

Appendix E – Summary of flood risk in the Fylde Coast Authorities

Table 1.1 below summarises the areas where there are notable flood risks within the Fylde Coast Authorities study area. For this summary the study area has been delineated into five sub-areas, as shown in Figure 1.1. Further information on these sub-areas can be found in Section 4.14 of the main report.

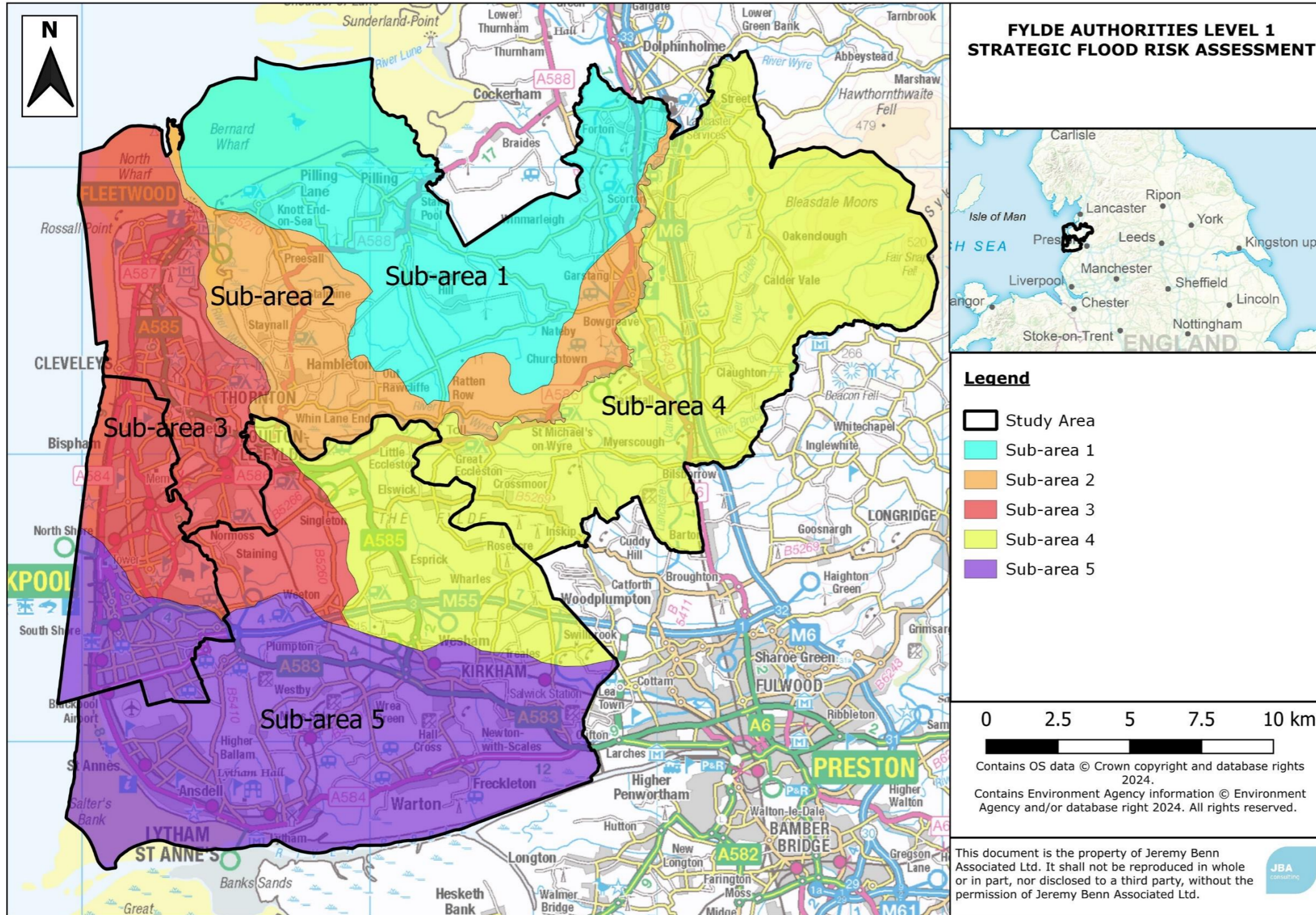


Figure 1.1: Sub-areas used to summarise the flood risk to the study area.

Table 1.1: Summary of flood risk in the Fylde Coast Authorities.

Sub-area	Fluvial flood risk	Tidal flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk	Reservoir inundation risks	Historic, recorded flood events
<p>Sub-area 1: Pilling and Winmarleigh</p> <p>This area is predominantly rural and located in the north of the Borough.</p>	<p>Pilling Water and Ridgely Pool flow south to north through Pilling to its outfall into the Irish Sea at Cockerham Marsh. Furthermore, two small tributaries of the River Cocker flow south to north, west of Winmarleigh, discharging into the River Cocker which flows north to south west along the northern border of the Sub-area.</p> <p>All watercourses mentioned above contribute to fluvial risk in this area, with Flood Zones 2 and 3a extending into surrounding farmland and urban areas such as Pilling. Much of the rural area between Knott End on Sea and Green Dick's Lane, to the north of Bourble's Lane is in Flood Zone 3a, at risk from fluvial-tidal flooding. Rural land south of Garstang Road and Black Lane is also shown to be in Flood Zone 3a, alongside land either side of Bradshaw Lane, south of Pilling. Flood Zones 2 and 3a associated with the River Cocker follow the northern border of the Sub-area.</p>	<p>The western border of the Sub-area follows the Irish Sea, and as such, is at significant tidal flood risk from tides. Flood Zones 2 and 3a propagate almost 6km in land, completely inundating the urban centres of Knott End on Sea and Pilling.</p>	<p>The EA AIMS dataset shows a series of embankments along the full coastline of the Sub-area. In addition, natural high ground borders some of the drainage ditches in and around Pilling Lane, and along the two small watercourses: Ridgely Pool and Pilling Water.</p>	<p>Surface water flood risk follows the topography of the area. Most of this Sub-area is flat, particularly to the west which lies at around 5m AOD; however, the eastern border reaches up to 62m AOD. In general, most surface water flow paths flow towards the north east of the Sub-area, channelled by small drainage ditches or small tributaries flowing from the area of higher elevation such as Park Lane Brook that flows into the River Cocker. Much of the west and central regions of the Sub-area appear to be at lower risk from surface water flooding compared to the east of the Sub-area, with flow paths on roads and ponding only apparent for the 0.1% AEP event. There are also small, isolated areas of surface water ponding, particularly in rural locations to the east of the Sub-area, which may suggest localised flood risk.</p>	<p>The AStGWF dataset shows areas greater than 50% susceptibility to groundwater flooding along the southern border, around Knotts End on Sea, and along Garstang Road. The majority of this Sub-area has a low susceptibility to groundwater flooding. The JBA groundwater emergence map mirrors this, with groundwater levels less than 0.5m below the surface in the north east of the area, particularly to the east of Winmarleigh Moss. In addition, areas of Knotts End on Sea are also shown as having groundwater emergence levels at or very near the surface.</p>	<p>The following reservoirs impact the Sub-area in the 'dry day' scenario:</p> <ul style="list-style-type: none"> Catterall Flood Storage and Garstang Flood Storage. The flood extent inundates the very south of the Sub-area. <p>The following reservoirs impact the Sub-area in the 'wet day' scenario:</p> <ul style="list-style-type: none"> Barnacre North, Barnacre South, Garstang Flood Storage, Grizedale Dock, Grizedale Lea, and Wyresdale Park. These reservoirs inundate mainly agricultural land in the south of the Sub-area to the west and south of Nateby. Blea Tarn and Langthwaite. These reservoir extents follow part of the northern border of the Sub-area along the River Cocker inundating farmland. 	<p>Historic flood mapping and EA recorded flood outlines record the following instances:</p> <ul style="list-style-type: none"> November 1977 – Overtopping of coastal defences October 1980 – Overtopping of fluvial defences on the River Wyre
<p>Sub-area 2: Hambleton and Garstang</p>	<p>All watercourses in this Sub-area, including Grisdale Brook and the River Brock, are tributaries of the River</p>	<p>As in Sub-area 1, there is high risk of coastal flooding along the western</p>	<p>The EA AIMS dataset shows long sections of engineered</p>	<p>Surface water flood risk follows the topography of the area. Much of this Sub-area is made up of</p>	<p>Large proportions of this Sub-area, particularly between St Michael's on Wyre</p>	<p>The following reservoirs impact the Sub-area in the 'dry day' scenario:</p>	<p>Historic flood mapping and EA recorded flood outlines record</p>

Sub-area	Fluvial flood risk	Tidal flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk	Reservoir inundation risks	Historic, recorded flood events
<p>This area is in the north of the study area and is bounded by the River Wyre to the south and the Irish Sea to the west.</p>	<p>Wyre and flow south west to their respective confluences. Flood Zones 2 and 3a extend into urban centres such as Hambleton and Preesall in the west. In the east of the Sub-area, St Michael's on Wyre, Churchtown, and Garstang are all highlighted to be at risk from fluvial flooding. Areas of flat topography between St Micheal's on Wyre and Churchtown are subject to extreme flooding in Flood Zone 3a, with extents covering most of both villages.</p>	<p>border, with much of Knott End on Sea and Preesall within Flood Zone 3a. Furthermore, areas around the River Wyre, which is a tidally influenced watercourse, are extremely susceptible to tidal flooding, particularly around the estuary. Land surrounding the wetland area, as well as the urban centre of Hambleton, is shown as being within Flood Zone 3a.</p>	<p>high ground along both banks of Grange Pool and Wardleys Pool. Furthermore, the River Wyre has a series of embankments on the northern bank between Catterall and Shard Bridge.</p>	<p>agricultural farmland, and as such, surface water tends to flow through the agricultural drainage system. There are also small flow paths through wooded areas and along highways such as Tarnacre Lane. Significant surface water ponding is shown in the west of Garstang, where a large residential development is inundated. There are also small, isolated areas of surface water ponding which may suggest localised flood risk.</p>	<p>and Hambleton, and north of Hambleton towards Stalmine, are shown to have greater than 50% susceptibility to groundwater flooding according to the AStGWF dataset. In addition, south of Knotts End on Sea and west of Preesall is shown to have greater than 50% susceptibility to groundwater flooding. On the other hand, the JBA Groundwater Emergence map shows very little risk of emergence within this Sub-area, with small, isolated areas around Preesall and Stalmine and northeast of Churchtown.</p>	<ul style="list-style-type: none"> Catterall Flood Storage, Garstang Flood Storage, Grizedale Lea, and Wyresdale Park. These flood extents flow southwest along the southern border of the Sub-area channelled by the River Wyre, before extending into the low lying farmland around Churchtown. This village is severely inundated. Damas Ghyll – The flood extent is channelled by the River Wyre along the southern border of the Sub-area. <p>The following reservoirs impact the Sub-area in the 'wet day' scenario:</p> <ul style="list-style-type: none"> Barnacre North, Barnacre South, Dama Ghyll, Garstang Flood Storage, Grizedale Dock, Grizedale Lea, and Wyresdale Park. These flood extents flow southwest along the southern border of the Sub-area, channelled by the River Wyre before extending into the low lying farmland around Churchtown and St Micheal on Wyre. 	<p>the following instances:</p> <ul style="list-style-type: none"> October 1980 – Overtopping of fluvial defences on the River Wyre December 2015 – Overtopping of defences of the River Wyre at St Micheal's on Wyre
<p>Sub-area 3: Poulton-le-Fylde and North Blackpool</p> <p>This area is primarily urban, with the north of</p>	<p>The River Wyre flows along the northern border of the Sub-area and poses great flood risk to land immediately adjacent, including Skippool, Norcross, and Thornton. Parts of these urban centres lie in Flood Zone 3a. Main Dyke flows from the southeast north to its</p>	<p>This Sub-area borders the Irish Sea along both its northern and western boundaries, however the extent of coastal flood risk from the</p>	<p>The EA AIMS dataset shows long sections of natural and engineered high ground along tributaries such as Royles Brook,</p>	<p>Surface water flood risk follows the topography of the area. In this Sub-area, much of the surface water is channelled by Main Dyke towards the River Wyre. Highways and roads also form a high number of surface water flow</p>	<p>The AStGWF dataset shows the centre of the Sub-area around northern Blackpool and Poulton-le-Fylde to have greater than 50% susceptibility to groundwater flooding. This includes Churchtown, Litle</p>	<p>The following reservoirs impact the Sub-area in the 'dry day' scenario:</p> <ul style="list-style-type: none"> Catterall Flood Storage, Garstang Flood Storage, No. 1 & Lagoons (Hillhouse). These reservoir extents are channelled into the River Wyre, and then flow along 	<p>Historic flood mapping and EA recorded flood outlines record the following instances:</p> <ul style="list-style-type: none"> November 1977 – Overtopping

Sub-area	Fluvial flood risk	Tidal flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk	Reservoir inundation risks	Historic, recorded flood events
Blackpool, Cleveleys, and Fleetwood along the western border and Poulton-le-Fylde in the centre.	confluence with the River Wyre just north of Skippool. Fluvial flood extents from Main Dyke and Horse Bridge Dyke highlight flood risk in areas of Little Carleton, Poulton-le-Fylde and Carleton. There is also fluvial flood risk from Hillylaid Pool and Royles Brook, with areas including Greenlands, Bispham and Churchtown in Flood Zone 3a and 2.	Irish Sea is quite minimal. The majority of the flood risk is confined to the northern portion of the Sub-area and originates from the tidally influenced portion of the River Wyre. Flood Zone 2 extends into much of Broadwater, Rosall Beach, Thornton, and Norcross; however, Flood Zone 3a is confined to Trunnah, Thornton, and Norcross. Tidal flood risk from overtopping is minimal in this area and does not inundate any of the urban areas.	Hillylaid Pool, Bispham Dyke, and Main Dyke. In addition, there is a series of natural high ground lining the southern bank of the River Wyre, as well as a wall at its estuary into the Irish Sea.	paths, particularly in the north of the Sub-area in Cleveleys and Thornton. There are also small areas of surface water ponding located throughout this Sub-area which may suggest localised flood risk.	Layton, Carlton, and High Cross. On the other hand, the JBA Groundwater Emergence map shows very little risk of emergence within Sub-area 3, with small areas of groundwater emergence in the north around west Fleetwood, in Anchorholme Park, and in the rural areas east of High Cross and Staining, particularly along the railway line.	<p>the north eastern border of the Sub-area.</p> <ul style="list-style-type: none"> Warbreck is located in the south west of the Sub-area. The 'dry day' reservoir extent flows through the urban areas of Knowle, Greenlands, and Claremont before reaching the Irish Sea between Knowle and North Shore. <p>The following reservoirs impact the Sub-area in the 'wet day' scenario:</p> <ul style="list-style-type: none"> No. 1 & Lagoons (Hillhouse) - This reservoir extent is channelled into the River Wyre, and then flows along the north eastern border of the Sub-area. In addition, Marton Mere is located in the south of the Sub-area in Blackpool Zoo. The 'wet day' extent flows east and then north along the route of the Preston and Blackpool railway line. 	<p>of coastal defences</p> <ul style="list-style-type: none"> November 2017 – operational failure at an ordinary watercourse
Sub-area 4: Great Eccleston and Catterall This area is very rural and covers the east of the study area. Small settlements include Great Eccleston, Catterall, and Elswick.	The River Wyre flows east to west along the northern border of the Sub-area, with Flood Zone 2 extending into Bonds and parts of Catterall. Furthermore, tributaries such as New Draught Brook, Lords Brook, and the River Brock also pose flood risk to small villages such as Myerscough. To the west of the area, eastern parts of Great Eccleston are also at risk from fluvial flooding, located in Flood Zone 3a.	This Sub-area does not border the coastline. Any risk presented from tidally influenced watercourses is summarised in the fluvial section.	The EA AIMS dataset shows long sections of embankments and engineered high ground along the southern bank of the River Wyre. There are also embankments along tributaries	The RoFSW map shows that much of the surface water in this Sub-area is channelled into and by watercourses such as Thistleton Brook, Raikes Brook, Inskip Brook, New Draught, Old River Brock, the River Brock, and other smaller unnamed watercourses. A major surface water flow path is apparent in all return periods, running between Thistleton and Elswick.	The AStGWF dataset shows most of the south of the site to be at greater than 50% susceptibility to groundwater flooding. This includes the urban centres of Elswick and Inskip, and highways such as the M55 and Fleetwood Road. Furthermore, a strip of land with greater than 50% susceptibility to groundwater flooding	The following reservoirs impact the Sub-area in the 'dry day' scenario: <ul style="list-style-type: none"> Abbeystead Reservoir, Barnacre North, Barnacre South, Catterall Flood Storage, Damas Ghyll, Garstang Flood Storage, Grizedale Dock, Grizedale Lea, Wyresdale Park. The flood extents for these reservoirs are channelled into and by the River Wyre, flowing south west through Garstang, Churchtown, and St Micheal's on Wyre, 	Historic flood mapping and EA recorded flood outlines record the following instances: <ul style="list-style-type: none"> November 1977 – Overtopping of coastal defences October 1980 – Overtopping of fluvial defences on

Sub-area	Fluvial flood risk	Tidal flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk	Reservoir inundation risks	Historic, recorded flood events
	In this Sub-area, there is considerable difference in flooding extent between Flood Zone 2 and 3a. This is particularly apparent for the River Brock and tributaries near Myerscough.		such as Thistleton Brook, Raikes Brook, Inskip Brook, New Draught, and the Old River Brock. Natural high ground is present along both banks of the River Crocker and the River Brock.	Extensive surface water flooding is apparent in the village of Bilsborrow, in all return periods, while other villages such as Great Eccleston and Catterall are impacted by surface water ponding on roads. There are also some small, isolated areas of surface water ponding which may suggest localised flood risk.	can be found in the north east of the Sub-area along the route of the M6 between Wyre Lakes and Bilsborrow Lane. The JBA Groundwater Emergence Map suggests a lower likelihood of groundwater emergence; however, the areas with higher risk are located in similar areas. In particular, in Inskip and south of Elswick. The same areas in the north east of the catchment are shown as having groundwater emergence levels within 0.5m of the surface, as well as land just east of Bleasdale.	before flowing west through Great Eccleston and out into the Irish Sea. The flood extent from Weeton inundates a small proportion of the south of the Sub-area, pooling around the reservoir and flowing east towards Mill Farm. The following reservoirs impact the Sub-area in the 'wet day' scenario: <ul style="list-style-type: none"> Garstang Flood Storage, Grizedale Lea, and Wyresdale Park. These flood extents are channelled into and by the River Wyre, flowing south west through Garstang, Churchtown, and St Micheal's on Wyre, before flowing west through Great Eccleston and out into the Irish Sea. Barnacre North and Barnsfold reservoir extents inundate parts of the south of the Sub-area east of Inskip. 	the River Wyre
Sub-area 5: South Blackpool and Kirkham This area is highly urban towards the west, and mostly rural towards the east. It is located on the southern boundary of	A series of smaller tributaries including Main Drain, Liggard Brook, Wrea Brook, Dow Brook, Deepdale Brook, and Savick Brook all flow south into the River Ribble, which flows along the southern border. Flood Zones 2 and 3a extend north from the River Ribble inundating mostly farmland; however, the eastern edges of urban areas such as Lytham St Annes, Great Marton Moss, and Common Edge are also	This Sub-area borders the Irish Sea along both its southern and western boundaries, the extent of coastal flood risk from the Irish Sea is quite minimal, only inundating small proportions of Lytham St Annes, Southshore, and Foxhall on the	The EA AIMS dataset shows long sections of natural high ground along watercourses such as Main Drain, Liggard Brook, Wrea Brook, Dow Brook, Deepdale Brook, and Savick Brook.	The RoFSW map shows that much of the surface water in this Sub-area is channelled into and by watercourses such as Main Drain, Liggard Brook, Wrea Brook, Dow Brook, Deepdale Brook, and Savick Brook. There is significant surface water ponding on highways and roads in urban areas such as South Blackpool, Lytham St Annes, Great Malton	The AStGWF shows most of the Sub-area is greater than 50% susceptible to groundwater flooding. This is particularly the case along the western and southern coastline and between Wrea Green and Warton. The JBA Groundwater Susceptibility Map shows the entirety of the western coastline	The following reservoirs impact the Sub-area in the 'dry day' scenario: <ul style="list-style-type: none"> Westby – This reservoir is located in the north of the Sub-area. The flood extents pool around the reservoir before being channelled into surrounding watercourses such as Main Drain, Carr Bridge Brook, and Dow Brook. Anglezarke, Fishmoor, and Stocks are located to the east, outside of the study 	Historic flood mapping and EA recorded flood outlines record the following instances: <ul style="list-style-type: none"> November 1977 – Overtopping of coastal defences October 1980 – Overtopping of fluvial defences on

Sub-area	Fluvial flood risk	Tidal flood risk	Existing defences	Surface water flood risk	Susceptibility to Groundwater flood risk	Reservoir inundation risks	Historic, recorded flood events
<p>the study area and is bordered by the Irish Sea to the west and River Ribble to the south.</p>	<p>shown to be at flood risk. Fluvial flood extents from Wrongway Brook inundate areas of Kirkham and Wesham, while there is also fluvial flood risk from Poolstream with extents inundating areas of Freckleton and Warton. In this Sub-area, there is a considerable difference between the extents of Flood Zones 2 and 3a, particularly in the west of the Sub-area around the urban centre of Lytham St Annes. There is also notable difference between the extents of Flood Zone 2 and Flood Zone 3a at Wrongway Brook through Kirkham and Wesham.</p>	<p>immediate coastline. The River Ribble is tidally influenced; however, these extents are summarised in the fluvial section.</p>	<p>In addition to this, a few embankments are located along the River Ribble protecting urban centres such as the east of Lytham St Annes and Warton.</p>	<p>Moss, and Common Edge. Much of this surface water ponding exists in all return periods, however, surface water flooding impacts a far greater number on roads in urban areas in the 0.1% AEP event compared to the 1% and 3.3% AEP events. There are also small, isolated areas of surface water ponding which may suggest localised flood risk.</p>	<p>as having groundwater levels less than 0.5m from the surface flooding, particularly around the east of Lytham St Annes. There are additional isolated areas of land with groundwater emergence levels within 0.5m from the surface towards the north of the area around Kirkham, Wrea Green, Great Plumpton, and Wesham.</p>	<p>area, but mapping shows that flow paths are channelled into the River Ribble, following the southern border of the Sub-area. The following reservoirs impact the Sub-area in the 'wet day' scenario:</p> <ul style="list-style-type: none"> • Marton Mere – This extent originates from Sub-area 3 and inundates a small area north of Mythop Road. • Anglezarke, Fishmoor, High Bullough, Highgate Park FSR, Rivington Lower, Stocks, and Yarrow are located to the east, outside of the study area, but mapping shows that the flood extents are channelled into the River Ribble. In addition, flood extents from these reservoirs also come out of bank west of Freckleton and inundate the low lying farmland in the area. Parts of Freckleton and Clifton are at risk of flooding in the 'wet day' scenario. 	<p>the River Wyre</p> <ul style="list-style-type: none"> • November 1990 – Overtopping of defences along the River Ribble • February 2020 – Local drainage or surface water around Foxhall.