

Cowman Stoddart Pty Ltd

PO Box 738

NOWRA NSW 2541

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4 December 2017

Attention: Mr. S Richardson

Dear Steve,

**Re: DCP2014 Chapter G9: Flood Compliance Report for Proposed Modification
Application to MP06-0228, Shoalhaven Starches Expansion Project, Bolong Road,
Proposed Use of Former Paper Mill at 340 Bolong Road, Bomaderry**

This letter has been prepared by R W Dewar BSc, MEngSci, MIEAust CPEng Member No 477618 who has over 30 years of experience in NSW in floodplain management.

1 Introduction

Shoalhaven Starches Pty Ltd intend to utilise the former Paper Mill site in conjunction with their factory operations located further west at 160 Bolong Road Bomaderry. Shoalhaven Starches seek to utilise the former Paper Mill site (refer GoogleMaps aerial photograph) to:

- use the existing buildings on the site for the storage of finished product, as well as engineering plant.
- use the existing storage tanks for the storage of syrups.
- use external areas on the site to lay down plant and materials that are to be used in the construction of approved projects on the Shoalhaven Starches factory sites as well as temporary and overflow shipping container storage.
- use existing administrative buildings for office staff.
- use workshop areas for maintenance purposes.



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Design plans of the proposed works are provided in Appendix A.

The site at 340 Bolong Road Bomaderry is inundated in the 1% Annual Exceedance Probability (AEP) flood event by floodwaters from the Shoalhaven River and this letter provides an assessment of the implications of this proposal on flood levels, flows and velocities.

WMAwater (formerly known as Webb McKeown & Associates) undertook the 1990 Shoalhaven River Flood Study and subsequent 2008 Floodplain Risk Management Study and Plan. We have also undertaken many similar type flood assessments for Shoalhaven Starches in the past and are therefore very familiar with flooding in the Shoalhaven River floodplain and the implications for flooding of further development in the northern floodplain and along Bolong Road.

2 Description of Proposal

The proposal is to undertake works and activities as described in Appendix A. An indicative ground level at the site is 4 to 5 mAHD (Figure 1) and the 1% AEP flood level is approximately 4.9 mAHD according to the Flood Certificate obtained on 19 October 2016 (attached as Appendix B).

Shoalhaven Starches intend to utilise the former Paper Mill in conjunction with their factory operations located further west at 160 Bolong Road, Bomaderry. This will generally involve those items listed in the Introduction. The proposed modification does not seek to increase production at any plant over that which has been approved. No additional buildings will be constructed on site at 340 Bolong Road and the only change in external land use activities are the:

- proposed external lay down area for plant and;
- proposed external storage for plant and equipment.

Council's flood certificate (Appendix B) advises that the site is inundated in the 1% AEP event and is described as High Hazard and Floodway. The projected sea level rise estimates due to climate change will increase the 1% AEP flood level at this site by up to 0.1m. It should be noted that the high hazard and floodway classifications were taken from the hydraulic model established in the 1990 Shoalhaven River Flood Study. These are the maximum classifications for the site and the hazard will decrease towards Bolong Road as floodwaters dissipate into the northern floodplain. This issue is discussed further in Section 3.2.1.

This report acknowledges receipt of Shoalhaven City Council's email of 3rd November 2017 which stated (in reference to flooding).

Flooding Comments/Requirements:

5. This site is categorised as high hazard floodway and the proposal is located predominantly at high hazard floodway including high hazard flood storage. A detailed flood assessment report is required on how the proposal will achieve all relevant objectives, performance criteria and/or acceptable solutions of Shoalhaven Development Control Plan 2014, as prescribed in Section 5.1 and 5.2 (if filling is proposed) of Chapter G9. Particular attention is required to the change of land use (if any) as the proposal involves use of an existing facility.
6. Given the proposed riverbank stability works adjacent to Shoalhaven River, the following will need to be submitted:
 - a) Plans confirming the location and detailed design of stabilisation works;
 - b) The flood assessment report with:
 - i. A hydraulic impact assessment report to prove that the proposal will not increase flood hazard or flood damage to other properties or adversely affect the flood behaviour for a 5% AEP up to a 1% AEP flood event; and
 - ii. An appropriate consulting engineers report for earthworks (if earthwork is proposed) with a length of more than 20m and that these earthworks will not increase flood hazard, flood damage or adversely affect other properties for a 5% AEP up to the PMF scenario.
 - c) An Acid Sulfate Soils (ASS) Management Plan.

This report is concerned with flooding and has made no reference to the riverbank stability works (Item 6 a) as indicated in the email. This report has focussed on Items 5 and 6 b) i) as no earthworks are proposed (Item 6 ii) and thus no acid sulphate soil management plan is required (Item 6 c).

There is a reasonably well documented history of flooding at the site as shown by the photographs taken in the 1974 and 1978 floods on below (photos courtesy www.illawarramercury.com.au/story/2906205/shoalhaven-paper-mill-through-the-years-photos).





3 Compliance with Chapter G9: Development on Flood Prone Land (DCP2014)

The following sections describe compliance with Chapter G9: Development on Flood Prone Land (DCP2014 Amended 1st July 2015). As the works will not involve fill, or subdivision of lands, compliance with these performance criteria has not been addressed.

3.1 Performance Criteria - General (Section 5.1 of DCP only)

PERFORMANCE CRITERIA	RESPONSE
P1 Development or work on flood prone land will meet the following:	
The development will not increase the risk to life or safety of persons during a flood event on the development site and adjoining land.	Up to approximately 24 workers from Shoalhaven Starches will be on the site during business hours but there will be no workers on site at night. Thus the proposed development will increase the number of workers from Shoalhaven Starches who may be subject to flood risk. The use of this site is further away from high ground than the existing site at 160 Bolong Road, thus rescue during a flood will be more hazardous. However there are a large number of buildings on the site which have areas for safe refuge above even the PMF / Extreme event.
The development or work will not unduly restrict the flow behaviour of floodwaters.	Refer Hydraulic Impact Assessment below.
The development or work will not unduly increase the level or flow of floodwaters or stormwater runoff on land in the vicinity. The development or work will not exacerbate the adverse consequences of floodwaters flowing on the land with regard to erosion, siltation and destruction of vegetation.	The proposed development is within existing built up industrial land which is largely clear of vegetation. Due to there being no increase in building footprint and all runoff under existing and future conditions reaching the ground in nearly identical locations, the works will have no impact on erosion or siltation.
The structural characteristics of any building or work that are the subject of the application are capable of withstanding flooding in accordance with the requirements of the Council.	A separate structural report will be provided.
The development will not become unsafe during floods or result in moving debris that potentially threatens the safety of people or the integrity of structures.	A separate structural report on the potential failure of existing buildings and stored equipment and product will be provided.
Potential damage due to inundation of proposed buildings and structures is minimised.	Inundation of the site and the existing buildings will damage unprotected product, stored goods and office plant. However the syrup product stored in the existing containers are sealed and should suffer no damage due to inundation, unless the structure itself fails. Potentially there will be some damage to electrical and other components feeding the equipment. Damage

PERFORMANCE CRITERIA	RESPONSE
	to product and equipment are to be considered in an updated Shoalhaven Starches Flood Plan. Of importance is the potential risk from stored (either temporary or permanent) equipment being moved by floodwaters from the site. This issue will be addressed in the updated Shoalhaven Starches Flood Plan.
The development will not obstruct escape routes for both people and stock in the event of a flood.	The works will not occupy escape routes or cause workers to become trapped.
The development will not unduly increase dependency on emergency services.	The works will increase the number of workers from Shoalhaven Starch who may be subject to flood risk. These issues will need to be examined in an updated Shoalhaven Starches Flood Plan.
Interaction of flooding from all possible sources has been taken into account in assessing the proposed development against risks to life and property resulting from any adverse hydraulic impacts.	Refer Hydraulic Impact Assessment below.
The development will not adversely affect the integrity of floodplains and floodways, including riparian vegetation, fluvial geomorphologic environmental processes and water quality.	<p>The works will be constructed on land designated as high hazard floodway in the 1% AEP event (from flood certificate in Appendix B). The site is industrial land with limited existing vegetation and is beyond the influence of normal fluvial geomorphic processes. The works will have no impact on water quality.</p> <p>The siting of the proposed storage areas is shown in Appendix A (to limit storage areas to outside 75m from the northern river bank) to ensure that the proposed storage areas are not in floodway areas (refer Hydraulic Impact Assessment below).</p>

3.2 Hydraulic Impact Assessment - Works within the former Paper Mill site

As noted above no additional buildings will be constructed on site or excavation undertaken and the only change in external land use activities are the proposed external lay down area and proposed external storage for plant and equipment. These areas are clearly shown on the plans in Appendix A.

The aerial image above from GoogleMaps and Figure 1 / Figure 2 indicates that the position of the proposed lay down / storage areas are partially surrounded by an extensive array of existing buildings / storage tanks. Thus the flow path of floodwaters from the Shoalhaven River over the river bank and towards Bolong Road through the Paper Mill site is already significantly impeded but this will be increased with the proposed lay down / storage areas (refer Figure 2).

The construction of any works on the floodplain will cause a loss of temporary floodplain storage and a loss of hydraulic conveyance. The resulting increase in flood levels will depend upon the magnitude of these losses. Given that not all the proposed lay down / storage areas are solid structures and the floodplain storage area of the Shoalhaven River floodplain is of the order of 100km² the loss of temporary floodplain storage due to the proposed works is too small to be evaluated.

The loss of hydraulic conveyance depends on the extent of the restriction to a flowpath caused by the proposed lay down / storage areas. Prior to construction of the Paper Mill plant in 1957 (it closed in 2015) there would have been significant flow through the site during a flood, as there is across any river bank. However, since then the construction of the plant has significantly blocked the flow path through the site.

3.2.1 Hydraulic Modelling

Hydraulic or flood modelling typically involves the setting up and calibration of two computer models. A hydrologic model that converts the rainfall to runoff and a hydraulic model that includes inflow from the hydrologic model, as well as ocean boundaries, which determines peak flood levels and velocities based on hydraulic formulae. Both models are calibrated to historical data, including historical flood levels and river flow gaugings, to ensure that they can replicate the historical events and are then used to determine design flood events. These are events that have a known probability of occurrence, such as the 1% Annual Exceedance Probability (AEP) event.

The CELLS model of the Shoalhaven River (established as part of the 1990 *Lower Shoalhaven River Flood Study*) represented the channel and floodplain as a series of interconnected cells, termed either river or floodplain cells. The river cells were connected by cross sections and the floodplain cells connected by weirs. Approximately 100 cells were used in the Shoalhaven River model with some cells over 4km² in area. The CELLS model is termed a one dimensional (1D) branched model in that it cannot account for flow in other than the one direction but has “branches” which allow flow to extend across the floodplain. The model used both field survey for weirs as well as bathymetric survey for the river cross sections at approximately 1 to 2 kilometre spacing.

The CELLS model is an unsteady flow model in that it modelled the full flood event (rising and falling water levels) and not just the peak and included ocean tidal hydrographs at both entrances, namely the Shoalhaven Heads and Crookhaven River, and some six flow hydrographs from the WBNM hydrologic model.

Since 1990 there have been significant advancements in the field of hydraulic modelling, though in hydrologic modelling there has been significantly less advancements and the WBNM model used previously is still current today.

The main advancements in hydraulic modelling are through the use of more complex computer software (TUFLOW) that allows the river and floodplain to be discretised into a grid. This is typically 15m by 15m on large rivers and up to 2m by 2m on small urban catchments. These models are termed 2 Dimensional (2D) in that they determine the flow direction between grid cells producing vector velocities. These models are thus able to more accurately define the topography and in turn can more accurately represent the hydraulic effects of even a small development on a large floodplain. The use of TUFLOW allows more accurate definition of all hydraulic parameters (hazard, hydraulic classification, peak velocities and depths etc.) on the site. Thus rather than a single value provided from the CELLS model (1990 *Lower Shoalhaven River Flood Study*) TUFLOW is able to demonstrate that hazard, velocity and other parameters will change as flow crosses over the northern bank and enters the northern floodplain.

Figure 1 shows the model discretisation of the existing plant / buildings and topography at the Paper Mill. Figure 2 shows the existing plant / buildings and the proposed lay down / storage areas as designated in Appendix A.

3.2.2 Hydraulic Modelling Process

The hydraulic effects (change in flood levels, flows or velocities) of the proposed works at the Paper Mill at Bomaderry were analysed using the TUFLOW hydraulic model established for the Shoalhaven Starches 2013 *Shoalhaven River Flood Study*. This model was calibrated to match the historical flood level data for the 1974, 1975, 1978 and 1988 floods and used to provide updated design flood levels for the Shoalhaven River downstream of Nowra.

For the analysis it is assumed that the proposed lay down / storage areas at the Paper Mill would block 100% of the flow through these areas. This is unlikely to be the case as there will be gaps between the equipment stored. Thus the modelling results provided will likely produce greater impacts than what will actually occur.

The modelling process was to compare the peak flood levels in each grid cell for the *Existing* and *Proposed* scenarios. The **Existing** scenario represents the floodplain as at the time of our October 2015 Report Titled *Proposed Modification Application to MP06-0228, Shoalhaven Starches Expansion Project, Relocation Of Product Dryer, Flood Impact Assessment*. The **Proposed** scenario reflects the *Existing* scenario but including the proposed lay down / storage areas. The comparison between the *Existing* and *Proposed* scenarios is termed a flood impact map.

More frequent events, smaller than the 1% AEP, have not been modelled as the northern river bank of the Shoalhaven River is not overtopped to any significant extent until an event larger than the 5% AEP. Thus in these small more frequent events there would be nil impact on peak flood levels of the works and activities. Larger events than the 1% AEP will occur but these events are obviously extremely rare and are not used for flood related planning determinations by Councils except when their failure has potential catastrophic consequences (such as dam failure).

Preliminary results indicated an increase in the 1% AEP flood level of greater than 10mm in the Shoalhaven River if the proposed lay down / storage areas were close to the river bank. Thus

all storage areas were limited to approximately 75 metres from northern river bank (as shown on Figure 2). The distance of 75m is arbitrary and was adopted as being beyond the line of existing buildings and would also be beyond the extent of what might be termed floodway. There is no universally accepted quantitative definition of floodway but it describes areas of significant discharge during floods, which, if partially blocked, would cause a significant redistribution of flood flow (i.e increase flood levels). Thus at the Paper Mill site there are higher velocities as the flow crosses over the northern river bank into the extensive flood storage areas northwards. Beyond 75m the land is flood storage rather than floodway and the proposed lay down / storage areas would have nil affect on possible geomorphic processes within the river (i.e no impact on river bank stability).

3.2.3 Hydraulic Modelling Results

The flood impact maps assuming the proposed lay down / storage areas as shown on Figure 2 for the 1% AEP and PMF events are provided as Figures 3 and 4. The different colours reflect the change in peak water levels as a result of the proposed works. In summary the blue/red tones reflect a decrease in flood level whilst the blue/green/brown tones reflect an increase in peak level.

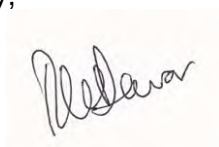
The proposed works do slightly decrease the amount of floodwaters from entering the northern floodplain across the river bank. Thus immediately south and east of the proposed works there is a slight increase in peak level in the 1% AEP event (Figure 3). Though this increase in level is largely within the confines of land owned by Shoalhaven Starches. The potential impact of the proposed works is much reduced as they are sheltered behind existing buildings and structures that already inhibit the flow path. In the Extreme / PMF event (Figure 4) there is an increase in flood level of greater than 0.05m to the immediate west (upstream) of the existing buildings and nil increase to the east (downstream).

In conclusion the proposed works do not significantly increase the 1% AEP or PMF / Extreme event flood levels on lands outside those owned by Shoalhaven Starches. Consequently it was not considered necessary to consider the cumulative effects of the proposed works as there is no significant incremental increase as a result of these works. The assessment of cumulative impacts was assessed in our October 2015 Report Titled *Proposed Modification Application To Mp06-0228, Shoalhaven Starches Expansion Project, Relocation Of Product Dryer, Flood Impact Assessment*.

Should you have any questions or require further clarification regarding the above do not hesitate to contact the undersigned.

Yours Sincerely,

WMAwater

A handwritten signature in blue ink, appearing to read "R W Dewar", is placed over a light pink rectangular background.

R W Dewar

Director



FIGURE 1
SHOALHAVEN RIVER
EXISTING TOPOGRAPHY

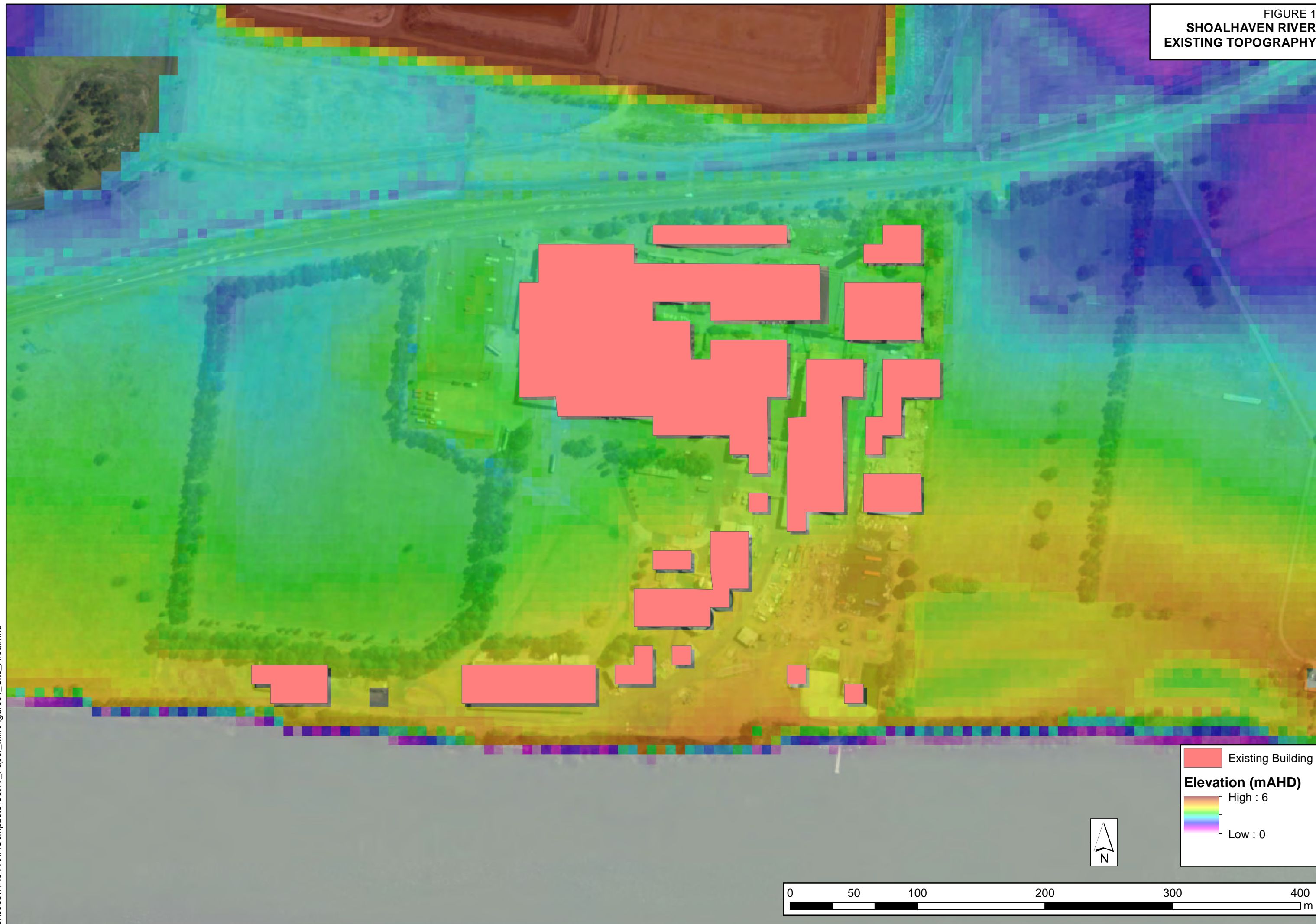


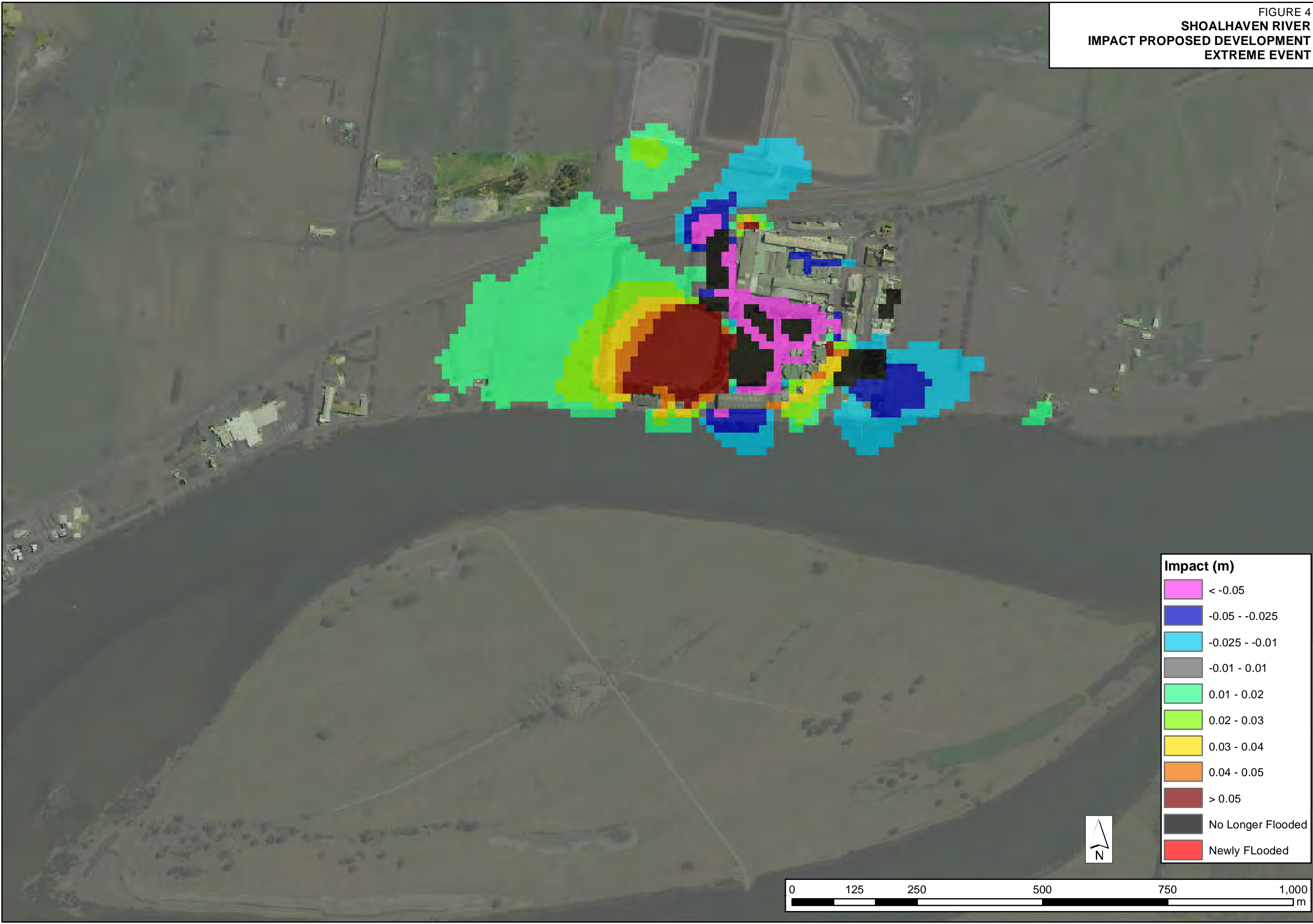
FIGURE 2
SHOALHAVEN RIVER
MODEL LAYOUT
AS PER DRAWING IN APPENDIX A



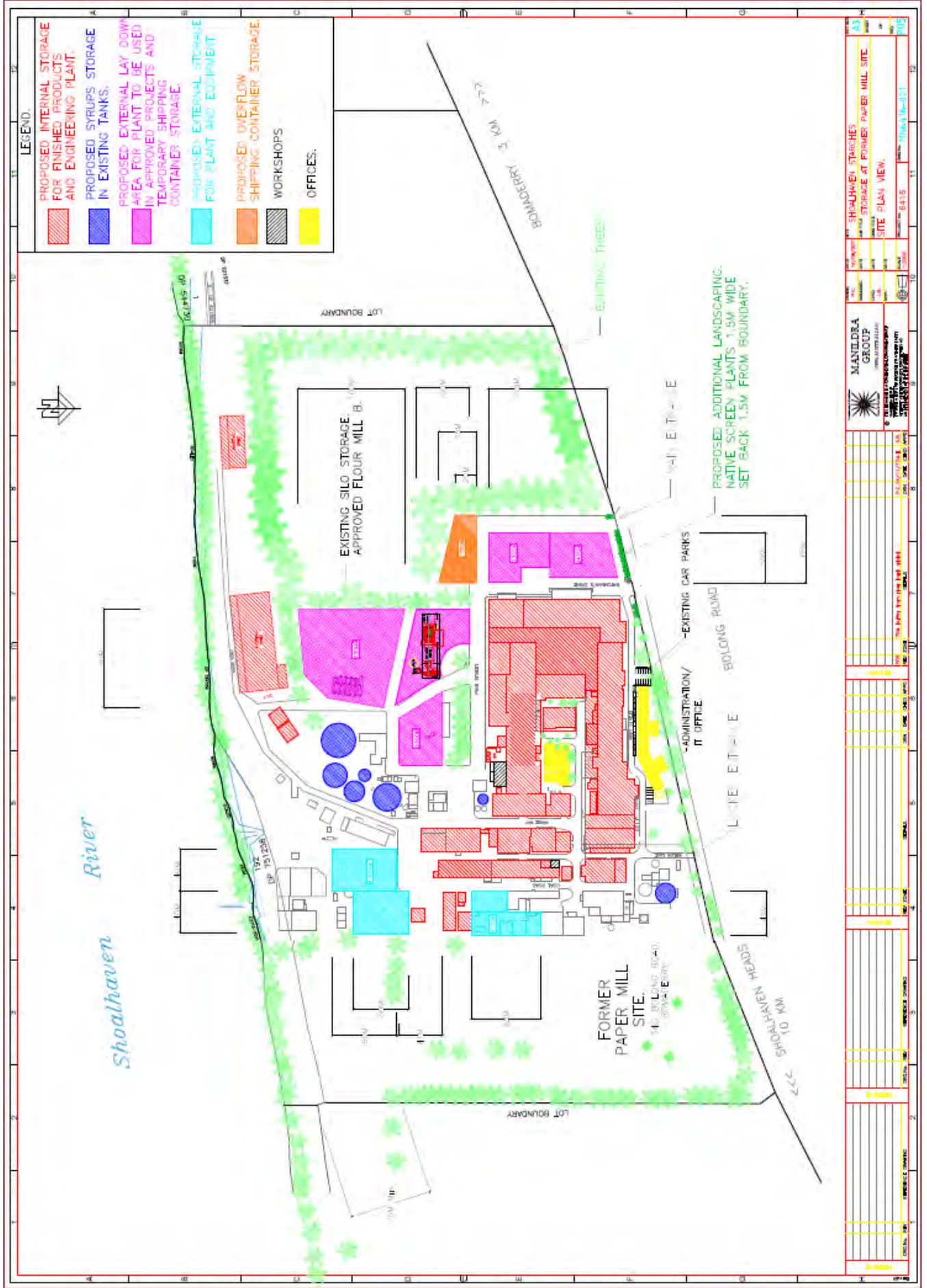
FIGURE 3
SHOALHAVEN RIVER
IMPACT PROPOSED DEVELOPMENT
1% AEP EVENT



FIGURE 4
SHOALHAVEN RIVER
IMPACT PROPOSED DEVELOPMENT
EXTREME EVENT









COUNCIL REFERENCE: 28112E (D16/334454)
CONTACT PERSON: Kate Britton
DATE: 2 November 2016

Stephen Richardson
PO Box 738
Nowra NSW 2541

Thank you for your recent inquiry in relation to flood data held by Shoalhaven City Council.

Please find below the original details of your inquiry, some general information on flooding as well as the requested property specific Flood Certificate.

Details of Inquiry:

Name of Inquirer	Stephen Richardson	Date Requested: 19 Oct 2016
Reason for Enquiry	New Construction	
Contact Details	Phone: 0244236198 Email: steve@cowmanstoddart.com.au Postal: PO Box 738 Nowra	
Preferred Response	Email	
Notes		
Survey Detail	Not Provided	
Flood Safety Tip	Causeways can kill! Never drive through flood waters! Wait and be safe!	
General Flood Information	Shoalhaven City Council in conjunction with SES has produced site specific flood brochures for Shoalhaven Heads, Nowra / Bomaderry / Terara, Greenwell Point/Orient Point and Sussex Inlet. General Flood Information booklets, such as "What to do before, during & after a flood" prepared by Emergency Management Australia are also available. You can pick up free copies of all brochures at the City Administration Building in Nowra.	

FLOOD CERTIFICATE

According to the *Lower Shoalhaven River Floodplain Risk Management Plan – Climate Change Assessment (2011)* this property, 340 Bolong Rd, BOLONG (Lot 1 DP 130968, Lot 1 DP 531429 and Lot A DP 384559) **is affected by the 1% AEP flood event.**

FLOOD INFORMATION

Year	Existing	Projected 2050	Projected 2100
Flood Planning Level	Not applicable	5.5m AHD	5.5m AHD

Hazard Category	High	High	High
Hydraulic Category	Floodway	Floodway	Floodway

Probable Maximum Flood Level	7.0m AHD	7.0m AHD	7.1m AHD
1% AEP Flood Level	4.9m AHD	5.0m AHD	5.0m AHD
2% AEP Flood Level	4.5m AHD	4.5m AHD	4.5m AHD
5% AEP Flood Level	3.9m AHD	3.9m AHD	3.9m AHD
10% AEP Flood Level	3.4m AHD	3.4m AHD	3.5m AHD

Velocity (1% AEP flood event)	3.5m/s	3.5m/s	3.5m/s
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SITE SPECIFIC CONSIDERATIONS

- Current NSW Government legislation requires climate change to be considered as part of this Floodplain Risk Management Study and Plan. Climate change related information evolves with time and it is expected that existing flood behaviour and levels may change in the future.
All applications for buildings, and the like, must take into account the projected 2050 flood information. All subdivision and other long-term planning must take into account the projected 2100 flood information.
Information provided in this flood certificate uses previous State Government sea level rise benchmarks (400mm and 900mm for the 2050 and 2100 horizon's respectively). On Tuesday 10th February 2015 Council's Policy & Resources Committee resolved to no longer use State Government benchmarks and to "Establish a sea level rise benchmarks for planning purposes based on a 2030 horizon 100 mm, a 2050 horizon of 230 mm and 360 mm horizon for 2100". The new benchmarks will be incorporated into the flood information in future. Until studies incorporating the new benchmarks are undertaken Council will continue to use the best available information.
- Not all of the property is categorised high hazard floodway. Part of the property is categorised high hazard flood storage. A detailed ground level survey would be required to determine the exact extent of flood inundation and associated categories.

STANDARD CONSIDERATIONS

Properties below the Flood Planning Level:

Council considers the land in question to be below the flood planning level and therefore subject to flood related development controls. The conditions as set out below will reduce flood risk in flood events up to the Flood Planning Level, however the property may still be subject to flooding at higher levels during rare flood events.

Development controls apply to flood affected properties.

Development conditions will vary depending on flood hazard, hydraulic category as well as the type of development that is proposed. Please refer to the following documents for information on Council's flood related development controls and the NSW State Government's Floodprone Land Policy.

- Shoalhaven Development Control Plan – Chapter 9: Development on Flood Prone Land <http://dcp2014.shoalhaven.nsw.gov.au/main-category/whole-document>
- NSW Floodplain Development Manual 2005: <http://www.environment.nsw.gov.au/floodplains/manual.htm>

DISCLAIMER

Your enquiry relating to the likelihood of the land specified in the application being flooded has been referred to the Council's Floodplain Engineer.

In responding to your application the Council seeks to bring to your attention the fact that pursuant to s.733 of the Local Government Act a council does not incur liability in respect of the giving of any advice furnished in good faith by the Council relating to the likelihood of any land being flooded or the nature or extent of any such flooding.

The Council does not have a legal obligation to provide advice to you and to the extent that this reply is giving advice, the Council provides that advice in good faith with the intention of preserving, so far as is legally possible, the Council's immunity from liability pursuant to s.733 of the Local Government Act.

While all reasonable care has been taken to ensure the accuracy of the information given in this reply, its purpose is to provide a general indication of flood risk in the area. Flood lines shown on Council maps indicate the approximate extent of flooding only in relation to the abovementioned land.

The information provided may contain errors or omissions and the accuracy may not suit the purposes of all users. A site survey and further investigation are strongly recommended before commencement of any project based on this data.

The information given is the most current information at the time of the request. It is to be noted, however, that flood information is constantly reviewed and updated and as such, the information contained in this regard is current only on the day of issue.

Before acting upon the information provided in this reply, the Council urges you to obtain separate and independent advice as Council, in giving this information, does not intend it to be relied upon in such a fashion as to impose liability upon the Council.

Should you not be prepared to accept the information contained in this reply upon that basis then you should immediately notify Council.

GLOSSARY

AEP (Annual Exceedance Probability) means the chance of a flood of a given or larger size occurring in any one year, usually expressed as a percentage – for example a 1% AEP flood event has a 1% chance of occurring in any one calendar year.

AHD (Australian Height Datum) is a common national surface level datum corresponding approximately to mean sea level.

Flood fringe is the part of the floodplain remaining after the floodway and flood storage areas have been defined.

Flood planning area is any land identified as being flood affected in the 1% AEP flood event plus freeboard.

Flood planning level (FPL) is the 1% AEP flood level plus freeboard. The FPL is used for planning purposes, as determined in floodplain risk management studies and incorporated in floodplain risk management plans.

Flood prone land means any land susceptible to flooding up to the probable maximum flood event (that is, land within the floodplain) as identified in an adopted Council flood study or floodplain risk management study and plan.

Flood storage areas are those parts of the floodplain that are important for the temporary storage of floodwaters during the passage of a flood.

Flood study is a technical investigation of flood behaviour. It defines the nature of flood risk by establishing the extent, level and velocity of floodwaters. The study also provides information on the distribution of flood flows across various sections of the flood plain for the full range of flood events up to and including the PMF.

Floodplain risk management plan is a plan developed in accordance with the principles and guidelines contained in the NSW Government Floodplain Management Manual. Usually includes both written and diagrammatic information describing how particular areas of flood prone land are to be used and managed to achieve defined objectives.

Floodplain risk management study is a study that identifies and compares various risk management options. This includes an assessment of their social, economic, ecological and cultural impacts, together with opportunities to maintain and enhance river and floodplain environments.

Floodway means those parts of the floodplain where a significant discharge of water occurs during floods. They are often aligned with natural defined channels. Floodways are areas that, even if only partially blocked, would cause a significant redistribution of flood flow, or a significant increase in flood levels.

Freeboard is currently 0.5m for all catchments in the Shoalhaven. Freeboard is a factor of safety used to set the FPL (i.e. $FPL = 1\% \text{ AEP flood level plus freeboard (0.5m)}$). Freeboard takes into account uncertainties in flood modelling and climate change predictions, local factors that cannot be included in the flood model or wave action caused by wind, boats or vehicles driving through flood waters.

Hazard category represents the risk or danger to personal safety, evacuation movements and buildings and structures within the Flood Planning Area during the 1% AEP flood. There are only two possible hazard categories – high or low.

Hydraulic category describes the function of a specific part of the Flood Planning Area in conveying flood waters during a 1% AEP flood. There are three possible hydraulic categories – floodway, flood storage or flood fringe.

Probable maximum flood (PMF) is the largest flood that could conceivably occur at a particular location, usually estimated from probable maximum precipitation. Generally, it is not physically or economically possible to provide complete protection against this event. The PMF defines the extent of flood prone land, that is, the floodplain.

Provisional is used for hazard categories that have been determined in a flood study. Hazard categories are provisional until the floodplain risk management study and plan has been completed and adopted by Council, as this document considers additional risks, not considered during the flood study.