Appendix 2 - KBLR response to the Masterplan Flood Risk and Drainage Strategy and Appendix 11.1 Lee Roxborough and McCloy Flood Risk Assessment

Executive Summary

- The Flooding assessment Appendix 11.1 fails to state what the uncontrolled surface water runoff will be for the development. This information is essential to set a design baseline. (para 1.2)
- By making reasonable assessment of impervious surfaces it is estimated that the post development run off from catchment A will be 4034 m3/hr and from catchment B 4076 m3/hr. (para 1.3, 1.4)
- In order to control this excessive run off rate the developer proposes a large flow-controlled gravity draining attenuation basin to the west of the site for catchment A, and a large flood basin with flow controlled pumped outflow to the North of the site for catchment B. (para 2.1, 2.2, 2.3, 2.4, 2.5)
- For catchment A the developer proposes that the new dwellings will have raised foundations with a <u>minimum</u> height of 0.15 m, however, tellingly the developer remains silent on the maximum height of foundations. Because of the need to dispose of 40,000 cubic metres of excavation spoil from the attenuation basin and associated swales it is almost certain that large areas of the site will be raised to the detriment of existing dwellings. (para 2.3).
- For existing dwellings at ground level this proposal will considerably increase flood risk relative to those with raised foundations. (para 2.3)
- The developer states that property in catchment A will be protected up to a 1 in 30-year rainfall event. For structures designed for a 60-year life those structures will on average experience two flooding events in that time. Data produced by the Met office states that the probability of 1 in 30 flooding events has increased for all regions of the UK during winter and for Dorset and the North West of England in particular for summer periods, so it is highly likely that these properties will experience more than two flooding events on average in 60 years. (para 2.3)
- The catchment B flood basin is designed with significantly raised earthworks on the southern side of the basin. Again, the developer states a <u>minimum</u> height of 0.63 m above the 1 in 100-year flood level. Note again no maximum is quoted and that the height is not relative to a ground level datum but to a flood level. It is quite possible that the earthwork berm could be 1-2 m in height. Note that this raised earthwork structure completely or partially surrounds a number of existing properties. Those properties will be at significantly increased risk of flooding and the environmental and visual impact will be severe. (para 2.6, 2.7,2.8)
- A graphic is provided in Appendix 11.1 that shows in a 1 in 100 flooding event plus a 40% global warming allowance the flood basin has insufficient capacity and it preferentially floods Kingsfold which is unprotected because of the absence of protective earthworks on the north side of the flood basin. Indeed, it appears that the raised earthworks to the South of the flood basin are designed to protect the site to the South whilst sacrificing Kingsfold to the North. (para 2.8, 2.15)
- The flood basin has a capacity of 16,205 cubic metres. At a run off rate of 4076 cubic metres per hour the basin will flood in just under four hours. It is suspected that this is the reason no post development run off rates are provided in any of the documents as this capacity appears inadequate. The pumps are limited to a rate of 100 litres/sec so they will have little impact on this flooding time. It is reported in a Defra/Environment Agency paper “Extreme

Rainfall and Flood Event Recognition" Aug 2002 that for the majority of extreme rainfall events measured from 1930 to 2000, the duration ranged from 3-60 hours with the average ~20 hours. This data indicates that the flood basin design will be ineffective for the majority of extreme rainfall events as it has insufficient capacity. (para 2.13, 2.14)

- The use of a pumped outflow from the flood basin provides another system vulnerability and is likely to be in continuous use to maintain a drained basin in the event that an extreme rainfall event should occur. If these pumps are electrically driven the electrical supply also needs flood protection, and no mention of this is made in the report. Indeed, the Welsh Government states that for groundwater drainage solutions "*because of the ongoing energy and maintenance requirements of pumping water and the risks associated with failure pumping should be avoided where possible"* (para 2.9,2.10). Certainly, the use of a pumped discharge system is not sustainable.
- There is no assessment, in any of the Flooding documentation, of the impact of system failure either through poor design or maintenance. Indeed, it unclear who will be responsible for the costs of system failure should this occur. The lack of clear accountability for system failure resonates with the situation apparent for the Grenfell Tower tragedy, with multiple design authorities involved but no clear accountability. (para 2.11 and section 4)
- There appears to be significant shortcomings regarding the hydrological model employed in the flood predictions. In the section of the appendix dealing with model validation the authors claim that the pictures of extreme flooding posted on the internet by scheme objectors represent a historic 1 in 30-year rainfall event and the model accurately predicts the extent of flooding observed in the photographs. Any local resident will point out that the flooding observed in the photographs occurs regularly and is not a 1 in 30-year event. This then raises serious questions regarding the integrity of the model and its ability to predict current regular flooding and a true 1 in 30-year event. (para 3.1, 3.2)

- The authors also state "No detailed flood data is available for accurate validation or calibration of the model" yet this proposal has been promoted by developers since 2015. It is therefore remarkable that in the intervening period no attempt has been made to collect this critical data. (para 3.2)
- Spoil disposal from the excavation of the attenuation basin and swale system to the west of the site will generate approximately 40,000 tonnes of waste boulder clay, requiring the equivalent of approximately 2,000 truck trips. This has the potential to generate a significant emission and transport problem. It is unclear how the developers propose to manage this spoil generation. (section 5)

- The utility company responsible for sewage treatment in the region is United Utilities. This company has a shocking record of underinvestment and routine discharge of untreated sewage to river and sea; indeed, it has the worst record in England. This is symptomatic of a local sewage treatment infrastructure that is not fit for purpose. On this basis alone no new housing development applications should be approved in South Ribble until United Utilities can guarantee that routine discharges of untreated sewage to river and sea have been halted. Approving this application is almost certain to increase the frequency and duration of such discharges. This is totally unacceptable as it is maximising shareholder profit at the expense of our environment. (Section 6).

Setting the baseline

1.1 Existing run off rates for the two main site catchment areas for the site, catchment A and catchment B are estimated by employing data from Figure 4.1 and Figure 4.4 and table 4.2, 4.3 and 4.4. Figures 4.1 and 4.4 are overlaid to provide a surface area weighted existing run off rate. Data for the 1 in 100-year rainfall event plus 40% global warming contingency is used.

1.2 Catchment B, 23.1 Ha total area, is covered entirely by existing catchment 3 and therefore has a total existing runoff rate of 23.1/54.5 x1335 litres/sec = 566 litres/sec = 2038 m3/hr.

1.3 Catchment A, 54 Ha total area, area consists of approximately 50% existing in catchment 3, 30% in catchment 2 and 10% in catchment 1 giving a weighted run off rate of ((0.5 x1335) +(0.3 x376.5) +(0.1 x 184.3)) x 54/77.4 = 560 litres/sec = 2017 m3/hr

1.4 Appendix 11.1 states "Uncontrolled flows from the development will exceed existing run off rates" but the report fails to state what they would be.

1.5 Data from a drainage strategy paper for a site off Blackburn Road Longridge indicates that for a site of this nature with a total development area of 30,000 m2, buildings occupy 10,090 m2 and roads footpaths and parking occupy 12,310 m2. Therefore, the percentage impervious surface is 22,400/30,000 = 75%. Leaving a permeable surface for run off attenuation equivalent to 25% of the development area.

1.6 Taking a position assuming 50% permeable land remains for both catchments post development, the development run off flow is likely to be at least double the existing run off flow, which for catchment A is 2017/0.5 m3/hr or 4034 m3 per hour and catchment B is 2038/0.5 m3/hr or 4076 tonnes per hour. This is fundamental baseline information which was excluded from Appendix 11.1.

1.7 The site is essentially landlocked with only one watercourse available for drainage namely Mill Brook.

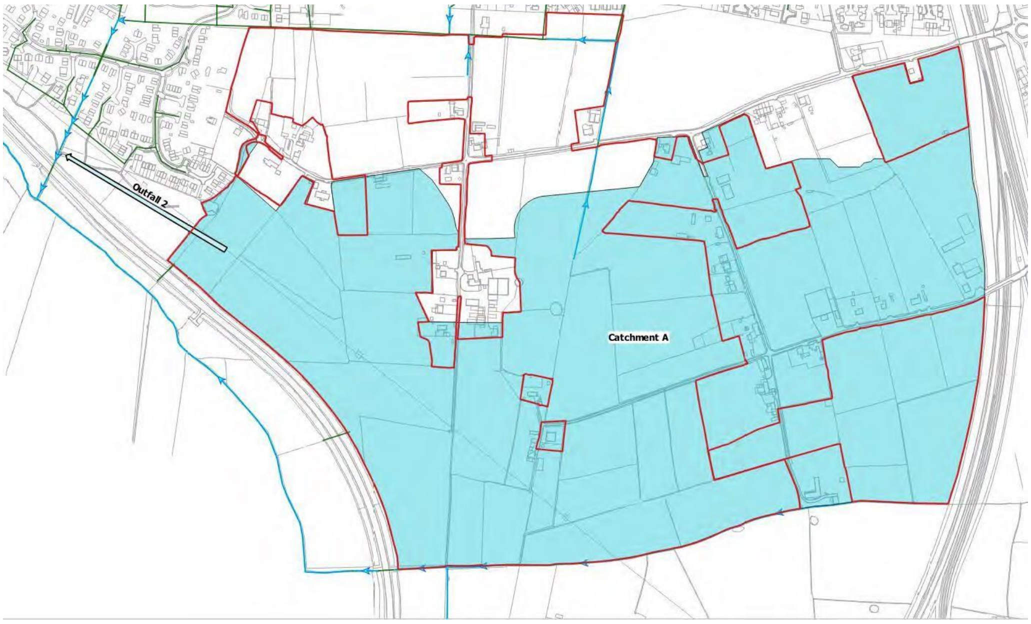
1.8 Mill Brook also serves to drain surface water from existing developments in Kingsfold and Penwortham and from the surface of the A582 and the Penwortham Bypass and from existing properties on site. There has been no attempt to calculate the run off flows from these existing sources for the I in 100-year design scenario above, and whether Mill Brook is capable of functioning under such circumstances and what the water levels are likely to be.

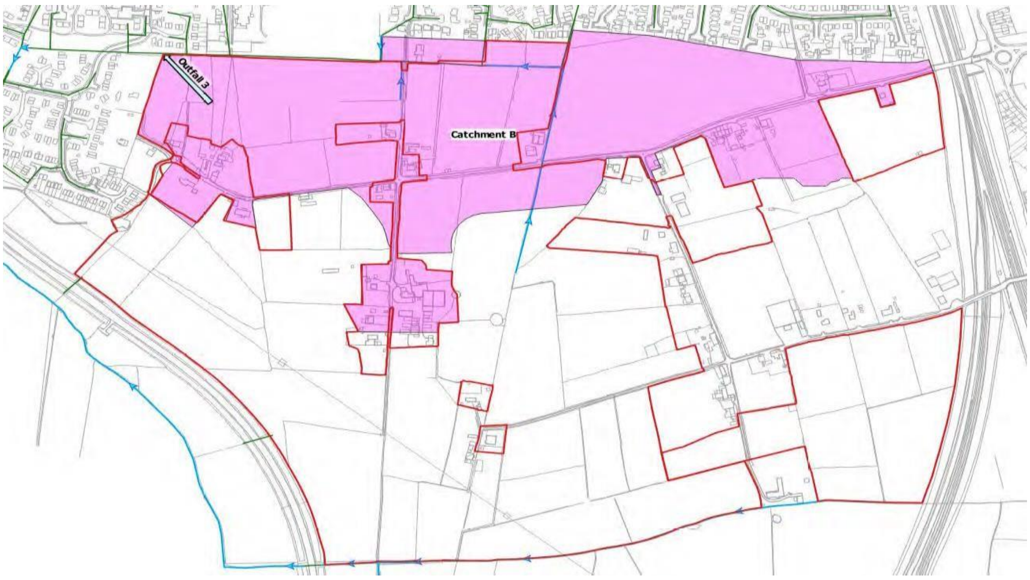
1.9 The developers recognise that site run off needs to be controlled.

2 The proposed solution.

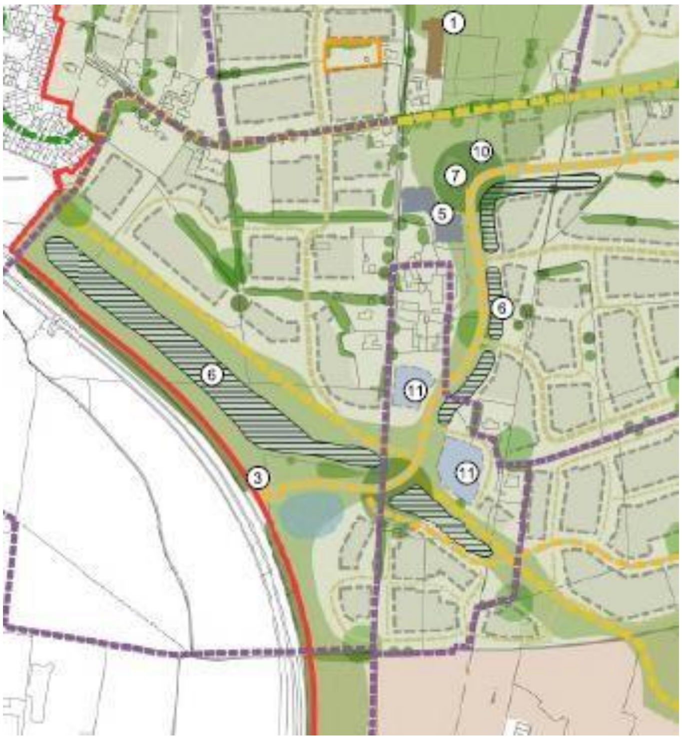
2.1 The developers propose the use of two outflows from site both draining to Mill Brook. One is to the North of Kingsfold using the Northern Tributary Boundary Culvert (Outfall 3). The second is to the South of Kingsfold where a drainage culvert crosses Penwortham Way (Outfall 2).

2.2 These outfalls will serve two drainage catchment areas A and B. Catchment B is the area of site that has the seriously challenging flooding risk and drainage conditions and will be drained to Mill Brook via Outfall 3 (Northern Culvert). Catchment A is 54 Ha and existing drainage is 560 litres/sec for the 100 year plus 40% event. It is proposed to drain this via Outfall 2. Catchment B is 23.1 Ha and has a drainage rate estimated at 566 litres/sec for the 100 year plus 40% event. Because of the site topography and geology both catchments face considerable flooding risk. The diagrams below show catchment details.





2.3 The proposed flood mitigation solution for catchment A is a large attenuation basin with an interconnected swale system. The development floor levels will be set to a <u>*minimum*</u> of 0.15 m above the ground level. The lack of any information on the likely maximum foundation elevation indicates extreme design uncertainty. In some areas it is likely that foundations could be raised to 0.5 m. Houses and hard surfaces will have piped surface drainage systems that will prevent flooding up to a 1 in 30-year event. That equates to a yearly probability of such an event occurring as 3.33 %. As these houses will be built to exist for a minimum of 60 years each property in this catchment is likely to experience on average two flooding events over sixty years. *The probability of flooding for existing properties in this catchment without raised foundations is likely to be far higher.* It is also noted that these "thirty year" events are becoming far more frequent as indicated in the met office report to Ofwat dated July 2010.It states all winter rainfall events for all areas of the UK are predicted to become more frequent, and that for the 20, 30 ,50 and 100 year events the biggest summer increases are projected to occur over both Dorset and North-West England



Catchment A attenuation ponds and swale system shown as feature 6.

2.4 The outflow from the catchment A attenuation basin is controlled to 100 litres/sec using a hydrobrake. These structures are vulnerable to silting and require regular maintenance. The reason for the outflow restriction is to prevent excessive demand on the outfall to Mill Brook. It is estimated that the attenuation basin has a surface area of approximately 600 x 25 m. Assuming it will be 2 m deep approximately 30,000 cubic metres of clay spoil will need to be disposed of either
on or off site. Assuming the catchment A attenuation basin capacity is 30,000 cubic metres will take approximately 7.5 hours to fill. This appears insufficient given the likely duration of the 1 in 100-year rainfall event, please refer to para 2.13 below. The total spoil resulting from the excavation of the attenuation basin and the swales is over 40,000 cubic metres. If disposed of on site, the implication is that significant areas of the site will be raised with an increased flood risk for the existing dwellings in the vicinity. Vague references are made in the documentation to the need to raise parts of the site, but no specific values are given.

2.5 The proposed flood mitigation for catchment B is far more complex because of the site topography and drainage catchment area. It is concluded in the appendix 11.1 that there is insufficient gradient for gravitational flow from an attenuation basin as for catchment A. The approach proposed is to create an artificial flood basin at the north boundary of the site shown as feature 4 on the Illustrative Master Plan. The scheme is also shown in figure 4.12 of Appendix 11.1 and on

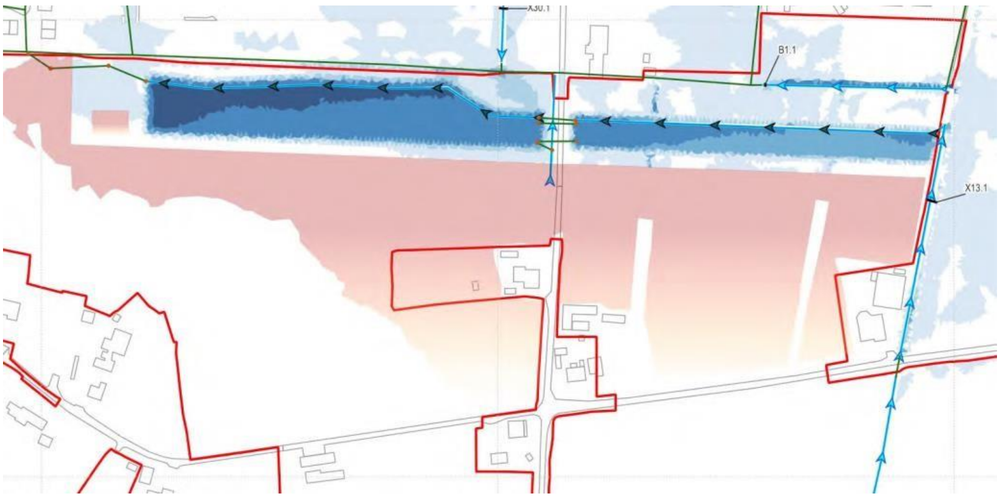
McCloy drawing titled "Proposed Daylighting and Reprofiling" Fig No M01852-01.

The flood basin as shown on the Illustrative Master Plan (marked as feature 4)

2.6 The drawing shows a flood basin with a capacity of 16,205 m3 Appendix 11.1 table 4.5. The estimated area of the flood basin is 400 x 20m. What is concerning is that water is channelled into the flood basin by employing raised earthworks to the south of the flood basin which are raised to a *<u>minimum level of</u>* *<u>0.63 m above the predicted 100-year event water level. Ref page 40 of appendix</u>* *<u>11.1.</u>* It is noted that no earthworks maximum height is given again demonstrating extreme design uncertainty. This statement leaves the developers with the freedom to raise earthworks significantly higher e.g. 1m+, with significant environmental detriment to the existing properties. This does not appear a credible solution given the impact the earthworks will have on existing property owners.

2.7 This artificial earth "berm" is <u>not</u> shown on the masterplan illustration. However, a number of existing properties at the North end of the site are shown in the referenced McCloy drawing at the back of Appendix 11.1 partially or completely surrounded by raised earthworks. This is a wholly unacceptable proposal. The authors of the report only state a minimum elevation. The actual height of these earthworks could be far higher (1 m+). This will place these properties at significantly elevated risk of flooding and will adversely impact visual amenity.

2.8 The proposed arrangement is shown below extracted from the McCloy drawing.



Catchment B Flood Basin. The area shown in red is the raised earthworks. Note the existing properties that are totally or partially surrounded by the raised earthworks.

2.9 The design of the flood basin is such that it cannot gravity drain to Mill Brook via the Northern Culvert. What is proposed is a flow controlled pumping station. There is very little design information on the pumping station other than it will incorporate a duty and standby pump. If electrically powered it is critical that the sub-station providing the power is also flood protected. This requirement is not mentioned in the Masterplan documents. The Welsh Government Standard for the design construction and operation of surface water drainage systems 2018 states wrt pumped systems "*Because of the ongoing energy and maintenance requirements of pumping water and the risks associated with failure, pumping should be avoided where possible*"

2.10 The standard also states "*Where the drainage system is to be adopted the developer should ensure that the adopting organisation has agreed in principle to adopt the pumping station before putting in the planning application*" The appendix 11.1 section 5.5.1 simply states "It is *proposed* that the main piped system and pumping station will be adopted by United Utilities". It is not clear if any agreement is in place with United Utilities. Clarification on this matter is the subject of an EIR with united Utilities.

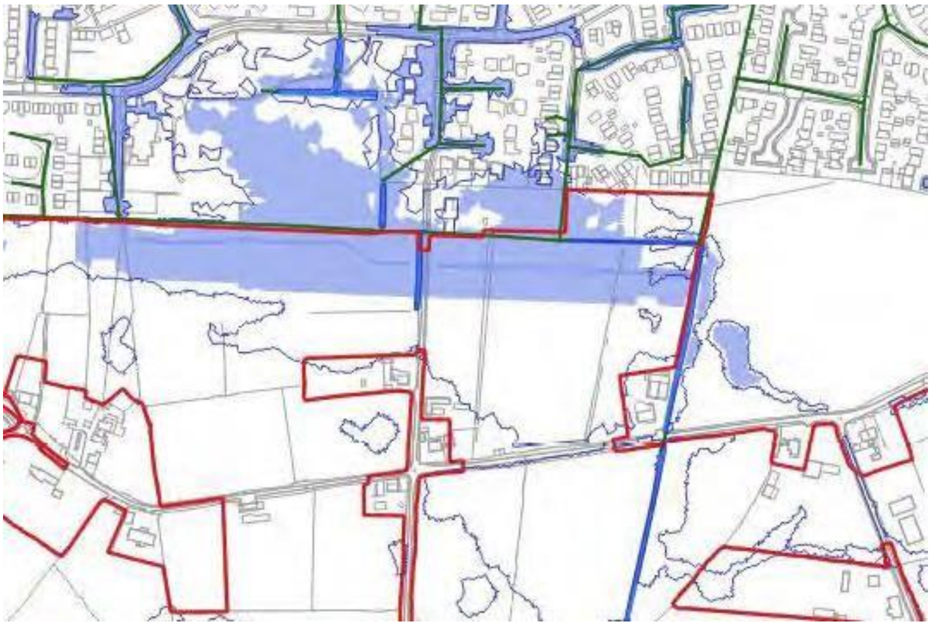
2.11 There is little evidence in the report of a proper analysis of the economic impact of pump system failure either through poor design or maintenance, and it is unclear who will be financially responsible. The impact of system failure will be profound effecting existing and development properties. The authors simply state there is a very low probability of both duty and standby pumps failing and in any case the capacity of the flood basin is sufficient to absorb all flood water runoff.
The paragraph below demonstrates that this is not true.

2.12 Assuming the current water runoff rate is 566 litres/sec for catchment B and the area when fully developed will consist of 50% impermeable structures such as houses, roads, parking, and gardens hydraulically isolated by road and housing foundations then the development run off rate for the 100 year event plus 40% global warming allowance is 566/0.5 = 1132 litres/sec = 4075 m3/hr. On this basis the flood basin has sufficient capacity to absorb runoff for 16205/4075 = 4 hours ~240 minutes. This is hardly sufficient as a one in 100-year flooding event is likely to last significantly longer than 4 hours. This capacity also appears insufficient to undertake emergency pump repairs should a common mode fault develop requiring either pump repairs, sump drainage or the installation of a diesel-powered pump back up pump. In any case the proposed pumped outflow of 100 litres/sec which is hydrobraked, will have little impact in arresting the impact of predicted runoff water rates.

2.13 A Defra report published in 2002 "Extreme Rainfall and Flood recognition" provides data on extreme rainfall event durations from the 1930's to 2000 shown in table 3 of the report. It lists 60 events of which 32 were of duration between 3 and 60 hours with the average being 20 hours. Should durations of this nature occur for the 1 in 100 storm the majority of catchment B would be flooded after a few hours as the flood basin will have insufficient capacity, and as the outfall pumps are constrained by a hydrobrake to 100 litres per second, which appears insufficient to make any impact on draining a flood basin capacity of 16,205,000 litres.

2.14 Appendix 11.1 section 3.8.1 outlines a "Critical Duration Analysis" which is an attempt to establish the duration of a flooding event (one in thirty and one in one hundred events plus 40% global warming allowance) over which flooding levels are at a maximum. The analysis results in table 3.2 show this to be 360 min (six hours). The authors do not state the duration of the rainfall event which was employed as the basis of this analysis. This result does not appear credible as it appears likely that most extreme rainfall events will occur over a much longer duration than 6 hours. Also, after four hours the flood basin protection will have failed rendering this analysis meaningless.

2.15 It is clear in the appendix 11.1 that the flood basin is designed to protect the site. What may not be apparent to the reader of the Masterplan documents is that the impact of the flood basin design is to considerably increase the risk of flooding to properties in Kingsfold to the north of the flood basin. The diagram below, next page, shows the impact of the proposed flood basin design on Kingsfold. It is unlikely that the residents of Kingsfold or the appropriate authorities are aware of this significantly enhanced flooding risk.



Note this figure given as Fig 4.15 in the Appendix 11.1 shows the flood basin filled and overflowing into Kingsfold in the case of a 1 in 100-year event plus a 40% global warming allowance. Note the raised earthworks to the immediate south of the flood basin "protect" the site at the expense of Kingsfold which has no protective earthworks. Note the diagram does not show the full extent of flooding in Kingsfold; and that the Penwortham Town Council Building appears to be impacted by flooding.

2.16 Not only has the flood basin been designed to flood Kingsfold in preference to the site it is also proposed to re-direct surface water that originates in Kingsfold and is currently managed via the Northern Culvert, to a more southerly culvert.
Para 6.5 of the Lees Roxborough report Appendix 11.1 states "it is proposed to redirect flows (from Kingsfold) currently entering the system from upstream outfall B (Northern Culvert) to downstream (outfall A) of the existing development (More southerly Culvert under Penwortham way) and hence reducing the volume of water reaching the most vulnerable area of site". In other words, the proposal is to shift the current drainage route from Kingsfold to a more vulnerable upstream position on Mill Brook in order to reduce the volume of flow to the Northern Culvert and hence help protect the site, at the expense of Kingsfold. There is

also no mention of how this re-routing is to be achieved and whether the developers have the agreement of all landowners or the Utility company responsible.

3 The integrity of the hydrological model.

3.1 Appendix 11.1 section 3.10 deals with model validation. In this section the authors argue that pictures of “historic” flooding provided by “objectors” to the scheme in fact help validate the model. The authors imply that the two photos in question are from a one-off historic event. By comparing the photos with what is predicted in the model they claim the model then accurately predicts such a “historic” event and proves the model is sound.

Figure 3-18: Predicted On-Site Flooding (3.3% & 1% AEP)

Light blue is the 1 in 100-year event (1% AEP) and the dark blue is the 1 in 30-year event (3.3% AEP)

They also use the second photo below to “validate” the model.

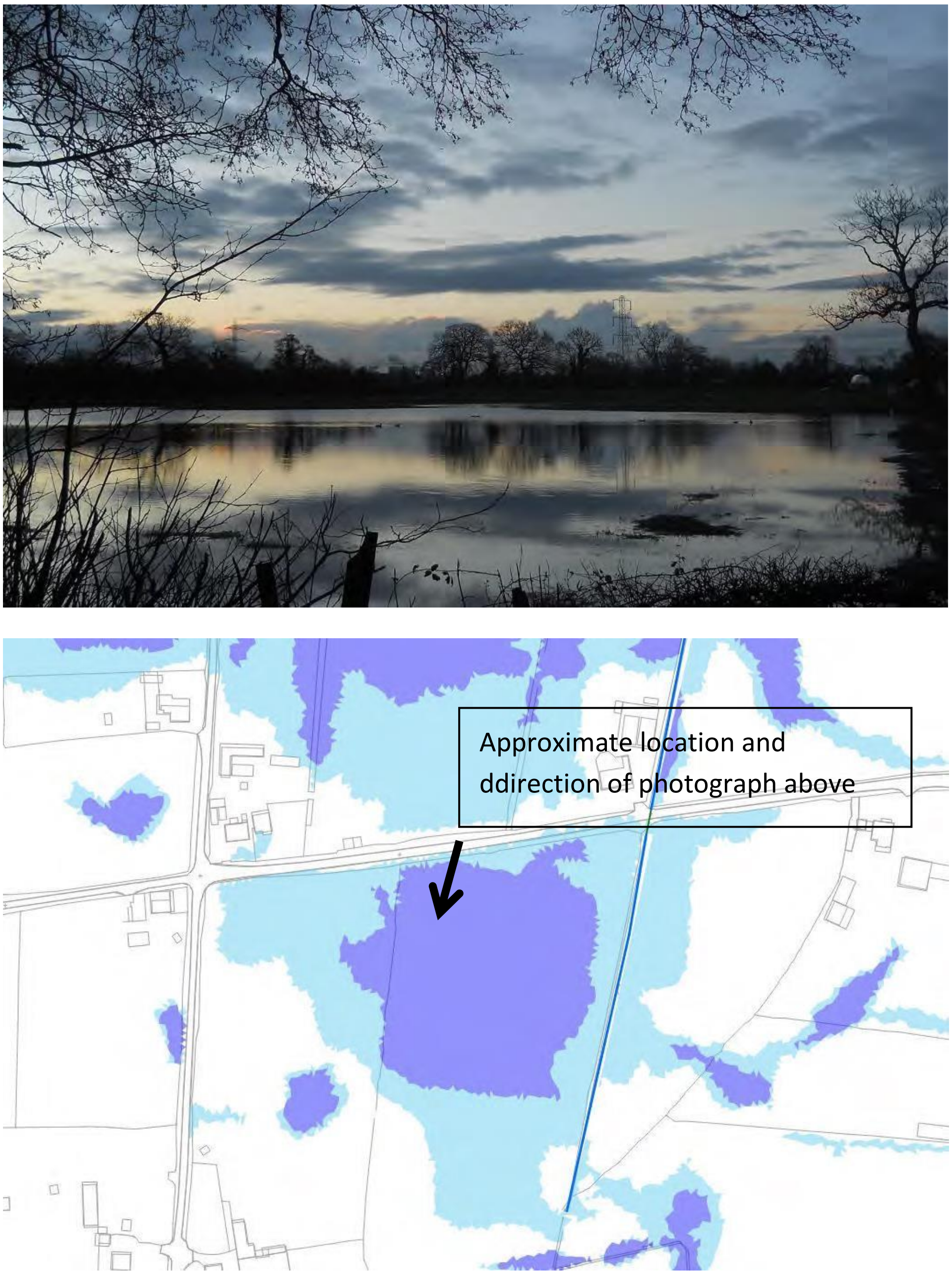


Figure 3-20: Predicted On-Site Flooding (3.3% 1% AEP).

The authors state;

“Model predictions have been reviewed at the two locations to form a degree of model validation; however, no dates were provided for the photographs and therefore no historical rainfall data could be obtained to determine the performance of the model under the same rainfall conditions. **The model predicts a significant area of flooding at the locations of the photographs for the 30-year event that corresponds with the general outlines of flooding in the photographs** and in the absence of more detailed historical data upon which to carry out verification, the model is considered to be sufficiently accurate.”

This statement beggar's belief, in effect the authors are claiming that the flooding shown in the two photographs is as a result of a 1 in 30-year rainfall event, and thus the model correlates with observed flooding.

It is abundantly clear to the local residents that the flooding shown in the photographs occurs routinely and regularly with major flood events such as those shown in the photographs occurring at least once every five years, so it is false to claim this as a one in thirty-year event as McCloy imply in their text.

This cynical misrepresentation of photographic evidence raises fundamental questions regarding the model accuracy and indeed the integrity of the whole report, as it appears to significantly underestimate the true extent of regular flooding that occurs in the development catchments.

3.2 Some additional observations regarding the assumptions underpinning the model

It appears that an assumption of 14% of the surface area of existing developments north of the site e.g. Kingsfold has been made to account for other impermeable surfaces e.g. driveways, footpaths, patios and parking. This appears to be a serious underestimation.

Extract from section 3.4.4 "The buildings are represented as porous polygons with a porosity of 0.1. This allows the building to impact the flow route whilst allowing a proportion of 'flow through' which would occur in the property via doorways and air bricks and venting etc.". In other words, the model assumes that houses will be flooded, and this beneficial impact has been accounted for in the model e.g. flooded houses increase the permeability of the development to water flow.

Extract from section 3.6

"<u>No particular investigation has been made on the effect of land drainage</u>, on the basis that the omission of field drainage provides conservative results."

"<u>All culverts and surface water drainage networks are modelled as free flowing</u> with no sedimentation or blockages modelled for purposes of the baseline assessment."

"<u>No detailed flood data is available for accurate validation or calibration of the model</u> (i.e. performance of the model prediction relative to a known rainfall magnitude and observed flood extent). The model is verified insofar as it ensures flooding is predicted in any areas where previous flooding has been recorded as discussed further in Section 3.10."

Regarding the last statement it is strange that this development has been proposed for many years yet in all that time there has been no effort to obtain metrological and flood data from the site.

Extract from section 3.7.3;

"In order to investigate the potential effect of the model downstream boundary, the downstream boundary level has been increased by 1.0 m. There was no measurable change to flood levels at the downstream site boundary."

The data from climate central ref picture below shows that the annual flood level predicted for 2050 will have a significant impact on the Ribble and potential water levels in Mill Brook shown crossing the A59 South of John Horrocks Way. It is not clear if projected coastal flooding has been accounted for in the analysis described in Appendix 11.1.

Extract from Appendix 11.1 section 3.7.6

<u>"The use of dry clay soil parameters may underestimate flood levels for some flood events with more saturated antecedent conditions, however it is not possible to account for all antecedent conditions. It is considered suitable to assume dry antecedent conditions for design simulations."</u>

<u>Bizarrely the authors have employed a dry clay soil as the basis for their model which appears to contradict the statement given in section 3.4.7 "Ground conditions across the site were noted to be very wet and were typical of a poorly drained soil."</u>

4. Responsibilities for Design and Maintenance of the Flood Management System.

The financial consequences of system failure through poor design or poor maintenance are significant. In none of the documents covering flooding and flood prevention is there any attempt to quantify the impact of system failure.

At this stage there appears to be a complex chain of third-party contributors including

McCloy consulting, Lees Roxborough, LCC as Lead Local Flood Authority and Taylor Wimpey as developer. Each third party appears to incorporate a number of disclaimers into their reports. Responsibility for system failure appears deliberately opaque.

It is unclear who is financially accountable for errors and omissions should the design principles be proven to be flawed, as they appear to be.

The systems proposed require regular and thorough maintenance and it is not clear who will be directly accountable for maintenance errors and omissions and who will be responsible for the substantial costs.

5. Spoil Disposal.

It is assumed that the flood basin spoil some 20,000 tonnes will be employed to construct the raised bank to the South.

It is unclear how the spoil generated from the excavation of the attenuation basins and swale system to the west of the site will be managed. It is estimated that approximately 50,000 tonnes of impermeable boulder clay will need to be disposed of by transporting offsite or to other parts of the site.

If it is transported for use on site this implies that parts of the site will be raised significantly, increasing the flood risk for existing dwellings

This spoil volume is equivalent to 2,000 truck trips that will occur during construction. It is unclear how this problem will be managed, however the potential environmental impact will be significant

6. Sewage treatment and dispersal.

Although this review focusses on the management of surface water run-off from site it is worth also reflecting on another key element of development infrastructure seldom given sufficient consideration when planning applications of this nature are submitted. This relates to the adequate provision of sewage treatment for the development.

We estimate that the population increase associated with the committed developments in South Ribble will be in the region of 6,400 people. The majority of this population increase is likely to come from outside the South Ribble region.

For this planning application development, the population of the site assuming 1100 dwellings is likely to be in the region of 3,600 people, again with the majority coming from outside the South Ribble region.

This is significant relative to the population of South Ribble measured as 110,527 in 2018.

The provider of the sewage treatment in the region is United Utilities. No doubt they will claim that there is adequate capacity to treat the arising sewage from the committed developments and this application in particular.

However, it is worth reflecting on the fact that United Utilities is the Company that discharges the most sewage to rivers and the sea in England, having amassed a total of 726,450 hours of routine discharges of raw sewage in a total of 113,940 events during 2020.

The sewage treatment infrastructure in NW England is in a shocking state and is wholly inadequate for the intended purpose.

The committed developments in South Ribble and the current planning applications for the Lanes will significantly increase the volume and frequency of such environmentally damaging discharges as the current sewage treatment systems have insufficient capacity as evidenced by United Utilities appalling record in 2020.

On the lack of adequate sewage treatment facilities alone, no new planning applications should be agreed until United Utilities can guarantee sufficient sewage treatment capacity in the region, as demonstrated by the absence of routine discharges to river and sea.