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FLOOD RISK ASSESSMENT

ON

**Land at
Butt End Mills,
Mirfield,
Huddersfield,
West Yorkshire**

FOR

T V Co. PARTNERSHIP

**E19/7438/FRA001B
Rev B**

**December 2019
Revised Mar 2020**

T. Haigh B.Sc., C.Eng., M.I.C.E.



1.0 INTRODUCTION

- 1.1 This report is commissioned to investigate and report on the Flood Risk for this site in accordance with Planning Practice Guidance - Flood Risk and Coastal Change April 2015 (PPG-FRCC) and the proposals for the drainage of this site when redeveloped as industrial land. The report is based on information supplied by the client and from relevant authorities in both written and verbal format. Some of this information is in verbal form only. No liability can be accepted for information supplied by third parties which is subsequently found to be inaccurate or incorrect. This revision is based on the responses to the application from **both the Environment Agency and Kirklees MDC Land Drainage Section.**

2.0 THE SITE

- 2.1 The site is located off Calder View, approx. 0.2 miles south of Mirfield Town centre. It is situated around Ordnance Survey grid reference SE 20018 19713. A site location plan is shown on Figure 1 in Appendix A.
- 2.2 The site is roughly trapezoidal in nature and situated on the site of an existing mill building and a former factory which was last used for manufacturing. There are a few industrial / commercial units contained within the old mill, but the factory has recently been demolished. The site is 70% covered with industrial properties, tarmacked areas, drained car parking and yard areas. The surrounding area to the south has all been redeveloped for residential use. Immediately to the north of the site is the river Calder with a major weir adjacent to the site. To the south runs the main Leeds to Manchester railway on an embankment. The factory to the west has been demolished but large areas of tarmac remain. The site area is approximately 0.87ha.



- 2.3 The site is generally flat around a level of 44.8m AOD with a high point in the South west corner of the site and a low point on the north western boundary to the site. The site to the west falls away from the site at a very slight gradient.

3.0 PROPOSED DEVELOPMENT

- 3.1 The proposals will create 5no. new commercial units to replace two existing buildings – One a former mill and the other a now-demolished factory (See Figure 1 below).

Site Location and Description

The site is shown on the aerial view below shaded red: -



Butt End Mills is an irregular shaped old stone mill building of various heights. The building (former factory) to the north of the site has recently been demolished.

There is an area of trees, a small area of grass and several hardstandings.

Figure 1 – Site Location & Description



Currently, the space within the mill building is practically impossible to let as the internal spaces are irregularly shaped with varying internal floor-to-ceiling heights. Access to the building for goods is difficult as thresholds are at different levels. The mill was designed for a specific single use in a bygone era and does not meet current standards, or the needs of modern business.

The new units will provide accommodation to modern standards for businesses new to the area, and to those businesses currently operating from the mill, namely 'Navigation Garage', 'SK Panel and Paint', and 'Mirfield Tyres and Batteries'. It is hoped that the new units will secure the long-term future of these businesses by allowing them to remain in this area, while offering them the potential to grow their business.

3.2 The proposed development is for the construction of modern industrial units with associated car parking and vehicular access. This will all be housed within new buildings constructed over the whole site. It is envisaged that the impermeable areas for the whole development would change significantly due to this development. At present there is a paved area of approx. 3000sq.m for the old mill and the site of the demolished factory. The proposed site would have impermeable areas totalling 6000sq.m. Some areas hardly change notably the car parking at the eastern edge of the site. The development will be only open during normal commercial / industrial hours and would not be occupied overnight. There is a proposed site plan in the appendices of this report.

3.3 The revised site plan now shows the required 8m easement to the River Calder on the northern boundary to allow maintenance as required by the E. A.

4.0 PROPOSED SURFACE WATER DRAINAGE

4.1 In the first instance and in accordance with the current hierarchy for new development of land, under planning legislation, the use of soakaways and



infiltration systems would normally be investigated. For this site however local knowledge suggests that the site would be unsuitable for infiltration systems and this has been confirmed by Kirklees MDC Land Drainage. The site has previously been developed, but the new development would increase the run-off from the site. However, this is not allowable with current re-development policies and normal practise for brown-field sites would have to show a reduction in surface water run-off rates by at least 30%.

- 4.2 The site is shown on the BGS Geology maps to be underlain by Alluvial deposits. These are normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present. There is no site investigation available at the time of writing this report, but whilst there is a possibility of sands or gravels beneath the site the close proximity of the river to the site and the elevated ground water levels associated with that, the possibility of using infiltration techniques on this site are not considered to be feasible. For the purpose of this report they are therefore not considered feasible for this site.
- 4.3 The adjacent developments have all utilised attenuation storage for the discharge of surface water. This site will use similar techniques. The current surface water discharge from this site is via an existing connection into the surface water sewer in Calder View, although this is partially filled with rubble at present. This is then passed through an attenuation system installed for the adjacent residential development before being pumped up into the River Calder on the edge of the site. The drainage for this site could use this system provided the discharge rates are reduced by 30% from current levels or to an even greater extent.
- 4.4 The flows from the development site could be attenuated down to acceptable levels but may require a second pumping station to enable it to be connected



into the existing system once the design is finalised. This is discussed later in this report.

- 4.5 The total site area of the development is 0.87Ha of which approx. 0.314Ha is shown as impermeable. The new site will have an area of 0.6Ha that will be considered impermeable, unless permeable surfaces are used. Based on an annual storm the original site would have produced a discharge of approx. 40l/s for the annual storm and approx. 65lit/s for the 1 in 100-year storm. However, the site has been partially demolished and proving the remaining direct flows from the system serving that area of the site would prove to be difficult. Some area may not have entered the surface water system and may have drained directly to the adjacent river. Based on this and the fact that the site may fall within a critical drainage area the discharge should be limited to approx. 16 lit/sec. This will have to be agreed with the local Land Drainage Authority and the Environment Agency but recognises the fact that the site has been developed previously. The discharge should be limited to as close as feasible to agricultural run figures for this site. Simple modelling of the agricultural run-off indicate that this proposal would be a substantial reduction in run-off directly or indirectly from this development site.

5.0 FLOOD RISK

- 5.1 The site currently falls within flood zone 3, as shown on the Environment Agency Flood risk maps for Planning. It does not fall within an area shown to benefit from flood defences up to the 1 in 100-year flood event, but falls wholly within Flood Zone 3(a). The areas directly to the west of the site are classed as flood zone 3(b) and act as wash lands and flood water storage areas. The area of the site is not shown as washland or flood water storage zones. The development is classified as Less Vulnerable in Table 2 of the PPG-FRCC. The proposed area of development falls within Zones 2 and 3 and as such table 3 of that document also states that the proposed development is applicable, subject to other constraints.



- 5.1.1 **Zone 3 High probability** means that each year this area has a chance of flooding of between 1% and greater. This only takes into account the effect of any flood defences in the area if they are maintained by the EA. These defences reduce, but do not completely stop the chance of flooding as they can be overtopped, or fail.
- 5.1.2 **Zone 2 Low Probability** means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce, but do not completely stop the chance of flooding as they can be overtopped, or fail.
- 5.1.3 **Zone 1 Very Low Probability** means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce, but do not completely stop the chance of flooding as they can be overtopped, or fail.
- 5.2 Due to the size of the development under 1Ha it will not be necessary to prepare a Site-Specific Flood risk Assessment for the site.
- 5.3 There are a number of potential flooding mechanisms that Planning Practice Guidance - Flood Risk and Coastal Change April 2015 (PPG-FRCC) now requires are evaluated for each proposed development site. Each method of flooding requires an assessment to be made on its probability relative to the site development. The normal requirement of the document is for no flooding of properties for storms up to a 1% probability or a once in 100 years storm. The risk assessment also includes for flooding both on site and off site, and the effects of the development on the downstream catchment or the flow regime of the watercourse. Planning Practice Guidance - Flood Risk and Coastal Change April 2015 (PPG-FRCC) also requires that the effects of severe storms above the normal 1% probability are reviewed together with the effects of climatic change relating to the design life of the development.



- 5.4 It also requires that the effects of climate change are taken into account together with the impacts of extreme events and flood defence failures.
- 5.5 Based on the published Environment Agency Flood Risk Maps the proposed development on site does fall within the 1% Flood Risk (i.e. Zone 3). The proposed development falls within the Less Vulnerable Classification in Table 2. The development is therefore considered appropriate in accordance with Table 3. However, it would be appropriate to consider the residual flood risks on this site because it stands within Zone 3 and what flood risk mitigation can be provided as part of this change of use.
- 5.6 PPG-FRCC requires that each flooding mechanism is addressed, and levels of risk evaluated. We consider there are three main risks of flooding to the site. The alternative mechanisms are not applicable to this site.
- 5.6.1 Inundation from floodwaters leaving watercourses or rivers entering the site. This can include the effects on culverted watercourses and where the risk of blockage can occur and from breach scenarios.
- 5.6.2 Rainwater falling on the site and not being able to leave the site at sufficient rate to prevent flooding on the site.
- 5.6.3 Risk of flooding from reservoirs coupled with flows from adjacent sewerage systems or other watercourses.
- 5.6.4 The impact of the developed site on the existing drainage systems and off-site surface water systems must also be assessed as part of this flood risk assessment.



5.7 Discussion of Flood risks

5.7.1 Flood Risk from Watercourses, River & Tidal

5.7.2 The nearest watercourse shown on the O.S Survey is the River Calder that runs immediately to the north of the site boundary of the site. The River Calder is classed as main-river and runs from west to east past the site. The area of site immediately adjacent to the main river appears to fall within the 1% probability Flood Risk Maps as published by the Environment Agency (Flood Zone 3a).

5.7.2 The area of the site is reported as being flooded in 2000, 2017 and 2019 but the mill buildings continued to function and did not flood in any of these flood events. These were recorded as events in excess of the 100-year flood event for this section of the river. This would suggest that the level of the existing mill buildings are above the required 1 in 100-year flood event for the river in contradiction to the modelled levels.

5.7.3 The site is generally flat with slight falls towards the northern and western area of the site. The lower site levels are around 44.6m to 44.7m AOD. The EA have requested that the floor levels for the new buildings should be set at a level 300mm above the river flood levels for the 100-year storm with allowances added to cater for climate change. The latest modelled information for the river Calder from the River Calder (Brighouse to Dewsbury) Flood Mapping Study 1515 at CALd10_0069 the upstream of the weir (SE 20074 19658) are given as 45.681m AOD for the 100-year flood event, rising to 45.947m AOD when climate changes are considered. Thus, the required floor level of the new units would be approx. 46.250m AOD. When compared with the existing ground



levels this is approximately 1.65m higher. This rise in floor slab levels of the proposed development will affect the external levels around the building and as such there would create an increase of displacement of flood water. This level is in contrast to the existing floor level of the existing units of 45.00m AOD which did not flood.

5.7.4 Based on the pretext that the existing buildings would have fallen within flood zone 3a and covered an area of 1689sq.m in total. The new buildings cover an area of 1662sq.m. There is therefore no increase in the area of buildings on the site which would have displaced flood waters from the site. The current 100-year modelled floodwater levels for the River Calder at the weir are 45.63m AOD which are still above the floor levels for the existing unit which has reportedly not flooded in the last three major events. However, with the ground levels around 44.7m the site could flood up to 900mm deep, which would affect any parked cars on the site. The site is only to be occupied during normal working hours and in the event of a flood warning could simply be evacuated. It is our understanding that in times of major flood risk, the main access to the site would not be accessible by vehicles. This would remove the risk of vehicles floating into the river as noted in the comments from the EA. And the risk to personnel on site is removed as the site will be vacant during any major flood warning.

5.7.4 If the site levels are raised to allow access into the proposed units then there is a substantial volume of displaced flood waters that would need compensatory storage. If external ground levels are raised to 150mm below the required floor levels then excluding the areas of the existing buildings there would be a displaced volume of 3775cu.m for the 100 year flood level rising to 4813cu.m., when climate change is taken into account. This is a large volume and there is no space on site to provide this other than beneath the carpark area in a manufactured void. Even this does not provide for storage to attenuate the flows from the site development.



- 5.7.5 The storage for the run-off from the buildings could however be catered for by providing a void beneath the ground floor of the industrial units. The concrete floors of these would be suspended to provide a 400mm deep void formed by PolyStorm crates, or similar, to allow rainwater from the buildings to be directed into this storage system and thence allowed to discharge to the existing systems at a reduced rate of 70% of the existing annual storm surface water discharge rate. Based on an existing building area of 1689sq.m. the annual discharge rate would be approx. 23.5 lit/s from the site. The restricted discharge rate would therefore be around 16.5 lit/s. If the discharge rate for the buildings only is limited to 5 lit /s then the storage provided is well in excess of the required storage for the 100-year event with climate change of 63.5cu.m. which equates to a 35mm deep void beneath the slabs or an area of 160sq.m. of 400mm deep Poly storm units. A simple inlet and outlet structure would allow the void to fill during storm and to drain down once the flood waters have receded.
- 5.7.6 A similar system could be provided to the car park area. The area of the car park and service area is close to 2000sq.m. To accommodate the required flood volume for displaced flood storage is 1.9m deep. 5no. deep units would be 2 metres deep, so a smaller area could be accommodated. To enable the required use of the carpark for access to industrial units then a cover of 600mm would be required. This would give an invert of the tank of 43.55m AOD which is approx. 1200mm below existing site levels. The carpark would be constructed in permeable paving allowing the rainfall on the car park to pass directly into the storage system and this could be attenuated by a simple weir wall and hydraulic outlet control to limit flows to approx. 10 lit/sec giving a total discharge rate of 16 lit/s for the redeveloped site. The volume of storage for the car park would be around 62cu.m. which equates to a depth of 35mm in the tank during a 100-year rain storm of 6800cu.m. thus a simple 300mm high weir wall would enable the hydraulic flow control device to work during rainstorms, but allow flood waters to pass through at a reduced rate during flood events. It would effectively mobilise the storage of the flood waters. The outfall would be on the



downstream side of the weir due to the required depth of storage crates. This proposal would ensure there is no increased flood risk to either the properties on site, or to the properties downstream of the development. The use of displaced flood water storage by the provision of crates beneath the car park and open areas is an accepted resolution of flood attenuation storage on congested sites.

- 5.7.5 An alternative scenario for the site as proposed in previous reports is to keep ground levels as close to the existing as possible, but to provide flood resilient construction within the buildings. The flood resilience construction would require the flood defence of the buildings to be capable of withstanding the raised water levels from possible flooding up to the 100-year plus climate change. In view of the fact that the existing buildings did not flood it would be suggested that a floor level of 45.000m would allow an operational system without raising levels significantly. This can be compensated by providing a single layer of drainage crates 400mm deep which relates to the required volume of displaced water by raising the external levels to this reduced height. The proposed building can then be designed with a demountable and incorporated flood protection system to cater for the extreme storms up to the 100-year plus climate change flood water levels. For the development to proceed in the knowledge that the site is considered to be at risk of flooding on greater than a 1% yearly return period, it would be a requirement to install flood resilience measures within the buildings where possible, or to provide a balance or feasible. This would entail raising power points and electrical equipment to a higher level, protection of wall finishes within an industrial building and flood gates or barriers at all openings. The floor slab will be a contiguous waterproof slab with sealed penetrations for any services. Foul water drainage would have to be fitted with reflux valves to prevent water ingress. This must be borne in mind with the possible source of flooding for the flood risk for planning map which suggests that the main cause of the site's inclusion within zone 3 is due to flood water from reservoirs.



5.7.6 The road level to the entrance to the site on the western boundary of the site will not be passable during the 100-year and the 1000-year flood event. The site should therefore have to be evacuated if such a flood risk is forecast. The site would not be operational overnight and as such this element of risk is removed. The site cannot therefore be accessed during the 1 in 100-year flood event. It should be noted however, that the Long Term Flood Risk from Surface Water maps issued by DEFRA do not show the site being at risk of flooding from surface water for events up to the 1% annual flood risk. They do however show the site to be flooded up 1m depth if there is a major reservoir failure giving rise to the flood maps being based on the risk from reservoirs, rather than river flows. The risk of flooding from reservoir failure is considered to be less than 1% due to the regime for reservoir maintenance and should be considered as an extreme event.

5.7.7 The site falls within the flood warning area designated by the E.A. The occupants will need to subscribe to the flood warning system already operated by the EA to ensure they are aware of any risks to personnel and property due to flooding on a daily basis and the facility should be closed and evacuated in such a scenario. Whilst it would not be necessary to evacuate the site up to the 100-year flood event, the risk of being isolated, which only occurs for exceedance events, remains, and refuge areas should be provided within the buildings at first floor or mezzanine levels. The flood events on the Calder to date have subsided with 24 hours so this scenario is considered acceptable.

5.8 Risk of Flooding from overland flows from adjacent land

5.8.1 The site lies at the bottom of a valley with significant slopes down to the site, but these are somewhat curtailed by the railway embankment to the south of the site. To the west of the site the land is slightly lower than the site and is designated as flood plain. To the south and east the adjacent land is higher than the site, but any overland flows are deflected by the railway embankments away from the site.



5.8.2 The Long Term Flood Risk from Surface Water Maps issued by DEFRA do not show the site being at risk of flooding from surface water for events up to the 1% annual flood risk and even then only shows a depth of flooding around 300mm in isolated areas. The risk of flooding due to overland flows is considered low, apart from reservoir breach events, which is discussed below.

5.8.3 The risk of overland flows following reservoir breach scenarios needs to be considered. The site is shown to be within a zone subject to flooding from reservoirs should a breach occur, with depths of flooding up to 1m deep. The plans do not show what the source would be for this site as there are a significant number of upstream reservoirs. It is assumed that these reservoirs are maintained and inspected on a regular basis under the Reservoirs Act by the owners and as such the level of risk of failure is considered to be less than 1% and therefore acceptable.

5.8.4 If a breach did occur the depth of flooding, indicated as being up to 1m deep, would be excessive and the use of residual or flood resilient measures would not be effective in this instance. We would therefore suggest that all electrical points should be a minimum of 1050mm above floor level and that all entries to the building are sealed or protected as a prudent measure, rather than an effective measure. It would however be prudent to ensure that the site managers are aware of the EA Flood Warnings system in management of the facility.

5.9 Risk of Flooding from Rainwater Falling on Site

5.9.1 The risk of flooding from water falling on site and not being able to leave is considered to be medium, partly due to the topography of the site and its previous development. The development of the site will require attenuation storage and as such the discharge rate will have to be agreed, as noted earlier. Based on the proposal that flows are limited to 16 l/s, for the on-site sewerage



system to be adopted there would still be a need for underground tanks to provide sufficient attenuation storage for the whole site, so that sewers do not surcharge for the 1 in 30-year event. This has been discussed earlier in this report and schemes can be conditioned for approval prior to commencement as part of the planning approval.

6.0 CONCLUSIONS

- 6.1 In our opinion the site is shown to be at risk of flooding, from river or tidal water for a 1% return period. The site is not defended by flood defences maintained by the Environment agency and as such the residual flood risk should be evaluated in respect of the planning application.
- 6.2 The risk of flooding from breaches in upstream reservoirs is considered to be high as is discussed in this report.
- 6.3 The site is in an area covered by the EA flood warning scheme and site occupants should be made aware that they should subscribe to this system and respond to any warning given. It is our opinion, however, that the site will not be at greater risk of flooding than currently exists.
- 6.4 The site is not considered suitable for infiltration systems due to the local geology and the high-water table adjacent to the river.
- 6.5 The site will need to incorporate compensatory flood water storage on the site due to the possible raising of site levels to accommodate the required floor level recommended by the EA. There is no increased footprint of development on the site. This storage could be provided beneath the ground floors of the new industrial units for their own surface water systems and beneath the car park area as outlined in this report.



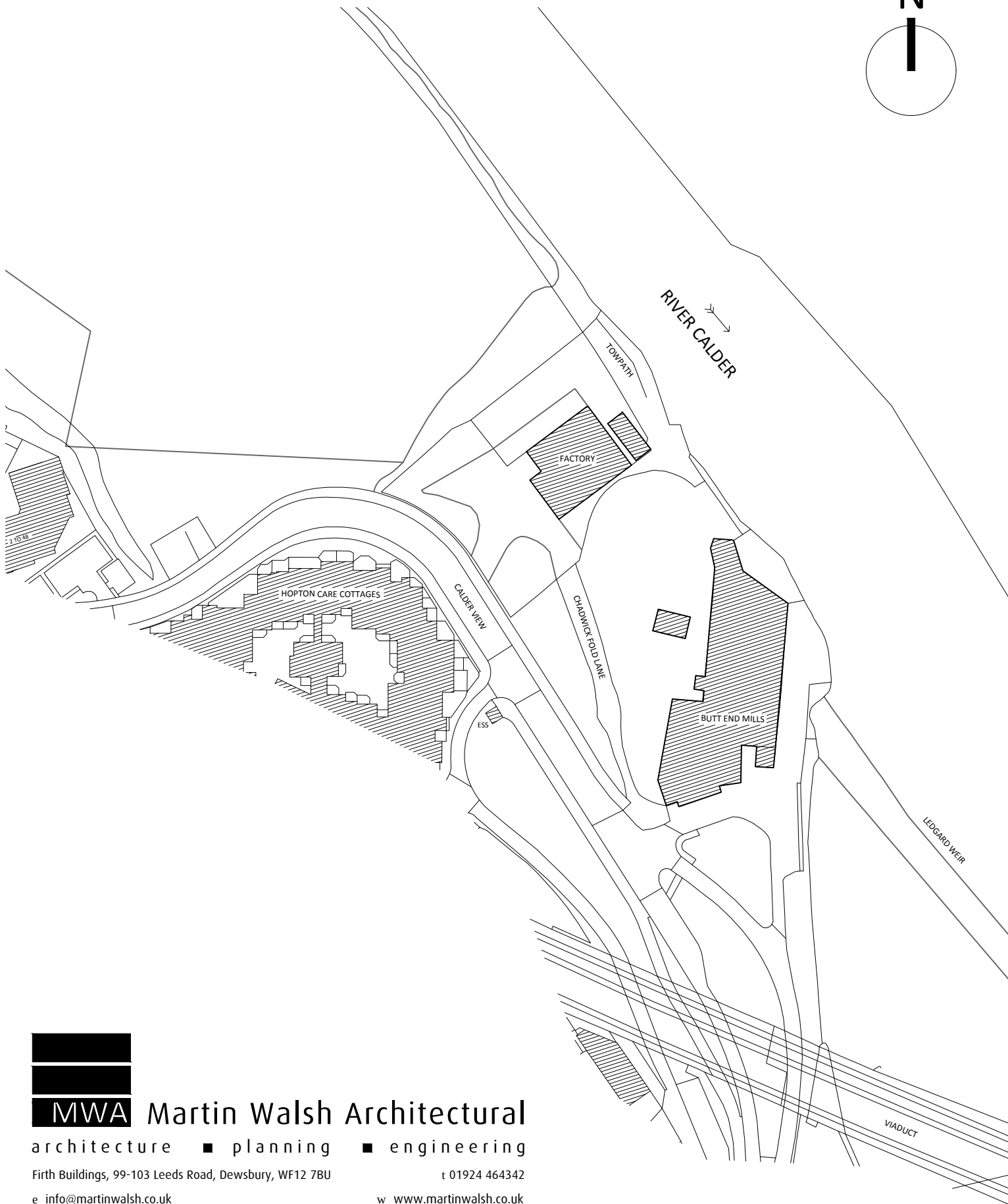
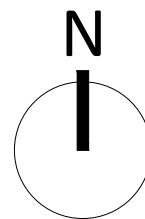
- 6.6 The site will have to provide storm-water attenuation storage to cater for the increase in impermeable areas on the site unless the car park is constructed in permeable surfacing. This will require under-ground tanks to provide the correct amount of storage and a pumping station to discharge these flows at 16 lit/s to the existing outfall from the site.
- 6.7 There may be some negotiation possible on a balanced system of underground storage due to raised site levels and protection of the buildings up to the preferred flood water levels.
- 6.7 We consider that we have shown that the site can be developed, and this report has assessed the risk to site and those in the downstream or upstream catchment. It outlines acceptable mitigation measures to develop the site in accordance with the EA requirements. We have stated that the site will not be occupied during any major flood risk scenarios to ensure people are kept safe during the flood hazards. By keeping discharges from the site down to 70% of existing and providing adequate flood water storage on site the scheme will ensure that flood risks both on site and off site are not increased and are effectively slightly reduced. This includes taking appropriate allowances for climate change into account. If this is provided then the Flood Risk Assessment for the development can predict that the effects of the development will not increase Flood Risks elsewhere, on or off the site.

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APPENDX A

LOCATION PLAN



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**Proposed Redevelopment At Butt End Mills and Adjacent
Sites At Calder View, Mirfield**

Location Plan

Rosie Carr

Dwg No.	Scale	Sheet Size	Dwn	Date
22/K17/6061/01	1:1250	A4	JEP	06/17

APPENDIX B

PROPOSED SITE LAYOUT



APPENDIX C

SITE SURVEY

APPENDIX D

FLOOD RISK MAPS

Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.

Basic view

☐

Detailed view

- Flood risk from rivers or the sea

Extent of flooding
- Flood risk from surface water

Extent of flooding
- Flood risk from reservoirs

Extent of flooding



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[View the flood risk information for the location you originally searched for](#)

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► [Other ways of getting this information](#)

13 June 2017

This information meets the requirements of the EU Floods Directive 2007/60/EC

Learn more about this area's flood risk

From the list on the left, select the information you're interested in. The map view will then update.

'Detailed view' shows more options.

Basic view  Detailed view

Flood risk from rivers or the sea

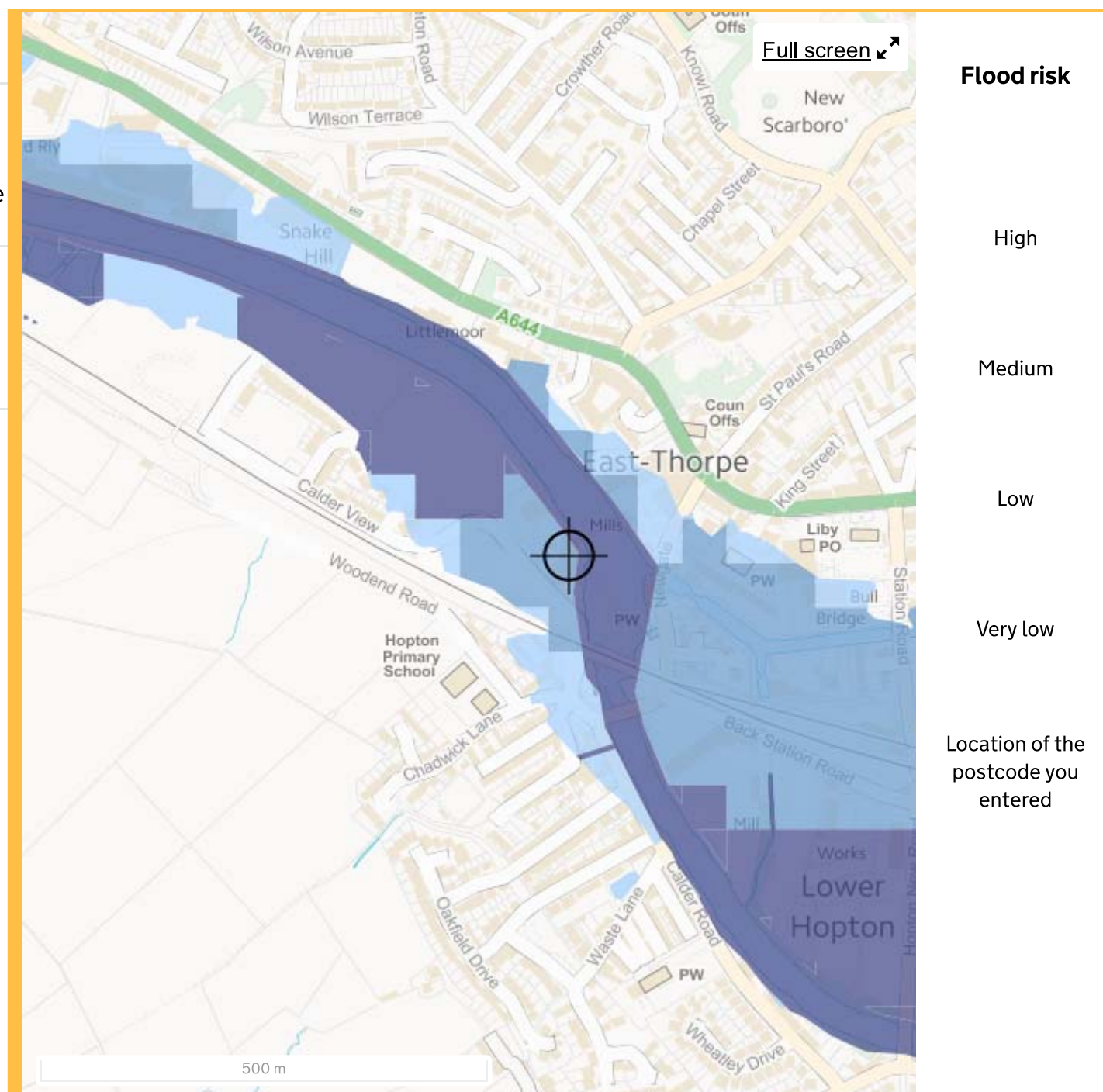
Extent of flooding

Flood risk from surface water

Extent of flooding

Flood risk from reservoirs

Extent of flooding



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Go to the national flood information service

► Other ways of getting this information

13 June 2017

This information meets the requirements of the EU Floods Directive 2007/60/EC

COMMERCIAL NAMEPLATES
BUTT END MILLS
CHADWICK FOLD LANE
MIRFIELD
WF14 8PW



This address is in a flood risk area

Be prepared: things you should do

1

Sign up for flood warnings

This service is free. You can get warnings by phone, email or text message.

2

Learn about flood planning

Know how you'll respond to a flood if:

- your home is at risk, for example how to get sandbags
- you're responsible for a school, hospital, care home or other community group
- you run a local business

3

Protect your property

Get organised now and improve your property's flood resilience.

Being at risk of flooding can affect your insurance. Check if your buildings and contents policies cover flood risk.

4

Know what to do during a flood or get help after a flood

- Flooding can affect transport networks and disrupt your travel plans
- Flooding can impact your gas, electricity and water supplies
- Even if flooding hasn't affected you directly, check on friends, family and the wider community

5

This address is in a flood risk area.

The flood risk from rivers or the sea is medium

[View map of river and sea flood risk](#)

The flood risk from surface water is very low

[View map of surface water flood risk](#)

There's a risk of flooding in this area from reservoirs

[View map of reservoir flood risk](#)

[View the flood risk information for another location](#)

13 June 2017

Detailed flood risk information for this area



The flood risk from rivers or the sea is medium

What this means

Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce, but do not completely stop the chance of flooding as they can be overtopped, or fail.

How to use this information

You can use this information to see which areas are more likely to flood first, deepest, or most often.

This information is suitable for identifying which parts of counties or towns are at risk, or have the most risk. It's also suitable for identifying the approximate extent of flooding and the shallower and deeper areas of flooding. It's unlikely to be reliable for a local area and very unlikely to be reliable for identifying individual properties at risk.

Planning a development

This information is not suitable for use in land-use planning. If you're planning a development, you must use the Risk of Flooding for Land-Use Planning (Rivers and Sea) for England or Development Advisory Map for Wales. This is information based on flooding without defences.



The flood risk from surface water is very low

What this means

Very low risk means that each year this area has a chance of flooding of less than 0.1%. Flooding from surface water is difficult to predict as rainfall location and volume are difficult to forecast.

How to use this information

You can use this information to see the approximate areas that would flood, and which parts would be shallower or deeper.

This information is suitable for identifying which parts of towns or streets are at risk, or have the most risk. It's also suitable for identifying the approximate extent and depth of flooding. It's likely to be reliable for a local area but not for identifying individual properties at risk.



There's a risk of flooding in this area from reservoirs

What this means

While there is a risk in this area, flooding from reservoirs is extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925.

An area is considered at risk if peoples' lives could be threatened by an uncontrolled release of water from a reservoir. You can see a map of the potential extent of flooding if this happened.

Reservoirs that could affect this area

Digley (grid reference SE1115306870)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Kirklees
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Bilberry (grid reference SE1036107035)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Kirklees
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Wessenden Old (grid reference SE0567708711)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Kirklees
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Wessenden Head (grid reference SE0682107703)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Kirklees
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Blackmoorfoot (grid reference SE1019412460)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Kirklees
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Booth Dean Upper (grid reference SE0113516012)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Calderdale
Risk designation: Not High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Green Withens (grid reference SD9926316421)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Calderdale
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Booth Dean Lower (grid reference SE0139415981)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Calderdale
Risk designation: Not High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Boothwood (grid reference SE0316216439)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Calderdale
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Gorple Upper (grid reference SD9257134384)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Calderdale
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Scammonden (grid reference SE0533116881)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Kirklees
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Baitings (grid reference SE0108418866)
Owner: Yorkshire Water Services
Lead Local Flood Authority: Calderdale
Risk designation: High Risk
Comments: If you have questions about local emergency plans for this reservoir you should contact the named Local Authority

Additional information

Lead Local Flood Authority
Kirklees

Created 13 June 2017

Location Plan



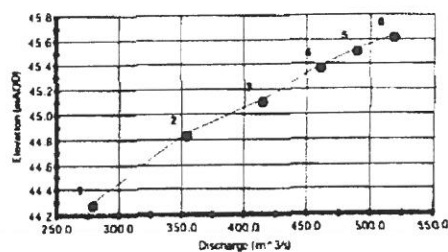
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Cross Section References

River: CAL
Reach: 01
Chainage: 6564
Section Type: SECTION, SPILL
OS NGR: SE 20074 19658
Survey Dwg Ref: N/A
Photograph Ref: CALD01_06564.JPG
Next
Section D/s: 6506
Section U/s: 6675



Rating Curve



Number represents model profile number

Summary of Results

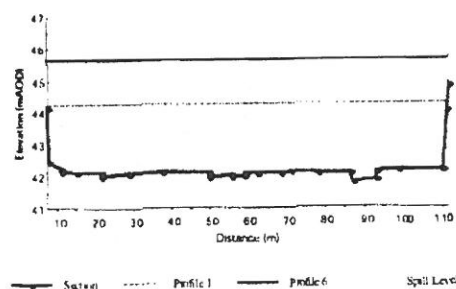
Profile No	AEP (%)	Flow (m³/s)	Water Level (mAOD)	Velocity (m/s)
1	20.00	277.1	44.295	1.59
2	10.00	353.1	44.837	1.60
3	4.00	411.9	45.114	1.60
4	2.00	459.4	45.381	1.63
5	1.33	488.3	45.515	1.64
6	1.00	516.7	45.629	1.65

Level of Left Bank 44.190 mAOD

Level of Right Bank 44.810 mAOD

AEP, Annual Exceedance Probability = 1/T, where T = Return Period (Years)

Cross Section Profile



CAL: 01: CROSS SECTION NUMBER 6564

APPENDIX E

STORMWATER STORAGE CALCULATIONS

Client MARTIN WALSH ASSOCIATES

Site BUTT END MILLS MIRFIELD

Design storm 100 M5-60 mm
r

Site area sq m. 8700

Imp Area sq m. 7000

T of Conc min 4 Time to Flow

Allow Discharge 10 Lit / sec Imp Ratio 0.80

100 year storm									100 year storm						100year plus 30% climate					
<u>Storm Duration</u>	<u>Intensity</u>	<u>Depth</u>	<u>Vol In</u>	<u>Vol Out</u>	<u>Storage</u>	<u>Q</u>	<u>t</u>		<u>Intensity</u>	<u>Depth</u>	<u>Vol In</u>	<u>Vol Out</u>	<u>Storage</u>		<u>Intensity</u>	<u>Depth</u>	<u>Vol In</u>	<u>Vol Out</u>	<u>Storage</u>	
<u>Mins</u>	<u>mm/hr</u>	<u>mm</u>	<u>cu.m</u>	<u>cu.m</u>	<u>cu.m.</u>				<u>mm/hr</u>	<u>mm</u>	<u>cu.m</u>	<u>cu.m</u>	<u>cu.m.</u>		<u>mm/hr</u>	<u>mm</u>	<u>cu.m</u>	<u>cu.m</u>	<u>cu.m.</u>	
10	81.8	13.63	95.43	8.25	87.18	159.18	0.3		101.27	16.88	118.15	8.25	109.90		131.65	21.94	153.59	8.25	145.34	
20	59.8	19.93	139.53	14.19	125.34	116.37	0.3		74.03	24.68	172.74	14.19	158.55		96.24	32.08	224.56	14.19	210.37	
30	47.6	23.80	166.60	20.14	146.46	92.63	0.4		58.93	29.46	206.25	20.14	186.11		76.61	38.30	268.13	20.14	247.99	
50	34.4	28.67	200.67	32.04	168.63	66.94	0.6		42.59	35.49	248.43	32.04	216.38		55.36	46.14	322.95	32.04	290.91	
60	30.3	30.30	212.10	37.99	174.11	58.96	0.7		37.51	37.51	262.58	37.99	224.59		48.76	48.76	341.35	37.99	303.36	
120	18.7	37.40	261.80	73.74	188.06	36.39	1.1		23.15	46.30	324.11	73.74	250.37		30.10	60.19	421.34	73.74	347.60	
180	14.1	42.30	296.10	109.53	186.57	27.44	1.5		17.46	52.37	366.57	109.53	257.05		22.69	68.08	476.54	109.53	367.02	
240	11.5	46.00	322.00	145.33	176.67	22.38	1.8		14.24	56.95	398.64	145.33	253.31		18.51	74.03	518.23	145.33	372.90	
300	9.8	49.00	343.00	181.14	161.86	19.07	2.1		12.13	60.66	424.63	181.14	243.49		15.77	78.86	552.02	181.14	370.88	
360	8.7	52.20	365.40	216.98	148.42	16.93	2.4		10.77	64.62	452.37	216.98	235.38		14.00	84.01	588.07	216.98	371.09	
420	7.9	55.30	387.10	252.84	134.26	15.37	2.6		9.78	68.46	479.23	252.84	226.39		12.71	89.00	623.00	252.84	370.16	
480	7.5	60.00	420.00	288.76	131.24	14.60	2.7		9.29	74.28	519.96	288.76	231.20		12.07	96.56	675.95	288.76	387.19	
540	6.9	62.10	434.70	324.61	110.09	13.43	3.0		8.54	76.88	538.16	324.61	213.55		11.10	99.94	699.61	324.61	374.99	
600	6.38	63.80	446.60	360.47	86.13	12.42	3.2		7.90	78.98	552.89	360.47	192.42		10.27	102.68	718.76	360.47	358.29	

			Storage	188.06				Storage	257.05				Storage	387.19
Length of 1800	73.90				Length of 1800	101.012				Length of 1800	152.156			
Length of 1500	106.43	Culvert	2.4*1.5m	52.24	Length of 1500	145.471				Length of 1500	219.124			
Length of 1200	166.28	culvert	3.6*1.8m	29.02	Length of 1200	227.274				Length of 1200	342.345			
Length of 1050	217.16				Length of 1050	296.82				Length of 1050	447.104			
Length of 900	295.69				Length of 900	404.16				Length of 900	608.793			
Length of 750	425.47				Length of 750	581.55				Length of 750	876.001			
Length of 600	664.52				Length of 600	908.29				Length of 600	1368.17			

Footprint Area (m)							
Aquacell Storage Crates (400mm deep)	494.89	30 year		Pond 900mm deep	208.96	30 year	
	676.44	100 year			285.61	100 year	
	1018.93	100 year plus climatic			430.21	100 year plus climatic	

APPENDIX F

DRAINAGE SURVEY

M1

Butt End Mills, Mirfield
Drainage survey - 17/01/19



MH1

CL - 44.84

IL - 41.91 (2930 mm deep)

MH 2



MH 2

CL - 44.87

IL - 41.47 (3400 mm deep)

MH 3



MH 3

CL - 44.79

IL - 43.38 (Rubble / blocked)

MH 4



MH 4

CL - 44.52

IL - 43.77 (750 mm deep)

MH 5

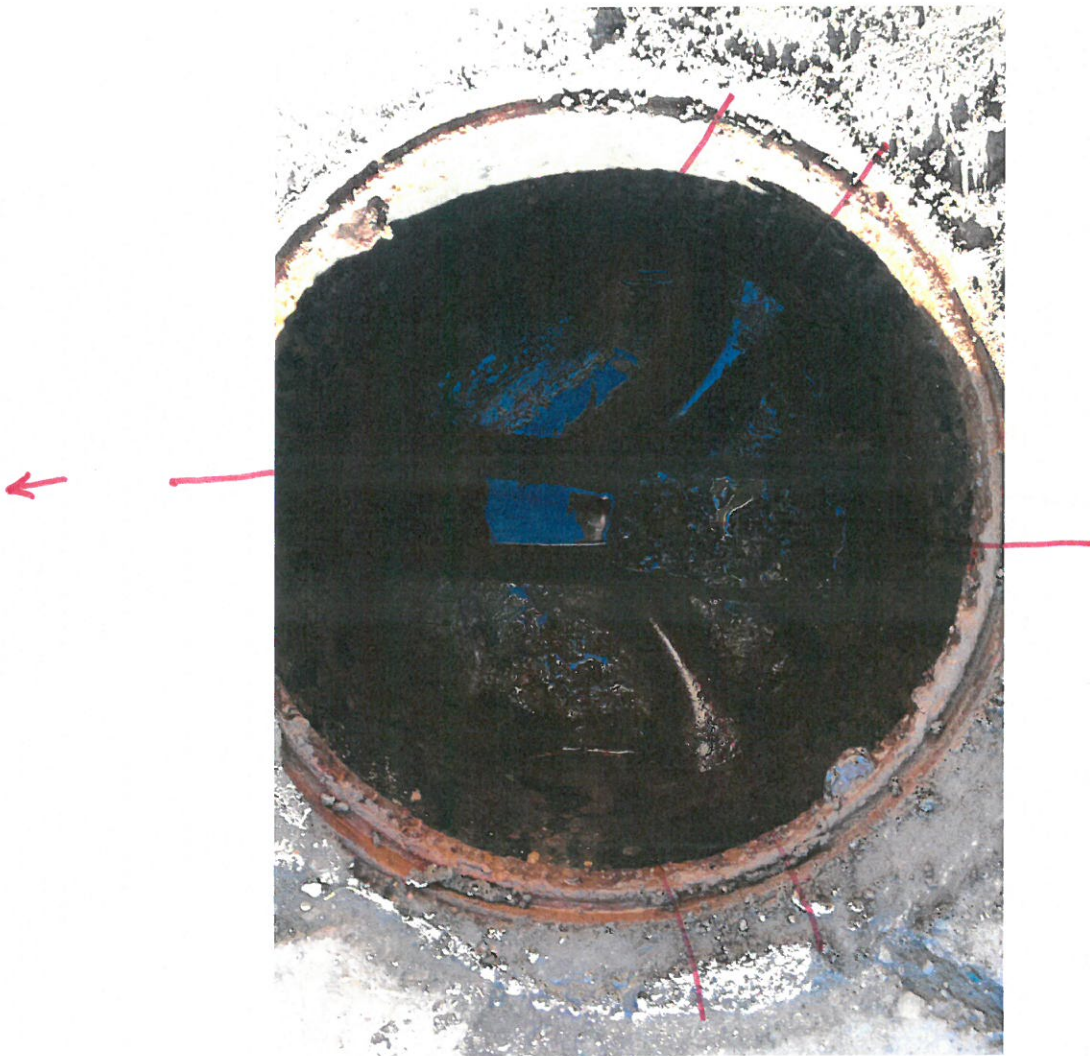


MH 5

CL - 44.54

IL - 43.765 (775 m deep)

MH 6



MH 6

CL - 44.84

IL - 44.325 (515 mm deep)

MH 7



outlet

MH 7

CL - 45.25

IL - 44.475 (To Pipe / outlet)

IL - 44.235 (To rubble / blocked)

MH 8

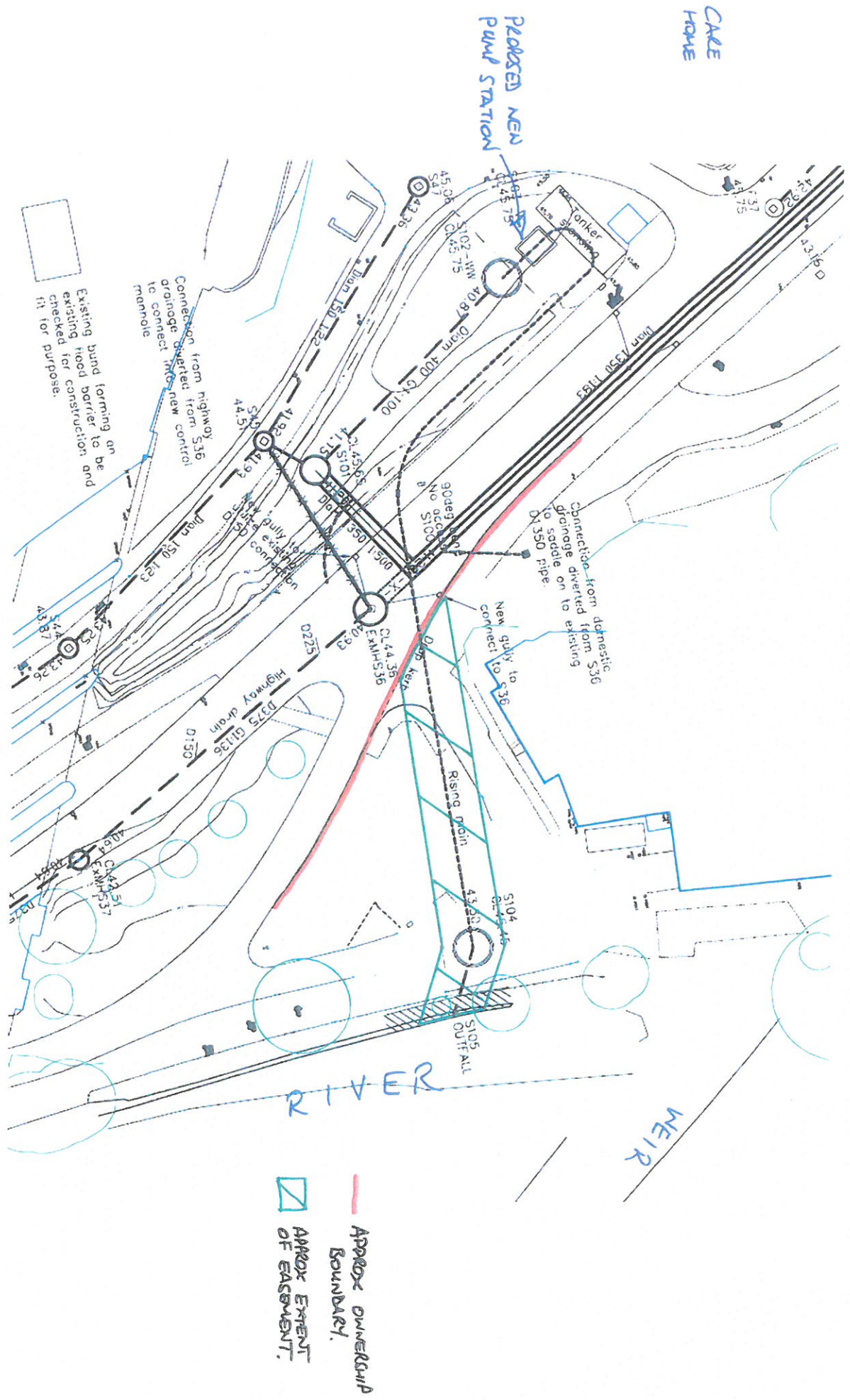


MH 8

CL - 44.37

IL - 41.17 (3200 mm deep)

Elements



DRAFT Bridge Easement location

For information only – subject to regulatory approval. Not to scale

But End Mills
nickfield



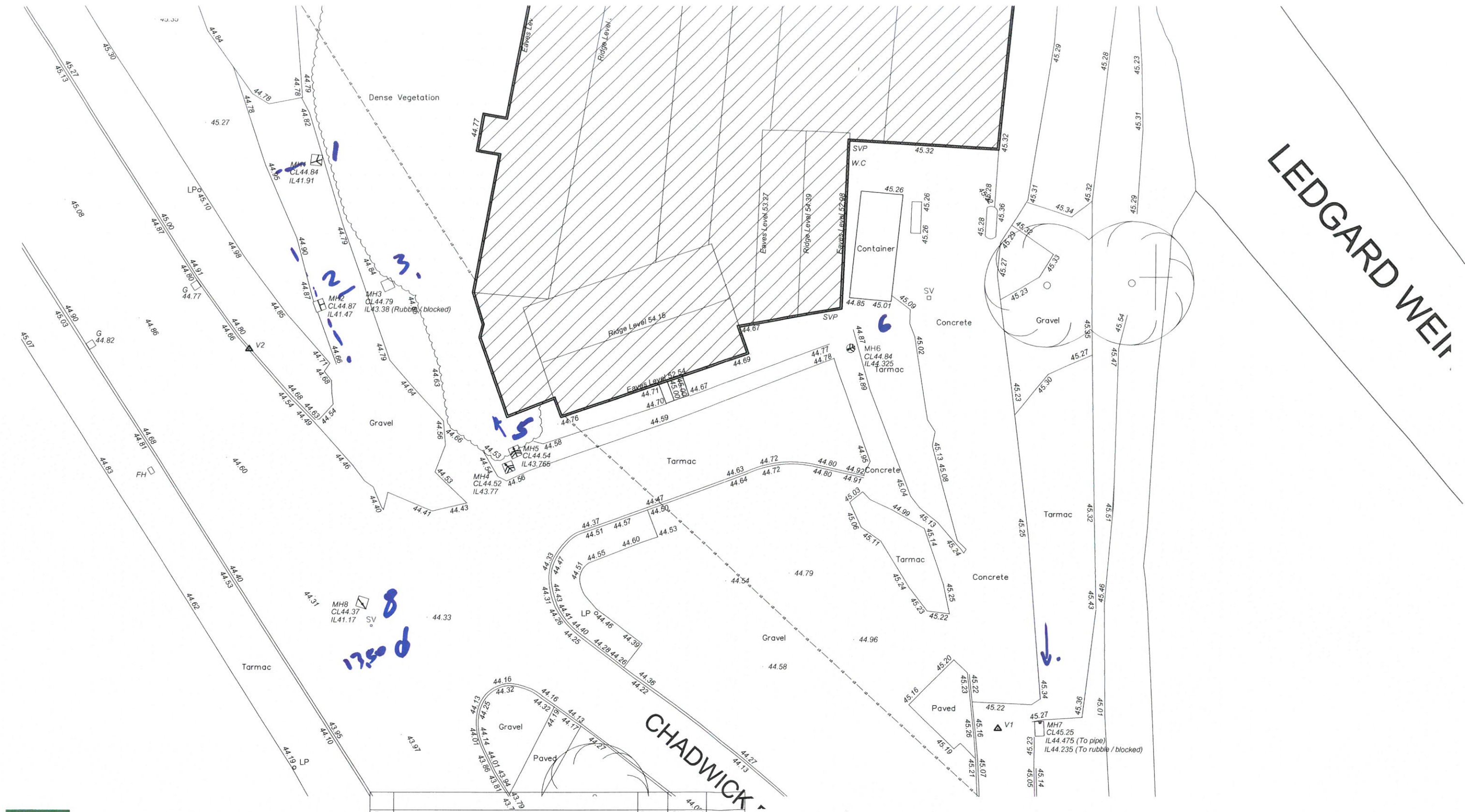
MWA

e: info@martinwalsh.co.uk

Client

Client

PRE



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ARCHITECTURAL

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w: www.martinwalsh.co.uk

Project
Project Name
Project Address

Client
Client

Rev	Description	Drawn	Checked	Date
Document Status : Purpose of Issue:				
S0	FOR INFORMATION			
Title				
Drawing Title				
MWA project ref	Scale	Original Paper Size	Orientation	Drawn
XXXX	1:100	@ A3	Landscape	ABC
Checked				
ABC				
File Identifier				
Project	Originator	Volume	Level	Type
ABCD	MWA	01	GF	DR
Role				
A				
Number				
0001				
Revision				
P1				