	3.34	3.337	3.527	3.607	3.717
DR2_1504.95	26.42	26.649	26.72	26.785	26.809	26.847	26.886	27.004
DR2_1444.675	25.839	26.064	26.123	26.189	26.217	26.237	26.255	26.298
DR2_1384.4	25.061	25.258	25.315	25.409	25.452	25.485	25.511	25.566
DR2_1324.125	24.43	24.657	24.709	24.775	24.799	24.822	24.841	24.887
DR2_1263.85	24.237	24.469	24.519	24.566	24.58	24.592	24.602	24.626
DR2_1193.575	24.198	24.41	24.46	24.509	24.523	24.535	24.544	24.565
DR2_1123.3	24.156	24.333	24.377	24.423	24.437	24.449	24.458	24.481
DR2_1053.025	24.111	24.229	24.258	24.286	24.293	24.3	24.305	24.317
DR2_982.75	24.076	24.184	24.211	24.235	24.242	24.248	24.252	24.262
DR2_974.95	23.367	23.376	23.379	23.388	23.413	23.442	23.467	23.57

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Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
DR2_970.43	23.354	23.363	23.366	23.378	23.406	23.438	23.464	23.571
DR2_964.34	23.296	23.303	23.303	23.335	23.378	23.418	23.449	23.566
DR2_935.115	22.988	23.053	23.109	23.241	23.318	23.379	23.423	23.556
DR2_905.89	22.701	22.981	23.072	23.229	23.311	23.374	23.42	23.555
DR2_876.665	22.588	22.969	23.066	23.227	23.309	23.373	23.419	23.553
DR2_847.44	22.563	22.965	23.063	23.225	23.308	23.372	23.418	23.553
DR2_809.44	22.553	22.963	23.062	23.224	23.308	23.372	23.418	23.553
DR2_758.44	22.548	22.961	23.061	23.223	23.307	23.371	23.417	23.553
DR2_711.14	22.545	22.957	23.059	23.222	23.306	23.37	23.417	23.552
DR2_692.39	22.54	22.95	23.056	23.221	23.305	23.369	23.415	23.551
DR2_656.34	22.537	22.945	23.055	23.22	23.303	23.367	23.413	23.55
DR2_640.465	22.537	22.944	23.055	23.22	23.303	23.367	23.413	23.549
DR2_624.59	22.536	22.944	23.055	23.22	23.303	23.367	23.413	23.549
DR2_608.715	22.536	22.944	23.055	23.22	23.303	23.367	23.413	23.549
DR2_592.84	22.535	22.944	23.055	23.22	23.303	23.367	23.413	23.549
DR2_576.965	22.535	22.944	23.055	23.22	23.303	23.367	23.413	23.549
DR2_561.09	22.535	22.944	23.055	23.22	23.303	23.367	23.413	23.549
DR2_545.215	22.535	22.944	23.055	23.22	23.303	23.367	23.413	23.549
DR2_529.34	22.535	22.944	23.055	23.22	23.303	23.367	23.412	23.548
DR2_513.465	22.535	22.944	23.055	23.22	23.303	23.366	23.413	23.549
DR2_497.59	22.535	22.944	23.055	23.22	23.303	23.366	23.413	23.549
DR2_478.28	22.535	22.944	23.055	23.22	23.303	23.366	23.412	23.548
DR2_458.97	22.535	22.943	23.055	23.219	23.303	23.366	23.412	23.548
DR2_439.66	22.534	22.943	23.054	23.219	23.302	23.366	23.412	23.547
DR2_420.35	22.534	22.942	23.054	23.218	23.302	23.365	23.411	23.547
DR2_401.04	22.534	22.942	23.054	23.218	23.301	23.365	23.411	23.546
DR2_381.73	22.534	22.942	23.053	23.218	23.301	23.365	23.411	23.546
DR2_362.42	22.534	22.941	23.053	23.217	23.3	23.364	23.41	23.545
DR2_343.11	22.534	22.941	23.053	23.217	23.3	23.363	23.41	23.545
DR2_323.8	22.534	22.941	23.053	23.217	23.3	23.363	23.409	23.545
DR2_304.49	22.534	22.94	23.053	23.216	23.299	23.363	23.409	23.544
DR2_292.74	22.533	22.94	23.052	23.216	23.299	23.363	23.409	23.544
DR2_280.99	22.533	22.94	23.052	23.216	23.299	23.363	23.409	23.544
DR2_269.24	22.533	22.94	23.052	23.216	23.299	23.363	23.409	23.544
DR2_257.49	22.533	22.94	23.052	23.216	23.299	23.362	23.409	23.544
DR2_244.24	22.533	22.939	23.052	23.215	23.298	23.362	23.408	23.543
DR2_230.99	22.533	22.939	23.052	23.215	23.298	23.361	23.408	23.543
DR2_217.74	22.533	22.939	23.052	23.215	23.298	23.361	23.407	23.542
DR2_204.49	22.533	22.938	23.051	23.214	23.297	23.361	23.407	23.542
DR2_189.43	22.533	22.938	23.051	23.213	23.296	23.359	23.406	23.54
DR2_159.31	22.533	22.937	23.05	23.212	23.295	23.358	23.405	23.54
DR2_144.25	22.533	22.936	23.05	23.211	23.294	23.358	23.404	23.539

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Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
DR2_129.19	22.532	22.933	23.047	23.209	23.292	23.356	23.403	23.538
DR2_35.63	22.532	22.933	23.047	23.207	23.29	23.354	23.4	23.535
DR2_0	22.53	22.933	23.048	23.21	23.293	23.358	23.404	23.54
H_1667.7	21.221	21.583	21.687	21.814	21.899	21.943	21.982	22.059
H_1639.2	20.876	21.243	21.349	21.474	21.562	21.608	21.616	21.643
H_1610.7	20.528	20.903	21.011	21.143	21.214	21.246	21.291	21.409
H_1582.2	20.183	20.563	20.674	20.816	20.979	21.05	21.112	21.238
H_1553.7	19.833	20.223	20.337	20.479	20.608	20.656	20.7	20.808
H_1525.2	19.493	19.89	20.005	20.149	20.273	20.314	20.346	20.426
H_1496.7	19.13	19.582	19.691	19.834	19.938	19.974	20.013	20.074
H_1468.2	18.844	19.167	19.261	19.488	19.619	19.685	19.731	19.791
H_1344.1	17.716	18.611	18.866	19.055	19.133	19.177	19.207	19.273
H_1220	17.192	18.61	18.868	19.057	19.134	19.177	19.206	19.274
H_1168.2	17.178	18.61	18.869	19.063	19.143	19.187	19.217	19.281
H_1094.15	17.171	18.61	18.869	19.062	19.141	19.184	19.214	19.279
H_1020.1	17.168	18.61	18.869	19.064	19.144	19.187	19.217	19.281
H_1013.74	17.167	18.61	18.869	19.064	19.144	19.187	19.217	19.281
H_941.64	17.167	18.61	18.869	19.064	19.143	19.187	19.217	19.28
H_869.54	17.167	18.61	18.869	19.064	19.144	19.187	19.217	19.281
H_768.94	14.823	14.939	14.956	15.359	15.757	15.912	15.901	15.982
H_701.44	14.613	14.684	14.696	14.893	14.987	15.199	15.29	15.424
H_695.09	14.596	14.676	14.69	14.94	15.106	15.228	15.271	15.42
H_646.155	14.276	14.374	14.392	14.667	14.909	15.044	15.104	15.241
H_597.22	13.96	14.07	14.089	14.402	14.707	14.872	14.875	15.005
H_589.77	13.885	14.002	14.021	14.298	14.562	14.723	14.798	14.918
H_550.735	13.732	13.877	13.898	14.128	14.333	14.448	14.477	14.541
H_511.7	13.552	13.716	13.742	13.884	13.922	13.997	14.095	14.205
H_400.8	12.983	12.988	12.988	13.101	13.297	13.629	13.853	13.944
H_325.6	12.713	12.795	12.817	12.968	13.247	13.71	13.908	14.005
H_215.09	12.367	12.521	12.578	12.836	13.132	13.385	13.652	13.906
H_215.09_DS	12.343	12.487	12.542	12.71	12.857	12.958	13.066	13.443
H_211.45	12.317	12.464	12.522	12.666	12.779	12.862	12.963	13.418
H_181.975	12.235	12.412	12.482	12.604	12.692	12.786	12.856	12.979
H_152.5	12.201	12.374	12.44	12.566	12.683	12.79	12.867	12.997
H_131.3	12.172	12.349	12.406	12.508	12.604	12.699	12.772	12.895
H_101.4	12.08	12.275	12.327	12.423	12.537	12.641	12.718	12.844
H_61.8	11.902	12.123	12.182	12.323	12.473	12.589	12.673	12.802
H_0	11.694	11.94	12.021	12.221	12.388	12.51	12.596	12.724
H_-16.675	11.657	11.897	11.975	12.183	12.352	12.475	12.564	12.694
H_-33.35	11.619	11.861	11.94	12.154	12.326	12.453	12.541	12.672
H_-50.025	11.568	11.819	11.907	12.131	12.308	12.435	12.526	12.657
H_-66.7	11.386	11.733	11.833	12.07	12.253	12.385	12.477	12.608

APPENDIX B-2

Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
G_90.3	13.74	14.253	14.38	14.543	14.712	14.841	15.017	15.567
G_72.8	13.704	14.225	14.355	14.521	14.692	14.828	15.01	15.565
G_51.6	13.502	13.878	13.958	14.069	14.243	14.331	14.399	14.524
G_51.6_DN	13.485	13.852	13.933	14.067	14.24	14.328	14.394	14.51
G_49.1	12.589	13.242	13.751	14.055	14.226	14.308	14.367	14.458
G_43	12.621	13.245	13.752	14.056	14.228	14.31	14.369	14.46
G_39.85	12.619	13.245	13.751	14.056	14.227	14.309	14.369	14.46
G_36.7	12.617	13.245	13.752	14.056	14.227	14.309	14.369	14.458
G_33.55	12.615	13.245	13.752	14.056	14.226	14.308	14.367	14.455
G_30.4	12.614	13.243	13.751	14.056	14.228	14.31	14.369	14.458
G_25.9	12.613	13.239	13.75	14.056	14.228	14.309	14.367	14.454
G_21.4	12.612	13.238	13.75	14.056	14.227	14.308	14.366	14.452
G_16.9	12.612	13.238	13.75	14.056	14.226	14.307	14.364	14.449
G_12.4	12.608	13.238	13.75	14.056	14.226	14.307	14.364	14.449
G_9.4	12.595	13.178	13.704	14.021	14.201	14.288	14.352	14.455
C_1036.71	31.221	31.709	31.926	32.202	32.261	32.298	32.321	32.367
C_1002.82	30.934	31.601	31.859	32.182	32.254	32.297	32.322	32.363
C_968.93	30.742	31.499	31.78	32.097	32.175	32.229	32.271	32.369
C_963.19	30.645	30.995	31.069	31.186	31.219	31.228	31.235	31.256
C_915.44	30.205	30.489	30.552	30.614	30.628	30.636	30.642	30.659
C_887.015	29.907	30.201	30.261	30.318	30.33	30.337	30.343	30.359
C_858.59	29.612	29.914	29.961	30.02	30.035	30.042	30.048	30.065
C_830.165	29.31	29.628	29.687	29.785	29.808	29.812	29.816	29.829
C_801.74	29.057	29.354	29.409	29.496	29.515	29.529	29.541	29.571
C_754.69	28.664	28.948	28.998	29.082	29.1	29.11	29.118	29.14
C_707.64	28.277	28.543	28.596	28.676	28.693	28.702	28.71	28.727
C_660.59	27.885	28.135	28.173	28.23	28.241	28.247	28.252	28.279
C_637.065	27.698	27.949	27.991	28.046	28.057	28.062	28.067	28.076
C_613.54	27.417	27.659	27.699	27.749	27.758	27.764	27.768	27.894
C_590.89	27.071	27.331	27.377	27.457	27.491	27.513	27.532	27.882
C_568.24	26.768	27.13	27.228	27.422	27.469	27.495	27.516	27.877
C_545.59	26.634	27.077	27.199	27.408	27.458	27.485	27.506	27.877
C_522.94	26.6	27.013	27.112	27.291	27.335	27.359	27.378	27.729
C_522.94_DS	26.551	26.841	26.894	26.983	27.003	27.014	27.023	27.171
C_517.1	26.489	26.739	26.792	26.883	26.903	26.915	26.923	27.072
C_508.1	26.227	26.428	26.492	26.595	26.618	26.63	26.64	26.79
C_501.25	25.958	26.196	26.272	26.383	26.407	26.42	26.43	26.574
C_494.4	25.701	26.021	26.106	26.217	26.24	26.253	26.263	26.413
C_487.55	25.537	25.912	25.997	26.109	26.133	26.146	26.156	26.319
C_480.7	25.458	25.889	25.971	26.103	26.132	26.147	26.159	26.354
C_447.6	25.088	25.532	25.609	25.728	25.754	25.768	25.779	25.959
C_420.45	24.838	25.334	25.413	25.52	25.542	25.553	25.562	25.708

APPENDIX B-2

Section	2yr + CC	5yr + CC	10yr + CC	20yr + CC	50yr + CC	100yr + CC	200yr + CC	500yr + CC
	Flood Levels (mAOD)							
C_393.3	24.756	25.243	25.319	25.413	25.431	25.44	25.448	25.559
C_348.6	24.609	25.071	25.142	25.212	25.223	25.229	25.234	25.297
C_303.9	24.406	24.823	24.897	24.963	24.97	24.975	24.978	25.021
C_226.1	23.91	24.333	24.415	24.484	24.495	24.499	24.504	24.556
C_175.1	23.533	24.016	24.1	24.17	24.181	24.185	24.185	24.229
C_124.1	23.188	23.693	23.769	23.838	23.849	23.86	23.863	23.902
C_62.05	22.913	23.364	23.414	23.472	23.49	23.505	23.522	23.591
C_0	22.788	23.184	23.207	23.279	23.318	23.364	23.404	23.534
C_-16.7	22.765	23.16	23.19	23.271	23.325	23.376	23.417	23.542
M_303.9	23.721	24.007	24.053	24.102	24.138	24.165	24.191	24.281
M_285.05	23.72	24.005	24.052	24.102	24.139	24.167	24.194	24.287
M_266.2	23.719	24.003	24.048	24.097	24.132	24.157	24.182	24.27
M_247.35	23.719	24.007	24.054	24.103	24.138	24.162	24.186	24.271
M_228.5	23.719	24.017	24.067	24.122	24.164	24.195	24.226	24.33
M_79.5	22.092	22.484	22.705	22.984	23.055	23.087	23.115	23.203
M_57.3	22.003	22.347	22.577	22.893	22.991	23.038	23.075	23.183
M_40.5	21.723	21.97	22.046	22.152	22.277	22.36	22.439	22.694
M_20.25	21.691	21.932	22.018	22.113	22.185	22.233	22.284	22.407
D_655.6	31.333	31.594	31.656	31.724	31.791	31.837	31.882	31.77
D_629.1	31.053	31.486	31.548	31.606	31.658	31.691	31.723	31.641
D_602.6	30.754	31.43	31.487	31.534	31.573	31.594	31.613	31.56
D_576.1	30.581	31.413	31.473	31.51	31.538	31.553	31.566	31.529
D_549.6	30.441	31.406	31.471	31.517	31.553	31.574	31.592	31.541
D_316.7	25.121	25.351	25.468	25.534	25.571	25.581	25.601	25.565
D_287.7	24.778	25.014	25.083	25.12	25.163	25.217	25.286	25.149
D_279.725	24.621	24.911	24.973	25.022	25.102	25.176	25.254	25.075
D_271.75	24.466	24.808	24.874	24.954	25.058	25.139	25.223	25.027
D_263.775	24.324	24.701	24.784	24.893	25.014	25.098	25.182	24.979
D_255.8	24.201	24.564	24.637	24.714	24.798	24.86	24.924	24.773
D_240.075	24.053	24.407	24.473	24.537	24.605	24.659	24.715	24.585
D_234.35	23.915	24.259	24.324	24.385	24.451	24.503	24.557	24.431
D_223.625	23.794	24.131	24.197	24.261	24.328	24.381	24.435	24.308
D_212.9	23.701	24.055	24.122	24.189	24.26	24.314	24.37	24.239
D_192.725	23.53	23.893	23.966	24.046	24.124	24.178	24.233	24.103
D_172.55	23.371	23.737	23.822	23.912	23.985	24.026	24.071	23.97
D_152.375	23.246	23.612	23.712	23.813	23.879	23.891	23.915	23.87
D_132.2	23.025	23.382	23.483	23.583	23.655	23.688	23.722	23.64
D_100.4	22.656	23.016	23.117	23.216	23.291	23.33	23.372	23.266
D_68.6	22.347	22.725	22.785	22.858	22.932	22.985	23.033	23.015
D_36.8	22.233	22.59	22.608	22.631	22.643	22.672	22.7	22.703
D_5	22.204	22.619	22.658	22.719	22.742	22.752	22.761	22.813

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
B_1599	9.716	9.574	9.735	9.809	9.642	9.654	9.647
B_1578	9.675	9.534	9.694	9.767	9.602	9.613	9.607
B_1557	9.617	9.484	9.636	9.709	9.546	9.556	9.553
B_2115.8	10.819	10.453	10.695	10.735	10.648	10.653	10.648
B_2014.4	10.478	10.291	10.393	10.432	10.348	10.353	10.348
B_2454.8	12.336	12.023	12.323	12.414	12.187	12.203	12.186
B_2395.45	12.177	11.892	12.156	12.241	12.042	12.056	12.041
B_2533.2	12.527	12.241	12.519	12.607	12.393	12.406	12.392
B_2516.9	12.5	12.221	12.492	12.583	12.366	12.38	12.366
B_2500.6	12.468	12.175	12.458	12.548	12.327	12.343	12.327
B_2484.3	12.433	12.153	12.429	12.521	12.295	12.31	12.295
B_2468	12.396	12.11	12.396	12.49	12.257	12.274	12.257
B_2468_DN	12.35	12.036	12.339	12.432	12.201	12.218	12.201
B_2460	12.35	12.036	12.339	12.432	12.201	12.218	12.201
B_2572.5	12.597	12.322	12.585	12.67	12.465	12.479	12.464
B_2638.6	12.673	12.398	12.644	12.723	12.536	12.551	12.536
B_2789.2	13.223	13.038	13.15	13.196	13.085	13.504	13.084
B_2784.7_UP	13.218	13.029	13.139	13.182	13.074	13.446	13.073
B_2784.7_DN	13.218	13.029	13.139	13.182	13.074	13.446	13.073
B_2744.2	13.166	13.035	13.162	13.227	13.086	13.579	13.086
B_2739.6	12.988	12.789	12.942	12.993	12.877	12.903	12.877
B_2663.9	12.73	12.488	12.693	12.767	12.595	12.615	12.595
B_2901.5	13.592	13.522	13.599	13.647	13.549	13.72	13.548
B_2846.5	13.426	13.307	13.4	13.461	13.352	13.629	13.351
B_2823.2	13.396	13.273	13.37	13.443	13.311	13.632	13.31
B_3676.8	15.964	15.651	16.013	16.1	15.877	15.88	15.874
B_3676.8_DS	15.576	15.321	15.517	15.562	15.457	15.457	15.455
B_2336.1	12.067	11.779	12.039	12.117	11.932	11.944	11.931
B_2272.9	12.048	11.807	12.056	12.143	11.938	11.952	11.938
B_2208.7	11.83	11.626	11.828	11.906	11.734	11.745	11.733
B_2183.1	11.874	11.718	11.919	12.032	11.797	11.811	11.796
B_2183.1_DS	11.31	11.113	11.278	11.352	11.214	11.222	11.214
B_2173.4	11.291	11.088	11.259	11.321	11.193	11.201	11.193
B_2163.1	11.279	11.091	11.252	11.295	11.187	11.195	11.187
B_2155.1	11.018	10.701	10.917	10.959	10.866	10.872	10.866
B_1913	10.216	10.165	10.179	10.228	10.122	10.128	10.123
B_1816.25	9.919	10.036	9.922	9.987	9.841	9.85	9.843
B_1719.5	9.85	9.56	9.847	9.916	9.756	9.768	9.759
B_1709.9	9.868	9.752	9.893	9.963	9.802	9.813	9.805
B_1709.9_DN	9.841	9.645	9.851	9.922	9.757	9.769	9.76
B_1704	9.84	9.645	9.851	9.922	9.756	9.768	9.759

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
B_1695.6	9.839	9.648	9.853	9.925	9.758	9.77	9.761
B_1557_DS	9.598	9.461	9.614	9.685	9.526	9.536	9.533
B_1544	9.565	9.436	9.583	9.653	9.496	9.505	9.504
B_1541	9.555	9.43	9.574	9.644	9.487	9.497	9.495
B_1541_DS	9.455	9.342	9.448	9.495	9.391	9.396	9.398
B_1536	9.462	9.359	9.461	9.509	9.403	9.409	9.41
B_1518	9.426	9.34	9.432	9.48	9.374	9.379	9.382
B_1510	9.424	9.347	9.431	9.48	9.378	9.383	9.387
B_1502	9.422	9.354	9.432	9.477	9.381	9.387	9.391
B_1494	9.419	9.357	9.439	9.482	9.385	9.391	9.397
B_1474	9.355	9.301	9.377	9.417	9.325	9.331	9.341
B_1462.67	9.344	9.303	9.369	9.411	9.315	9.32	9.331
B_1451.34	9.346	9.328	9.348	9.372	9.319	9.322	9.327
B_1440	9.408	9.385	9.45	9.496	9.39	9.397	9.403
B_6088.9	22.311	22.201	22.263	22.298	22.242	22.242	22.243
B_5938.1_UP	22.228	22.094	22.236	22.297	22.179	22.181	22.179
B_5938.1_DN	22.228	22.094	22.236	22.297	22.179	22.181	22.179
B_5923.3	22.218	22.069	22.232	22.298	22.166	22.168	22.165
B_4001.6	17.051	16.734	17.016	17.094	16.918	16.92	16.916
B_3920.1	16.6	16.306	16.607	16.698	16.49	16.492	16.488
B_3893	16.569	16.279	16.583	16.677	16.462	16.464	16.46
B_3865.9	16.551	16.266	16.568	16.663	16.446	16.448	16.444
B_3838.8	16.534	16.255	16.554	16.65	16.432	16.434	16.429
B_3811.7	16.514	16.236	16.538	16.634	16.414	16.416	16.411
B_2163.1_DS	11.071	10.779	10.984	11.022	10.933	10.939	10.933
B_1440_DS	9.282	9.225	9.29	9.317	9.251	9.256	9.269
B_1436	9.283	9.232	9.293	9.321	9.254	9.259	9.272
B_1407.37	9.229	9.22	9.256	9.288	9.215	9.22	9.242
B_3797.9	16.502	16.223	16.527	16.624	16.402	16.404	16.399
B_3784.1	16.486	16.204	16.511	16.608	16.386	16.388	16.383
B_3770.3	16.467	16.184	16.491	16.588	16.368	16.37	16.365
B_3756.5	16.447	16.167	16.47	16.564	16.35	16.352	16.347
B_3742.7	16.438	16.165	16.462	16.555	16.343	16.345	16.34
B_3728.9	16.433	16.164	16.458	16.551	16.34	16.342	16.337
B_2744.2_DS	13.035	12.857	12.998	13.048	12.936	12.933	12.935
B_4294.2	18.596	18.06	18.537	18.665	18.359	18.361	18.355
B_4252.1	18.618	18.229	18.595	18.717	18.433	18.435	18.43
B_4156	18.45	18.078	18.433	18.548	18.269	18.271	18.266
B_4117.6	18.258	17.736	18.202	18.339	18.022	18.025	18.018
B_4015.6	17.741	17.28	17.687	17.844	17.502	17.504	17.498
B_4015.6_DS	17.469	16.968	17.302	17.377	17.206	17.208	17.204
B_4542.8	19.737	19.221	19.768	19.979	19.544	19.547	19.538

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
B_4514.9	19.705	19.202	19.764	19.979	19.523	19.527	19.516
B_4487	19.693	19.197	19.764	19.981	19.516	19.52	19.509
B_4462	19.681	19.177	19.758	19.977	19.506	19.51	19.499
B_4438	19.678	19.174	19.756	19.975	19.503	19.507	19.496
B_4413.5	19.674	19.173	19.754	19.974	19.5	19.505	19.493
B_4389	19.661	19.165	19.745	19.966	19.49	19.494	19.483
B_4364.5	19.642	19.157	19.732	19.954	19.477	19.481	19.47
B_4340	19.477	18.976	19.559	19.796	19.307	19.311	19.3
B_4315.5	19.381	18.891	19.468	19.706	19.221	19.225	19.214
B_4315.5_DS	18.954	18.573	18.916	18.992	18.814	18.815	18.81
B_4304.6	18.88	18.493	18.837	18.903	18.743	18.745	18.74
B_4299.3	19.023	18.588	19.04	19.164	18.863	18.866	18.858
B_4299.3_DS	18.663	18.165	18.618	18.742	18.442	18.445	18.438
B_5121.5	21.168	20.893	21.136	21.219	21.027	21.03	21.025
B_4983.2	21.027	20.623	21.016	21.113	20.885	20.888	20.882
B_4955.5	21.039	20.668	21.033	21.126	20.907	20.91	20.904
B_4908.75	20.965	20.538	20.97	21.078	20.818	20.821	20.814
B_4862	20.88	20.395	20.892	21.014	20.716	20.721	20.712
B_4741	20.861	20.404	20.886	21.011	20.704	20.709	20.699
B_4603.6_DS	20.061	19.61	20.021	20.176	19.878	19.881	19.875
B_4598.6	19.932	19.52	19.86	20.029	19.681	19.684	19.678
B_5396.7	22.05	21.935	22.056	22.116	21.997	21.998	21.995
B_5335.9	22.082	21.983	22.104	22.171	22.039	22.04	22.038
B_5335.9_DS	21.643	21.363	21.65	21.756	21.516	21.519	21.513
B_5325.7	21.644	21.367	21.652	21.758	21.518	21.521	21.515
B_5604.2	22.169	22.039	22.19	22.267	22.117	22.116	22.112
B_5532	22.161	22.039	22.176	22.244	22.107	22.108	22.106
B_5512	22.162	22.038	22.177	22.248	22.107	22.109	22.106
B_5462.8	22.16	22.041	22.175	22.242	22.108	22.11	22.107
B_5458.5	22.156	22.038	22.173	22.239	22.105	22.106	22.103
B_5462_DS	22.156	22.038	22.173	22.239	22.105	22.107	22.103
B_5462	22.16	22.041	22.175	22.242	22.109	22.11	22.107
B_5915.9	22.211	22.055	22.224	22.292	22.157	22.158	22.156
B_5843.5	22.169	21.997	22.168	22.234	22.102	22.104	22.101
B_5785.4	22.194	22.124	22.223	22.288	22.158	22.16	22.158
B_5779.4	22.165	22.039	22.183	22.254	22.111	22.112	22.109
B_5758.3	22.168	22.039	22.187	22.263	22.114	22.116	22.112
B_5666	22.175	22.039	22.198	22.284	22.121	22.124	22.119
B_4603.6	20.448	19.876	20.488	20.665	20.256	20.261	20.25
B_6093.6	22.502	22.485	22.529	22.585	22.484	22.484	22.485
B_6093.6_DS	22.361	22.279	22.335	22.37	22.309	22.309	22.309
B_7787.9	26.344	26.14	26.378	26.496	26.2	26.2	26.2

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
B_6896.6	23.367	23.254	23.368	23.415	23.316	23.316	23.317
B_7718.9	25.813	25.483	25.767	25.843	25.637	25.637	25.637
B_7668.9	25.425	25.116	25.383	25.453	25.267	25.267	25.267
B_7615.4	25.001	24.779	24.968	25.025	24.884	24.884	24.884
B_7472.5	23.999	23.999	23.999	24.003	23.999	23.957	23.914
B_7386.35	23.565	23.387	23.526	23.565	23.473	23.473	23.473
B_7300.2	23.433	23.289	23.423	23.464	23.369	23.369	23.371
B_6551.7	23.337	23.205	23.344	23.397	23.278	23.278	23.279
B_6628.7	23.346	23.225	23.355	23.409	23.29	23.291	23.291
B_6483.5	23.338	23.208	23.346	23.399	23.279	23.28	23.281
B_6381.3	23.316	23.186	23.325	23.378	23.257	23.257	23.259
B_6347.3	23.248	23.091	23.258	23.324	23.182	23.182	23.184
B_6347.3_DS	23.114	22.933	23.108	23.178	23.043	23.043	23.045
B_6339.6	23.087	22.894	23.082	23.159	23.012	23.012	23.014
B_6317.1	23.054	22.882	23.048	23.115	22.983	22.983	22.985
B_6237.6	22.787	22.625	22.721	22.755	22.7	22.7	22.701
B_6222.7	22.64	22.546	22.611	22.645	22.585	22.585	22.586
B_6233.3_DN	22.761	22.593	22.685	22.717	22.671	22.671	22.671
B_6162.3	22.579	22.372	22.52	22.546	22.495	22.494	22.495
B_6632.4D	23.341	23.202	23.346	23.4	23.279	23.28	23.281
B_1396	9.038	9.01	9.044	9.062	9.02	9.023	9.062
B_1372	9.006	8.988	9.018	9.037	8.994	8.997	9.046
B_1339.97	8.958	8.962	8.992	9.02	8.957	8.961	9.047
B_1275	8.433	8.37	8.441	8.478	8.401	8.406	8.682
B_1232	8.389	8.348	8.411	8.449	8.368	8.373	8.667
B_1157	8.381	8.375	8.421	8.46	8.379	8.384	8.675
B_936.6	6.679	6.46	6.635	6.704	6.575	6.583	6.388
B_930.75	6.703	6.503	6.665	6.732	6.607	6.614	6.412
B_898	6.502	6.27	6.453	6.526	6.391	6.4	6.265
B_858	6.355	6.076	6.306	6.392	6.23	6.241	6.102
B_813	6.275	6.08	6.254	6.33	6.18	6.19	6.049
B_752	6.195	6.048	6.198	6.274	6.122	6.132	5.995
B_717	6.132	5.999	6.142	6.216	6.065	6.076	5.947
B_717_DS	5.955	5.82	5.945	5.986	5.892	5.9	5.824
B_710.5	5.932	5.798	5.922	5.961	5.87	5.877	5.806
B_704	5.905	5.77	5.894	5.931	5.843	5.85	5.785
B_683.7	5.868	5.741	5.865	5.908	5.808	5.816	5.755
B_663.6	5.793	5.665	5.785	5.825	5.731	5.738	5.688
B_648.7	5.741	5.618	5.732	5.768	5.682	5.689	5.645
B_634	5.679	5.566	5.667	5.689	5.62	5.627	5.593
B_620.5	5.717	5.635	5.725	5.751	5.682	5.689	5.643
B_607_UP	5.742	5.681	5.767	5.799	5.718	5.726	5.668

APPENDIX B-3

Section	Roughness +20%	Roughness - 20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
SPILL	5.742	5.681	5.767	5.799	5.718	5.726	5.668
WEIR	5.742	5.681	5.767	5.799	5.718	5.726	5.668
B_607_DN	5.661	5.587	5.677	5.703	5.631	5.638	5.594
B_597.5	5.676	5.605	5.697	5.729	5.649	5.656	5.607
B_591	5.678	5.608	5.699	5.731	5.651	5.659	5.609
B_555	5.505	5.428	5.515	5.547	5.478	5.486	5.465
B_520	5.388	5.309	5.397	5.419	5.36	5.367	5.353
B_470	5.402	5.352	5.436	5.472	5.391	5.398	5.377
B_424	5.13	5.022	5.15	5.193	5.089	5.097	5.089
B_391	5.097	5.008	5.107	5.151	5.057	5.064	5.058
B_361	5.161	5.09	5.192	5.23	5.135	5.143	5.133
B_332	5.162	5.091	5.197	5.237	5.136	5.144	5.134
B_312	5.155	5.091	5.19	5.231	5.133	5.141	5.13
B_312_DS	5.109	5.044	5.146	5.188	5.086	5.094	5.084
B_309	5.11	5.044	5.147	5.189	5.087	5.095	5.084
B_285	5.093	5.032	5.135	5.178	5.073	5.081	5.07
B_285_DS	4.997	4.944	5.042	5.086	4.979	4.987	4.978
B_281	5.002	4.95	5.046	5.09	4.985	4.992	4.983
B_263	5.012	4.963	5.057	5.099	4.997	5.004	4.995
B_263_DS	4.928	4.878	4.975	5.018	4.913	4.921	4.912
B_251	4.925	4.876	4.973	5.016	4.91	4.918	4.91
B_228	4.877	4.828	4.931	4.978	4.862	4.871	4.862
B_202	4.823	4.781	4.87	4.913	4.809	4.816	4.81
B_181	4.804	4.767	4.854	4.897	4.793	4.799	4.793
B_151.1	4.736	4.714	4.789	4.823	4.732	4.738	4.732
B_131.1	4.632	4.615	4.698	4.742	4.636	4.644	4.635
B_125	3.616	3.389	3.607	3.623	3.618	3.528	3.517
B_95.5	3.341	3.156	3.285	3.295	3.395	3.256	3.252
B_66	3.146	3.04	3.126	3.135	3.287	3.099	3.096
B_46	3.025	2.977	3.032	3.04	3.266	3.007	3.004
B_26	2.999	2.956	2.985	2.987	3.407	2.978	2.977
B_25.4	2.995	2.954	2.982	2.984	3.406	2.975	2.974
B_25.4_DS	2.995	2.954	2.982	2.984	3.406	2.975	2.974
B_18	2.926	2.91	2.952	2.958	3.161	2.926	2.923
B_10	2.93	2.93	2.93	2.93	3.43	2.93	2.93
B_6628.7_DS	23.342	23.212	23.35	23.404	23.284	23.285	23.286
B_6618.7	23.342	23.213	23.35	23.404	23.284	23.285	23.285
B_3672.2	15.5	15.25	15.43	15.467	15.377	15.378	15.376
B_3663.975	15.342	15.112	15.257	15.275	15.226	15.228	15.227
B_3655.75	15.275	15.064	15.18	15.188	15.172	15.173	15.172
B_3647.525	15.446	15.278	15.442	15.447	15.446	15.447	15.446
B_3639.3	15.511	15.377	15.527	15.533	15.532	15.534	15.532

APPENDIX B-3

Section	Roughness +20%	Roughness - 20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
B_3636.4	15.583	15.282	15.519	15.525	15.524	15.526	15.524
B_3633.5	15.446	15.246	15.36	15.363	15.363	15.364	15.363
B_3629.6	15.499	15.269	15.391	15.394	15.393	15.395	15.394
B_3626.2	15.017	14.85	15.043	15.053	15.003	15.004	15.002
B_3622.8	15.088	14.804	14.99	14.99	14.972	14.974	14.972
B_3619.4	15.122	14.927	15.085	15.112	15.039	15.039	15.037
B_3606.125	15.073	14.89	15.048	15.08	14.997	14.997	14.995
B_3592.85	14.926	14.762	14.892	14.921	14.854	14.853	14.851
B_3579.575	14.78	14.647	14.735	14.748	14.717	14.715	14.714
B_3566.3	14.848	14.773	14.88	14.939	14.813	14.814	14.812
B_3566.3_DS	14.744	14.598	14.721	14.762	14.675	14.675	14.674
B_3555.9	14.675	14.537	14.651	14.689	14.607	14.607	14.606
B_3542.65	14.557	14.392	14.506	14.542	14.466	14.466	14.465
B_3529.4	14.341	14.298	14.363	14.404	14.317	14.318	14.316
B_3520.4	14.304	14.232	14.294	14.331	14.252	14.253	14.251
B_3511.4	14.276	14.171	14.238	14.271	14.201	14.201	14.2
B_3502.4	14.248	14.126	14.202	14.229	14.173	14.173	14.172
B_3493.4	14.218	14.098	14.188	14.21	14.159	14.16	14.159
B_3480	14.14	14.039	14.12	14.137	14.095	14.095	14.094
B_3470.9	14.073	13.977	14.048	14.063	14.026	14.027	14.026
B_3461.8	14.021	13.925	13.994	14.008	13.972	13.973	13.972
B_3452.7	13.978	13.888	13.956	13.968	13.936	13.938	13.936
B_3443.6	13.962	13.885	13.954	13.969	13.93	13.92	13.929
B_3429	13.899	13.83	13.891	13.906	13.868	13.897	13.867
B_3414.4	13.84	13.763	13.831	13.855	13.805	13.861	13.804
B_3399.8	13.816	13.757	13.826	13.859	13.786	13.866	13.785
B_3385.2	13.735	13.64	13.733	13.778	13.687	13.807	13.686
B_3367.375	13.725	13.636	13.727	13.772	13.68	13.804	13.679
B_3349.55	13.714	13.632	13.721	13.767	13.672	13.801	13.671
B_3331.725	13.708	13.632	13.718	13.765	13.668	13.799	13.667
B_3313.9	13.703	13.628	13.715	13.763	13.665	13.798	13.664
B_3298	13.701	13.619	13.711	13.759	13.66	13.795	13.66
B_3282.1	13.704	13.633	13.717	13.764	13.666	13.799	13.666
B_3269.6	13.701	13.629	13.714	13.762	13.663	13.797	13.662
B_3257.1	13.701	13.631	13.715	13.762	13.665	13.798	13.664
B_3244.6	13.699	13.63	13.714	13.761	13.663	13.797	13.663
B_3232.1	13.697	13.629	13.712	13.76	13.661	13.796	13.661
B_3219.225	13.698	13.628	13.713	13.76	13.662	13.796	13.661
B_3206.35	13.697	13.629	13.713	13.76	13.661	13.796	13.661
B_3193.475	13.697	13.627	13.712	13.759	13.661	13.796	13.661
B_3180.6	13.698	13.632	13.714	13.76	13.664	13.796	13.663
B_3167.775	13.699	13.642	13.717	13.763	13.668	13.798	13.667

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
B_3154.95	13.7	13.647	13.719	13.764	13.669	13.799	13.668
B_3142.125	13.699	13.644	13.718	13.764	13.668	13.799	13.667
B_3129.3	13.697	13.634	13.714	13.761	13.664	13.796	13.663
B_3114.38	13.696	13.63	13.712	13.759	13.662	13.795	13.661
B_3099.46	13.695	13.629	13.711	13.758	13.66	13.795	13.66
B_3084.54	13.695	13.628	13.711	13.758	13.66	13.795	13.659
B_3069.62	13.694	13.628	13.711	13.758	13.66	13.795	13.659
B_3054.7	13.694	13.628	13.711	13.758	13.659	13.795	13.659
B_3040.7	13.694	13.628	13.711	13.758	13.66	13.795	13.659
B_3026.7	13.695	13.628	13.711	13.757	13.659	13.794	13.658
B_3014.2	13.694	13.628	13.71	13.757	13.659	13.794	13.658
B_3001.7	13.693	13.627	13.71	13.757	13.659	13.794	13.657
B_2989.2	13.694	13.627	13.71	13.757	13.659	13.794	13.658
B_2976.7	13.692	13.626	13.707	13.755	13.657	13.793	13.656
B_2955.7	13.686	13.622	13.703	13.749	13.652	13.789	13.651
B_2941.1	13.681	13.62	13.698	13.745	13.648	13.786	13.647
B_2926.5	13.659	13.599	13.675	13.722	13.624	13.77	13.623
B_7228.3	23.406	23.27	23.398	23.442	23.343	23.342	23.344
B_7178.3	23.394	23.261	23.387	23.432	23.332	23.332	23.333
B_7118.4	23.375	23.251	23.372	23.421	23.316	23.316	23.317
B_7078.1	23.369	23.254	23.368	23.418	23.313	23.313	23.314
B_7028.1	23.371	23.26	23.372	23.418	23.32	23.32	23.321
B_6978.1	23.372	23.257	23.374	23.421	23.319	23.319	23.32
B_6928.9	23.373	23.259	23.374	23.421	23.32	23.32	23.321
B_6912.9	23.373	23.261	23.374	23.421	23.322	23.322	23.323
B_6912.9_DS	23.373	23.265	23.375	23.421	23.323	23.324	23.325
B_6905.9	23.373	23.265	23.375	23.421	23.323	23.324	23.325
B_6887.3	23.362	23.241	23.364	23.413	23.309	23.309	23.31
B_6878	23.355	23.213	23.356	23.408	23.293	23.293	23.294
B_6865.475	23.351	23.21	23.353	23.406	23.289	23.29	23.291
B_6852.95	23.349	23.21	23.353	23.406	23.288	23.288	23.289
B_6840.425	23.348	23.214	23.352	23.405	23.288	23.288	23.289
B_6827.9	23.35	23.218	23.355	23.408	23.291	23.291	23.292
B_6810.4	23.349	23.218	23.354	23.407	23.29	23.29	23.292
B_6792.9	23.348	23.218	23.354	23.406	23.289	23.29	23.291
B_6775.4	23.348	23.215	23.353	23.406	23.288	23.289	23.291
B_6757.9	23.348	23.225	23.356	23.408	23.292	23.292	23.293
B_6638.4	23.341	23.199	23.345	23.399	23.278	23.279	23.281
H_1667.7	22.018	21.759	21.944	21.982	21.898	21.899	21.899
H_1639.2	21.62	21.422	21.608	21.616	21.563	21.562	21.562
H_1610.7	21.291	21.085	21.246	21.291	21.214	21.214	21.214
H_1582.2	21.084	20.749	21.05	21.112	20.979	20.979	20.979

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
H_1553.7	20.704	20.418	20.655	20.7	20.608	20.608	20.608
H_1525.2	20.341	20.095	20.314	20.346	20.273	20.273	20.273
H_1496.7	20.026	19.806	19.974	20.013	19.938	19.938	19.938
H_1468.2	19.673	19.591	19.681	19.729	19.619	19.623	19.62
H_1344.1	19.146	19.123	19.173	19.205	19.133	19.139	19.133
H_1220	19.156	19.109	19.172	19.204	19.133	19.14	19.134
H_1168.2	19.158	19.133	19.183	19.214	19.143	19.15	19.144
H_1094.15	19.158	19.126	19.18	19.211	19.141	19.147	19.141
H_1020.1	19.158	19.133	19.183	19.214	19.143	19.15	19.144
H_1013.74	19.158	19.133	19.183	19.214	19.143	19.15	19.144
H_941.64	19.158	19.133	19.182	19.214	19.143	19.15	19.144
H_869.54	19.158	19.134	19.183	19.214	19.143	19.15	19.144
H_768.94	15.881	15.564	15.904	15.9	15.755	15.785	15.758
H_701.44	15.127	14.952	15.216	15.285	14.986	15.005	14.988
H_695.09	15.199	15.047	15.214	15.265	15.106	15.119	15.107
H_646.155	15.028	14.797	15.041	15.098	14.908	14.93	14.91
H_597.22	14.835	14.557	14.87	14.874	14.707	14.736	14.71
H_589.77	14.698	14.371	14.718	14.793	14.561	14.586	14.564
H_550.735	14.418	14.212	14.431	14.469	14.333	14.351	14.334
H_511.7	13.969	13.883	13.987	14.087	13.921	13.923	13.921
H_400.8	13.491	13.215	13.598	13.841	13.296	13.364	13.298
H_325.6	13.574	13.051	13.681	13.897	13.246	13.421	13.253
H_215.09	13.255	13.043	13.354	13.633	13.132	13.138	13.133
H_215.09_DS	12.978	12.747	12.946	13.054	12.857	12.878	12.857
H_211.45	12.919	12.638	12.852	12.947	12.778	12.816	12.779
H_181.975	12.829	12.578	12.785	12.856	12.689	12.739	12.69
H_152.5	12.823	12.555	12.79	12.867	12.679	12.732	12.679
H_131.3	12.735	12.489	12.698	12.772	12.6	12.622	12.6
H_101.4	12.669	12.396	12.639	12.718	12.532	12.548	12.532
H_61.8	12.601	12.323	12.588	12.673	12.467	12.482	12.467
H_0	12.519	12.231	12.508	12.596	12.382	12.396	12.382
H_-16.675	12.486	12.192	12.474	12.565	12.346	12.361	12.346
H_-33.35	12.46	12.168	12.451	12.541	12.32	12.335	12.32
H_-50.025	12.442	12.146	12.434	12.526	12.302	12.317	12.301
H_-66.7	12.387	12.091	12.384	12.477	12.246	12.262	12.246
G_90.3	14.718	14.695	14.835	15.017	14.706	14.706	14.706
G_72.8	14.685	14.685	14.822	15.01	14.685	14.685	14.685
G_51.6	14.336	14.135	14.33	14.401	14.237	14.239	14.236
G_51.6_DN	14.334	14.118	14.327	14.396	14.235	14.237	14.234
G_43	14.324	14.078	14.31	14.371	14.223	14.225	14.222
G_49.1	14.323	14.076	14.308	14.369	14.222	14.224	14.221
G_39.85	14.324	14.077	14.309	14.37	14.223	14.225	14.221

APPENDIX B-3

Section	Roughness +20%	Roughness - 20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
G_36.7	14.323	14.078	14.309	14.37	14.222	14.224	14.221
G_33.55	14.322	14.078	14.308	14.368	14.222	14.224	14.221
G_30.4	14.324	14.078	14.31	14.37	14.223	14.225	14.222
G_25.9	14.323	14.078	14.309	14.369	14.223	14.225	14.222
G_21.4	14.322	14.078	14.308	14.367	14.222	14.224	14.221
G_16.9	14.321	14.078	14.306	14.366	14.222	14.224	14.221
G_12.4	14.321	14.078	14.307	14.366	14.222	14.224	14.221
G_9.4	14.303	14.044	14.288	14.354	14.196	14.198	14.195
M_303.9	24.177	24.097	24.164	24.191	24.137	24.137	24.137
M_285.05	24.178	24.098	24.166	24.194	24.138	24.138	24.138
M_266.2	24.167	24.094	24.156	24.182	24.13	24.13	24.13
M_247.35	24.17	24.104	24.162	24.186	24.136	24.136	24.136
M_228.5	24.194	24.132	24.195	24.226	24.163	24.163	24.163
M_79.5	23.064	23.048	23.086	23.115	23.055	23.055	23.055
M_57.3	23.002	22.982	23.037	23.075	22.992	22.992	22.992
M_40.5	22.327	22.199	22.356	22.439	22.273	22.274	22.274
M_20.25	22.241	22.096	22.235	22.288	22.183	22.184	22.182
C_1036.71	32.294	32.18	32.297	32.321	32.261	32.261	32.261
C_1002.82	32.28	32.17	32.297	32.322	32.254	32.254	32.254
C_968.93	32.189	32.092	32.229	32.271	32.174	32.174	32.174
C_968.93_DS	31.404	31.208	31.336	31.336	31.337	31.337	31.337
C_963.19	31.271	31.138	31.228	31.235	31.219	31.219	31.219
C_915.44	30.672	30.58	30.636	30.642	30.628	30.628	30.628
C_887.015	30.38	30.282	30.337	30.343	30.33	30.33	30.33
C_858.59	30.072	29.99	30.042	30.048	30.035	30.035	30.035
C_830.165	29.856	29.72	29.812	29.815	29.808	29.808	29.808
C_801.74	29.587	29.464	29.529	29.541	29.515	29.515	29.515
C_754.69	29.171	29.044	29.11	29.117	29.1	29.1	29.1
C_707.64	28.751	28.628	28.702	28.71	28.693	28.693	28.693
C_660.59	28.289	28.206	28.247	28.252	28.241	28.241	28.241
C_637.065	28.107	28.016	28.062	28.067	28.057	28.057	28.057
C_613.54	27.785	27.719	27.764	27.768	27.759	27.758	27.758
C_590.89	27.543	27.473	27.513	27.532	27.491	27.491	27.491
C_568.24	27.507	27.457	27.495	27.516	27.469	27.469	27.469
C_545.59	27.489	27.455	27.484	27.506	27.457	27.457	27.457
C_522.94	27.361	27.342	27.359	27.379	27.335	27.335	27.335
C_522.94_DS	27.078	26.927	27.014	27.023	27.003	27.003	27.003
C_517.1	26.979	26.826	26.915	26.923	26.903	26.903	26.903
C_508.1	26.696	26.529	26.63	26.64	26.617	26.617	26.617
C_501.25	26.483	26.31	26.42	26.43	26.407	26.407	26.407
C_494.4	26.311	26.141	26.253	26.263	26.24	26.24	26.24
C_487.55	26.201	26.025	26.146	26.156	26.133	26.133	26.133

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
C_480.7	26.215	25.956	26.147	26.159	26.132	26.132	26.132
C_447.6	25.864	25.685	25.768	25.779	25.754	25.754	25.754
C_420.45	25.638	25.458	25.553	25.562	25.542	25.542	25.542
C_393.3	25.491	25.36	25.44	25.448	25.431	25.431	25.431
C_348.6	25.254	25.183	25.229	25.234	25.223	25.223	25.223
C_303.9	24.995	24.93	24.975	24.978	24.97	24.97	24.97
C_226.1	24.514	24.449	24.499	24.504	24.495	24.495	24.495
C_175.1	24.194	24.139	24.185	24.185	24.181	24.181	24.181
C_124.1	23.869	23.799	23.86	23.864	23.849	23.849	23.849
C_62.05	23.53	23.428	23.505	23.523	23.49	23.49	23.491
C_0	23.37	23.256	23.363	23.409	23.317	23.317	23.318
C_-16.7	23.373	23.265	23.375	23.421	23.323	23.324	23.325
DR2_1504.95	26.838	26.82	26.848	26.886	26.81	26.81	26.81
DR2_1444.675	26.265	26.139	26.238	26.255	26.217	26.217	26.217
DR2_1384.4	25.513	25.339	25.485	25.511	25.453	25.453	25.453
DR2_1324.125	24.855	24.707	24.823	24.841	24.8	24.8	24.8
DR2_1263.85	24.602	24.539	24.592	24.602	24.58	24.58	24.58
DR2_1193.575	24.541	24.48	24.535	24.544	24.523	24.523	24.523
DR2_1123.3	24.457	24.393	24.449	24.458	24.437	24.437	24.437
DR2_1053.025	24.309	24.263	24.3	24.305	24.293	24.293	24.293
DR2_982.75	24.232	24.244	24.248	24.252	24.242	24.242	24.242
DR2_974.95	23.46	23.362	23.441	23.469	23.413	23.413	23.413
DR2_970.43	23.453	23.352	23.437	23.466	23.406	23.406	23.407
DR2_964.34	23.43	23.311	23.417	23.452	23.377	23.377	23.378
DR2_935.115	23.379	23.241	23.378	23.427	23.317	23.317	23.318
DR2_905.89	23.372	23.234	23.373	23.424	23.31	23.31	23.311
DR2_876.665	23.37	23.233	23.372	23.423	23.308	23.308	23.309
DR2_847.44	23.369	23.232	23.371	23.422	23.307	23.307	23.308
DR2_809.44	23.368	23.232	23.37	23.422	23.306	23.306	23.308
DR2_758.44	23.367	23.231	23.369	23.421	23.305	23.305	23.307
DR2_711.14	23.366	23.23	23.369	23.421	23.305	23.305	23.306
DR2_692.39	23.365	23.229	23.368	23.42	23.303	23.303	23.305
DR2_656.34	23.363	23.228	23.366	23.417	23.301	23.302	23.303
DR2_640.465	23.363	23.228	23.365	23.417	23.301	23.302	23.303
DR2_624.59	23.363	23.228	23.365	23.417	23.301	23.302	23.303
DR2_608.715	23.362	23.228	23.365	23.417	23.301	23.302	23.303
DR2_592.84	23.362	23.228	23.365	23.417	23.301	23.302	23.303
DR2_576.965	23.362	23.228	23.365	23.417	23.301	23.301	23.303
DR2_561.09	23.362	23.228	23.365	23.417	23.301	23.301	23.303
DR2_545.215	23.362	23.228	23.365	23.417	23.301	23.301	23.303
DR2_529.34	23.362	23.228	23.365	23.417	23.301	23.301	23.303
DR2_513.465	23.362	23.228	23.365	23.416	23.301	23.301	23.303

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
DR2_497.59	23.362	23.228	23.365	23.416	23.301	23.301	23.303
DR2_478.28	23.362	23.228	23.365	23.417	23.301	23.301	23.302
DR2_458.97	23.362	23.228	23.365	23.416	23.301	23.301	23.302
DR2_439.66	23.361	23.228	23.364	23.416	23.3	23.301	23.302
DR2_420.35	23.361	23.227	23.364	23.416	23.3	23.3	23.301
DR2_401.04	23.36	23.227	23.364	23.415	23.3	23.3	23.301
DR2_381.73	23.36	23.226	23.363	23.415	23.299	23.299	23.3
DR2_362.42	23.359	23.226	23.362	23.414	23.298	23.299	23.3
DR2_343.11	23.358	23.226	23.362	23.414	23.298	23.298	23.299
DR2_323.8	23.358	23.226	23.362	23.414	23.298	23.298	23.299
DR2_304.49	23.358	23.225	23.362	23.413	23.298	23.298	23.299
DR2_292.74	23.357	23.225	23.361	23.413	23.297	23.298	23.299
DR2_280.99	23.357	23.225	23.361	23.413	23.297	23.298	23.299
DR2_269.24	23.357	23.225	23.361	23.413	23.297	23.297	23.299
DR2_257.49	23.357	23.225	23.361	23.413	23.297	23.297	23.298
DR2_244.24	23.356	23.225	23.36	23.412	23.296	23.297	23.298
DR2_230.99	23.356	23.224	23.36	23.412	23.296	23.296	23.297
DR2_217.74	23.355	23.224	23.36	23.412	23.296	23.296	23.297
DR2_204.49	23.354	23.224	23.359	23.411	23.295	23.295	23.297
DR2_189.43	23.353	23.223	23.358	23.41	23.294	23.294	23.295
DR2_159.31	23.351	23.222	23.357	23.409	23.293	23.293	23.294
DR2_144.25	23.351	23.222	23.356	23.409	23.292	23.293	23.294
DR2_129.19	23.348	23.22	23.355	23.407	23.29	23.29	23.291
DR2_35.63	23.347	23.215	23.353	23.405	23.288	23.288	23.289
DR2_0	23.349	23.222	23.356	23.409	23.291	23.292	23.293
D_655.6	31.88	31.709	31.837	31.882	31.792	31.792	31.792
D_629.1	31.71	31.609	31.692	31.723	31.659	31.659	31.659
D_602.6	31.585	31.563	31.595	31.613	31.573	31.573	31.573
D_576.1	31.554	31.511	31.553	31.566	31.538	31.538	31.538
D_549.6	31.553	31.552	31.574	31.592	31.554	31.554	31.554
D_316.7	25.592	25.519	25.581	25.601	25.572	25.572	25.572
D_287.7	25.274	25.079	25.217	25.286	25.164	25.164	25.164
D_279.725	25.218	24.985	25.176	25.254	25.104	25.104	25.104
D_271.75	25.168	24.907	25.14	25.223	25.06	25.06	25.06
D_263.775	25.116	24.857	25.099	25.182	25.015	25.015	25.015
D_255.8	24.909	24.691	24.86	24.924	24.799	24.799	24.799
D_240.075	24.707	24.511	24.66	24.715	24.606	24.606	24.606
D_234.35	24.551	24.367	24.504	24.557	24.452	24.452	24.452
D_223.625	24.444	24.248	24.381	24.435	24.329	24.329	24.329
D_212.9	24.381	24.153	24.315	24.37	24.261	24.261	24.261
D_192.725	24.238	24.009	24.178	24.233	24.125	24.125	24.125
D_172.55	24.085	23.852	24.026	24.071	23.986	23.986	23.986

APPENDIX B-3

Section	Roughness +20%	Roughness -20%	Flow +10%	Flow +20%	D/S boundary	Blockage at St Vigeans culvert	50% blockage at Morrisons culvert
	Flood Levels (mAOD)						
D_152.375	23.943	23.708	23.892	23.916	23.879	23.879	23.879
D_132.2	23.726	23.522	23.688	23.722	23.656	23.656	23.656
D_100.4	23.375	23.168	23.331	23.372	23.291	23.291	23.291
D_68.6	23.034	22.848	22.986	23.033	22.933	22.933	22.933
D_36.8	22.705	22.604	22.673	22.7	22.643	22.643	22.643
D_5	22.771	22.738	22.753	22.762	22.742	22.742	22.742

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
B_1599	8.083	8.438	8.529	8.636	8.785	8.941	9.133	9.604
B_1578	8.016	8.35	8.445	8.556	8.718	8.885	9.097	9.571
B_1557	7.879	8.248	8.355	8.476	8.654	8.833	9.057	9.532
B_2115.8	9.847	10.117	10.157	10.2	10.243	10.271	10.344	10.534
B_2014.4	9.535	9.787	9.825	9.867	9.905	9.93	10.002	10.205
B_2454.8	11.119	11.434	11.478	11.528	11.576	11.605	11.677	11.852
B_2395.45	11.025	11.33	11.372	11.423	11.469	11.497	11.563	11.727
B_2533.2	11.577	11.797	11.825	11.857	11.881	11.897	11.944	12.078
B_2516.9	11.456	11.697	11.724	11.762	11.8	11.824	11.889	12.042
B_2500.6	11.346	11.614	11.651	11.694	11.736	11.762	11.832	12.004
B_2484.3	11.255	11.551	11.592	11.639	11.684	11.712	11.784	11.962
B_2468	11.187	11.497	11.54	11.589	11.635	11.664	11.736	11.915
B_2468_DN	11.127	11.441	11.485	11.536	11.583	11.612	11.684	11.861
B_2460	11.127	11.441	11.485	11.536	11.583	11.612	11.684	11.861
B_2572.5	11.863	11.956	11.997	12.039	12.062	12.077	12.124	12.241
B_2638.6	11.985	12.174	12.194	12.224	12.251	12.264	12.305	12.409
B_2789.2	12.406	12.688	12.718	12.753	12.787	12.809	12.864	12.929
B_2784.7_UP	12.392	12.677	12.706	12.742	12.776	12.799	12.845	12.912
B_2784.7_DN	12.392	12.677	12.706	12.742	12.776	12.799	12.845	12.912
B_2744.2	12.346	12.658	12.688	12.725	12.76	12.783	12.83	12.897
B_2739.6	12.314	12.616	12.641	12.67	12.697	12.716	12.752	12.803
B_2663.9	12.054	12.266	12.296	12.326	12.349	12.362	12.401	12.523
B_2955.7	12.933	13.338	13.377	13.452	13.636	13.778	13.899	14.037
B_2941.1	12.921	13.331	13.372	13.447	13.635	13.776	13.902	14.042
B_2926.5	12.863	13.242	13.28	13.349	13.534	13.662	13.789	13.926
B_2926.5_DN	12.769	13.041	13.066	13.096	13.186	13.238	13.284	13.33
B_2901.5	12.739	13.015	13.044	13.075	13.175	13.231	13.278	13.329
B_2846.5	12.631	12.898	12.931	12.969	13.057	13.145	13.202	13.243
B_2823.2	12.513	12.77	12.798	12.831	12.873	12.947	13.039	13.12
B_3054.7	12.971	13.343	13.382	13.456	13.643	13.78	13.908	14.048
B_3040.7	12.966	13.343	13.382	13.456	13.644	13.781	13.908	14.049
B_3026.7	12.959	13.342	13.382	13.456	13.639	13.78	13.908	14.048
B_3014.2	12.959	13.342	13.381	13.456	13.643	13.78	13.908	14.049
B_3001.7	12.959	13.342	13.381	13.456	13.644	13.78	13.908	14.047
B_2989.2	12.956	13.342	13.381	13.455	13.639	13.779	13.908	14.049
B_2976.7	12.947	13.342	13.381	13.455	13.639	13.782	13.907	14.046
B_3313.9	13.211	13.37	13.398	13.464	13.645	13.782	13.91	14.049
B_3298	13.193	13.359	13.391	13.459	13.642	13.78	13.909	14.049
B_3282.1	13.176	13.361	13.394	13.463	13.646	13.782	13.91	14.049
B_3269.6	13.163	13.355	13.389	13.46	13.644	13.781	13.91	14.049
B_3257.1	13.151	13.355	13.391	13.462	13.645	13.782	13.91	14.049
B_3244.6	13.139	13.35	13.387	13.459	13.644	13.781	13.909	14.049
B_3232.1	13.127	13.349	13.385	13.458	13.643	13.781	13.909	14.049
B_3219.225	13.119	13.351	13.387	13.458	13.643	13.781	13.909	14.049
B_3206.35	13.112	13.351	13.387	13.459	13.643	13.781	13.909	14.049
B_3193.475	13.106	13.355	13.39	13.461	13.644	13.781	13.909	14.049
B_3180.6	13.102	13.357	13.393	13.463	13.644	13.781	13.909	14.049
B_3167.775	13.089	13.358	13.394	13.465	13.646	13.782	13.909	14.049
B_3154.95	13.072	13.356	13.392	13.464	13.647	13.782	13.909	14.049
B_3142.125	13.053	13.353	13.39	13.462	13.645	13.782	13.909	14.049

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
B_3129.3	13.029	13.349	13.387	13.46	13.644	13.781	13.909	14.049
B_3114.38	13.014	13.347	13.385	13.458	13.643	13.781	13.909	14.048
B_3099.46	13.001	13.345	13.384	13.457	13.642	13.781	13.909	14.049
B_3084.54	12.989	13.344	13.383	13.457	13.644	13.78	13.909	14.048
B_3069.62	12.979	13.343	13.382	13.456	13.641	13.781	13.908	14.049
B_3480	13.592	13.795	13.813	13.86	13.928	13.961	14.01	14.095
B_3470.9	13.545	13.746	13.763	13.809	13.878	13.918	13.974	14.071
B_3461.8	13.506	13.702	13.719	13.766	13.837	13.884	13.949	14.061
B_3452.7	13.473	13.668	13.685	13.732	13.808	13.861	13.936	14.058
B_3443.6	13.443	13.643	13.66	13.711	13.791	13.849	13.937	14.061
B_3429	13.412	13.607	13.623	13.668	13.757	13.836	13.934	14.06
B_3414.4	13.384	13.57	13.585	13.626	13.722	13.818	13.925	14.056
B_3399.8	13.356	13.531	13.545	13.586	13.701	13.814	13.929	14.061
B_3385.2	13.326	13.48	13.494	13.526	13.655	13.786	13.912	14.05
B_3367.375	13.299	13.45	13.464	13.506	13.653	13.785	13.911	14.05
B_3349.55	13.271	13.42	13.438	13.488	13.649	13.783	13.911	14.05
B_3331.725	13.243	13.394	13.416	13.474	13.647	13.783	13.91	14.05
B_3676.8	14.799	15.009	15.025	15.1	15.203	15.246	15.296	15.376
B_3676.8_DS	14.776	14.965	14.978	15.045	15.117	15.142	15.176	15.228
B_3493.4	13.695	13.855	13.871	13.916	13.98	14.008	14.048	14.121
B_2336.1	10.913	11.202	11.245	11.295	11.342	11.372	11.439	11.611
B_2272.9	10.78	11.031	11.067	11.111	11.159	11.194	11.284	11.557
B_2208.7	10.222	10.545	10.604	10.669	10.73	10.761	10.876	11.359
B_2183.1	10.249	10.582	10.64	10.708	10.778	10.824	10.958	11.374
B_2183.1_DS	10.174	10.464	10.512	10.564	10.617	10.652	10.75	11.012
B_2173.4	10.106	10.42	10.469	10.524	10.579	10.615	10.716	10.985
B_2163.1	10.082	10.407	10.457	10.512	10.568	10.605	10.707	10.979
B_2155.1	9.99	10.274	10.317	10.364	10.411	10.442	10.523	10.735
B_1913	9.222	9.48	9.521	9.565	9.606	9.635	9.713	9.974
B_1816.25	8.885	9.06	9.09	9.127	9.17	9.232	9.348	9.729
B_1719.5	8.565	8.817	8.864	8.923	9.006	9.107	9.266	9.697
B_1709.9	8.582	8.84	8.889	8.948	9.03	9.129	9.286	9.717
B_1709.9_DN	8.462	8.735	8.791	8.859	8.961	9.076	9.246	9.691
B_1704	8.425	8.72	8.78	8.85	8.955	9.072	9.244	9.69
B_1695.6	8.37	8.667	8.735	8.817	8.935	9.061	9.239	9.69
B_1557_DS	7.879	8.242	8.348	8.468	8.645	8.824	9.048	9.517
B_1544	7.807	8.191	8.305	8.43	8.615	8.8	9.028	9.496
B_1541	7.785	8.177	8.292	8.418	8.606	8.791	9.021	9.492
B_1541_DS	7.785	8.177	8.292	8.418	8.606	8.791	9.011	9.427
B_1536	7.778	8.172	8.288	8.414	8.605	8.794	9.016	9.435
B_1518	7.684	8.098	8.226	8.362	8.564	8.763	8.993	9.417
B_1510	7.67	8.088	8.218	8.355	8.559	8.759	8.989	9.422
B_1502	7.661	8.081	8.211	8.349	8.554	8.755	8.986	9.424
B_1494	7.655	8.075	8.206	8.344	8.55	8.751	8.983	9.43
B_1474	7.547	7.977	8.12	8.266	8.486	8.697	8.937	9.393
B_1462.67	7.496	7.929	8.079	8.229	8.456	8.673	8.918	9.377
B_1451.34	7.445	7.882	8.039	8.192	8.426	8.648	8.898	9.361
B_1440	7.394	7.832	7.996	8.153	8.393	8.621	8.875	9.342
B_6088.9	21.57	21.949	22.001	22.051	22.09	22.11	22.125	22.141
B_5938.1_UP	21.384	21.733	21.776	21.825	21.863	21.889	21.906	21.956

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
B_5938.1_DN	21.384	21.733	21.776	21.825	21.863	21.889	21.906	21.956
B_5923.3	21.355	21.698	21.738	21.784	21.82	21.845	21.862	21.915
B_4001.6	16.244	16.391	16.403	16.447	16.528	16.556	16.581	16.617
B_3920.1	15.77	15.9	15.91	15.938	15.989	16.011	16.035	16.08
B_3893	15.673	15.796	15.806	15.832	15.894	15.922	15.953	16.009
B_3865.9	15.571	15.693	15.705	15.742	15.827	15.863	15.902	15.967
B_3838.8	15.461	15.585	15.599	15.645	15.758	15.808	15.856	15.932
B_3811.7	15.309	15.457	15.477	15.538	15.683	15.746	15.802	15.887
B_2163.1_DS	10.025	10.314	10.359	10.407	10.455	10.487	10.57	10.789
B_1440_DS	7.394	7.832	7.996	8.153	8.372	8.576	8.804	9.175
B_1436	7.403	7.842	8.004	8.16	8.379	8.581	8.808	9.179
B_1407.37	7.369	7.82	7.989	8.149	8.372	8.578	8.809	9.184
B_3797.9	15.28	15.421	15.441	15.504	15.654	15.72	15.778	15.864
B_3784.1	15.269	15.404	15.424	15.485	15.635	15.7	15.757	15.843
B_3770.3	15.263	15.395	15.414	15.475	15.622	15.686	15.741	15.826
B_3756.5	15.26	15.39	15.409	15.468	15.615	15.678	15.734	15.818
B_3742.7	15.258	15.387	15.406	15.465	15.611	15.675	15.73	15.814
B_3728.9	15.257	15.385	15.404	15.463	15.609	15.672	15.727	15.811
B_2744.2_DS	12.333	12.636	12.662	12.694	12.722	12.742	12.78	12.833
B_4294.2	17.323	17.51	17.526	17.597	17.721	17.764	17.814	17.887
B_4252.1	17.221	17.452	17.472	17.557	17.704	17.758	17.817	17.903
B_4156	16.956	17.163	17.186	17.253	17.419	17.481	17.551	17.656
B_4117.6	16.763	16.954	16.973	17.042	17.189	17.246	17.31	17.405
B_4015.6	16.362	16.537	16.554	16.614	16.741	16.791	16.846	16.933
B_4015.6_DS	16.356	16.52	16.536	16.59	16.702	16.744	16.789	16.86
B_4542.8	18.393	18.558	18.572	18.645	18.765	18.808	18.853	18.922
B_4514.9	18.25	18.416	18.43	18.504	18.629	18.671	18.716	18.789
B_4487	18.12	18.293	18.308	18.388	18.517	18.561	18.609	18.685
B_4462	18.009	18.179	18.195	18.275	18.397	18.438	18.485	18.563
B_4438	17.896	18.065	18.08	18.162	18.293	18.342	18.4	18.499
B_4413.5	17.783	17.954	17.971	18.067	18.225	18.281	18.349	18.461
B_4389	17.67	17.854	17.871	17.961	18.132	18.206	18.29	18.42
B_4364.5	17.606	17.818	17.838	17.936	18.113	18.187	18.27	18.401
B_4340	17.501	17.702	17.72	17.81	17.972	18.038	18.114	18.233
B_4315.5	17.42	17.621	17.639	17.724	17.88	17.944	18.02	18.138
B_4315.5_DS	17.406	17.596	17.612	17.688	17.826	17.882	17.948	18.051
B_4304.6	17.307	17.496	17.512	17.583	17.721	17.779	17.849	17.956
B_4299.3	17.339	17.529	17.545	17.619	17.759	17.818	17.887	17.994
B_4299.3_DS	17.339	17.529	17.545	17.619	17.748	17.794	17.846	17.924
B_5121.5	20.018	20.232	20.248	20.376	20.537	20.595	20.657	20.749
B_4983.2	19.631	19.822	19.84	19.935	20.091	20.148	20.21	20.305
B_4955.5	19.516	19.717	19.738	19.823	19.99	20.05	20.116	20.217
B_4908.75	19.378	19.555	19.572	19.666	19.827	19.885	19.948	20.052
B_4862	19.283	19.424	19.438	19.518	19.666	19.724	19.79	19.904
B_4741	19.073	19.288	19.308	19.414	19.593	19.66	19.734	19.844
B_4603.6_DS	18.757	18.932	18.947	19.027	19.157	19.205	19.256	19.334
B_4598.6	18.7	18.866	18.881	18.954	19.074	19.117	19.162	19.229
B_5396.7	20.543	20.834	20.858	21.093	21.31	21.442	21.545	21.646
B_5335.9	20.473	20.769	20.796	21.032	21.268	21.414	21.534	21.648
B_5335.9_DS	20.385	20.587	20.601	20.707	20.84	20.892	20.949	21.033

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
B_5325.7	20.386	20.598	20.613	20.723	20.854	20.903	20.956	21.038
B_5604.2	20.779	21.074	21.098	21.278	21.438	21.536	21.626	21.725
B_5532	20.679	20.979	21.004	21.232	21.434	21.535	21.626	21.724
B_5512	20.65	20.952	20.977	21.211	21.431	21.536	21.626	21.725
B_5462.8	20.603	20.907	20.933	21.173	21.41	21.53	21.625	21.726
B_5458.5	20.603	20.903	20.927	21.141	21.362	21.497	21.601	21.707
B_5462_DS	20.603	20.902	20.926	21.141	21.362	21.497	21.601	21.707
B_5462	20.603	20.906	20.932	21.173	21.41	21.529	21.625	21.726
B_5915.9	21.341	21.68	21.719	21.764	21.799	21.822	21.839	21.895
B_5843.5	21.218	21.537	21.561	21.594	21.626	21.648	21.685	21.753
B_5785.4	21.141	21.489	21.523	21.566	21.646	21.693	21.747	21.827
B_5779.4	20.993	21.286	21.31	21.383	21.492	21.561	21.635	21.727
B_5758.3	20.963	21.258	21.282	21.365	21.485	21.559	21.636	21.729
B_5666	20.846	21.142	21.166	21.31	21.454	21.544	21.63	21.727
B_4603.6	18.762	18.942	18.958	19.041	19.178	19.23	19.284	19.367
B_6093.6	21.594	21.989	22.048	22.107	22.157	22.184	22.205	22.229
B_6093.6_DS	21.584	21.969	22.023	22.074	22.115	22.137	22.153	22.171
B_7787.9	25.399	25.766	25.851	25.949	26.046	26.113	26.123	26.446
B_6896.6	22.893	23.801	23.992	24.222	24.453	24.613	24.836	25.267
B_6887.3	22.88	23.801	23.992	24.222	24.451	24.616	24.833	25.26
B_6878	22.866	23.801	23.992	24.222	24.451	24.617	24.834	25.253
B_6912.9	22.906	23.801	23.992	24.222	24.456	24.612	24.839	25.269
B_6912.9_DS	22.903	23.801	23.992	24.222	24.456	24.612	24.839	25.268
B_6905.9	22.903	23.801	23.992	24.222	24.456	24.612	24.839	25.268
B_7718.9	25.071	25.325	25.385	25.454	25.523	25.57	25.577	25.81
B_7668.9	24.683	24.938	24.997	25.068	25.135	25.182	25.19	25.422
B_7615.4	24.295	24.541	24.596	24.664	24.724	24.763	24.84	25.241
B_7472.5	23.449	23.81	23.995	24.223	24.45	24.611	24.831	25.238
B_7386.35	23.077	23.801	23.992	24.222	24.45	24.611	24.831	25.239
B_7300.2	22.961	23.801	23.992	24.222	24.451	24.611	24.83	25.239
B_7282.225	22.956	23.801	23.992	24.222	24.454	24.608	24.831	25.237
B_7264.25	22.951	23.801	23.992	24.222	24.453	24.614	24.832	25.237
B_7246.275	22.947	23.801	23.992	24.222	24.456	24.609	24.832	25.238
B_7228.3	22.944	23.801	23.992	24.222	24.455	24.616	24.83	25.239
B_7203.3	22.939	23.801	23.992	24.222	24.456	24.619	24.832	25.239
B_7178.3	22.935	23.801	23.992	24.222	24.465	24.615	24.834	25.249
B_7148.35	22.931	23.801	23.992	24.222	24.459	24.623	24.833	25.252
B_7118.4	22.927	23.801	23.992	24.222	24.459	24.623	24.837	25.255
B_7098.25	22.925	23.801	23.992	24.222	24.463	24.618	24.837	25.247
B_7078.1	22.923	23.801	23.992	24.222	24.458	24.622	24.832	25.247
B_7053.1	22.921	23.801	23.992	24.222	24.46	24.613	24.836	25.243
B_7028.1	22.92	23.801	23.992	24.222	24.463	24.611	24.837	25.266
B_7003.1	22.918	23.801	23.993	24.222	24.483	24.629	24.847	25.275
B_6978.1	22.916	23.801	23.992	24.222	24.474	24.627	24.84	25.274
B_6953.5	22.913	23.801	23.992	24.222	24.457	24.616	24.84	25.281
B_6928.9	22.909	23.801	23.992	24.222	24.463	24.62	24.847	25.281
B_6865.475	22.858	23.801	23.992	24.222	24.451	24.612	24.835	25.252
B_6852.95	22.851	23.801	23.992	24.222	24.45	24.608	24.832	25.254
B_6840.425	22.847	23.801	23.992	24.222	24.45	24.609	24.832	25.257
B_6827.9	22.845	23.801	23.992	24.222	24.45	24.606	24.831	25.258

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
B_6810.4	22.838	23.801	23.992	24.222	24.447	24.606	24.83	25.253
B_6792.9	22.82	23.801	23.992	24.222	24.45	24.606	24.831	25.26
B_6775.4	22.832	23.801	23.992	24.222	24.449	24.604	24.835	25.252
B_6757.9	22.829	23.801	23.992	24.222	24.449	24.606	24.831	25.253
B_6747.775	22.828	23.801	23.992	24.222	24.448	24.604	24.832	25.263
B_6737.65	22.827	23.801	23.992	24.222	24.449	24.604	24.835	25.265
B_6727.525	22.826	23.801	23.992	24.222	24.449	24.606	24.834	25.261
B_6705.8	22.832	23.798	23.989	24.22	24.446	24.605	24.83	25.296
B_6658.8	22.081	22.441	22.515	22.575	22.618	22.646	22.671	22.776
B_6638.4	22.074	22.438	22.512	22.573	22.62	22.651	22.674	22.784
B_6628.7	22.065	22.433	22.508	22.57	22.618	22.65	22.671	22.784
B_6632.4D	22.067	22.434	22.509	22.572	22.619	22.65	22.673	22.784
B_1396	7.262	7.694	7.875	8.018	8.254	8.45	8.67	9.002
B_1372	7.163	7.604	7.802	7.954	8.205	8.41	8.637	8.976
B_1339.97	7.035	7.458	7.68	7.836	8.106	8.322	8.559	8.925
B_1275	6.764	7.125	7.253	7.441	7.667	7.845	8.041	8.351
B_1232	6.601	6.96	7.119	7.34	7.592	7.784	7.992	8.314
B_1157	6.383	6.831	7.037	7.297	7.574	7.777	7.993	8.323
B_936.6	5.638	6.012	6.047	6.126	6.205	6.269	6.332	6.466
B_930.75	5.648	6.037	6.076	6.157	6.239	6.304	6.369	6.502
B_898	5.581	5.888	5.943	6.006	6.067	6.116	6.164	6.277
B_858	5.265	5.579	5.638	5.708	5.778	5.835	5.889	6.042
B_813	5.187	5.515	5.58	5.655	5.732	5.794	5.854	6.008
B_752	5.042	5.386	5.455	5.537	5.62	5.688	5.754	5.932
B_717	4.981	5.322	5.39	5.472	5.554	5.621	5.686	5.869
B_717_DS	4.95	5.252	5.31	5.379	5.448	5.504	5.555	5.717
B_710.5	4.921	5.222	5.279	5.349	5.418	5.474	5.525	5.691
B_704	4.875	5.181	5.24	5.31	5.38	5.436	5.488	5.659
B_683.7	4.792	5.104	5.162	5.234	5.306	5.364	5.416	5.602
B_663.6	4.634	4.964	5.026	5.105	5.184	5.25	5.305	5.523
B_648.7	4.591	4.897	4.954	5.03	5.107	5.172	5.224	5.459
B_634	4.569	4.842	4.892	4.96	5.03	5.09	5.135	5.373
B_620.5	4.468	4.746	4.798	4.886	4.981	5.065	5.149	5.459
B_607_UP	4.379	4.665	4.718	4.811	4.917	5.006	5.099	5.49
SPILL	4.379	4.665	4.718	4.811	4.917	5.006	5.099	5.49
WEIR	4.379	4.665	4.718	4.811	4.917	5.006	5.099	5.49
B_607_DN	3.9	4.359	4.456	4.561	4.684	4.793	4.904	5.387
B_597.5	3.901	4.36	4.458	4.562	4.685	4.794	4.906	5.393
B_591	3.915	4.372	4.469	4.572	4.695	4.804	4.915	5.397
B_555	3.867	4.276	4.359	4.447	4.549	4.639	4.732	5.197
B_520	3.675	4.059	4.142	4.231	4.327	4.424	4.521	5.07
B_470	3.596	4.015	4.105	4.199	4.303	4.405	4.509	5.079
B_424	3.493	3.87	3.943	4.015	4.089	4.162	4.239	4.782
B_391	3.427	3.811	3.886	3.962	4.031	4.106	4.186	4.761
B_361	3.405	3.8	3.878	3.959	4.026	4.104	4.185	4.767
B_332	3.371	3.773	3.851	3.932	4.001	4.08	4.164	4.76
B_312	3.298	3.709	3.791	3.87	3.944	4.027	4.115	4.744
B_312_DS	3.298	3.704	3.783	3.858	3.929	4.011	4.097	4.64
B_309	3.295	3.705	3.784	3.859	3.931	4.013	4.099	4.641
B_285	3.152	3.546	3.62	3.69	3.744	3.826	3.915	4.55

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
B_285_DS	3.152	3.546	3.62	3.69	3.744	3.826	3.915	4.419
B_281	3.132	3.554	3.638	3.718	3.781	3.874	3.97	4.459
B_263	3.199	3.645	3.728	3.807	3.877	3.965	4.057	4.511
B_263_DS	3.171	3.588	3.664	3.734	3.791	3.87	3.952	4.365
B_251	3.16	3.575	3.651	3.721	3.776	3.855	3.937	4.354
B_228	3.075	3.476	3.549	3.616	3.668	3.738	3.822	4.255
B_202	3.065	3.487	3.563	3.633	3.687	3.762	3.847	4.267
B_181	3.035	3.454	3.53	3.599	3.652	3.724	3.81	4.238
B_151.1	2.986	3.394	3.467	3.533	3.585	3.648	3.734	4.168
B_131.1	2.941	3.332	3.402	3.464	3.513	3.566	3.653	4.102
B_125	2.667	2.917	2.964	3.015	3.012	3.064	3.16	3.29
B_95.5	2.555	2.772	2.813	2.873	2.858	2.939	3.025	3.153
B_66	2.434	2.607	2.641	2.715	2.702	2.808	2.885	3.012
B_46	2.46	2.505	2.536	2.62	2.609	2.754	2.804	2.93
B_26	2.494	2.54	2.547	2.681	2.679	2.85	2.931	3.043
B_25.4	2.493	2.539	2.546	2.68	2.677	2.849	2.93	3.042
B_25.4_DS	2.493	2.539	2.546	2.68	2.677	2.849	2.93	3.042
B_18	2.445	2.494	2.503	2.579	2.569	2.696	2.714	2.843
B_10	2.489	2.51	2.51	2.66	2.66	2.85	2.93	3.04
B_3529.4	13.828	13.973	13.985	14.02	14.069	14.091	14.115	14.143
B_3520.4	13.777	13.924	13.938	13.974	14.027	14.049	14.074	14.127
B_3511.4	13.739	13.89	13.904	13.945	14.002	14.025	14.059	14.124
B_3502.4	13.713	13.868	13.883	13.926	13.988	14.014	14.052	14.123
B_3606.125	14.226	14.439	14.461	14.523	14.615	14.644	14.675	14.712
B_3592.85	14.193	14.402	14.423	14.485	14.574	14.598	14.624	14.652
B_3579.575	14.148	14.353	14.374	14.435	14.524	14.548	14.574	14.599
B_3566.3	14.078	14.282	14.302	14.363	14.453	14.481	14.512	14.549
B_3566.3_DS	14.069	14.255	14.273	14.326	14.403	14.426	14.452	14.481
B_3555.9	14.03	14.212	14.23	14.282	14.356	14.378	14.402	14.43
B_3542.65	13.958	14.13	14.147	14.195	14.261	14.279	14.3	14.327
B_6713.4_DN	22.825	23.801	23.992	24.222	24.448	24.606	24.832	25.287
B_6628.7_DS	22.065	22.433	22.508	22.57	22.618	22.65	22.671	22.783
B_6618.7	22.065	22.434	22.508	22.57	22.618	22.65	22.671	22.783
B_6551.7	22.021	22.375	22.441	22.499	22.548	22.578	22.614	22.712
B_6483.5	21.969	22.321	22.383	22.441	22.495	22.529	22.573	22.67
B_6381.3	21.893	22.252	22.314	22.373	22.438	22.48	22.526	22.614
B_6347.3	21.861	22.21	22.262	22.319	22.386	22.432	22.475	22.542
B_6347.3_DS	21.86	22.203	22.252	22.308	22.373	22.418	22.458	22.517
B_6339.6	21.839	22.181	22.225	22.283	22.35	22.397	22.436	22.484
B_6317.1	21.84	22.198	22.255	22.311	22.372	22.41	22.446	22.503
B_6237.6	21.781	22.16	22.216	22.273	22.329	22.363	22.392	22.432
B_6233.3_UP	21.777	22.156	22.213	22.269	22.325	22.359	22.388	22.425
B_6233.3_DN	21.777	22.156	22.213	22.269	22.325	22.359	22.388	22.425
B_6222.7	21.749	22.126	22.184	22.241	22.295	22.327	22.353	22.385
B_6162.3	21.669	22.057	22.115	22.173	22.221	22.247	22.265	22.281
B_3672.2	14.787	14.98	14.994	15.061	15.143	15.169	15.193	15.23
B_3663.975	14.736	14.934	14.947	15.016	15.083	15.099	15.109	15.119
B_3655.75	14.684	14.892	14.906	14.997	15.081	15.101	15.118	15.124
B_3647.525	14.631	14.846	14.866	15.019	15.155	15.192	15.227	15.269
B_3639.3	14.575	14.797	14.817	15.008	15.164	15.206	15.246	15.295

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
B_3636.4	14.454	14.653	14.678	14.955	15.139	15.186	15.229	15.281
B_3633.5	14.386	14.586	14.613	14.747	15.029	15.092	15.144	15.196
B_3629.6	14.246	14.446	14.48	14.65	14.996	15.066	15.128	15.189
B_3626.2	14.147	14.333	14.352	14.411	14.515	14.549	14.584	14.628
B_3622.8	14.219	14.426	14.447	14.506	14.586	14.614	14.65	14.691
B_3619.4	14.251	14.47	14.492	14.556	14.647	14.677	14.71	14.749
B_6632.4U	22.067	22.434	22.509	22.572	22.619	22.65	22.673	22.784
B_6713.4_UP	22.825	23.801	23.992	24.222	24.448	24.606	24.832	25.287
H_152.5	12.159	12.266	12.289	12.328	12.363	12.377	12.445	12.614
H_131.3	12.129	12.238	12.262	12.303	12.338	12.352	12.408	12.528
H_1667.7	21.219	21.543	21.621	21.712	21.799	21.847	21.846	21.927
H_1639.2	20.884	21.209	21.288	21.379	21.466	21.514	21.513	21.6
H_1610.7	20.549	20.876	20.956	21.047	21.135	21.18	21.179	21.239
H_1582.2	20.214	20.543	20.623	20.715	20.803	20.87	20.869	21.047
H_1553.7	19.879	20.21	20.291	20.383	20.471	20.528	20.527	20.654
H_1525.2	19.544	19.876	19.958	20.051	20.14	20.193	20.192	20.313
H_1496.7	19.214	19.555	19.635	19.724	19.808	19.875	19.878	19.973
H_1468.2	18.996	19.169	19.219	19.292	19.462	19.628	19.791	19.972
H_1344.1	17.865	18.371	18.588	18.875	19.171	19.399	19.547	19.675
H_1220	17.117	18.356	18.588	18.877	19.168	19.391	19.527	19.632
H_1168.2	17.084	18.355	18.588	18.881	19.178	19.408	19.558	19.682
H_1094.15	17.072	18.355	18.588	18.88	19.177	19.404	19.55	19.669
H_1020.1	17.069	18.355	18.588	18.881	19.179	19.408	19.558	19.679
H_1013.74	16.783	18.345	18.587	18.881	19.178	19.407	19.557	19.678
H_941.64	16.781	18.345	18.587	18.881	19.178	19.407	19.557	19.677
H_869.54	16.78	18.345	18.587	18.88	19.178	19.407	19.556	19.678
H_768.94	14.836	14.975	14.993	15.014	15.034	15.049	15.253	15.877
H_701.44	14.606	14.691	14.702	14.715	14.729	14.738	14.843	15.208
H_695.09	14.588	14.686	14.699	14.715	14.731	14.742	14.872	15.245
H_646.155	14.275	14.396	14.413	14.432	14.452	14.466	14.616	15.037
H_597.22	14.043	14.165	14.183	14.202	14.222	14.236	14.39	14.838
H_589.77	13.995	14.111	14.128	14.146	14.165	14.178	14.316	14.672
H_550.735	13.781	13.893	13.911	13.93	13.949	13.963	14.073	14.418
H_511.7	13.541	13.686	13.711	13.739	13.767	13.785	13.865	13.963
H_400.8	12.977	12.983	12.984	12.984	12.984	12.984	13.054	13.523
H_325.6	12.698	12.776	12.786	12.801	12.819	12.831	12.909	13.589
H_215.09	12.325	12.452	12.473	12.508	12.542	12.56	12.711	13.263
H_215.09_DS	12.304	12.418	12.438	12.47	12.501	12.517	12.629	12.92
H_211.45	12.28	12.391	12.411	12.443	12.475	12.491	12.592	12.833
H_181.975	12.195	12.303	12.325	12.364	12.401	12.417	12.499	12.643
H_101.4	12.035	12.145	12.175	12.212	12.24	12.254	12.3	12.409
H_61.8	11.828	11.968	12.005	12.045	12.068	12.082	12.126	12.241
H_0	11.613	11.776	11.808	11.843	11.867	11.884	11.937	12.077
H_-16.675	11.576	11.736	11.773	11.808	11.83	11.845	11.895	12.036
H_-33.35	11.532	11.694	11.732	11.768	11.792	11.807	11.86	12.005
H_-50.025	11.472	11.637	11.676	11.711	11.738	11.758	11.817	11.974
H_-66.7	11.218	11.502	11.542	11.588	11.629	11.656	11.726	11.901
G_90.3	13.711	14.103	14.203	14.33	14.458	14.552	14.557	14.823
G_72.8	13.653	14.057	14.163	14.295	14.43	14.528	14.533	14.809
G_51.6	13.469	13.771	13.841	13.925	14.006	14.062	14.065	14.208

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
G_51.6_DN	13.442	13.742	13.812	13.896	13.977	14.033	14.036	14.179
G_43	12.555	12.91	12.991	13.129	13.285	13.448	13.458	13.67
G_49.1	12.561	12.857	12.929	13.058	13.213	13.39	13.402	13.637
G_39.85	12.542	12.904	12.986	13.125	13.282	13.447	13.456	13.669
G_36.7	12.529	12.898	12.981	13.121	13.28	13.446	13.456	13.669
G_33.55	12.517	12.892	12.975	13.115	13.275	13.443	13.453	13.669
G_30.4	12.504	12.89	12.974	13.114	13.274	13.442	13.453	13.668
G_25.9	12.492	12.883	12.967	13.107	13.269	13.439	13.449	13.667
G_21.4	12.481	12.88	12.964	13.105	13.267	13.435	13.445	13.662
G_16.9	12.473	12.877	12.962	13.104	13.265	13.433	13.443	13.661
G_12.4	12.465	12.875	12.96	13.102	13.263	13.431	13.441	13.659
G_9.4	12.444	12.839	12.92	13.062	13.227	13.4	13.41	13.631
C_1036.71	31.178	31.524	31.648	31.854	32.044	32.199	32.227	32.315
C_1002.82	30.877	31.344	31.522	31.776	31.993	32.174	32.208	32.315
C_968.93	30.677	31.205	31.412	31.689	31.908	32.087	32.12	32.247
C_968.93_DS	30.66	31.046	31.142	31.255	31.291	31.318	31.318	31.319
C_963.19	30.601	30.906	30.976	31.046	31.102	31.179	31.202	31.239
C_915.44	30.169	30.419	30.474	30.54	30.6	30.642	30.653	30.683
C_887.015	29.872	30.129	30.186	30.25	30.311	30.353	30.363	30.392
C_858.59	29.579	29.841	29.898	29.964	30.026	30.068	30.079	30.105
C_830.165	29.273	29.552	29.609	29.676	29.741	29.785	29.796	29.823
C_801.74	29.016	29.287	29.338	29.398	29.455	29.492	29.502	29.533
C_754.69	28.629	28.882	28.934	28.99	29.045	29.081	29.09	29.114
C_707.64	28.243	28.485	28.533	28.591	28.641	28.678	28.687	28.712
C_660.59	27.856	28.087	28.131	28.172	28.218	28.241	28.246	28.262
C_637.065	27.671	27.892	27.935	27.984	28.026	28.05	28.056	28.072
C_613.54	27.394	27.609	27.65	27.697	27.736	27.756	27.761	27.779
C_590.89	27.049	27.279	27.327	27.379	27.43	27.487	27.507	27.56
C_568.24	26.782	27.048	27.135	27.24	27.369	27.462	27.486	27.546
C_545.59	26.716	26.974	27.076	27.203	27.346	27.447	27.472	27.534
C_522.94	26.695	26.92	27.011	27.118	27.24	27.33	27.353	27.414
C_522.94_DS	26.668	26.803	26.859	26.923	26.988	27.03	27.04	27.066
C_517.1	26.53	26.731	26.782	26.84	26.9	26.938	26.947	26.971
C_508.1	26.303	26.478	26.524	26.578	26.634	26.67	26.679	26.701
C_501.25	26.065	26.252	26.303	26.361	26.422	26.462	26.472	26.496
C_494.4	25.834	26.051	26.109	26.175	26.244	26.287	26.298	26.325
C_487.55	25.642	25.903	25.967	26.04	26.116	26.163	26.175	26.203
C_480.7	25.534	25.829	25.903	25.989	26.078	26.133	26.147	26.181
C_447.6	25.134	25.447	25.526	25.614	25.698	25.75	25.763	25.795
C_420.45	24.838	25.227	25.319	25.408	25.485	25.53	25.541	25.57
C_393.3	24.702	25.127	25.223	25.311	25.381	25.42	25.429	25.455
C_348.6	24.539	24.954	25.047	25.131	25.186	25.213	25.219	25.25
C_303.9	24.335	24.722	24.808	24.888	24.94	24.963	24.966	25.249
C_226.1	23.849	24.225	24.315	24.401	24.467	24.61	24.836	25.249
C_175.1	23.481	23.91	24.006	24.225	24.452	24.606	24.835	25.252
C_124.1	23.179	23.803	23.993	24.222	24.45	24.604	24.835	25.249
C_62.05	22.985	23.801	23.992	24.222	24.45	24.605	24.832	25.249
C_0	22.914	23.801	23.992	24.222	24.454	24.604	24.834	25.246
C_-16.7	22.903	23.801	23.992	24.222	24.456	24.612	24.839	25.268
M_303.9	23.641	23.943	23.985	24.037	24.079	24.108	24.116	24.175

APPENDIX B-4

Section	2yr	5yr	10yr	20yr	50yr	100yr	200yr	500yr
	Flood Levels (mAOD)							
M_285.05	23.639	23.941	23.984	24.036	24.078	24.107	24.116	24.177
M_266.2	23.638	23.939	23.981	24.032	24.074	24.101	24.109	24.166
M_247.35	23.637	23.941	23.984	24.036	24.079	24.107	24.115	24.172
M_228.5	23.637	23.948	23.993	24.048	24.095	24.127	24.136	24.205
M_79.5	22.085	22.262	22.364	22.533	22.733	22.904	22.967	23.077
M_57.3	21.98	22.095	22.185	22.37	22.591	22.784	22.86	23.017
M_CUL1_0	21.939	22.062	22.149	22.327	22.541	22.727	22.802	22.981
M_40.5	21.55	21.82	21.873	21.937	21.997	22.042	22.065	22.268
M_20.25	21.446	21.766	21.814	21.869	21.916	21.95	21.969	22.042
D_655.6	31.31	31.534	31.591	31.669	31.725	31.763	31.777	31.689
D_629.1	31.004	31.266	31.421	31.54	31.589	31.621	31.632	31.557
D_602.6	30.735	31.1	31.346	31.477	31.517	31.541	31.549	31.491
D_576.1	30.546	30.997	31.311	31.461	31.494	31.512	31.518	31.474
D_549.6	30.355	30.914	31.301	31.458	31.498	31.521	31.529	31.473
D_316.7	25.109	25.325	25.371	25.469	25.527	25.545	25.55	25.491
D_287.7	24.76	24.964	25.012	25.08	25.124	25.147	25.158	25.096
D_279.725	24.613	24.847	24.9	24.977	25.033	25.068	25.084	24.997
D_271.75	24.47	24.739	24.799	24.882	24.949	24.997	25.018	24.907
D_263.775	24.337	24.631	24.689	24.774	24.86	24.925	24.951	24.805
D_255.8	24.223	24.494	24.551	24.631	24.699	24.744	24.762	24.656
D_240.075	24.081	24.337	24.392	24.468	24.529	24.566	24.581	24.49
D_234.35	23.943	24.192	24.246	24.322	24.382	24.418	24.433	24.344
D_223.625	23.812	24.072	24.127	24.206	24.267	24.304	24.319	24.228
D_212.9	23.723	24.01	24.071	24.154	24.219	24.258	24.274	24.178
D_192.725	23.554	23.868	23.93	24.014	24.083	24.124	24.14	24.04
D_172.55	23.388	23.727	23.789	23.874	23.938	23.976	23.992	23.898
D_152.375	23.228	23.579	23.64	23.722	23.786	23.825	23.84	23.747
D_132.2	23.001	23.348	23.411	23.496	23.562	23.603	23.617	23.521
D_100.4	22.644	22.972	23.038	23.128	23.198	23.241	23.257	23.154
D_68.6	22.267	22.668	22.717	22.783	22.843	22.881	22.897	22.806
D_36.8	22.023	22.531	22.557	22.583	22.598	22.604	22.607	22.6
D_5	21.947	22.503	22.547	22.603	22.643	22.664	22.675	22.642

Appendix C – Scheme Drawings

Appendix D - Correspondence

Huws, Dylan

From: MacConnachie, Malcolm <Malcolm.MacConnachie@SEPA.org.uk>
Sent: 06 May 2013 17:16
To: Stuart King; Nicholas Williams[redacted]
Subject: RE: Brothock Water Design Flows

Hi,

Please accept my apologies for the delay in responding to your recent consultation regarding design flows for the Brothock Water at Arbroath.

I note that in Table 1 of your email you have quoted the catchment area draining to Arbroath gauging station as 44.12 km^2. The published catchment area for the gauging station has been 50 km^2 since it was constructed by the former Tay River Purification Board in 1990.

I have undertaken a FEH Pooling Analysis for the Brothock Water at the Arbroath gauging station location. The results are as follows:-

Return period (years)	**Discharge (m^3s^{-1})**
2	11.243
5	15.466
10	18.531
25	22.960
50	26.770
100	31.090
200	36.018

Table 1 – Design flows for Arbroath Gauging Station

SEPA's flow estimate for the 200 year return period flow is approximately 11% higher than the URS estimate which is put down to the difference in the gauging stations selected for inclusion in the pooling group. The 50 year return period flow estimates are almost identical. If you adopt the flows contained in your email then I strongly recommend undertaking a sensitivity analysis as part of the modelling work which will determine how sensitive the design flood levels are to a 10-20% change in the design flow. I would ask that you should be satisfied that these are well within the range of any proposed freeboard allowance otherwise some consideration might be given to adopting the higher figures.

You have asked that SEPA confirms the allowance that should be applied to the design flows for the flood damages assessment. Our advice would be to use a 20% allowance to account for the impact of climate change over the lifetime of a development, in this case the flood protection measures.

I can confirm that we would be satisfied for you to adopt the high emissions scenario to determine the design flood levels. The importance of the adopted downstream boundary can be checked within the model sensitivity analysis.

Please do not hesitate to contact me again should you have any queries regarding the above or if you require any further information.

Regards,

Malcolm MacConnachie

A.Malcolm MacConnachie
Senior Hydrologist
Scottish Environment Protection Agency
7 Whitefriars Crescent
Perth

tel: 01738 627989
fax: 01738 630997
email: malcolm.macconnachie@sepa.org.uk

From: Stuart King [mailto:Stuart.King@Urs.com]
Sent: 26 April 2013 15:24
To: MacConnachie, Malcolm
Cc: Nicholas Williamson
Subject: FW: Brothock Water Design Flows

Brothock Water FPS – Design Flows

Hi Malcolm,

Following your meeting with my colleague Nicholas Williamson on 18/03/13, we had an action to present the design flows we intend on using for the scheme.

In summary, we intend on using the existing design flows used for the Arbroath Flood Strategy. This is since the latest Annual Maxima dataset received from Una Thom of SEPA (covering the gauged period up to December 2012) has not updated $QMED_{obs}$. We would also intend on using the flood growth curve factors derived from the pooling group method based on the most conservative $QMED_{ADJ}$ value (see Table below).

Table 1 – Calculated QMED values

Catchment Area (km2)	Subject Site	$QMED_{CDS}$		$QMED_{OBS}$	$QMED_{ADJ}$	
		FEH	Kjeldsen		FEH data transfer eqn	Kjeldsen data transfer eqn
44.12	B Water @ Arbroath Gauging Station	5.38	6.54	11.036	-	-
46.75	B Water @ Arbroath Harbour	5.76	6.93	-	11.81	-

** FEH equation used to adjust QMED Kjeldsen estimate to subject site

Table 2 – Results of Flood Flow Estimation

Return Period (yrs)	Growth Curve Fittings (derived from pooled analysis at gauging	FEH Pooled Analysis (using $QMED_{ADJ}$ FEH)	FEH Rainfall-Runoff Method

	station)		
2	1	11.81	15.62
5	1.47	17.36	21.44
10	1.78	21.02	26.65
25	2.15	25.39	33.17
30	2.22	26.22	34.65
50	2.42	28.58	38.91
75	2.58	30.47	41.94
100	2.68	31.65	44.40
200	2.94	34.72	50.35
1000	3.5	41.34	71.65

We also intend on adopting the joint probability analysis of fluvial flows vs. extreme sea levels with regards to setting the boundary conditions in our hydraulic model at the downstream (harbour end). The joint probability hydraulic modelling carried out for the AFS confirmed that fluvial flooding was dominant and therefore the adopted scenario was (for the example of the 1:200yr event) Scenario 1 in Table 3 below.

Table 3 – Joint Probability Combinations for Extreme Sea Levels versus River Flows for 1:200yr Joint Exceedance Return Period (JERP)

Scenario No	River Flow and Extreme Sea Level return period combinations for a 1:200yr JERP		Results in terms of values for present day scenario (2011)	
	Extreme Sea Level (Yrs)	River Flow (Yrs)	Extreme Sea Level (mAOD)	River Flow (m^3/s)
1	0.2	200	2.93	34.72
2	0.5	128	3.04	32.74
3	2	32	3.26	26.45
4	5	12.8	3.35	22.16
5	10	6.4	3.42	18.66
6	20	3.2	3.49	14.66
7	50	1.28	3.59	10.73
8	100	0.64	3.67	9.06
9	200	0.32	3.75	6.57

We would appreciate it if SEPA confirm that they are satisfied with the hydrology for the scheme. As you will be aware the Scheme is being designed to provide a 1:200yr standard of protection and Angus Council at this stage in the design do not desire an allowance for climate change effects. However for the purposes of the flood damages assessment we need SEPA to confirm the allowance we should apply to the design flows. For the feasibility study (Arbroath Flood Strategy) SEPA advised on uplifting the design flows by 20% to include the effects of climate change.
With regard to extreme sea levels SEPA were also happy for us to adopt the UCKP09 research and adopt the high emissions 95%ile scenario given for the Arbroath coastline which produces a sea level change of +0.677m. We would appreciate it if SEPA could also confirm that they are happy for us to adopt this value.

We hope that we have provided enough detail to SEPA with regards to the hydrological model for the scheme at this stage. However if you require more information please do not hesitate to contact me.

We are trying to get the baseline modelling complete and we would appreciate it if you could respond to this request by 03/05/13.

Kind regards,

Stuart King BA (Hons) MSc
Assistant Hydrologist
URS Infrastructure & Environment UK Limited

23 Chester Street, Edinburgh, EH3 7EN, United Kingdom

Direct: 0131 718 5133
Fax: 0131 225 5582
stuart.king@urs.com
www.ursglobal.com

Angus House Orchardbank Business Park Forfar DD8 1AN Tel: 01307 473360 Fax: 01307 461 895 Email: plnprocessing@angus.gov.uk

Applications cannot be validated until all the necessary documentation has been submitted and the required fee has been paid.

Thank you for completing this application form:

ONLINE REFERENCE 100544362-001

The online reference is the unique reference for your online form only. The Planning Authority will allocate an Application Number when your form is validated. Please quote this reference if you need to contact the planning Authority about this application.

Type of Application

What is this application for? Please select one of the following: *

☒ Application for planning permission (including changes of use and surface mineral working).

☐ Application for planning permission in principle.

☐ Further application, (including renewal of planning permission, modification, variation or removal of a planning condition etc)

☐ Application for Approval of Matters specified in conditions.

Description of Proposal

Please describe the proposal including any change of use: * (Max 500 characters)

change of Use from Public House to Flat, and dormer extension to attic

Is this a temporary permission? * ☐ Yes ☒ No

If a change of use is to be included in the proposal has it already taken place? (Answer 'No' if there is no change of use.) * ☐ Yes ☒ No

Has the work already been started and/or completed? *

☒ No ☐ Yes – Started ☐ Yes - Completed

Applicant or Agent Details

Are you an applicant or an agent? * (An agent is an architect, consultant or someone else acting on behalf of the applicant in connection with this application) ☐ Applicant ☒ Agent

Agent Details

Please enter Agent details

Company/Organisation:	Building Design Services		
Ref. Number:		You must enter a Building Name or Number, or both: *	
First Name: *	Gianni	Building Name:	Kirkton Enterprise Centre
Last Name: *	Giacomini	Building Number:	
Telephone Number: *	01241435236	Address 1 (Street): *	Sir William Smith Road
Extension Number:		Address 2:	
Mobile Number:		Town/City: *	Arbroath
Fax Number:		Country: *	Scotland
		Postcode: *	DD11 3RD
Email Address: *	gianni@building-design-services.com		

Is the applicant an individual or an organisation/corporate entity? *

☐ Individual ☒ Organisation/Corporate entity

Applicant Details

Please enter Applicant details

Title:		You must enter a Building Name or Number, or both: *	
Other Title:		Building Name:	
First Name: *		Building Number:	14
Last Name: *		Address 1 (Street): *	Applegate
Company/Organisation	H & Co Leisure Ltd	Address 2:	
Telephone Number: *		Town/City: *	Arbroath
Extension Number:		Country: *	Scotland
Mobile Number:		Postcode: *	DD11 1HX
Fax Number:			
Email Address: *	[redacted]		

Site Address Details

Planning Authority: Angus Council

Full postal address of the site (including postcode where available):

Address 1: SMUGGLERS TAVERN

Address 2: 65 LADYBRIDGE STREET

Address 3:

Address 4:

Address 5:

Town/City/Settlement: ARBROATH

Post Code: DD11 1AX

Please identify/describe the location of the site or sites

Northing 740670 Easting 364221

Pre-Application Discussion

Have you discussed your proposal with the planning authority? * ☐ Yes ☒ No

Site Area

Please state the site area: 170.00

Please state the measurement type used: ☐ Hectares (ha) ☒ Square Metres (sq.m)

Existing Use

Please describe the current or most recent use: * (Max 500 characters)

public house

Access and Parking

Are you proposing a new altered vehicle access to or from a public road? * ☐ Yes ☒ No

If Yes please describe and show on your drawings the position of any existing. Altered or new access points, highlighting the changes you propose to make. You should also show existing footpaths and note if there will be any impact on these.

Are you proposing any change to public paths, public rights of way or affecting any public right of access? * ☐ Yes ☒ No

If Yes please show on your drawings the position of any affected areas highlighting the changes you propose to make, including arrangements for continuing or alternative public access.

How many vehicle parking spaces (garaging and open parking) currently exist on the application Site? 0

How many vehicle parking spaces (garaging and open parking) do you propose on the site (i.e. the Total of existing and any new spaces or a reduced number of spaces)? * 0

Please show on your drawings the position of existing and proposed parking spaces and identify if these are for the use of particular types of vehicles (e.g. parking for disabled people, coaches, HGV vehicles, cycles spaces).

Water Supply and Drainage Arrangements

Will your proposal require new or altered water supply or drainage arrangements? * ☐ Yes ☒ No

Do your proposals make provision for sustainable drainage of surface water?? * (e.g. SUDS arrangements) * ☐ Yes ☒ No

Note:-

Please include details of SUDS arrangements on your plans

Selecting 'No' to the above question means that you could be in breach of Environmental legislation.

Are you proposing to connect to the public water supply network? *

☐ Yes

☐ No, using a private water supply

☒ No connection required

If No, using a private water supply, please show on plans the supply and all works needed to provide it (on or off site).

Assessment of Flood Risk

Is the site within an area of known risk of flooding? * ☐ Yes ☐ No ☒ Don't Know

If the site is within an area of known risk of flooding you may need to submit a Flood Risk Assessment before your application can be determined. You may wish to contact your Planning Authority or SEPA for advice on what information may be required.

Do you think your proposal may increase the flood risk elsewhere? * ☐ Yes ☒ No ☐ Don't Know

Trees

Are there any trees on or adjacent to the application site? * ☐ Yes ☒ No

If Yes, please mark on your drawings any trees, known protected trees and their canopy spread close to the proposal site and indicate if any are to be cut back or felled.

Waste Storage and Collection

Do the plans incorporate areas to store and aid the collection of waste (including recycling)? * ☒ Yes ☐ No

If Yes or No, please provide further details: * (Max 500 characters)

new bin store areas to rear of new flat

Residential Units Including Conversion

Does your proposal include new or additional houses and/or flats? * ☒ Yes ☐ No

How many units do you propose in total? * 1

Please provide full details of the number and types of units on the plans. Additional information may be provided in a supporting statement.

All Types of Non Housing Development – Proposed New Floorspace

Does your proposal alter or create non-residential floorspace? * ☐ Yes ☒ No

Schedule 3 Development

Does the proposal involve a form of development listed in Schedule 3 of the Town and Country Planning (Development Management Procedure (Scotland) Regulations 2013 * ☐ Yes ☒ No ☐ Don't Know

If yes, your proposal will additionally have to be advertised in a newspaper circulating in the area of the development. Your planning authority will do this on your behalf but will charge you a fee. Please check the planning authority's website for advice on the additional fee and add this to your planning fee.

If you are unsure whether your proposal involves a form of development listed in Schedule 3, please check the Help Text and Guidance notes before contacting your planning authority.

Planning Service Employee/Elected Member Interest

Is the applicant, or the applicant's spouse/partner, either a member of staff within the planning service or an elected member of the planning authority? * ☐ Yes ☒ No

Certificates and Notices

CERTIFICATE AND NOTICE UNDER REGULATION 15 – TOWN AND COUNTRY PLANNING (DEVELOPMENT MANAGEMENT PROCEDURE) (SCOTLAND) REGULATION 2013

One Certificate must be completed and submitted along with the application form. This is most usually Certificate A, Form 1, Certificate B, Certificate C or Certificate E.

Are you/the applicant the sole owner of ALL the land? * ☒ Yes ☐ No

Is any of the land part of an agricultural holding? * ☐ Yes ☒ No

Certificate Required

The following Land Ownership Certificate is required to complete this section of the proposal:

Certificate A

Land Ownership Certificate

Certificate and Notice under Regulation 15 of the Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

Certificate A

I hereby certify that –

(1) - No person other than myself/the applicant was an owner (Any person who, in respect of any part of the land, is the owner or is the lessee under a lease thereof of which not less than 7 years remain unexpired.) of any part of the land to which the application relates at the beginning of the period of 21 days ending with the date of the accompanying application.

(2) - None of the land to which the application relates constitutes or forms part of an agricultural holding

Signed: Gianni Giacomini

On behalf of: H & Co Leisure Ltd

Date: 22/03/2022

☒ Please tick here to certify this Certificate. *

Checklist – Application for Planning Permission

Town and Country Planning (Scotland) Act 1997

The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

Please take a few moments to complete the following checklist in order to ensure that you have provided all the necessary information in support of your application. Failure to submit sufficient information with your application may result in your application being deemed invalid. The planning authority will not start processing your application until it is valid.

a) If this is a further application where there is a variation of conditions attached to a previous consent, have you provided a statement to that effect? *

☐ Yes ☐ No ☒ Not applicable to this application

b) If this is an application for planning permission or planning permission in principal where there is a crown interest in the land, have you provided a statement to that effect? *

☐ Yes ☐ No ☒ Not applicable to this application

c) If this is an application for planning permission, planning permission in principle or a further application and the application is for development belonging to the categories of national or major development (other than one under Section 42 of the planning Act), have you provided a Pre-Application Consultation Report? *

☐ Yes ☐ No ☒ Not applicable to this application

Town and Country Planning (Scotland) Act 1997

The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013

d) If this is an application for planning permission and the application relates to development belonging to the categories of national or major developments and you do not benefit from exemption under Regulation 13 of The Town and Country Planning (Development Management Procedure) (Scotland) Regulations 2013, have you provided a Design and Access Statement? *

☐ Yes ☐ No ☒ Not applicable to this application

e) If this is an application for planning permission and relates to development belonging to the category of local developments (subject to regulation 13. (2) and (3) of the Development Management Procedure (Scotland) Regulations 2013) have you provided a Design Statement? *

☐ Yes ☐ No ☒ Not applicable to this application

f) If your application relates to installation of an antenna to be employed in an electronic communication network, have you provided an ICNIRP Declaration? *

☐ Yes ☐ No ☒ Not applicable to this application

g) If this is an application for planning permission, planning permission in principle, an application for approval of matters specified in conditions or an application for mineral development, have you provided any other plans or drawings as necessary:

- [x] Site Layout Plan or Block plan.
- [x] Elevations.
- [x] Floor plans.
- [x] Cross sections.
- [x] Roof plan.
- [ ] Master Plan/Framework Plan.
- [ ] Landscape plan.
- [ ] Photographs and/or photomontages.
- [ ] Other.

If Other, please specify: * (Max 500 characters)

Provide copies of the following documents if applicable:

A copy of an Environmental Statement. *	☐ Yes	☒ N/A
A Design Statement or Design and Access Statement. *	☒ Yes	☐ N/A
A Flood Risk Assessment. *	☐ Yes	☒ N/A
A Drainage Impact Assessment (including proposals for Sustainable Drainage Systems). *	☐ Yes	☒ N/A
Drainage/SUDS layout. *	☐ Yes	☒ N/A
A Transport Assessment or Travel Plan	☐ Yes	☒ N/A
Contaminated Land Assessment. *	☐ Yes	☒ N/A
Habitat Survey. *	☐ Yes	☒ N/A
A Processing Agreement. *	☐ Yes	☒ N/A

Other Statements (please specify). (Max 500 characters)

Declare – For Application to Planning Authority

I, the applicant/agent certify that this is an application to the planning authority as described in this form. The accompanying Plans/drawings and additional information are provided as a part of this application.

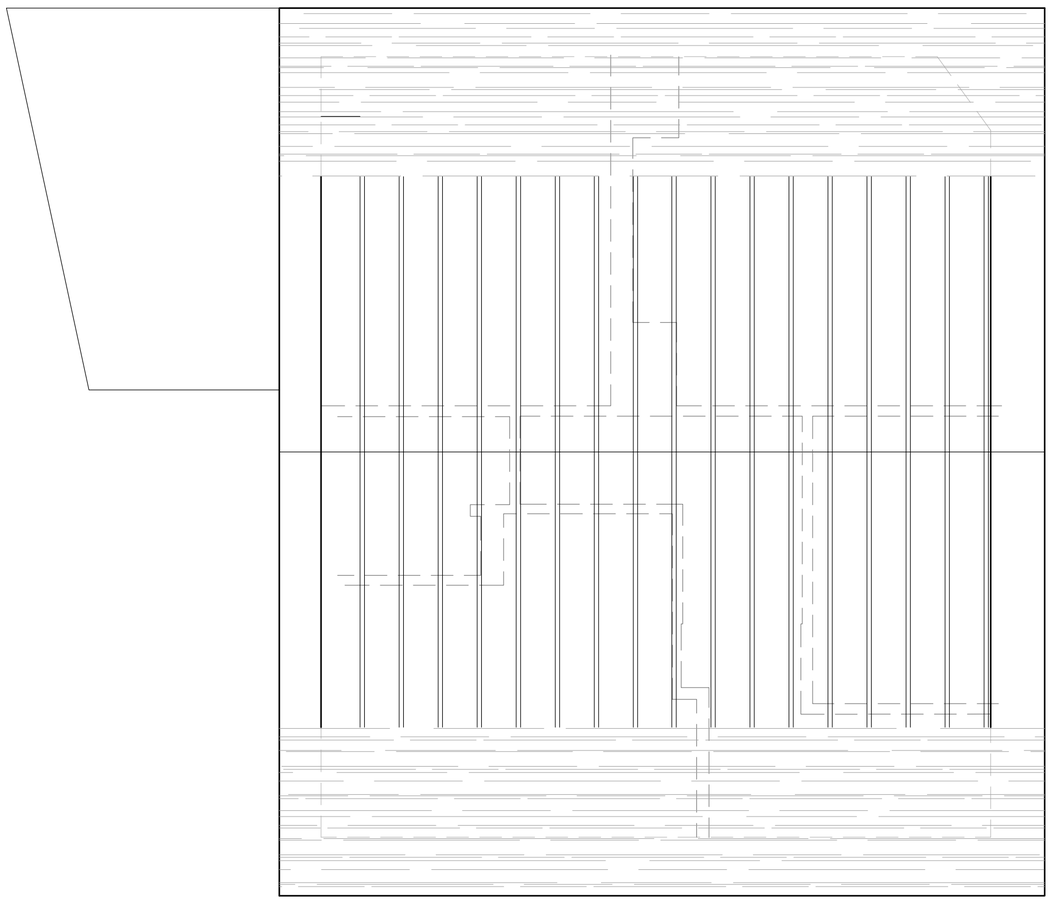
Declaration Name: Mr Gianni Giacomini

Declaration Date: 22/03/2022

Payment Details

Pay Direct

Created: 22/03/2022 21:17



existing attic floor plan - flat @ 1:50

Scale in Meters

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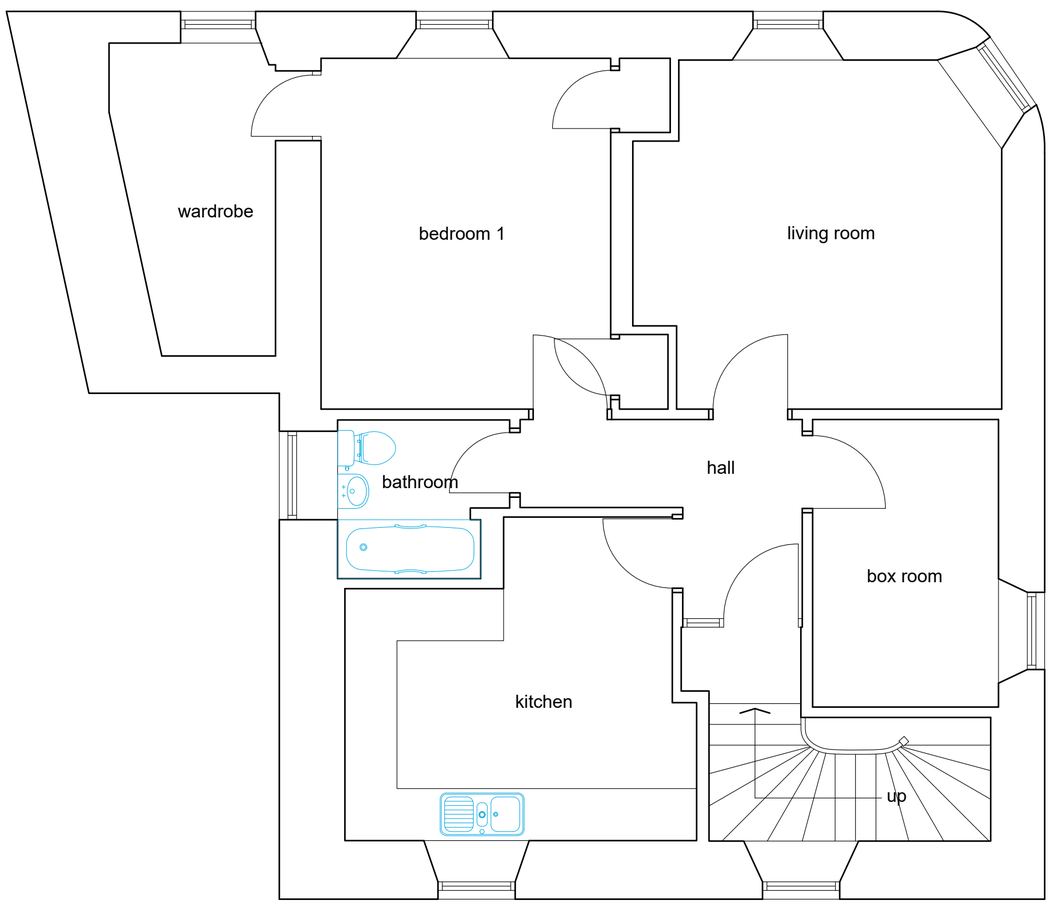
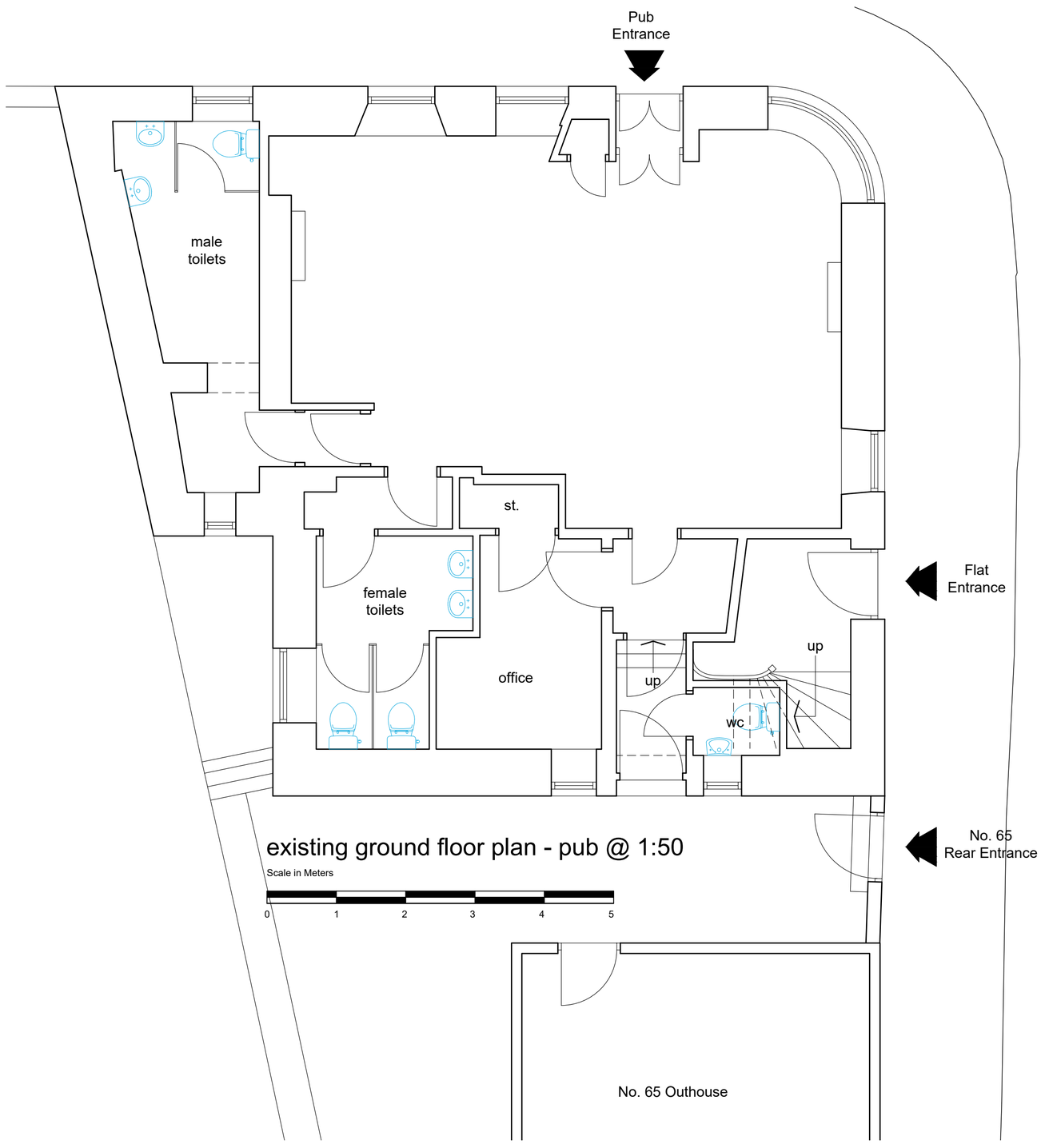


existing first floor plan - flat @ 1:50



existing ground floor plan - pub @ 1:50

Scale in Meters

0 1 2 3 4 5

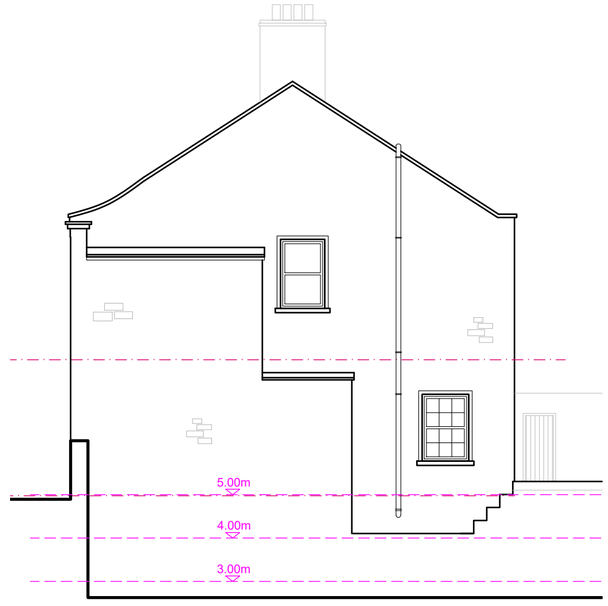
existing south elevation @ 1:100

existing west elevation @ 1:100

Scale in Meters

0 1 2 3 4 5

existing north elevation @ 1:100



existing east elevation @ 1:100

existing site/roof plan @ 1:200

Scale in Meters

0 2 4 6 8 10

Rev	Date	Description
A	26.10.22	boundary wall steps added

Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RD
Tel: 01241 435236
www.building-design-services.com
building design services

project: Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	client: Mr Mitchell	drawing: Existing Plans & Elevations.	
scale: 1:50, 1:100 & 1:200	date: February 2022	drg no.: EX-01	rev.: A

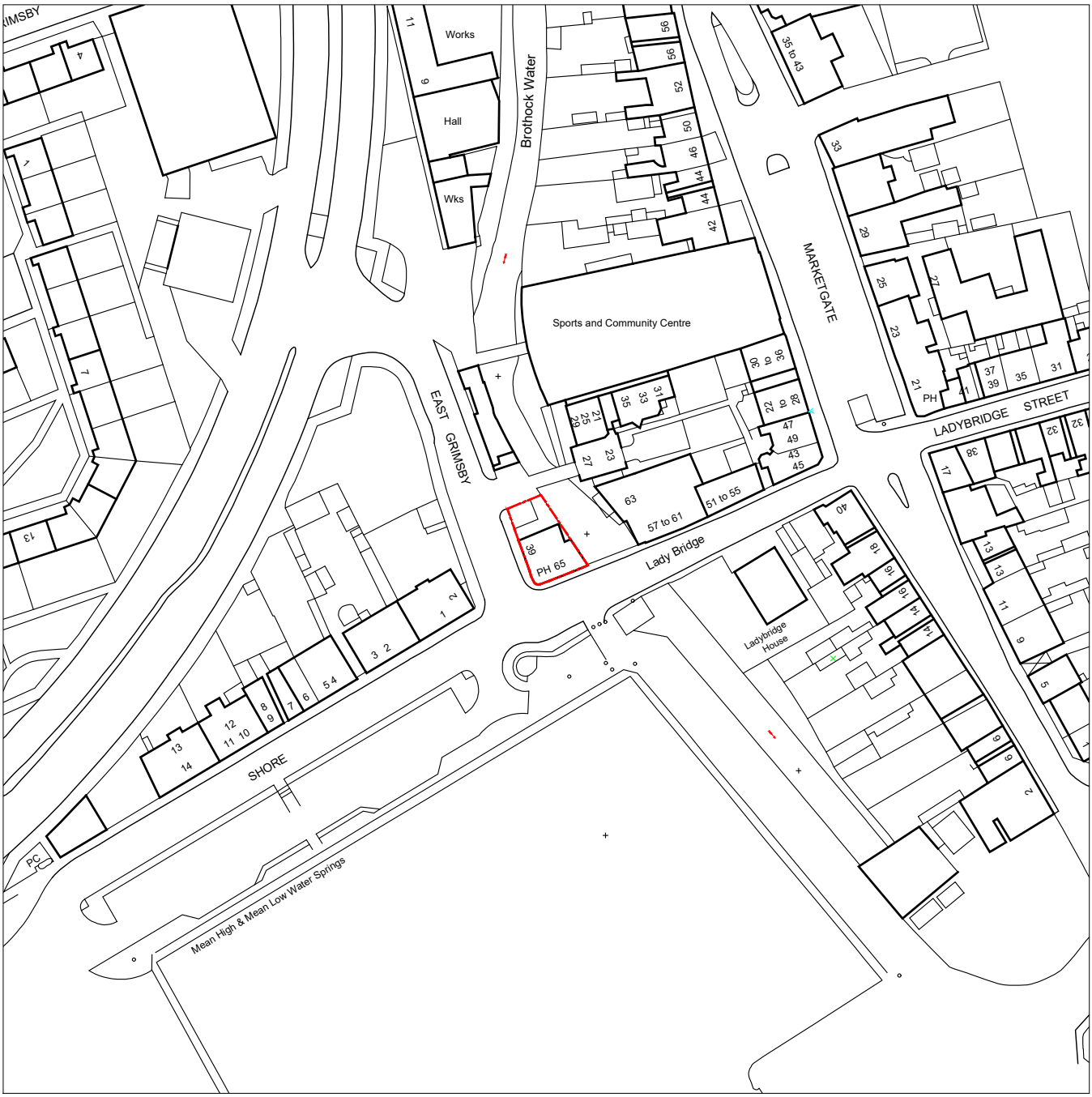
Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RD
Tel: 01241 435236
www.building-design-services.com
building design services

project	client	drawing
Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	Mr Mitchell	Existing Location Plan

scale	date	drg no.	rev.
1:1250	February 2022	EX-02	-

Rev	Date	Description
-	--	----

ITEM 6ii



Scale in Meters

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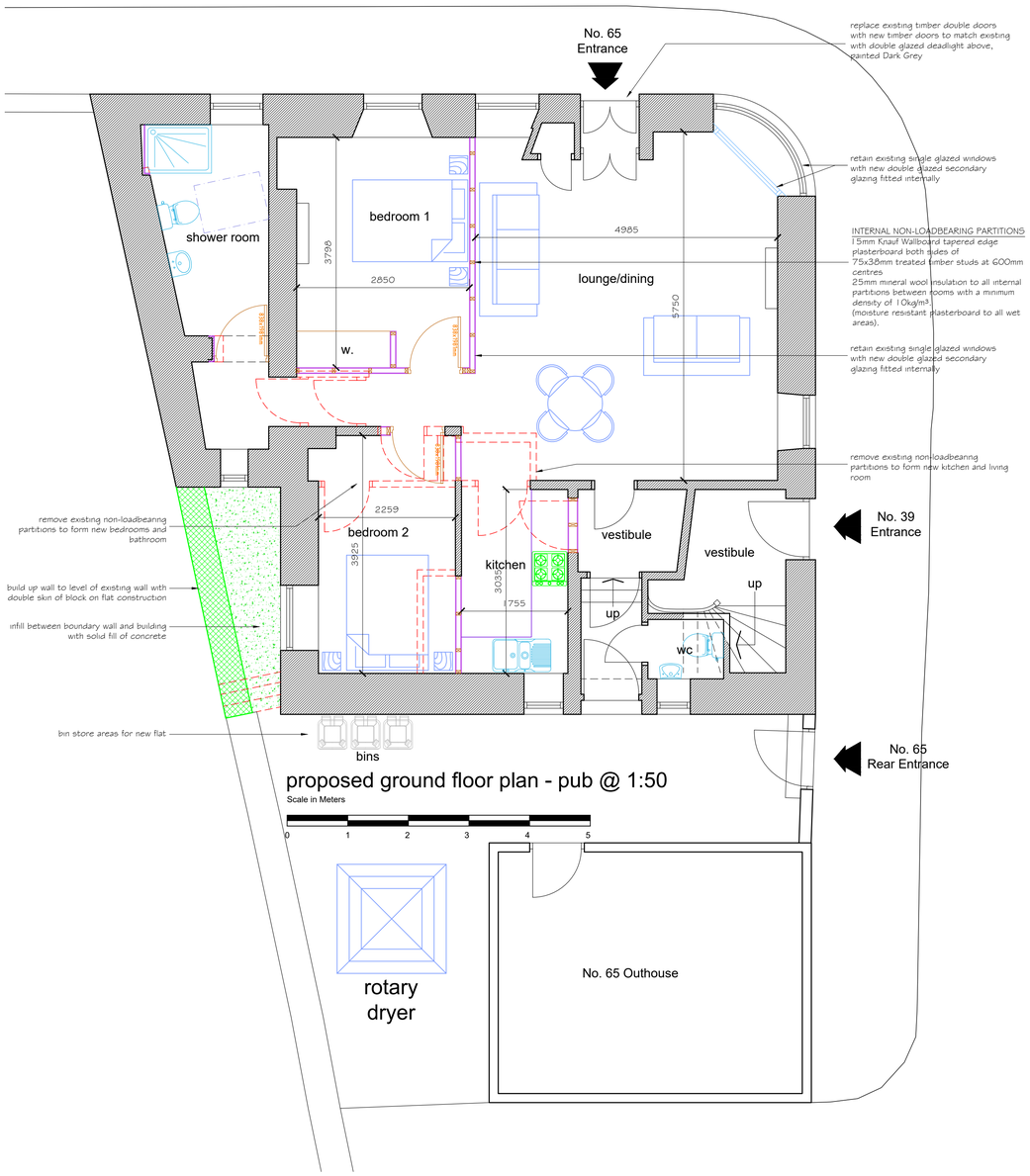
location plan @ 1:1250



proposed ground floor plan - pub @ 1:50

Scale in Meters

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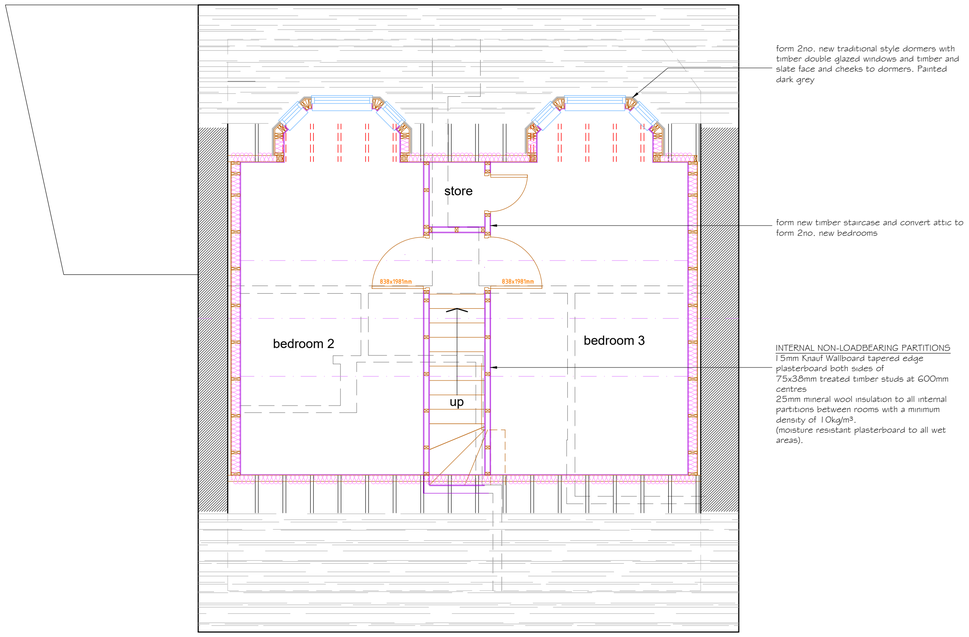

proposed attic floor plan - flat @ 1:50

Scale in Meters

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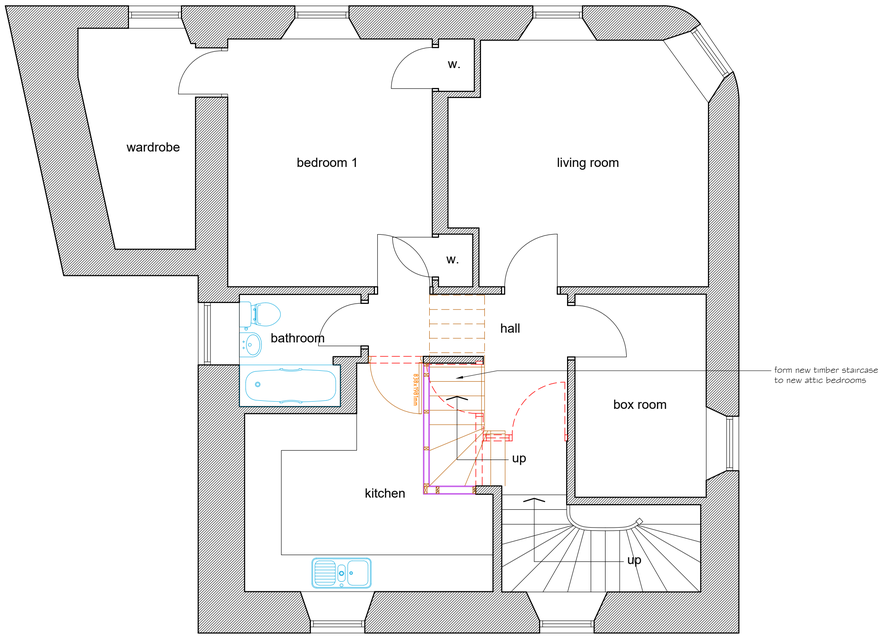
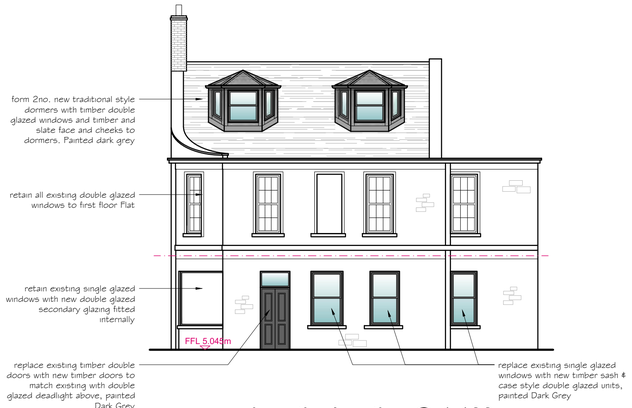


proposed first floor plan - flat @ 1:50

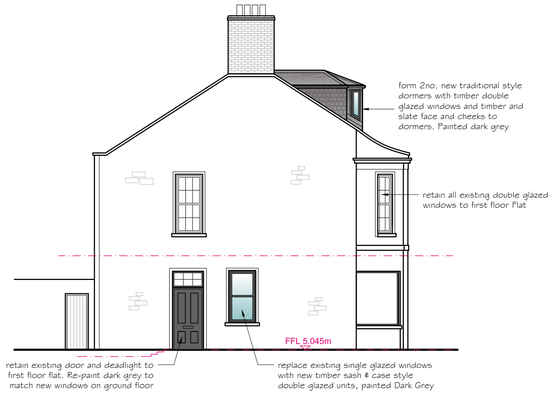
Rev	Date	Description
A	26.10.22	Boundary wall built up

Kirkton Enterprise Centre
Sir William Smith Road
Kirkton Industrial Estate
Arbroath
DD11 3RG
tel: 01241 435236
www.building-design-services.com
building design services

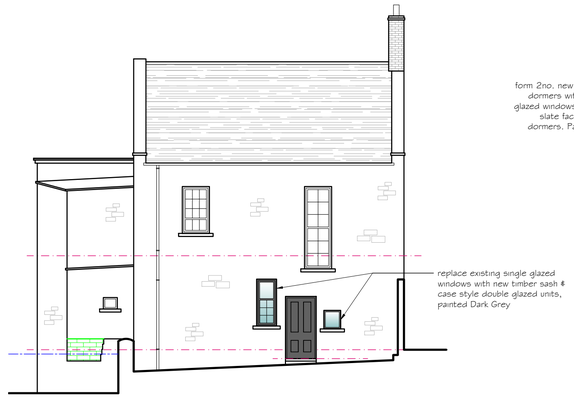
project: Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	client: Mr Mitchell	drawing: Proposed Plans & Elevations.
scale: 1:50, 1:100 & 1:200	date: February 2022	drg no.: PL-01 rev.: A



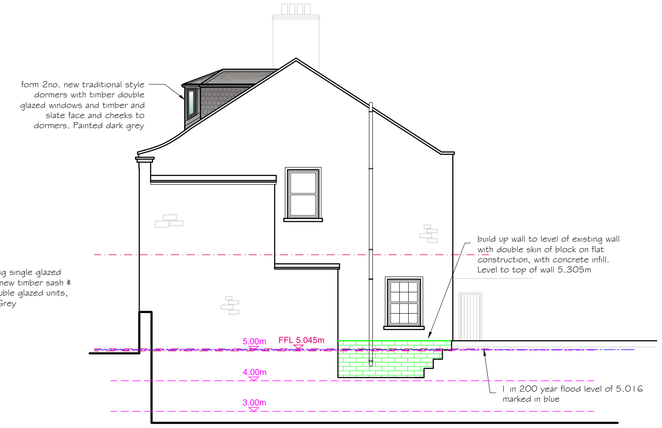
proposed south elevation @ 1:100



proposed west elevation @ 1:100



proposed north elevation @ 1:100



proposed east elevation @ 1:100

section A-A @ 1:50

Scale in Meters

0 1 2 3 4 5

proposed site/roof plan @ 1:200

Scale in Meters

0 2 4 6 8 10

Rev	Date	Description
A	26.10.22	Boundary wall built up

Kirton Enterprise Centre
Sir William Smith Road
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DD11 3RD
Tel: 01241 435236
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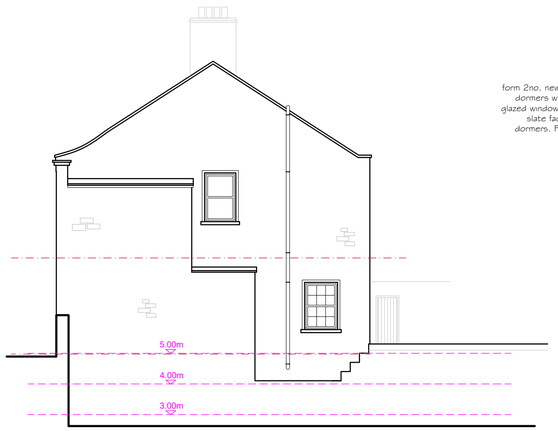
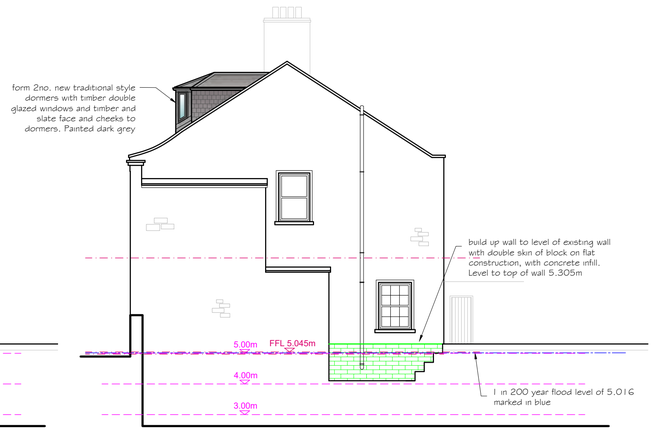
building design services

project: Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	client: Mr Mitchell	drawing: Proposed Site Plan, Section & Elevations.
scale: 1:50, 1:100 & 1:200	date: February 2022	drg no.: PL-02 rev.: A

PHOTO A



existing east elevation @ 1:100



proposed east elevation @ 1:100

proposed site/roof plan @ 1:200

Scale in Meters
0 2 4 6 8 10

PHOTO B

PHOTO C

PHOTO D

Rev	Date	Description
-	--/--/--	-----

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project: Alterations to Smugglers Tavern 65 Ladybridge Street, Arbroath DD11 1AX	client: Mr Mitchell	drawing: Proposed Site Plan, Section & Elevations.	
scale: 1:50, 1:100 & 1:200	date: February 2022	drg no.: PL-03	rev.: -