



RIVER TEIGN

Overview of Draft High Level Flood Risk Assessment

Teignbridge District Council

November 2006
Overview Report
9R5691

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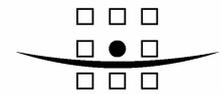
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ROYAL HASKONING



**WBB MINERALS LTD
RIVER TEIGN - OVERVIEW OF DRAFT HIGH LEVEL FLOOD RISK
ASSESSMENT**

1 INTRODUCTION

Teignbridge District Council has commissioned a non-technical overview report of a draft High Level Flood Risk Assessment prepared by Royal Haskoning for WBB Minerals Ltd in March 2006. Since preparation of the draft High Level Flood Risk Report, new flood risk guidance and advice has been produced by the Government. An assessment will be made of the implications of this recent guidance and advice for the River Teign and development of land within the proposed urban extension to the west of Kingsteignton and north of Newton Abbot (the 'Northern Option') and this will inform the Final Detailed Flood Risk Assessment Report that is scheduled for release by WBB at the end of 2006.

This report has been prepared directly for Teignbridge District Council, with WBB's permission. Although no significant changes are expected to be made whilst finalising the report it should be noted that changes may occur.

The draft High Level Flood Risk Assessment concludes with a preferred WBB option for development that meets the requirement of Planning Policy Guidance Note 25 – Development and Flood Risk (PPG25). It should be noted that any development being considered will need to comply with the requirements of the emerging government guidance contained in Planning Policy Statement 25 (PPS25) and with the Environment Agency's most up to date methods of joint probability analysis when determining flood water levels in this tidal/fluvial zone.

In addition to facilitating the provision of new roads, infrastructure and mixed use development in Newton Abbot, WBB's proposals have the following significant benefits:

- The flood risk posed to Kingsteignton will be reduced in the future as the proposed development will prevent overland flood flows across Newton Road.
- Existing flood risk is reduced to areas of Newton Abbot by lowering water levels using a bypass channel (flood way).
- The volume of functional floodplain is increased.
- A 'green corridor' is provided along both banks of the River Teign with flood reduction, recreational and environmental benefits.
- Reducing extreme flood levels in the Teigngrace area.

1.1 Background

The Environment Agency's flood maps indicate that there are areas at risk of flooding within low lying parts of Newton Abbot and Kingsteignton. WBB wish to develop a number of areas currently used for, or with consent for, mineral extraction. The location of the flood risk study area is shown in Figure 1. Mixed use development is proposed including additional infrastructure. Areas of WBB's proposed development, although protected with flood defences, lie within currently high risk flooding areas (referred to as Flood Zone 3). As such they are only suitable for development if the minimum standard of defence can be provided for the lifetime of the development, without increasing flood risk elsewhere.

In partnership with the Environment Agency, WBB have undertaken to re-assess the risk of flooding from the River Teign in the Newton Abbot area.

Royal Haskoning were retained by WBB Minerals Limited in November 2004 to prepare a High Level Flood Risk Assessment for the River Teign at Newton Abbot and identify the potential flood risk management implications relevant to both the existing and proposed developments.

A document of joint understanding has been drawn up between Royal Haskoning, WBB Minerals and the Environment Agency which states all parties are committed to undertaking the assessment of flood risk in such a way that future uncertainty in extreme water levels is minimised, flood risk to any development is minimised and potential opportunities are maximised to produce sustainable improvements to the area.

1.2 Reports

The full findings of the assessment are contained in the draft River Teign, High Level Flood Risk Assessment Report of March 2006. This report is due to be finalised by the end of 2006.

The draft report summarises the work previously undertaken to determine the existing flood risk to the catchment and discusses the preferred WBB option to allow the development to proceed without putting existing and new development at an inappropriate risk of flooding. PPG 25 has been followed both in the assessment of current risk and in the development of the preferred WBB option.

This report is a short summary of the most critical issues contained in the emerging full High Level Flood Risk Assessment Report.

2 THE STRATEGIC STUDY

2.1 Hydrology and Hydraulics

A detailed hydraulic model of the River Teign has been constructed to determine the existing conditions under extreme events and in order to test the impacts of the proposed development and mitigation measures.

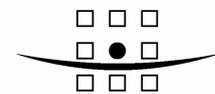
In accordance with PPG25, the flood risk assessment includes the necessary allowances for climate change. At the recommendation of the Environment Agency, the allowance adopted was a 20% increase in peak flows.

In undertaking the tidal assessment, the Environment Agency Report on Regional Extreme Tide Levels for the South West has been examined. The report provides regionally consistent still water tide levels and the values are realistic and precautionary. Values have been calculated for the River Teign Estuary to Newton Abbot and are therefore applicable to this flood risk assessment.

When considering the modelling of options, an allowance of 5mm per annum for the design life of the development has been added to the figures calculated to take account of sea level rise through climate change. The estimation of the extreme flood extents has been carried out in accordance with the Environment Agency's Strategic Flood Risk Management Framework guidance on flood mapping.

2.2 Geomorphology

A geomorphological assessment was undertaken. Its main conclusions are that the river has the potential to become geomorphologically active, although relatively stable at present through the areas of proposed development. The main factor to consider is



allowing space for the river to change course without affecting defences. This is achieved in the preferred WBB option by setting back the raised development land by a minimum of 25m.

2.3 Existing Standard of Defence

The analysis has highlighted that several existing flood defences do not provide the standard of flood protection originally envisaged. In particular flood defences protecting Kingsteignton, the racecourse and low lying areas of Newton Abbot, downstream of Newton Road have been found to be below the described 1 in 100 year standard of protection.

This change in the current standard of protection has occurred due to changes and improvements in hydrological modelling methods and standard procedures. It is not a case of the defences deteriorating.

2.4 Current Flood Risk - Flooding Mechanisms

A 1 in 100 year event in combination with a Highest Astronomical Tide currently has the potential to flood large areas around Newton Abbot and Kingsteignton. The extent of flooding mapped for this event is shown in Figure 2.

2.5 Preferred Flood Management Option - Performance and Design Criteria

The majority of land in WBB's proposed development area, although protected is within the 1 in 100 year flood extent. This land has either had mineral extraction activities or extraction is planned.

PPG25 provides comprehensive guidance on development and flood risk. Following this guidance means that the proposed development will be designed to provide at least the minimum standard of protection, will not impede flows and does not result in a net loss of storage. The minimum standard of protection for new development is 1 in 100 years, with appropriate allowances for climate change. Essential infrastructure such as hospitals and schools should be protected to 1 in 1000 years.

PPG25 also requires that new development within the floodplain should not increase flood risk elsewhere.

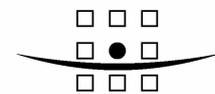
Wherever flood defences are implemented, there is always a risk of a flood event in excess of the design standard, which will result in residual flooding. It is important that residual flooding occurs in a steady and predictable manner and provides ample opportunity for emergency evacuation.

The performance of each option in terms of residual flooding is considered in a qualitative manner. More detailed consideration will be required at subsequent stages in the design process and for the submission of individual Flood Risk Assessments.

3 PROPOSED DEVELOPMENT

3.1 Flood Management Options

In excess of 20 options were investigated to both allow the development of WBB's land and to reduce flood risk. Of these, 16 options were modelled and assessed in detail. The options included creating large areas of flood storage in mineral extraction areas, removing flow constrictions and creating flood storage upstream. Based on the criteria noted in Section 2.5 and WBB's desire to develop the area, a preferred flood



management option has been selected. This preferred option is referred to as “Increased Capacity, Flood Way and Zitherixon Flood Storage”.

3.2 Preferred Option–Increased Capacity, Flood Way & Zitherixon Flood Storage

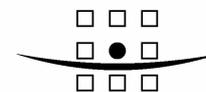
This option represents the development proposal plus the specific flood risk mitigation measures. The key assumptions used to develop this option are indicated below. Reference should also be made to Figure 3 which indicates the preferred option, and Figure 2 which indicates flooding extent during the 1 to 100 year event.

The development proposal includes new highway infrastructure. All new highways have been assumed to be at a similar level to the proposed development areas (i.e. above flood level).

New surface water drainage will be required for the development areas. There are various sustainable techniques that should be employed to manage surface water drainage. It has also been assumed that the new development will be designed with due regard to the catchment boundaries of existing watercourses. On this basis, it has been assumed that the new drainage systems will not increase the run-off rates relative to the existing situation.

The development proposal comprises the following key elements. Where appropriate, the proposed flood mitigation measures for each element are also described below:

- **East Golds Flood Way.** The northern portion of the site contains a large depression resulting from mineral extractions. The southern part of the site contains industrial facilities associated with the ongoing mineral operations. The site is situated within the River Teign’s 1 in 100 year floodplain, but the area is currently defended. A major flood channel is proposed between the Whitelake Channel/Stover Canal and the River Teign. This will be 120m in width with a bed level at approximately that of the natural flood plain before flood banks were constructed and mineral extraction commenced. This flood way will allow extreme flows to pass from the Whitelake Channel back to the River Teign, thereby reducing water levels in the Whitelake Channel downstream and reducing the risk to existing development along Jetty Marsh Road. The flood way is likely to be operational under a 1 in 10 year event, so there is potential to use this area for recreation or environmental purposes, as long as flood flows are not restricted. Works to the railway line that crosses the flood way are included in the proposals.
- **East Golds Development.** With the exception of the flood way, the remainder of the site will be raised to provide a development level above the 1 in 100 year fluvial against HAT water level, plus an allowance for climate change and freeboard. The boundaries of the site are the existing defence along the right bank of the River Teign, Exeter Road, Newton Road and the Stover Canal/Heathfield railway.
- **Newton Road.** This site includes the existing Tesco Superstore and the fishing ponds. It is situated in the River Teign’s 1 in 100 year floodplain, but it is currently defended. The whole of the currently undeveloped site will be raised to provide a development level above the 1 in 100 year fluvial against HAT water level, plus an allowance for freeboard and climate change.



- **Zitherixon.** This site is a mixture of fishing ponds and rough woodland. It is within the River Teign's 1 in 100 year floodplain, but is currently defended. There is still mineral extraction planned in this area, although only a small area will have mining operations underway at any one time. It is proposed that the majority of this area will be used for open space, environmental enhancement and flood storage. Other than the mineral extraction in discrete areas, there is no residential or commercial development planned on this site. A secondary flood bank will be constructed to the rear of the flood storage area to prevent flows crossing Newton Road and entering Kingsteignton. The secondary flood bank will be designed to the 1 in 100 year flood plus allowances for climate change and freeboard. Culverts will be installed through the lowered River Teign flood banks to allow the flood storage area to drain, both normally and following an extreme event. Flap valves will be installed to prevent lower return period events flooding the storage area.

- **River Teign Widening.** At present there are flood banks either side of the river Teign between Exeter Road and Newton Road. These banks are set very close to the river and do not, therefore, allow for any significant functional floodplain. To both improve the river's ability to convey extreme flows and to provide a more open area for environmental and recreational reasons, it is proposed to set both banks back by 25m. This will create more functional flood plain. An amount of existing development will have to be removed to allow this to occur. This includes the current Tesco site and infrastructure related to WBB's operations. The flood banks will also have to be removed. Instead of replacing flood banks, which can fail, subside or suffer from erosion, the raised land for the East Golds and Newton Road developments will provide the required flood defence levels. A new flood bank will be placed alongside Zitherixon, designed to overtop in an extreme event to allow the areas to be used as flood storage.

- **Exeter Road.** A small area of land immediately downstream of Exeter Road, on the right bank of the River Teign (at Teign Bridge) will be lowered to allow extreme flows to more easily re-enter the widened River Teign.

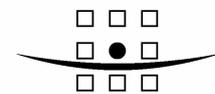
- **Jetty Marsh.** The site is largely within the River Teign's 1 in 100 year floodplain. It is relatively low-lying, but part of the area has been artificially raised by previous earthworks. The development area will be raised to provide a development level above the maximum water level, plus allowance for climate change and freeboard. An area of land will be restored to floodplain by reducing the level to ensure there is no loss of flood plain storage.

- **New Cross, Abbrook and Sandy Gate.** None of these sites are within the River Teign's flood risk area. They are not considered further within this report. However, the areas may be at risk of flooding from other sources, such as the Ugbrooke Stream.

- **Highways.** All existing highways and associated infrastructure remain in place and therefore have a minimal impact on hydraulics. All proposed bridges will be designed to have a minimal impact on hydraulics.

3.3 Design of Preferred Option

A precautionary approach to the design of the proposed development in relation to flood risk has been taken in the assessment of design levels and large freeboards have been applied in addition to conservative assessments throughout the modelling. Minimum levels for each element of the development have been calculated and are detailed in the



full report. However, each of the developments will also require the submission of site specific flood risk assessments in due course.

3.4 Phasing of Development

It is important that all of the flood risk mitigation measures are implemented prior to constructing new bridges and raising ground levels. The exception to this is the Jetty Marsh development (including the associated floodplain lowering), which was shown to have no discernable impact on flood risk.

The development proposal represents the long-term plan. There are likely to be intermediate phases affecting areas as noted below:

2005 to 2007 Jetty Marsh.

2007 to 2009 Newton Road (without any new bridges).

2008 to 2009 Southern end of East Golds, including the new highway bridges.

2009 to 2011 Northern end of East Golds.

4 IMPACT ON EXISTING FLOOD RISK

4.1 Introduction

This section describes the impact of the preferred flood mitigation on existing flood risk from the River Teign within the study area. It also assesses the potential impact of the development proposal on other existing flooding issues within the area.

4.2 Kingsteignton

The low-lying areas of Kingsteignton are currently at risk of flooding from the River Teign during flood events exceeding the defence standard (less than 1 in 100 years). The flooding arises when the defences along the left bank of the River Teign between Exeter Road and the mainline railway are overtopped. The flooding inundates the areas of Zitherixon and Newton Road and also the racecourse.

The preferred WBB option will reduce flood risk to Kingsteignton. The raised ground levels the proposed Newton Road and the secondary defences associated with Zitherixon flood storage developments will cut off one of the flood routes leading to Kingsteignton, although another, through the racecourse, would still remain. There will be no change to the current flood risk at the Racecourse.

Although not specifically included in the preferred WBB option, a further reduction in flood risk to Kingsteignton arising from both fluvial and tidal flooding would be relatively straightforward to achieve by raising the flood embankments in the vicinity of the racecourse. Any such works would also have to address the Hackney Outfall defences. It would be important, however, to ensure that the works did not increase flood risk to Newton Abbot on the right bank.

4.3 Newton Abbot

The low-lying areas of Newton Abbot on the right bank of the River Teign/Whitelake Channel downstream of Newton Road are currently at risk of flooding. The defence standard is variable, but could be as low as 1 in 10 years. The preferred flood mitigation option does not increase peak water levels in this area and will therefore not increase the flood risk from the River Teign.

Upstream of Newton Road, the peak water levels in the Whitelake Channel are lower (locally up to 276mm). This will decrease flood risk in this area.



4.4 Upstream Areas

Upstream of Exeter Road there is a decrease in water levels compared to the existing situation. The minimum decrease is approximately 140mm immediately upstream of Exeter Road under the 1 in 100 year event. This reduction in water levels will marginally reduce the flood risk to properties upstream of Exeter Road, such as in Teigngrace.

4.5 Catchment to Hackney Outfall

The Hackney Outfall is situated just downstream of Newton Abbot Racecourse and consists of four flap valves. It discharges flows from the Rydon Stream, other smaller catchments and drainage ditches within Hackney Marshes. The catchment has a number of existing flood problems and there is a concern that these may be exacerbated by the proposed development.

The flooding problem is related to the duration of tidal locking and the magnitude of fluvial inflow. The Kingsteignton Flood Studies Report (Halcrow, September 1999) suggests that the flap valves sometimes fail to seat correctly and allow ingress of saline water.

Teignbridge District Council is currently developing a flood storage reservoir on the Rydon Stream just upstream of the A380. The aim of the storage reservoir is to attenuate peak flows passing through Kingsteignton.

The Newton Road development is the main aspect of WBB Minerals' development proposal that could potentially affect the fluvial inflow. However, providing WBB's development proposal does not increase run-off rates (e.g. through use of sustainable urban drainage systems) and does not increase the size of the catchment draining to the outfall then the existing flood risk directly related to the catchment will not be affected. The development proposal could actually alleviate some of the flooding issues by discharging surface water drainage from the Newton Road and Zitherixon development sites directly into the River Teign.

5 CONCLUSIONS AND RECOMENDATIONS

The work undertaken for the High Level Flood Risk Assessment has confirmed that parts of the proposed development site lie within areas considered to be at a high risk of flooding (Flood Zone 3).

WBB have identified a preferred option to reduce the risk of flooding on their development land without increasing risk elsewhere. This preferred option comprises the following flood mitigation measures, the majority of which can be accommodated on land owned by WBB:

- Raising all proposed development areas above the future 1 in 100 year fluvial against HAT water level, having included an appropriate allowance for climate change and freeboard.
- Creating a 120m wide flood way between the Whitelake Channel and the River Teign.
- Increasing the capacity of the River Teign by setting back defences 25m on each side.
- Lowering a small area of land immediately downstream of Exeter Road, on the right bank of the River Teign.
- Lowering and setting back the Zitherixon flood banks to create a flood storage area.



- Creating secondary flood defences, enclosing the proposed Zitherixon Flood Storage Area and preventing overland flow across Newton Road and into Kingsteignton.

The six measures noted above will both ensure an appropriate standard is provided to the proposed development and significantly reduce the risk of flooding to the Kingsteignton area, by interrupting the current flow routes across low lying land.

In creating a flood way and setting back the River Teign's defences, additional functional flood plain will be created. This is an improvement over the current situation. These areas of new flood plain will also provide environmental and recreational benefit through the provision of a green corridor, with public access. These areas will only flood infrequently during higher return period events.

The risk of inundation to the Kingsteignton area is reduced up to the 1 in 100 year standard if the development proceeds with the preferred flood mitigation measures. A flooding mechanism across the race course's flood banks remains but this can be improved relatively economically.

The preferred option for new development does not rely on flood banks but raises all ground levels above the 1 in 100 year fluvial against HAT water level, plus an allowance for climate change and the provision of a freeboard.

Both the proposed development and existing development will remain at risk of flooding during a 1 in 1000 year event. Lower level areas across the new development should be planned to both keep flood water away from people and property for as long as possible, and to allow time for people to become aware of the flooding, provide warnings and evacuate.

This study has only considered the developments directly affected by the River Teign's extreme flood extent. Flood risk assessments should be undertaken for the developments not considered within this study, such as New Cross, Abbrook and Sandygate within the Ugbrooke Stream catchment.

The High Level Flood Risk Assessment has broadly demonstrated that WBB's proposed development can take place without increasing flood risk to existing development and that new development can be protected to an appropriate standard. More detailed investigations will however, be required as the various elements of the projects progress. These will include ensuring the following:

- Surface water flows are not increased
- Catchment boundaries are not affected
- New banks and culverts will be stable under extreme flood events
- Flood routes and evacuation routes are designed for extreme events
- Environment Agency Land Drainage Consent is obtained
- Environmental Impact Assessments are carried out
- Permission is given to formalise a flood route across Stover Canal and the branch line
- Foul water can be accommodated

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Figures