

CATEGORY (BASED ON SWMP Guidance (2010) Table 8-2)																
CRITERIA				TECHNICAL		ENVIRONMENTAL		SOCIAL		ECONOMIC		OBJECTIVES				
Description / examples				Is the option buildable? Will it be robust and reliable?		Will the environment benefit or suffer from implementation of the measure?		Will the community benefit or suffer from implementation of the measure?		Will benefits exceed costs?		Will it help to achieve the objectives?				
Scoring				-2 - the measure is not technically feasible without being coupled with another measure.		-2 - the measure is likely to have a significant adverse effect on the environment e.g. increase flood risk downstream, alter the WFD status of a waterbody or compromise an environmental designation.		-2 - the measure will have a significant negative effect on the community e.g. it will remove an existing amenity and recreation area.		-2 - the costs of the measure are likely to significantly outweigh the benefits.		-2 - the measure will detriment the objectives.				
				-1 - it is uncertain whether this measure is feasible and further investigations are required.		-1 - the measure will have a moderate adverse impact on the environment.		-1 - the measure will have a moderate negative effect on the community e.g. it will temporarily remove an existing amenity and recreation area.		-1 - the costs of the measure are likely to moderately outweigh the benefits		-1 - the measure will not help achieve any objectives				
				1 - the measure is slightly more complex to implement, some investigations will need to be carried out and there are many construction issues will need to be overcome.		1 - the measure will improve the environment e.g. encourage wildlife to an existing area of open space.		1 - the measure would moderately benefit the community on a local scale e.g. small scale attenuation SuDS would provide amenity to a small number of people.		1 - the benefits of the measure are likely to moderately outweigh the costs.		1 - the measure will help achieve some of the objectives.				
				2 - the measure is simple to implement, no further investigations are required and are few constructions issues to overcome.		2 - the measure will have a significant improvement on the environment e.g. after the WFD status of a waterbody for the better or create new habitats.		2 - the measure would significantly benefit the a large community e.g. a wetland area would provide opportunities for amenity and recreation.		2 - the benefits of the measure are likely to significantly outweigh the costs.		2 - the measure will help achieve all of the objectives.				
Source control measures	CDC	Measure	Measure description	Potential Measure and Location within CDC	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	OVERALL SCORE	TAKEN FORWARD TO MODELLING
		Do Nothing	• Make no intervention / maintenance	Throughout CDC.	No effort to implement.	2	By doing nothing surface water flood risk is predicted to become more frequent with the effects of climate change.	-2	Doing nothing is likely to create opposition from the community and negative feelings.	-2	There would be no benefits from this measure.	-2	Doing nothing would not achieve the objectives.	-2	-6	No
		Do Minimum	• Continue existing maintenance regime update • Update surface water management policies in line with national guidance. • React of flood events and subsequent damage.	Throughout CDC.	Minimal effort to implement.	2	By doing minimum surface water flood risk is likely to become more frequent with the effects of climate change.	-1	Doing minimum could create opposition from the community and negative feelings.	-1	There would be few benefits from this measure.	-1	Doing minimum would not achieve the objectives.	-2	-3	No
		Green / living roofs, rain gardens	• Installing of layers of planting onto buildings or streets (rain gardens) slows runoff from the building in lower return period rain events.	It is considered that there are no feasible places for this measure to be implemented. Both of the schools within this CDC have pitched roofs.												
		Infiltration SuDS	• E.g. permeable paving, soakaways, filter strips that provide a pathway for rainwater to infiltrate into the ground at a restricted rate. • Infiltration SuDS are easier to install for new developments but can be retrofitted. • All methods of infiltration can silt up over time, which will lead to the volume of storage for surface water decreasing.	(5) The majority of residential and commercial buildings in the Northern areas of Drayton could accommodate infiltration SuDS as gardens appear to be big enough to allow the required clearance distances. This is a relatively easy option but it would need to be carried out in conjunction with other measures.	Site-specific infiltration testing would need to be carried out but geology appears to be favourable for infiltration in the north of this CDC.	1	The measure could have moderate environmental benefits by reducing pollutants that infiltrate into the ground.	1	This measure could come up against some local opposition as it relies on the use of residents gardens.	-1	The benefits of the measure are likely to moderately out way the costs although only with other measures.	1	The measure will help achieve some of the objectives if there is enough take-up by residents.	1	3	No - the flood risk benefits of this measure are very local to the building and therefore it is considered that these are quantifiable without modelling. The benefits would only be seen in low return periods (lower than the ones intended to be modelled for the CDC).
				(3) A flood flow pathway routes through the east of Drayton. As the mobile home park is at a significant risk of flooding, it appears sensible to try and intercept flows before they reach the mobile home park. This flood flow pathway in east Drayton can be intercepted by installing an infiltration swale to the east and north of Drayton Hall mobile home park. However, if it is found that the groundwater level is too high for infiltration methods to be utilised, any attenuation feature here should discharge to the surface water drainage system at QBAR. There are gullies within the access road that are likely associated with a highway drain, information on which we do not have. The closest public surface water sewer is located in Carter Road, west of the mobile home park. A new surface water sewer may need to be constructed to convey flows from any attenuation feature adjacent to the mobile home park to the existing surface water sewer. Alternatively, the existing highway drain could be utilised and possibly upgraded and adopted by Anglian Water.	It is uncertain whether this option is feasible as infiltration may not be possible.	-1	The ground beneath this site is a Principal Aquifer and near to a Inner Source Protection Zone, indicating water abstraction for potable may be conducted in the area. Permission would need to be obtained for the Environment Agency.	0	This measure could raise awareness of flooding locally and offer an amenity area.	1	It is considered that if infiltration is feasible at this location the benefits of this measure would moderately outweigh the costs. If infiltration is not feasible at this location and the construction costs of pumping surface water to the nearest and larger excavation volumes would significantly outweigh the benefits.	1	This measure will help achieve the objectives.	1	2	Yes
				(7) Install borehole soakaways throughout CDC. Norfolk County Council indicates that groundwater beneath Drayton is at a depth no greater than 10m below ground level. Surface water run-off from roof areas (and other 'clean' surfaces) could soak to the ground, but runoff arising from road areas and farmland, both of which contain pollutants, is unlikely to qualify for infiltration without prior treatment.	The measure is slightly more complex to build as boreholes deeper than 10m would need to be dug.	1	Areas of the ground beneath Drayton are indicated to be permeable. However, it is classified as a Principal Aquifer and near to an Inner Source Protection Zone, indicating water abstraction for potable may be conducted in the area. Discharge of a significant amount may impact on the WFD status of the source protection zone.	-2	As this measure could pollute drinking water this is considered to have a negative social impact.	-1	The construction costs are likely to be high and therefore it is considered that they will considerably outweigh the benefits.	-2	The measure will help achieve some of the objectives.	1	-3	No
		Attenuation SuDs	• E.g. storage basins, rainwater harvesting, swales that store surface water and then allow to flow into a sewer or over ground at a restricted rate. • All methods of attenuation can silt up over time, which will lead to the volume of storage for surface water decreasing.	(1) A flood storage area near to the ditch north-west of Drayton could be created to attenuate flood flows. Flows could be conveyed to the surface water sewer in Mariot Way or if the levels make this unfeasible an alternative surface water sewer. Infiltration may be possible as part of this measure but permission from the EA would need to be sought as it could impact on a Source Protection Zone.	This measure is relatively simple to implement although would require detailed modelling.	1	This measure is likely to have wildlife benefits as it will create a new habitat on a local scale.	1	This measure would help alleviate flooding to the businesses and communities downstream so should have a positive impact.	1	The initial construction costs are likely to be high but as this measure is near to the source of a flood flow pathway there are likely to be many properties that benefit.	2	The measure will help achieve some of the objectives.	1	6	Yes
				(4) The area between Low Road and Drayton High Road sees the three main flood flow pathways converging. Surface water runoff converging in this area could be conveyed via existing surface water sewers to the field south-west of Low Road, adjacent to Fairview Close, from which surface water could then flow to the water meadows and finally into the River Wensum. If use of this field is not feasible, the highway drains and public surface water sewers which currently appear to discharge to an area of the water meadow, could be increased in capacity. Also the inclusion of an oil interceptor to this network would be favourable.	This is a relatively simple solution although will involve a detailed model to be constructed of the area to verify that the measure will be constructed to an appropriate standard of protection.	1	This measure could potentially cause pollution of River Wensum from contaminants collected from road surfaces / overland field flows.	-1	It is not envisaged that this measure would have any social impact.	0	As the location is after the three main flow paths have converged the number of properties that this measure could protect is fewer than if another measure is implemented upstream. It is therefore considered that this measure is unlikely to be cost beneficial.	-1	This measure will help achieve the objectives.	1	0	No
		Other source measures														



Pathway control measures	CDC1 Drayton	Increasing capacity or conveyance of drainage systems (eg. Ditches or sewers)	<ul style="list-style-type: none">Increasing conveyance could be achieved by clearing ditches, upsizing sewers or by incorporating new ditches / sewers.However, increasing conveyance can often lead to an increase in flood risk downstream.	(8) The ditch in the north-west of Drayton is overgrown and could be cleared to increase its capacity and conveyance.	This measure is relatively simple to implement.	2	Increasing the conveyance of the ditch north-west of Drayton could increase the risk of flooding rather than offer mitigation. Clearing out the ditch and widening it would increase the flow velocity, increasing the speed at which it flows towards the properties in west Drayton.	-2	As this measure is likely to increase flood risk downstream it is likely to have an adverse social impact.	-2	As there would be no benefits they would not exceed costs.	-2	This measure is likely to increase flood risk downstream and is therefore detrimental to the objectives.	-2	-6	No
				There are surface water sewers within the CDC which could be increased in size to convey more flow to the Wensum.	This measure is technically feasible although is likely to come across construction issues such as diverting services and would also require detailed modelling.	-1	This measure could potentially mean that additional pollutants are discharged into the Wensum, although oil interceptors could be installed to prevent this.	0	This measure would cause local disruption during construction.	-1	The cost of this measure would be high and as the main flood flow pathways are not in areas where there are surface water sewers it is considered that the costs would significantly outweigh the benefits.	-2	This measure may help to alleviate flooding at very local scale.	1	-3	No
		Separation of Foul and Surface Water Sewers	<ul style="list-style-type: none">Where the CDC is served by a combined drainage network separation of the surface water from the combined system should be considered. In growth areas separation creates capacity for new connections	The sewers within this CDC are already separated so this measure is not an option.												
		Improved Maintenance Regimes	<ul style="list-style-type: none">Target improved maintenance to critical points in the system.Where drainage ditches are blocked, quick win measures such as maintenance can greatly reduce risk.	There are no specific locations where blocked drains or gullies are causing flooding. However, the surface water network within Drayton outfalls into the River Wensum so regular inspection and maintenance of these outfalls would be beneficial.	This measure is relatively simple to implement and would not require any further investigations.	2	It is considered that this measure would not have an impact on the environment.	0	It is not envisaged that this measure would have any social impact.	0	This measure is low cost and therefore considered that it is likely to be cost beneficial.	1	This measure may help to alleviate flooding at very local scale.	1	4	No - as the drainage network is not included in the model and it is not known where blockages, if any occur.
		Managing Overland Flows	<ul style="list-style-type: none">Intercepting known flow pathways and diverting away from receptors.Creating flood routes, e.g. use highway network to keep flood water away from property in all but the most extreme events.Changes to profiling of roads, kerb heights, the use of speed bumps can all be used.	As the main flow paths in this CDC are not along roads there are no obvious places where this measure could be implemented.												
		Land Management Practices	<ul style="list-style-type: none">This can include increased tree coverage and perpendicular ploughing in order to slow down the surface water runoff and potentially assist in removing diffuse pollution from runoff arising from agricultural land.Land management is easy to implement and requires little technological input. However, this will require continuous management.	(6) Areas that would benefit from agricultural land management include the area to the north-west of Drayton surrounding the ditch and land north of Hall Lane.	This measure has little technological input although as the land to the north of Hall Lane is planned to be developed this measure is unlikely to be possible in the long term.	-1	This measure could potentially assist in removing diffuse pollution arising from agricultural land on a local scale.	1	The social impact of this measure depends on the willingness of the landowner.	0	This measure has a low cost but as the benefits are only minor and unlikely to be long term it is considered that the cost benefit of this measure will be neutral.	0	This measure will not prevent flooding only slow flooding down.	0	0	No
		Deculverting Watercourse(s)	<ul style="list-style-type: none">e.g. deculverting watercourses, improving in stream conveyance of water	A small watercourse rising in a field in the north west of Drayton is assumed to have been culverted under Drayton Grove and Pond Lane. However, the connection from the ditch into the culvert could not be found on the walkover. The line of the watercourse is one of the main flood flow pathways into Drayton and if it were deculverted the increase in capacity would help alleviate surface water flooding.	As the deculverting of this watercourse would mean the relocation of properties and diverting Pond Road there are significant construction issues to overcome.	-2	The deculverting of the watercourse would have significant environmental benefits through the creation of new habitats.	2	As the implementation of this measure would mean the relocation of a properties it is likely to come up against significant public objection.	-2	The cost of this measure is likely to be significant given the relocation of properties and diversion of roads and therefore unlikely to outweigh the benefits.	-2	This measure will help achieve the objectives.	1	-3	No
	Receptor control measures	Other 'Pathway' Measures		None identified.												
		Planning Policies to Influence Development	<ul style="list-style-type: none">Use forthcoming development control policies to direct development away from areas of surface water flood risk or implement flood risk reduction measures.The policies could be Borough wide or area specifice.g. Basement dwellings are not permitted in areas of known surface water floodinge.g. A reduction in surface water runoff from a new development is required to be demonstrated in an area of known surface water flooding	(2) Land north of Hall Lane is earmarked for development. Surface water attenuation basins could be installed on this land now, which can be added to when the land is developed. Attenuation basins could possibly discharge to the ground as the groundwater level is approximately 5-10m below ground level in this area. If the groundwater level in this area prevents infiltration measures being utilised, attenuation basins could discharge to the surface water drainage network. According to Anglian Water's asset mapping, the closest surface water sewer is in Low Road, approximately 500m south of potential basins. A new surface water sewer will need to be constructed to convey flows. Any flows discharged from attenuation basins in this area should be restricted to QBAR.	Attenuation ponds are widely used as part of a new developments SuDS strategy and would be relatively simple to incorporate as part of the construction of a new development.	2	This measure is likely to have wildlife benefits as it will create a new habitat on a local scale.	1	This measure could provide a local amenity area and raise awareness of flooding locally.	2	As this measure could be constructed at the same time as the new development there is a potential to maximise economies of scale. Given the location is on an overland flood flow pathway there is a potential that this could alleviate flooding to many properties and therefore it is considered that this measure would be cost beneficial.	2	This measure will help achieve the objectives.	2	9	No - the developer should be taking this measure on and therefore considered to be separate from this study.
		Improved Resilience and Resistance Measures	<ul style="list-style-type: none">Improve community resilience and resistanceExisting and new buildings can be adapted to reduce damages from flooding.Resistance measures to prevent water entering the property (e.g. demountable barriers).Resilience measures to reduce the damage caused by water within the property (e.g. raising electrics, solid floors)	All of the properties that are shown in the modelled surface water flood extents could have property level flood protection measures.	These are relatively simple to implement although the type of flood protection suitable for each property would need to be determined following a structural survey.	1	It is considered that this measure would not have an impact on the environment. Although it is possible that flood risk to neighbouring properties could be increased which would need to be ascertained through modelling.	0	Depending on the willingness of uptake by the residents this could have a positive or negative social impact. Although, it is considered that if residents have experienced flooding before (as they have in Drayton) they will be happy to install property level flood protection.	1	These measures are typically low-cost and would prevent flooding to the individual properties.	1	This measure will help achieve the objectives.	1	4	No - by including this measure in a combined model it would be difficult to see the benefits of the other measures. Assuming that this measure will not increase flood risk elsewhere the benefits of this measure are easily quantifiable without modelling.
Social Change, Education and Awareness		<ul style="list-style-type: none">Increase activities of local flood groups to educate the community e.g. holding flood awareness events, leaflets dropping.	Where not already implemented, Norfolk County Council could work with local community flood groups to develop community flood plans and raise awareness of flooding .													
Other 'Receptor' Measures																

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Description / examples				Is the option buildable? Will it be robust and reliable?		Will the environment benefit or suffer from implementation of the measure?		Will the community benefit or suffer from implementation of the measure?		Will benefits exceed costs?		Will it help to achieve the objectives?				
Scoring				-2 - the measure is not technically feasible without being coupled with another measure.		-2 - the measure is likely to have a significant adverse effect on the environment e.g. increase flood risk downstream, alter the WFD status of a waterbody or compromise an environmental designation.		-2 - the measure will have a significant negative effect on the community e.g. it will remove an existing amenity and recreation area.		-2 - the costs of the measure are likely to significantly outweigh the benefits.		-2 - the measure will detriment the objectives.				
				-1 - it is uncertain whether this measure is feasible and further investigations are required.		-1 - the measure will have a moderate adverse impact on the environment.		-1 - the measure will have a moderate negative effect on the community e.g. it will temporarily remove an existing amenity and recreation area.		-1 - the costs of the measure are likely to moderately outweigh the benefits.		-1 - the measure will not help achieve any objectives				
				1 - the measure is slightly more complex to implement, some investigations will need to be carried out and there are many construction issues will need to be overcome.		1 - the measure will improve the environment e.g. encourage wildlife to an existing area of open space.		1 - the measure would moderately benefit the community on a local scale e.g. small scale attenuation SuDS would provide amenity to a small number of people.		1 - the benefits of the measure are likely to moderately outweigh the costs.		1 - the measure will help achieve some of the objectives.				
				2 - the measure is simple to implement, no further investigations are required and are few constructions issues to overcome.		2 - the measure will have a significant improvement on the environment e.g. alter the WFD status of a waterbody for the better or create new habitats.		2 - the measure would significantly benefit the a large community e.g. a wetland area would provide opportunities for amenity and recreation.		2 - the benefits of the measure are likely to significantly outweigh the costs.		2 - the measure will help achieve all of the objectives.				
	CDC	Measure	Measure description	Potential Measure and Location within CDC	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	OVERALL SCORE	TAKEN FORWARD TO MODELLING
Source control measures		Do Nothing	• Make no intervention / maintenance		No effort to implement.	2	By doing nothing surface water flood risk is predicted to become more frequent with the effects of climate change.	-2	Doing nothing is likely to create opposition from the community and negative feelings.	-2	There would be no benefits from this measure.	-2	Doing nothing would not achieve the objectives.	-2	-6	No
		Do Minimum	• Continue existing maintenance regime update • Update surface water management policies in line with national guidance. • React of flood events and subsequent damage.		Minimal effort to implement.	2	By doing minimum surface water flood risk is likely to become more frequent with the effects of climate change.	-1	Doing minimum could create opposition from the community and negative feelings.	-1	There would be few benefits from this measure.	-1	Doing minimum would not achieve the objectives.	-2	-3	No
		Green / living roofs, rain gardens	• Installing of layers of planting onto buildings or streets (rain gardens) slows runoff from the building in lower return period rain events.	Larger roof areas within this CDC that could be fitted with green roofs have been identified to be the offices, apartments and car parks around St Crispins Road and the schools within the CDC.	These are relatively simple to install although recent guidance means that handrails will need to be incorporated as well.	2	Green roofs create new habitats as well as having an insulating effect on the building so improving the buildings energy efficiency.	2	If a green roof is installed in a school they could be used as an educational aid.	1	A green roof is only likely to provide benefit to the building it has been installed on in very low return periods. Generally, the cost of a green roof is offset by the amount of saving in	0	A green roof would only provide a small amount of local flood risk alleviation in very low return periods.	1	6	No - the flood risk benefits of this measure are very local to the building and therefore it is considered that these are quantifiable without modelling. The benefits would only be seen in low return periods (lower than
		Infiltration SuDS	• E.g. permeable paving, soakaways, filter strips that provide a pathway for rainwater to infiltrated into the ground at a restricted rate. • Infiltration SuDS are easier to install for new developments but can be retrofitted. • All methods of infiltration can silt up over time, which will lead to the volume of storage for surface water decreasing.	Install borehole soakaways	As the groundwater is shallow soakaways are unlikely to be feasible.	-2	The area beneath Norwich has shallow groundwater which is a Principal Aquifer that is classified as an Inner Source Protection Zone therefore discharge to it is likely to impact the WFD status of the waterbody.	-2	As this measure could pollute drinking water this is considered to have a negative social impact.	-1	The construction costs are likely to be high and therefore it is considered that they will considerably outweigh the benefits.	-2	The measure will help achieve some of the objectives.	1	-6	No
				Infiltration SuDS could be implemented on the main flood flow pathways.	The groundwater levels are generally near to the surface in Norwich and therefore it is unlikely that infiltration will be possible.	-1	The area beneath Norwich has shallow groundwater which is a Principal Aquifer therefore discharge to it is likely to impact the WFD status of the waterbody.	-2	This measure could come up against some local opposition as it relies on the use of residents gardens.	-1	As this measure is likely not to be feasible there will be no benefits to offset the costs.	-1	As this measure is likely not to be feasible it will not achieve the objectives.	-1	-6	No
		Attenuation SuDS	• E.g. storage basins, rainwater harvesting, swales that store surface water and then allow to flow into a sewer or overground at a restricted rate. • All methods of attenuation can silt up over time, which will lead to the volume of storage for surface water decreasing.	(1) Flood storage area within the open space north of Oak Lane in Old Catton. The flood flow pathway routing through this land could be intercepted through landscaping the area in order to direct flows to an attenuation basin. Attenuation basins could possibly discharge to the ground as the groundwater level is approximately 5-10 m below ground level in this area. If the groundwater level in this area prevents infiltration measures being utilised, attenuation basins could discharge to the surface water drainage network. According to Anglian Water's asset mapping, the closest surface water sewer is in the southern stretch of Oak Lane, immediately south of the open space that could potentially accommodate attenuation basins. A new surface water sewer will need to be constructed to convey flows. Any flows discharged from attenuation basins in this area should be restricted to QBAR.	This measure is technically feasible as this area is a natural basin but would require detailed modelling. As this is an area of open space (to the north of the trees) there are unlikely to be many services.	1	This measure has the potential to create a new habitats.	2	This measure has the potential to provide an additional amenity area for the local community while it is flooded and could be used by the local schools as an educational aid.	2	This measure is likely to have a relatively high cost as would require excavation. Although, as this location is near the source of surface water flooding there are potentially many properties that could benefit.	1	The measure will help achieve some of the objectives.	1	7	Yes
				(2) A ditch or swale could be incorporated into the green space alongside Ives Road. Surface water runoff from highways and/or roof areas could be directed to a ditch or swale which would assist in cleaning the surface water runoff to a certain extent. This could be connected to the surface water network. According to Anglian Water's asset mapping, the closest surface water sewer is in Ives Road, adjacent to the green space that could be utilised. Any flows discharged from a ditch or swale should be restricted to QBAR.	This is a relatively simple measure but would require detailed modelling.	1	Ditches and swales can include planting to assist in the removal of pollutants. This measure could potentially create new habitats although the existing area appears to be a water meadow so care would need to be taken during construction.	1	It is not envisaged this measure would have a social impact.	0	This measure is likely to have a relatively high cost as would require excavation. Although, as this location is near the source of surface water flooding there are potentially many properties that could benefit.	1	The measure will help to achieve the objectives.	1	4	Yes
				(7) Angel Road Junior School lies in the path of a flood flow route, and it also within an area indicated as being at risk from surface water ponding. The school grounds comprise a considerable area of hardstanding which could be utilised for surface water storage. The groundwater in this area is approximately 5m below ground level, therefore infiltration SuDS unlikely to be suitable in this area. Surface water storage in the form of underground tanks, water butts, tanked permeable paving and small swales or attenuation basins in the green areas of the school grounds could be utilised. Surface water from any storage measure would then discharge to the closest public surface water sewer (Roseberry Road) at a restricted rate. Discharge at QBAR would be preferable.	This measure is technically feasible but would require detailed modelling.	1	There is potential that this measure could create new habitats (for example the attenuation basin and swale.	1	This measure could have educational benefits for the school pupils.	1	This measure is likely to be of a moderate cost but as it has the potential to manage a main overland flood flow pathway it could potentially benefit a large number of properties.	2	The measure will help to achieve the objectives.	1	6	Yes



Control measures	Pathway control measures	CDC2 - Catton Grove and Sewell			(6) There is a minor flood flow pathway which routes through Sleaford Green. The public green spaces along this road can be used for any form of surface water storage such as ponds, underground storage or rain gardens. Surface water would then discharge to the closest surface water sewer at a restricted rate.	This measure is technically possible and the land ownership is not a constraint although would require detailed modelling.	1	This measure will potentially have environmental benefits as a new habitat may be created.	1	This measure is in an area of public open space and therefore could become an amenity area for the community.	1	The costs for this measure are likely to be relatively high as excavation would be required.	1	The measure will help to achieve the objectives.	1	5	Yes
					The following locations have been identified for the potential installation of water butts (maximum of 5 per property): • Bowditch has been identified in the SWMP as the residential area. The houses around Catton Grove Road appear to have large gardens and driveways that would be suitable for tanked permeable paving and water butts. Surface water from any storage measure would then discharge to the closest public surface water sewer (Roseberry Road) at a restricted rate. Discharge at QBAR would be preferable.	Retro-fitting water butts is relatively simple and would not require any further investigations. This measure is technically feasible but would require detailed modelling.	2	The use of water butts is considered to be generally favourable to the environment as it reduces household water consumption.	1	This measure could come up against some local opposition as it relies on the use of residents gardens and / or driveways.	-1	As the costs are relatively low it is considered that this measure would be cost beneficial if a number of properties are installed.	1	The measure will help to achieve the objectives.	1	4	Yes - but separately to the combined CDC model.
					(9) There are a number of car parking areas between Lawson Road and Denmark Road. These areas could be used for surface water storage by making use of tanked permeable paving, tanked storage crates or other forms of underground storage. This attenuated surface water runoff would then discharge to public surface water sewers, at a restricted rate, in both Lawson Road	This measure is technically feasible but would require detailed modelling.	1	This measure would have a neutral impact on the environment.	0	As this measure is within a public car park it is considered likely to generate less public opposition.	1	The construction costs for this measure are likely to be high as it will require a large amount of excavation. As the car park is on private land the ongoing maintenance costs also may be high. As its situation is in a low	-1	The measure will help to achieve the objectives.	1	2	Yes
			Other source measures		None identified.											0	
			Increasing capacity or conveyance of drainage systems (eg. Ditches or sewers)	• Increasing conveyance could be achieved by clearing ditches, upsizing sewers or by incorporating new ditches / sewers. • However, increasing conveyance can often lead to an increase in flood risk downstream.	There are many roads within this CDC that act as flood flow pathways. The capacity of the surface water sewers that drain these roads could be increased to alleviate flooding.	This is technically possible although would have a number of construction issues e.g. avoiding services.	-1	This measure would have a neutral impact on the environment.	0	This measure has the potential to have a temporary adverse social affect during construction but overall as flooding will be reduced it has a moderate benefit.	1	The costs of this measure are likely to be significant due to the large amount of excavation work and service diversions. Therefore it is likely that the costs would outweigh the benefits.	-1	The measure will help to achieve the objectives.	1	0	No
			Separation of Foul and Surface Water Sewers	• Where the CDC is served by a combined drainage network separation of the surface water from the combined system should be considered. In growth areas separation creates capacity for new connections	Within the CDC there are locations are shown in the modelling to be overland flow paths and are served by combined sewers. Separating the sewers in these locations would increase the capacity of the system and potentially reduce flood risk. The effect downstream would need to be assessed through detailed modelling to ensure that there is no increase in flood risk downstream due to increased conveyance. The following locations have been identified: Waterloo Road; Catton Grove Road; and, Oak Lane.	This is technically possible although would have a number of construction issues e.g. avoiding services and potentially work under buildings.	-1	This measure would have a neutral impact on the environment.	0	This measure has the potential to have a temporary adverse social affect during construction but overall as flooding will be reduced it has a moderate benefit.	1	The costs of this measure are likely to be significant due to the large amount of excavation work and service diversions. Therefore it is likely that the costs would outweigh the benefits.	-1	The measure will help to achieve the objectives.	1	0	No
			Improved Maintenance Regimes	• Target improved maintenance to critical points in the system. • Where drainage ditches are blocked, quick win measures such as maintenance can greatly reduce risk.	There are no specific locations where blocked drains or gullies are causing flooding. However, the surface water network within Norwich outfalls into the River Wensum so regular inspection and maintenance of these outfalls would be beneficial.	This measure is relatively simple to implement and would not require any further investigations.	2	It is considered that this measure would not have an impact on the environment.	0	It is not envisaged that this measure would have any social impact.	0	This measure is low cost and therefore considered that it is likely to be cost beneficial.	1	This measure may help to alleviate flooding at very local scale.	1	4	No - as the drainage network is not included in the model and it is not known where blockages, if any occur.
			Managing Overland Flows	• Incepting known flow pathways and diverting away from receptors. • Creating flood routes, e.g. use highway network to keep flood water away from property in all but the most extreme events. • Changes to profiling of roads, kerb heights, the use of speed bumps can all be used.	No locations have been identified for this measure.												
			Land Management Practices	• This can include increased tree coverage and perpendicular ploughing in order to slow down the surface water runoff and potentially assist in removing diffuse pollution from runoff arising from agricultural land. • Land management is easy to implement and requires little technological input. However, this will require continuous management.	The majority of this area is developed and therefore land management practises are not applicable.											0	
			Deculverting Watercourse(s)	• e.g. de-culverting watercourses, improving in stream conveyance of water	No watercourses have been identified as culverted within this CDC.											0	
Control measures	Pathway control measures	CDC2 - Catton Grove and Sewell	Other 'Pathway' Measures													0	
			Planning Policies to Influence Development	• Use forthcoming development control policies to direct development away from areas of surface water flood risk or implement flood risk reduction measures. • The policies could be Borough wide or area specific. • e.g. Basement dwellings are not permitted in areas of known surface water flooding • e.g. A reduction in surface water runoff from a new development is required to be demonstrated in an area of known surface water flooding	No major development planned for this CDC area. Incorporate relevant mitigation measures within planning policy, for example, development within areas of flood risk should complete a Flood Risk Assessment as part of any planning application.											0	

CATEGORY (BASED ON SWMP Guidance (2010) Table 8-2)															
CRITERIA		TECHNICAL		ENVIRONMENTAL		SOCIAL		ECONOMIC		OBJECTIVES					
Description / examples		Is the option buildable? Will it be robust and reliable?		Will the environment benefit or suffer from implementation of the measure?		Will the community benefit or suffer from implementation of the measure?		Will benefits exceed costs?		Will it help to achieve the objectives?					
Scoring		-2 - the measure is not technically feasible without being coupled with another measure.		-2 - the measure is likely to have a significant adverse effect on the environment e.g. increase flood risk downstream, alter the WFD status of a waterbody or compromise an environmental designation.		-2 - the measure will have a significant negative effect on the community e.g. it will remove an existing amenity and recreation area.		-2 - the costs of the measure are likely to significantly outweigh the benefits.		-2 - the measure will detriment the objectives.					
		-1 - it is uncertain whether this measure is feasible and further investigations are required.		-1 - the measure will have a moderate adverse impact on the environment.		-1 - the measure will have a moderate negative effect on the community e.g. it will temporarily remove an existing amenity and recreation area.		-1 - the costs of the measure are likely to moderately outweigh the benefits.		-1 - the measure will not help achieve any objectives					
		1 - the measure is slightly more complex to implement, some investigations will need to be carried out and there are many construction issues will need to be overcome.		1 - the measure will improve the environment e.g. encourage wildlife to an existing area of open space.		1 - the measure would moderately benefit the community on a local scale e.g. small scale attenuation SuDS would provide amenity to a small number of people.		1 - the benefits of the measure are likely to moderately outweigh the costs.		1 - the measure will help achieve some of the objectives.					
		2 - the measure is simple to implement, no further investigations are required and are few constructions issues to overcome.		2 - the measure will have a significant improvement on the environment e.g. after the WFD status of a waterbody for the better or create new habitats.		2 - the measure would significantly benefit the a large community e.g. a wetland area would provide opportunities for amenity and recreation.		2 - the benefits of the measure are likely to significantly outweigh the costs.		2 - the measure will help achieve all of the objectives.					
		N - neutral impact		N - neutral impact		N - neutral impact		N - neutral impact		N - neutral impact					
CDC		Measure	Measure description	Potential Measure and Location within CDC	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	N - neutral impact	N	OVERALL SCORE	TAKEN FORWARD TO MODELLING	
Source control measures	3 Nelson and Town Close	Do Nothing	• Make no intervention / maintenance		No effort to implement.	2	By doing nothing surface water flood risk is predicted to become more frequent with the effects of climate change.	-2	Doing nothing is likely to create opposition from the community and negative feelings.	-2	There would be no benefits from this measure.	-2	Doing nothing would not achieve the objectives.	-2	No
		Do Minimum	• Continue existing maintenance regime update • Update surface water management policies in line with national guidance. • React of flood events and subsequent damage.		Minimal effort to implement.	2	By doing minimum surface water flood risk is likely to become more frequent with the effects of climate change.	-1	Doing minimum could create opposition from the community and negative feelings.	-1	There would be few benefits from this measure.	-1	Doing minimum would not achieve the objectives.	-2	No
		Green / living roofs, rain gardens	• Installing of layers of planting onto buildings or streets (rain gardens) slows runoff from the building in lower return period rain events.	Larger roof areas within this CDC could be fitted with green roofs such as schools.	These are relatively simple to install although recent guidance means that handrails will need to be incorporated as well.	2	Green roofs create new habitats as well as having an insulating effect on the building so improving the buildings energy efficiency.	2	If a green roof is installed in a school they could be used as an educational aid.	1	A green roof is only likely to provide benefit to the building it has been installed on in very low return periods. Generally, the cost of a green roof is offset by the amount of saving in energy bills.	0	A green roof would only provide a small amount of local flood risk alleviation in very low return periods.	1	No - the flood risk benefits of this measure are very local to the building and therefore it is considered that these are quantifiable without modelling. The benefits would only be seen in low return periods (lower than the ones intended to be modelled for the CDC).
	3 Nelson and Town Close	Infiltration SuDS	• E.g. permeable paving, soakaways, filter strips that provide a pathway for rainwater to infiltrate into the ground at a restricted rate. • Infiltration SuDS are easier to install for new developments but can be retrofitted. • All methods of infiltration can silt up over time, which will lead to the volume of storage for surface water decreasing.	Install borehole soakaways	As the groundwater is shallow soakaways are unlikely to be feasible.	1	The area beneath Norwich has shallow groundwater which is a Principal Aquifer that is classified as an Inner Source Protection Zone therefore discharge to it is likely to impact the WFD status of the waterbody.	-2	As this measure could pollute drinking water this is considered to have a negative social impact.	-1	The construction costs are likely to be high and therefore it is considered that they will considerably outweigh the benefits.	-2	The measure will help achieve some of the objectives.	1	No
		Attenuation SuDS	• E.g. storage basins, rainwater harvesting, swales that store surface water and then allow to flow into a sewer or overground at a restricted rate. • All methods of attenuation can silt up over time, which will lead to the volume of storage for surface water decreasing.	There is very limited space in this CDC for large attenuation features such as ponds and / or wetlands.	The main flood flow pathways in this CDC are down roads and it would be unfeasible to construct them.	-2	This measure is likely to have wildlife benefits as it will create a new habitat on a local scale.	1	This measure could provide additional amenity areas and become an educational aid.	2	As it is not feasible to locate these measures on a flood flow pathway the construction costs are likely to significantly outweigh the benefits.	-2	As it is not feasible to locate these measures on a flood flow pathway the number of properties they will protect is low to none therefore this measure will not achieve the objectives.	-1	No
				The following locations have been identified for the potential installation of water butts (maximum of 5 per property): • (1) The SWMP indicates an area of ponding around Stafford Street, Alexandra Road, Gladstone Street and Belvoir Street. • (2a) Earham Road appears to be a flood flow pathway in the SWMP. • (4) The SWMP has indicated ponding in the residential areas of West Parade, Park Lane, Pembroke Road, Parker Road, Doris Road, Avenue Road, Whitehall Road and Portersfield Road. • (3) Mill Hill Road appears to be a flood flow pathway in the SWMP. A number of gardens along Mill Hill Road appear to have ample space for surface water runoff attenuation. • (5) Jessop Road, which changes to Portersfield Road, is indicated as being a flood flow route in the SWMP. Any flows discharged from attenuation SuDS in this area should be restricted. As the space for surface water storage is restricted, this option may need to be coupled with an increased capacity in the public surface water sewer network.	Retro-fitting water butts is relatively simple and would not require any further investigations.	2	The use of water butts is considered to be generally favourable to the environment as it reduces household water consumption.	1	This measure could come up against some local opposition as it relies on the use of residents gardens.	-1	As the costs are relatively low it is considered that this measure would be costs beneficial if a number of houses linked water butts. The ongoing maintenance costs of this measure are low as these could be undertaken by the resident.	1	The measure will help to achieve the objectives.	1	Yes
				The following locations where there is considered more space for both waterbutts as well as tanked permeable paving are: • (2) Earham Road appears to be a flood flow pathway in the SWMP. Gardens in the western stretch of Earham Road appear to have ample space for surface water runoff attenuation, as does the grounds of Recreation Road Junior School. Attenuated surface water runoff would then discharge to the surface water drainage network. • (6) Unthank Road, Rose Valley and Gloucester Street are all indicated in the SWMP as flood flow pathways. • (7) The SWMP indicates ponding around Newmarket Road.	This measure is technically feasible but would require detailed modelling.	1	The use of water butts is considered to be generally favourable to the environment as it reduces household water consumption.	1	This measure could come up against some local opposition as it relies on the use of residents gardens and / or driveways.	-1	This measure is likely to be of a moderate to high cost as it will require excavation to fit the tanked permeable paving. The number of properties that benefit will be dependent on the number of household take-ups.	-1	The measure will help to achieve the objectives.	1	Yes
	3 Nelson and Town Close	Other source measures		None identified.										0	
		Increasing capacity or conveyance of drainage systems (eg. Ditches or sewers)	• Increasing conveyance could be achieved by clearing ditches, upsizing sewers or by incorporating new ditches / sewers. • However, increasing conveyance can often lead to an increase in flood risk downstream.	There are many roads within this CDC that act as flood flow pathways. The capacity of the surface water sewers that drain these roads could be increased to alleviate flooding.	This is technically possible although would have a number of construction issues e.g. avoiding services.	-1	This measure would have a neutral impact on the environment.	0	This measure has the potential to have a temporary adverse social affect during construction but overall as flooding will be reduced it has a moderate benefit.	1	The costs of this measure are likely to be significant due to the large amount of excavation work and service diversions. Therefore it is likely that the costs would outweigh the benefits.	-1	The measure will help to achieve the objectives.	1	No



Pathway control measures	CDC	Separation of Foul and Surface Water Sewers	<ul style="list-style-type: none">Where the CDC is served by a combined drainage network separation of the surface water from the combined system should be considered. In growth areas separation creates capacity for new connections	Within the CDC there are locations are shown in the modelling to be overland flow paths and are served by combined sewers. Separating the sewers in these locations would increase the capacity of the system and potentially reduce flood risk. The effect downstream would need to be assessed through detailed modelling to ensure that there is no increase in flood risk downstream due to increased conveyance. The following locations have been identified: Unthank Road; Earlham Road; Jessop Road; Mill Hill Road; and, Newmarket Road.	This is technically possible although would have a number of construction issues e.g. avoiding services and potentially work under buildings.	-1	This measure would have a neutral impact on the environment.	0	This measure has the potential to have a temporary adverse social affect during construction but overall as flooding will be reduced it has a moderate benefit.	1	The costs of this measure are likely to be significant due to the large amount of excavation work and service diversions. Therefore it is likely that the costs would outweigh the benefits.	-1	The measure will help to achieve the objectives.	1		0	No
		Improved Maintenance Regimes	<ul style="list-style-type: none">Target improved maintenance to critical points in the system.Where drainage ditches are blocked, quick win measures such as maintenance can greatly reduce risk.	There are no specific locations where blocked drains or gullies are causing flooding. However, the surface water network within Norwich outfalls into the River Wensum so regular inspection and maintenance of these outfalls would be beneficial.	This measure is relatively simple to implement and would not require any further investigations.	2	It is considered that this measure would not have an impact on the environment.	0	It is not envisaged that this measure would have any social impact.	0	This measure is low cost and therefore considered that it is likely to be cost beneficial.	1	This measure may help to alleviate flooding at very local scale.	1		4	No - as the drainage network is not included in the model and it is not known where blockages, if any occur.
Receptor control measures	CDC	Managing Overland Flows	<ul style="list-style-type: none">Incepting known flow pathways and diverting away from receptors.Creating flood routes, e.g. use highway network to keep flood water away from property in all but the most extreme events.Changes to profiling of roads, kerb heights, the use of speed bumps can all be used.	No locations have been identified for this measure.													
		Land Management Practices	<ul style="list-style-type: none">This can include increased tree coverage and perpendicular ploughing in order to slow down the surface water runoff and potentially assist in removing diffuse pollution from runoff arising from agricultural land.Land management is easy to implement and requires little technological input. However, this will require continuous management.	The majority of this area is and therefore land management practises are not applicable.												0	
		Deculverting Watercourse(s)	<ul style="list-style-type: none">e.g. de-culverting watercourses, improving in stream conveyance of water	No watercourses have been identified as culverted within this CDC.												0	
		Other 'Pathway' Measures														0	
		Planning Policies to Influence Development	<ul style="list-style-type: none">Use forthcoming development control policies to direct development away from areas of surface water flood risk or implement flood risk reduction measures.The policies could be Borough wide or area specifice.g. Basement dwellings are not permitted in areas of known surface water floodinge.g. A reduction in surface water runoff from a new development is required to be demonstrated in an area of known surface water flooding	No major development planned for this CDC area. Incorporate relevant mitigation measures within planning policy, for example, development within areas of flood risk should complete a Flood Risk Assessment as part of any planning application.												0	
		Improved Resilience and Resistance Measures	<ul style="list-style-type: none">Improve community resilience and resistanceExisting and new buildings can be adapted to reduce damages from flooding.Resistance measures to prevent water entering the property (e.g. demountable barriers).Resilience measures to reduce the damage caused by water within the property (e.g. raising electrics, solid floors)	All of the properties that are shown in the modelled surface water flood extents could have property level flood protection measures.	These are relatively simple to implement although the type of flood protection suitable for each property would need to be determined following a structural survey.	1	It is considered that this measure would not have an impact on the environment. Although it is possible that flood risk to neighbouring properties could be increased which would need to be ascertained through modelling.	0	Depending on the willingness of uptake by the residents this could have a positive or negative social impact. Although, it is considered that if residents have experienced flooding before (as they have in Drayton) they will be happy to install property level flood protection.	1	These measures are typically low-cost and would prevent flooding to the individual properties.	1	This measure will help achieve the objectives.	1		4	No - by including this measure in a combined model it would be difficult to see the benefits of the other measures. Assuming that this measure will not increase flood risk elsewhere the benefits of this measure are easily quantifiable without modelling.
Receptor control measures	CDC	Social Change, Education and Awareness	<ul style="list-style-type: none">Increase activities of local flood groups to educate the community e.g. holding flood awareness events, leaflets dropping.	Where not already implemented, Norfolk County Council could work with local community flood groups to develop community flood plans and raise awareness of flooding.												0	
		Other 'Receptor' Measures														0	