

Wyong Shire Council

ORDINARY COUNCIL MEETING

ENCLOSURES – PART 3, PAGES 74 - 104

Wednesday, 14 March, 2012

WYONG SHIRE COUNCIL

CONSULTANT BRIEF FOR: WYONG RIVER CATCHMENT FLOOD STUDY

IN TWO (2) PARTS:

PART A: OBJECTIVES, REQUIRED SERVICES, DELIVERABLES and RELEVANT INFORMATION

PART B: LODGEMENT of PROPOSALS, PROJECT MANAGEMENT and CONDITIONS of ENGAGEMENT

NOTE: This Brief is based on DECCW's Generic Flood Study Brief. Text shaded "grey" is "standard" text that was last amended on 5 November, 2010 and is current at 7 March 2012

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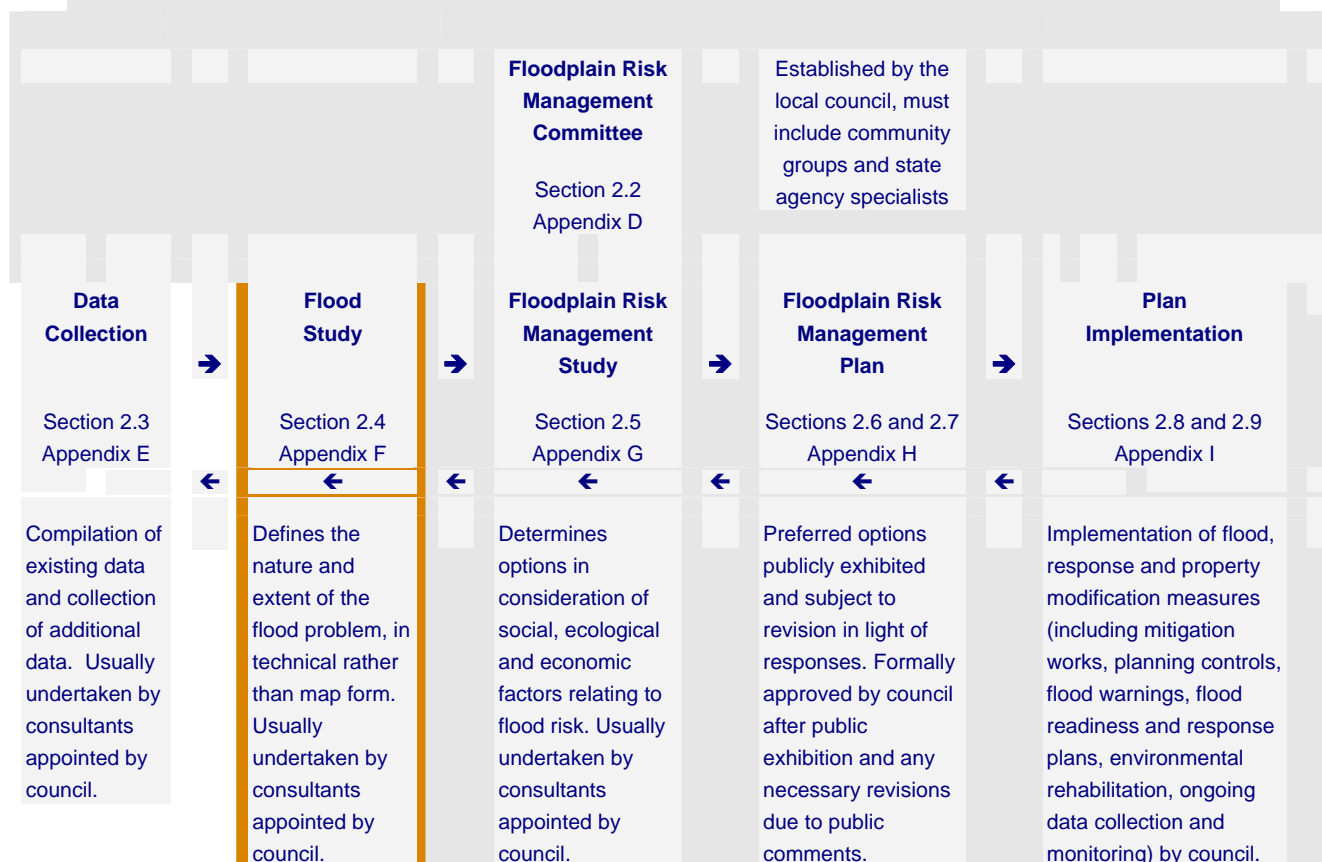
PART A: OBJECTIVES, REQUIRED SERVICES, DELIVERABLES & RELEVANT INFORMATION

A1. INTRODUCTION

The primary objective of the New South Wales Government's Flood Prone Land Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers of flood prone property, and to reduce private and public losses resulting from floods, utilising ecologically positive methods wherever possible.

Through the Office of Environment and Heritage (OEH), the Department of Planning and Infrastructure (DoPI) and the State Emergency Service (SES), the NSW Government provides specialist technical assistance to local government on all flooding and land use planning matters. The Floodplain Development Manual (NSW Government, 2005) is provided to assist councils to meet their obligations through

the preparation of floodplain risk management plans. The following Figure 2.1 from the Manual documents the process for plan preparation, implementation and review.



Wyong Shire Council is responsible for local land use planning in its service area, including in the Wyong River catchment and its floodplain.

Through its Floodplain Risk Management Committee the Wyong Shire Council proposes to prepare a comprehensive floodplain risk management plan for the study area in accordance with the NSW Government's "Floodplain Development Manual: the management of flood liable land", April 2005 (The Manual). This brief relates to the flood study phase of the process.

A2. BACKGROUND and STUDY AREA

Wyong Shire is located in the Central Coast, approximately 90 kilometres north of Sydney. It borders Lake Macquarie Local Government Area (LGA) to the north and Gosford City LGA to the south. The current population of the Shire is approximately 150,000 with an estimated annual grow rate of 1.44%. Refer to the attached Figure A1 for location detail.

Most of the Wyong LGA drains via three major drainage systems into Tuggerah Lakes - Wyong River, Ourimbah Creek and Wallarah Creek. The Wyong River has an approximate catchment area of 440 square kilometres (sq km), with the F3 freeway traversing the study area in north-south direction, dissecting the study area into western and eastern parts which have distinct characteristics. The western part is quite steep and contains large sections of State forest with dense vegetation and rural development. The eastern part contains mostly cleared, low-lying developed areas that include low to medium density residential,

commercial and industrial uses. Refer to the attached Figures A1 -A3 for details of the study area.

Wyong River catchment can be dividing into the following sub catchments: Wyong River, Cedar Brush Creek, Jilliby Creek, Deep Creek, Porters Creek, Mardi Creek and Tuggerah Creek.

The upper reaches of Wyong River are formed in the state forest area on the higher uphill slope to the north-west of the Wyong town centre. The main creek length is approximately 50 kilometres (kms) and drains into Tuggerah Lake, at Tacoma. There are many tributaries that drain into the Wyong River along its full length – from very small to very large. Details of the larger tributaries are listed below.

Cedar Brush Creek, approximately 17km in length, originates in the state forest and runs in a north to south direction, parallel to the Wyong River. It is the most north-westerly area of the Wyong River catchment. It converges with Wyong River near the intersection of Ravensdale Road and Brush Creek Road, Ravensdale. Most of the catchment of Cedar Brush Creek is state forest; however there are rural residential lots along both sides of the creek.

Jilliby Creek, approximately 24.5km in length, originates in the state forest, Ravensdale and runs in a north-south direction, and converges with Wyong River approximately 1km downstream of Jilliby Road, Alison. It is the most north-easterly area of the Wyong River catchment. The catchment draining into this creek is predominantly rural residential with cleared grazing and farm lands.

Deep Creek, approximately 7km in length, originates in the state forest, Wyong Creek. The creek runs in a west to east direction and converges with the Wyong River near Mardi Road, Mardi. The upstream catchment of Deep Creek is mainly rural area and the downstream catchment is primarily large lot residential.

Mardi Creek, approximately 3.6km in length, runs west-easterly along the southern boundary of the Tuggerah Straight Business area. It is the most southerly area of the Wyong River catchment. It has Mardi dam at its upstream reaches, and discharges under the railway line via box culverts into the wetland area east of the Pacific Highway commonly referred to as Pioneer Dairy, which then drains into Wyong River then Tuggerah Lake. In the downstream extent, part of the creek line between the Pacific Highway and Gavenlock Road is an open concrete channel.

Tuggerah Creek is located near the southern east boundary of the study area. The creek is approximately 3.7km in length and runs south-northerly along the Northern Railway line and crosses the railway line at Wyong Road. The creek drains into the lagoon north of the Tuggerah Train Station.

Porters Creek is found in the middle of the Wyong River catchment and has a catchment area of approximately 55 Km². It converges with Wyong River near Alison Road, Wyong. The catchment that drains into Porters Creek has a range of land uses including residential, commercial, rural and natural conservation areas. In 2011 Council completed a flood study with 2-D hydraulic modelling using TUFLOW software for this catchment. Council will make hydrological (RAFTS) and hydraulic models and information available to the successful consultant for appropriate consideration and inclusion in the flood study.

The study area has a history of both mainstream and overland flooding. The major historic flood events are in year 1949, 1964, 1990, 2004 and 2007.

The study area and the tributaries for which detailed, reliable flooding information is required are shown on Figure A2 – Study Area.

Detailed survey information is available for 70 bridges/culverts within the study area. Refer to Figure A3 for details of the location of these structures to be included in the flood model.

A3. OBJECTIVES

The primary objective of the study is to define the flood behaviour under historical and existing floodplain conditions in the Study Area (Figure A2) while addressing possible future variations in flood behaviour due to climate change.

The study will produce information on:

- flood levels and extents, velocities, flows for a range of flood events including probable maximum flood (PMF) event and another specified extreme flood event (see Section A6.8), the 0.5%, 1%, 2%, 5%, 10% and 20% AEP events
- hydraulic categories for the 1% AEP and probable maximum flood events as a minimum;
- preliminary residential flood planning level (based upon 1% AEP plus a 0.5m freeboard) and where relevant (in tidal waterways including intermittently open and closed lakes and lagoons, ICOLLs), provide equivalent information incorporating the NSW Government's sea level rise planning benchmarks;
- where relevant (in tidal waterways), tidal inundation extents for existing conditions and for conditions incorporating the sea level rise planning benchmarks and the sensitivity of flood behaviour to changes in flood producing rainfall events due to climate change

To achieve this objective the consultant is expected to collect, compile and review all available relevant data (including survey, aerial photography and satellite imagery).

It is expected that hydrologic and hydraulic modelling will be required to satisfy the study objectives (see also Sections A6.5 and A6.6). The models and results produced in this study are intended to also form the basis for a subsequent floodplain risk management study where detailed assessment of flood mitigation options and floodplain risk management measures will be undertaken. Therefore the models established in the flood study must be suitable for use to assess a range of management options in the floodplain risk management study.

A3.1 Specific Objectives for the Study Area

- Sensitivity of flood levels in the catchment to consider culvert blockage in significant locations. Further information in section 6.6.2.

A4. DELIVERABLES

A4.1 General

The deliverables specified in Section A4 are to be provided as a minimum from this study. Handover of these deliverables is specified in Section A6.13.

A4.2 Key Project Stages

A4.2.1 General Requirements

Key project stages for reporting and managing progress payments shall be:

- Stage 1. Completion of Data Collection and Assessment and Community Consultation Report
- Stage 2. Completion of Model Calibration and Validation Report – separate reports for
 - (i) hydrological model calibration and validation and
 - (ii) hydraulic model calibration and validation.
- Stage 3. Completion of Modelling and Mapping Report
- Stage 4. Draft Flood Study Report
- Stage 5. Final Flood Study Report
- Stage 6. Completion of Contract

All reports including all diagrams, figures and inserts, are to be provided in hardcopy form plus an electronic copy compatible with the word processing software outlined in Section A4.8. A PDF version of the Final Flood Study Report is also required. **Electronic model output files for all design runs and scenarios are also to be provided as waterRIDE™ files or raw results suitable for direct translation into waterRIDE™ - see OEH's Guideline "Model Reporting & Supporting Information (including Model Files) for Review" for requirements.**

A4.2.2 Specific Requirements

Hydraulic model results are to be presented in a format that is compatible with **waterRIDE™ FLOOD Viewer**

A4.3 Progress Reports

A4.3.1 General Requirements

Upon acceptance of their proposal, the Consultant shall provide a final draft of the program and timetable of major tasks for completion of the study, together with estimated monthly expenditure. The program shall be in a form suitable for updating to show the status of the technical work, timing and expenditure during the course of the study.

The Consultant shall submit brief monthly progress reports to the Council outlining progress on the technical work, together with an updated program showing the status of project completion, timing and budget. Any issues that may affect the timely and efficient completion of the study shall be identified in the progress reports.

More detailed progress reports are required at Stages 1 to 3 as indicated in Section A4.2.

Sufficient information shall be provided to enable the Council to review the progress of the study. Where progress or other reports detail the modelling that has been undertaken the report shall include the information set out in the OEH Guideline "Model Reporting & Supporting Information (including Model Files) for Review". The progress reports may include draft versions of the relevant sections of the final report, where appropriate. Where

progress reports relate to the study stages identified in Section A4.2.1 above and are to be discussed at a meeting of the Committee, Technical Sub-Committee or Council, the reports are to be submitted no later than 7 days (5 working days) prior the date of the relevant meeting.

Whenever possible, progress and draft reports are to be submitted electronically in the word processor format outlined in Section A4.8.

A4.3.2 Specific Requirements

Electronic copies of the hydrological and hydraulic modelling files are to be submitted with the progress reports, where appropriate. Final approval of each model from Council is required before commencement of work on subsequent stages of the project.

A4.4 Draft and Final Reports

A4.4.1 General Requirements

On completion of the study, the Consultant shall present a final report. The final report shall not be printed without written direction from Council.

Whilst the format is not rigid, the report shall incorporate a description of flood behaviour, the methodology and findings of the study in sufficient detail to support the validity of the conclusions including a detailed discussion of the model calibration and validation process. The report shall include the following as a minimum:

- i. Flood profiles (A3 size minimum) for the number of design events specified in Section A4.4.2. Additional profiles should be added for the 1% AEP flood and PMF including the 2050 and 2100 sea level rise planning benchmarks where relevant.
- ii. Tabulated flood levels, velocities and flow distributions for **all** design events.
- iii. Maps (A3 size minimum) showing hydraulic categories for the number of design events specified in Section A4.4.2.
- iv. Maps (A3 size minimum) showing the provisional hazard categories for the number of design events specified in Section A4.4.2.
- v. Maps (A3 size minimum) showing the preliminary true hazard categories (see Section A3) for the number of design events specified in Section A4.4.2.
- vi. Maps (A3 size minimum) showing preliminary flood planning areas for the current situation and considering the 2050 and 2100 sea level rise benchmarks where relevant.
- vii. Maps (A3 size minimum) showing preliminary emergency response classifications for communities as per the OEH Guideline on Flood Emergency Response Classification of Communities.
- viii. Provide the results of sensitivity analyses including those undertaken to examine potential changes in flood producing rainfall events due to climate change.
- ix. Stage hydrographs (all to a common time base if possible) for each flood event investigated (historical and design events) at the following locations:
 - a. The reference river gauging and Flood Warning station(s) for the study area (see Figure A2)
 - b. All locations referred to in Section A3.1

The stage hydrographs are required in tabular and graphical form.

- x. Provide the information necessary to meet the data requirements of the SES in accordance with the Floodplain Risk Management Guideline “SES Requirements from the Floodplain Risk Management Process”.
- xi. Provide electronic model output files for all design runs and scenarios as waterRIDE™ files or raw results suitable for direct translation into waterRIDE™. A summary of the model files relevant to each runs is to be included.

The draft report shall be provided in hard copy form plus one electronic copy on CD/DVD(s) (in the word processor format outlined in Section A4.8) to assist in the review process. The number of hard copies to be provided is specified in Section A4.4.2. After review of the draft report by the Council, the Consultant shall undertake any additional work necessary to achieve the final draft for approval by the Council and, if required (see Section A7.1), placed on public exhibition. If the final draft report is placed on public exhibition the consultant shall undertaken all work associated with collating and assessing submissions received, preparing a brief report to Council on the submissions received and any amendments to the final draft report that are considered necessary. On receipt of written direction from Council the consultant shall make the necessary changes to achieve the final report.

The final report will be required in hard copy form, plus an electronic version (WORD plus PDF formats). The electronic versions are to be provided on CD/DVD(s) to be placed in a suitable wallet to be inserted in copies of the final report. The number of hard copy final reports to be provided with CD/DVD(s) in a wallet is specified in Section A4.4.2. The wallet is also to include CD/DVD(s) containing the information specified in Section A6.13.

Printing of the final report shall not proceed without the written direction of the Council. The cost of all work associated with preparing the approved final report shall be included in the Consultant's fee estimate.

A4.4.2 Specific Requirements

- 1 - In conjunction with point ii above, maps (A3 size minimum) of flood contours for the design flood events listed in section A6.5 are required.
- 2 - Required number of hard copy draft reports – Three (3)
- 3 - Required number of hard copy final reports – six (6).
- 4 - Number of hard copy final reports to be provided with electronic versions (WORD and PDF format) on CD/DVD(s) in a suitable wallet - Three (3)
- 5 - Both draft and final reports are to include:
 - Flood profiles for “7” number of design events (see Section A6.5 below). The selection of the design events for this purpose is to be approved by Council.
 - Hydraulic category maps for “2” number of design events (see Section A4.4.1, iii above), including PMF and 1% AEP.
 - Provisional hazard category maps for “2” number of design events (see Section A4.4.1, iv above) including PMF and 1% AEP.

A4.5 Survey Data

Survey data including any DTM/DEM model (or other topographic information obtained using aerial survey methods as part of this study) is to be provided in a form compatible with the survey package indicated in Section A4.8 and arranged in a file structure similar to that shown in Figure A3. In addition the cross-sectional data points or topographical terrain x, y, z coordinates in the case of 2D models and structure geometry should be provided in ASCII format.

A4.6 Hydrological and Hydraulic Modelling and Results

In addition to the deliverables required to be included in the reports (see Section A4.4) the following deliverables are also required, preferably as an appendix or similar:

- Model data files and accompanying specifications arranged in a file structure similar to that shown in Figure A3.
- Model data including; adopted design inflows, recorded flood levels, flow paths, floodways, development data and major infrastructures;
- Model run data, ie, the input files used to make up each model run, to enable re-creation of results in future.
- Complete model results including; flood heights, flow distributions, velocities and flood storage variations and hydraulic and provisional hazard categories for all calibration, validation and design events.

A4.7 Geographic Information System (GIS) Files

A4.7.1 General Requirements

A complete set of GIS files, arranged in a suitable file structure in a format compatible with Council's systems as indicated in Section A4.8. These should include all mapping information developed as part of the study.

Information requirements for the State Emergency Service are to meet the requirements outlined in the relevant OEH Guideline (refer Section A5).

A4.7.2 Specific Requirements

2 CD's/DVD's that include the GIS files are to be supplied to Council.

A4.8 Format of Deliverables

The Relevant Software packages for deliverables are as follows:

- Survey Package: Civilcad 2012-Survey / AutoCAD Map 3D–Version 2010
- DTM/DEM LiDAR survey data, digital aerial photography and spatial modelling products: The supply of these products is to satisfy the specifications produced by the NSW Land and Property Management Authority, "*LPMA Standard LiDAR Product Specifications (Including RCD105 Imagery)*" Version 2.0, July 2010 (copy available from DECCW on request)

- GIS: ArcMap 10.0
- Spreadsheet: Excel – 2003
- Word processor: MSWord - 2003
- XP-Rafts – Version 2009/latest version
- TUFlow - _iDP_w32
- Electronic model output files for all design runs and scenarios are also to be provided as waterRIDE™ files or raw results suitable for translation into waterRIDE™ - see OEH's Guideline "Model Reporting & Supporting Information (including Model Files) for Review" for requirements.



A5. AVAILABLE INFORMATION and REFERENCES

A5.1 General Reference Information

Unless stated otherwise in Section A5.2 below the following relevant Data, Documents and OEH Guidelines are to be considered in this investigation:

- NSW Flood Prone Land Policy (Section 1.1 - Floodplain Development Manual, 2005)
- NSW Government's *Floodplain Development Manual – the management of flood liable land*, April 2005.
- The Institution of Engineers, Australia 1987 and 1998, *Australian Rainfall and Runoff, A Guide to Flood Estimation*.
- Bureau of Meteorology, "*The Estimation of Probable Precipitation in Australia: Generalised Short-Duration Method*", 2003
- Austroads "*Waterway Design A Guide to the Hydraulic Design of Bridges, Culverts and Floodways*", 1994)
- Bureau of Meteorology rainfall data
- River flow, tidal and ocean level data from Department of Finance and Services, Manly Hydraulics Laboratory
- River flow and height data from Office of Water (NOW - DECCW)
- NSW Government's Sea Level Rise Policy (2009)
- NSW Coastal Planning Guideline: Adapting to Sea Level Rise.
- Land and Property Information (formally LPMA) "*LPMA Standard LiDAR Product Specifications (Including RCD105 Imagery)*" Version 2.0, July 2010
- Floodplain Risk Management Guidelines (OEH Guidelines):
 - ❖ Floodway Definition
 - ❖ Residential Flood Damages
 - ❖ Ocean Boundary Conditions
 - ❖ SES Requirements from the FRM Process
 - ❖ Flood Emergency Response Classification of Communities
 - ❖ DTMs derived from Aerial Survey Methods – draft Guideline

- ❖ Practical Consideration of Climate Change
- ❖ Model Reporting & Supporting Information (including Model Files) for Review – includes specifications for the provision of model files in a format compatible with waterRIDE™
- ❖ “Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments”

NOTE: Consultants are to ensure that only current versions of the relevant documents are referred to and used in this study.

A5.2. Specific Relevant Information

Unless otherwise indicated the following information will be made available to the consultant **free of charge**:

- GIS information / layers including:
 - Aerial photos;
 - Topographic survey (point data LiDAR and contours)
 - Cadastre;
 - Zoning;
 - Vegetation / Environmental;
- Previous flood related studies/reports:
 - Cardno (2011) Porters Creek Floodplain Risk Management Study
 - Cardno (2010) Porters Creek Flood Study – Addendum -1
 - Paterson (2010) Lower Wyong River Floodplain Risk Management Study and Plan
 - NSW Government Office of Water (2010)- Mardi Dam Safety Inspection Report
 - WMAwater (2010) Tuggerah Lakes Floodplain Risk Management Study – Exhibition Report
 - Department Of Commerce Sydney (2006) Flood Hydrology Report - Mardi Dam
 - ADW Johnson (2008) Field survey and Flood inundation extent mapping June 2007 flood
 - Web McKeown (2006) Upgrade of SH10 Pacific Highway
 - Web McKeown (2004) Woodbury Park Stage 4 – Addendum to Flood Assessment
 - Buzz (2004) Flood in Warnervale Oct 2004
 - ERM (2000) Yarramalong and Dooralong Valleys Baseline Flood Study - Coal Operations Australia
 - Web McKeown (1997) Mardi Creek, Tuggerah Investigation & Concept Design of Flood Mitigation Works

- Paterson Consultants (1997) Tuggerah Business Park - Flood Report 1997 & Closure of Railway culverts 1996
- Paterson Consultants (1995) Tuggerah Business Park - Review Drainage Options Draft Report
- Web McKeown r (1992) Lower Wyong River Flood Study Review 1991
- Web McKeown (1991) Mardi Creek Assessment of downstream channel works
- PWD (1988) Upper Wyong River Flood Study
- PWD (1988) Upper Wyong River Flood Study Compendium of Data

A6. SCOPE OF WORK

The Consultant shall provide all services required to satisfy the objectives of the flood study.

The services shall include, but not necessarily be limited to, the following major tasks, listed in Section A6.1 to A6.13 and the provision of the deliverables outlined in Section A4.

Any additions or amendments considered necessary will be received and should be submitted as “additional” or “amended” works respectively and itemised and scheduled accordingly (see Part B, Section B2.4).

The consultant must clearly indicate in the proposal if their offer for services will not provide any of the deliverables, follow the procedures outlined in any Guideline/policy/specification referred to in Section A5.1 or otherwise meet the scope of works as outlined in this brief.

A6.1 Collect, Compile and Review of Available Information

A6.1.1 General Requirements

All data listed in Section A5 shall be collected, compiled and reviewed and any additional data required to achieve the objectives of this Brief shall be identified. Where the need and availability for data additional to that listed in Section A5 could have reasonably been anticipated prior to the close of tenders the consultant shall obtain the data. The cost of obtaining this data is to be included in the proposal fee.

A6.1.2 Specific Requirements

“NIL”.

A6.2 Consultation

A6.2.1 General Requirements

A6.2.1 (a) Community Consultation

Council recognises the important role that community consultation will have in this study. Council's goals for community consultation are to inform the community about the study, identify community concerns, to gather information from the community and to develop and maintain community confidence in the study results. Consultants need to demonstrate how they intend to meet these goals by providing a preliminary community consultation program. This program will be tabled for discussion at the inception meeting of the floodplain risk management committee.

A6.2.1 (b) Other Consultation

In addition to the local community and community groups consultation by consultants should include (but not limited to) the following key stakeholders and agencies:

- (i) Council's Planners and Engineers
- (ii) Council's floodplain risk management committee (FMC).
- (iii) Office of Environment and Heritage (OEH),
- (iv) Gosford-Wyong Water Authority (if appropriate)
- (v) State Emergency Services (SES),
- (vi) Bureau of Meteorology (BoM),
- (vii) NSW Office of Water (NOW - OEH) - stream flow and stream gauge height data (generally in non-tidal area).
- (viii) Department of Finance and Services (Manly Hydraulics Laboratory) – stream flow, stream gauge height (generally in tidal areas), tidal and ocean level data
- (ix) Roads and Maritime Services (formally RTA) (if appropriate)
- (x) Transport for NSW (formally State Rail Authority) (if appropriate),
- (xi) Land and Property Information (formally LMPA)
- (xii) Geographical Names Board (www.gnb.nsw.gov.au)

Consultants will need to demonstrate how they intend to consult with these bodies and in particular the types of issues that will need to be addressed.

A progress report is required at the end of Stage 1 (see Sections A4.2.1 and A4.3.1) addressing the outcomes from data collection and progress with the consultation processes.

A6.2.2 Specific Requirements

As a significant landowner in this catchment, NSW National Parks may also need to be consulted.

A6.3 Topographical Survey

A6.3.1 General Requirements

A topographic survey of watercourses and the adjoining floodplain was completed in 2010/11 for the Wyong River catchment. This information includes survey of structures such as bridges, culverts and road levels which Wyong Shire Council considered likely to control or significantly influence flood behaviour.

The provisional hydraulic model configuration should be based on the information reasonably available to consultants at the time of tendering following reasonable enquiry. If alternative modelling approaches with different survey requirements are proposed for consideration or it is believed that additional survey information will be required for the purposes of hydraulic modelling and hydraulic and hazard categorisation, then realistic

survey costs associated with each option must be provided. Where alternative modelling approaches are proposed, any additional costs associated with collection of detailed data on control structures such as bridges, culvert and roads across the floodplain must be included. Topographic data obtained using aerial survey methods is to comply with the specification produced by the Land and Property Management Information (formally LMPA) ("*LPMA Standard LiDAR Product Specifications (Including RCD105 Imagery)*") Version 2.0, July 2010 copy available from OEH on request).

Consultants are advised that any sub-contract under this consultancy for the acquisition of topographic information using aerial survey methods will be required to include provisions relating to intellectual property that will permit unlimited use by NSW Government of the Products including but not limited to:

- Any Product to be reformatted or modified into different formats or media for use of NSW Government and,
- Unlimited copies to be made for internal and archival purposes of NSW Government of any Products and,
- Any Product to be made available to any NSW Government agency, for its internal use including their consultants, contractors and agents and,
- Any Product to be placed on any NSW Government Intranet site and ,
- Any product to be supplied to any client or customer of a NSW Government agency (including research organisations, land holders and community groups) and placed on a NSW Government Internet site and,
- Any Product placed on public record in the Survey Control Information Management System (SCIMS) managed by the Land and Property Management Information (formally LMPA).

Following engagement and a detailed inspection of the study area and survey information available, the successful consultant shall submit to the Council a survey brief outlining details of the survey required together with a firm fee to undertake this portion of work if required. At this stage, Wyong Shire Council does not believe that this will be necessary. Following receipt of written approval from Council, the Consultant shall arrange for the survey to be undertaken. The consultant shall be responsible for the engagement and supervision of the approved sub-consultant to complete the work.

If approved by Council the successful consultant may carry out the survey component using in-house resources, however the consultant will have to demonstrate that its price for the work is competitive by participating in a competitive tendering process. Council will arrange for other quotations to be obtained, evaluate the quotations (including that of the study consultant) and engage the successful survey sub consultant. The flood study consultant will supervise the work of the successful sub-consultant.

A6.3.2 Specific Requirements

The approximate location of the culverts for which detail survey information is available for inclusion in the flood models is shown on the Figure A3.

Bathymetric survey is available for the downstream 9.2 kms of Wyong River – from the F3 freeway to confluence with Tuggerah Lake.

A6.4 Acquisition of Additional Data

A6.4.1 General Requirements

If, during the course of the study, it becomes necessary or desirable to acquire additional data, including survey, flood photography and satellite imagery, **and it can be shown that the need or availability could not have been reasonably anticipated prior to the close of tenders**, the Consultant may submit to Council a brief outlining details of the data required, together with a firm quotation for the cost and timing of the work. Following receipt of written approval by Council, the Consultant will undertake the additional data collection. Where additional survey is required the Consultant will use the services of the successful sub-consultant appointed to undertake the topographical survey component of the flood study, unless directed otherwise by Council.

A6.4.2 Specific Requirements

“NIL”.

A6.5 Hydrology

A6.5.1 Hydrologic Modelling

A6.5.1(a) General Requirements

The Consultant shall set up appropriate computer-based hydrologic model to suit the purposes of the study considering the potential use of the model in assessing management options. The Consultant shall nominate the choice of hydrologic modelling technique, the model to be used and a sound basis for doing so. The model shall have the capability to represent all features of the study area, which are likely to have a significant effect on flood behaviour. The extent of the model shall be sufficient to establish reliable boundary conditions for input to the hydraulic model covering the defined study area.

A6.5.1(b) Specific Requirements

Following design storm events are to be investigated:

1. probable maximum precipitation (PMP) event or another specified extreme storm event,
2. 0.5% AEP,
3. 1% AEP,
4. 2% AEP,
5. 5% AEP
6. 10% AEP and
7. 20% AEP storm events.

See Section 6.11 for additional modelling that is required to determine impacts of potential climate change.

Hydrological information is required in key locations such as bridges, culverts and confluence of tributaries with major water courses for the following sub-catchments as well as particular locations along the main Wyong River:

- A. Cedar Brush Creek
- B. Wyong River
- C. Jilliby Creek
- D. Porters Creek
- E. Deep Creek
- F. Mardi Creek; and
- G. Tuggerah Creek

Set-up and calibration and validation of the hydrological model are to be confirmed/approved by Council prior to running design storm events.

A6.5.2 Flood Frequency Analysis

A6.5.2(a) General Requirements

Where a long and preferably continuous record of stream gauging is available in the catchment a flood frequency analysis is required. The flood frequency is to be carried out in accordance with procedures outlined in the Australian Rainfall and Runoff (1987) and the forthcoming Australian Rainfall and Runoff, At-Site Flood Frequency Analysis, Book 4, Chapter 2.

The stream gauging data used for flood frequency analysis should be checked for consistency and accuracy. Issues to be considered include:

- Any relocation of the gauge though its recording history,
- Any change of gauge zero datum,
- Any change of gauge equipment, and
- Any change of channel cross-section at the control point.
- The rating curve and its accuracy especially in the upper range and extrapolation of the rating curve.

Adjustments to the stream gauging data is only anticipated where a definite error can be proved.

The results of the flood frequency analysis should be consistent with that of the hydrologic model (if one is set up) in keeping with the relevant sections of the current version of Australian Rainfall and Runoff. To this end the hydrologic model parameters should be adjusted to fit the flood frequency curve, if warranted not the frequency analysis adjusted to suit the model.

A6.5.2(b) Specific Requirements

Historical river height data is available at four locations: Wyong Bridge, Gears, Jilliby and Gracemere which can be used for flood frequency analysis. The locations of the gauges are shown in Figure A2.

A6.6 Hydraulic Modelling

A6.6.1 General Requirements

The Consultant shall nominate the choice of hydraulic modelling technique, the model to be used and a sound basis for doing so. This decision should consider the potential use of the model in assessing mitigation options as part of a future management study. The proposal shall indicate if it is proposed to run the model(s) in steady state mode and the reasons for doing so. The concurrence of the Council shall be obtained in relation to the selection and design of the model. The Council reserves the right to select the technique deemed most appropriate and direct the Consultant accordingly.

In modelling structures on the floodplain the consultant shall consider the likely behaviour/performance of the structure (such as potential for blockage, failure potential and response to overtopping) during the events being modelled.

The extent of the floodplain modelled shall be sufficient to ensure the reliability of the model results in the area shown in Figure A2. **The watercourses identified on Figure A2 are to be specifically modelled in the hydraulic model**

A6.6.2 Specific Requirements

Council's preferred hydraulic modelling of the catchment would be two-dimensional (2-D) hydraulic modelling with 'TUFlow' software.

If a grid terrain model is to be setup for the hydraulic model, the following minimum configuration is preferred. Council is open to innovative solutions to achieve the objective of the study and will consider alternatives options after appropriate discussion with Council officers.

Catchment Description	Proposed Maximum Grid Size (m x m)
State Forest	No limit
Rural (zone 1a,1c and 1d)	12 x 12
Residential (zone 2a, 2b, 2c, 2d, 2e and 2g)	4x 4
Industrial and Commercial	4x4
River and tributary floodways	4 x4

There are 70 culverts which detail survey information is available for that are to be included in the hydraulic model. For 15 of these culverts, a sensitivity analysis for blockage is required for 1%AEP flood event. These culverts will be identified after preliminary hydraulic model runs.

A6.7 Model Calibration and Validation

A6.7.1 General Requirements

The Consultant shall calibrate and validate the hydrologic and hydraulic models using available data from historical flood event(s). Where sufficient data is available at least 3 flood events, the selection of which is to be approved by Council, are to be used for calibration/validation.

Model parameters for calibration events should reflect the relevant catchment and floodplain conditions at the time of these events. Where possible floodplain topography including structures on the floodplain should reflect the conditions that existed at the time. The differences between the current situation and that at the time of the selected events is to be clearly outlined. A clear outline of the modelling parameters used for each event is to be given.

A6.7.2 Specific Requirements

Calibration information available includes:

Historical flood information for the 2007 flood event is available for 4 of water level gauges. A post-flood field survey and report was also completed after the 2007 flood.

A post flood survey and report is also available for October 2004 flood event for Warnervale area.



A6.8 Modelling of Design Events for Existing Conditions

A6.8.1 General Requirements

The design floods to be modelled are specified in Section A3. The use of an extreme flood event instead of the PMF is to be approved by Council.

The Consultant shall modify the calibrated models as necessary to represent accurately the existing catchment and floodplain conditions, and clearly outline the changes in the model and modelling parameters. The Consultant shall liaise with Council in relation to the definition of existing conditions, the selection of design inputs to the model, the adoption of model parameters and adoption of design results.

Where investigation of flood impacts from a variety of flood mechanisms are to be modelled (eg mainstream flooding from catchment runoff &/or from tidal &/or other receiving water backwater flooding, &/or Local Overland Flow) then each mechanism should be appropriately modelled and an envelope approach to reporting adopted.

A6.8.2 Specific Requirements

Wyong River drains into the Tuggerah Lakes system; therefore the flooding in Wyong River is influenced by water level in the lakes. Accordingly, backwater flooding from Tuggerah Lake is to be investigated and appropriate tailwater conditions for different design storm events are to be investigated.

Potential sea level rise will also need to be investigated as part of the determination of appropriate tailwater conditions, as well as changed rainfall intensity as specified in section A6.11.2.

A6.9 Model Parameter Sensitivity and Checks with Alternative Methods

A6.9.1 General Requirements

Sensitivity analyses shall be carried out to assess how much influence the model parameter values have on the results of the calibration and validation. The principal parameters are those simulating rainfall (spatial and temporal), rainfall losses, catchment storage and lag, friction, energy losses and blockage at culverts, bridges and other structures. The sensitivity of the model results to downstream boundary condition shall also be tested. The Consultant is to clearly state the nature and extent of sensitivity testing to be undertaken.

Sensitivity analyses shall also be carried out to assess the relative uncertainty associated with the design results. The Consultant is to clearly state the proposed approach and methodology along with nature and extent of sensitivity testing that will be undertaken.

Sensitivity analyses shall also be undertaken to the potential impacts of climate change in accordance with the Floodplain Development Manual, 2005 and the relevant OEH Guideline.

Where Local Overland Flow flooding and/or tidal and/or other receiving water backwater influence is being investigated, the sensitivity of the model results to downstream boundary conditions due to the interaction between the Local Overland Flow and/or tidal and/or other receiving water influences and mainstream flooding shall be tested, as appropriate.

The model results shall be checked using agreed alternative methods appropriate for the situation. These may include waterway calculations (eg Austroads "*Waterway Design A Guide to the Hydraulic Design of Bridges, Culverts and Floodways*", 1994) and alternate hydrological methods.

The concurrence of the Council shall be obtained in relation to the adoption of model parameter values.

The final Flood Study report shall include a section outlining the results of the sensitivity analyses and model checks and the associated potential ramifications of climate change.

A6.9.2 Specific Requirements

Nil

A6.10 Hydraulic and Hazard Categorisation

A6.10.1 General Requirements

Hydraulic categories and provisional hazard (based on hydraulic considerations such as velocity and depth) categories are to be determined for design events in accordance with the *Floodplain Development Manual*, and the relevant OEH *Guidelines* or as agreed in writing by Council.

To provide early assistance in future land use planning and emergency response it is **also** required that a preliminary true hazard assessment be undertaken taking into account the flood emergency classification of communities. This assessment requires engineering judgement and should account for issues including, but not limited to, rate of rise of floodwaters and emergency response issues generally stemming from isolation, for example, low flood islands as outlined in the OEH Guideline (refer to OEH website for guidelines) on flood emergency response classification of communities. This breakdown is to identify the key drivers of hazard in different areas of the floodplain, for example: velocity, depth, emergency response classification.

The final “True” hazard categories will only be able to be determined during the subsequent Floodplain Risk Management Study.

See Section A4.4.2 for the number of design events for which this information is required.

A6.10.2 Specific Requirements

Floodways to be determined as per OEH guidelines.

A6.11 Modelling and Reporting on Impacts of Climate Change on Flooding and Tidal Inundation

A6.11.1 General Requirements

In areas affected by sea level rise (tidal waterways and ICOLLS) an assessment of the impacts of sea level rise on both tidal inundation and flood levels is to be undertaken.

In addition, sensitivity to the impacts of changing flood producing rainfall events due to climate change needs to be assessed in all cases. This assessment is to be independent of sea level rise modelling runs and reported separately as outlined below.

Tidal Inundation Extents

Existing tidal inundation extents are to be mapped. These extents can be determined based upon the 100% annual exceedance probability tidal inundation for existing conditions.

The impacts of the sea level rise planning benchmarks on tidal inundation extents are to be determined. These can be assessed by adding the relevant 2050 and 2100 benchmarks to the tidal plane and mapping this plane.

Sea Level Rise Impacts upon Flood Planning Areas

Where relevant, that is, in tidal waterways including ICOLLS, modelling for the 1% AEP flood event is also to be undertaken with revised initial water level conditions in the waterway and revised ocean boundary conditions that reflect the impacts of the sea level rise planning benchmarks for 2050 and 2100 on these conditions. The DECCW “Flood Risk Management Guide: Incorporating sea level rise benchmarks in flood risk assessments”, provides advice relevant to the assessment of impacts that are to be considered.

The model results for these events are to be translated into current, 2050 and 2100 flood planning levels and areas using a 0.5m freeboard on the 1% AEP flood level. These areas are to be mapped to meet the needs of council in addressing the “NSW Coastal Planning Guideline: Adapting to Sea Level Rise”.

Sensitivity to Changes in the Intensity of Flood Producing Rainfall Events

The sensitivity of changes in flood producing rainfall events due to climate change can be assessed by undertaking sensitivity analyses for a 10, 20, or 30% increase in flows.

Reporting on Climate Change Impacts on Flooding

The report is to incorporate a specific section on climate change and its impacts. This is to be broken down to provide specific advice on:

- The impacts of sea level rise, where relevant in tidal waterways and ICOLLS.

This is to provide information on both the scale of the impacts of sea level rise on:

- the tidal plane;
- the flood planning area.

It should outline the change in the area, infrastructure and public/private land and property affected by both the changing tidal inundation and the change in flood planning area. The plan of changing extents should highlight the location of major impacts on existing development areas and areas zoned for future development.

- Sensitivity to flood producing rainfall events should be reported based upon the estimated change in impacts between the modelled events and the 1% AEP and 5% AEP flood events. These impacts can be based upon the number of properties affected and damages resulting (where calculated) and consider change in exposure of infrastructure.

A6.11.2 Specific Requirements

Wyong River drains into Tuggerah Lakes, which is an ICOLL with an entrance to the ocean that is managed by Wyong Shire Council so as to reduce the likelihood of complete closure. The tidal range experienced in the lakes system is very minor, and only extends approximately 1.5kms from the mouth of the entrance channel. For the purposes of this flood study, the increase in water levels in the lakes, in both flood and non-flood times is assumed equivalent to the State Government Sea Level Rise benchmarks of 0.4 metres by 2050 and 0.91 metres by 2100. Both of these scenarios must be investigated as part of the determination of appropriate downstream conditions as well as the sensitivity analysis of all climate change impacts.

A6.12 Flood Damage Assessment

This item is not required as part of this study

A6.13 Hand-over of the Study Materials

A6.13.1 General Requirements

At the completion of the project the Consultant is required to handover all data files and provide details of the hardware and software requirements to run the models. The hydrologic and hydraulic software are not required in the hand-over. However any software developed (including source) or acquired by the Consultant to interface or transfer data between the hydrologic model to the hydraulic model or to pre-process data into a format required for input to these models or post-process data to a required output format is to be supplied (along with any licences) to the Council as part of the study.

As a minimum Council needs to be confident that all results presented in the Final Report can be recreated by a specialist Consultant.

The Consultant is to provide the following documentation at handover:

- Survey data including any DTM/DEM model (or other topographic information obtained using aerial survey methods as part of this study) in a format compatible with the software specified in Section A4.8 arranged in file structure similar to that shown in Part A, Figure A3. In addition the cross-sectional data points or topographical terrain x, y, z coordinates in the case of 2D models and structure geometry should be provided in ASCII format.
- Any detailed information collected on floodplain structures.
- A complete set of GIS files, arranged in a suitable file structure in a format compatible with the software specified in Section A4.8.
- Model data files and accompanying specifications, arranged in a file structure similar to that shown in Part A, Figure A3.
- Electronic model output files for all design runs and scenarios as waterRIDE™ files or raw results suitable for translation into waterRIDE™
- Originals of the report including all diagrams, figures and inserts, and a copy of the report compatible with the software specified in Section A4.8. Note: Electronic copies of final reports are also required in PDF format (high quality and website quality).
- Model data including; adopted design inflows, recorded flood levels, flow paths, major floodways, development data and major infrastructures;
- Complete model results including; flood heights, flow distributions, velocities and flood storage variations for all calibration, validation and design events and hydraulic and provisional hazard categories..
- The information necessary for the State Emergency Service under the FRM guideline on SES requirements from the FRM Process.
- Copies of any aerial photographs and satellite images (hard copy and/or electronic) that may have been acquired during the course of the study.

If possible all of the requested information above should also be provided on CD(s)/DVD(s). **Each CD/DVD is to include a fully detailed “Read Me” file to explain the content and purpose of all files on the CD/DVD.** The CD(s)/DVD(s) are to be placed in a suitable wallet to be inserted in copies of the final report as specified in Section A4.4.2.

A6.13.2 Specific Requirements

Council requires the model results presented in a format that is compatible with waterRIDE™ FLOOD Viewer.

A7. MEETINGS

A7.1 General Requirements

Unless otherwise approved by Council, the Consultant shall attend meetings with Council's representatives and/or the Floodplain Risk Management Committee at inception and to discuss the progress of the study. It is envisaged that such meetings will usually take place at Inception and the end of Stages 1 to 5 described in Section A4.2.1 or at the interval specified in Section A7.2 throughout the study period.

The number of meetings to be allowed for and their location is specified in Section A7.2. These are to be included in the fee for the study. A separate cost for additional meetings is to be provided in the proposal (see Attachment C - Cost Schedule, Item A1).

Council may also direct the Consultant to:

- Present the draft flood study report to a public meeting and/or mount a display of the principal findings of the flood study. For this purpose a display period should be allowed for in the study program. An itemised cost for providing this component of work should be provided as part of the fee proposal (see, Attachment C - Cost Schedule).
- Present the Final Flood Study Report to a meeting of Council. An itemised cost for providing this component of work should be provided as part of the fee proposal. (see Attachment C - Cost Schedule).

A7.2 Specific Requirements

All meetings to be held at Wyong Shire Council's Civic Centre, 2 Hely Street, Wyong.

Total of seven (7) meetings are to be included in costing. Expected frequency of meetings –

- 1 – Inception;
- 2 - Calibration and validation of hydrological model;
- 3 - Calibration and validation of hydraulic model;
- 4 – Completion of modelling and mapping report;
- 5 - First Draft Flood Report Completion.

Two (2) meetings during this period to present study findings to the Floodplain Management Committee.

A8. HOLD POINTS

Progress on the study will observe hold points after Stages 2, 3 and 4 (see Section A4.2) have been completed.

Progress on the study will observe hold points after:

- 1 – Calibration and validation report for hydrological model;

- 2 - Calibration and validation report for hydraulic model;
- 3 - First Draft of Hydraulic and Provisional Hazard Categorisations;
- 4 – Completion of modelling and mapping report;
- 5 - First Draft Flood Report

The Consultant shall not progress the study beyond the above hold points without the written approval of Council.

Figure A1 – Localty Plan

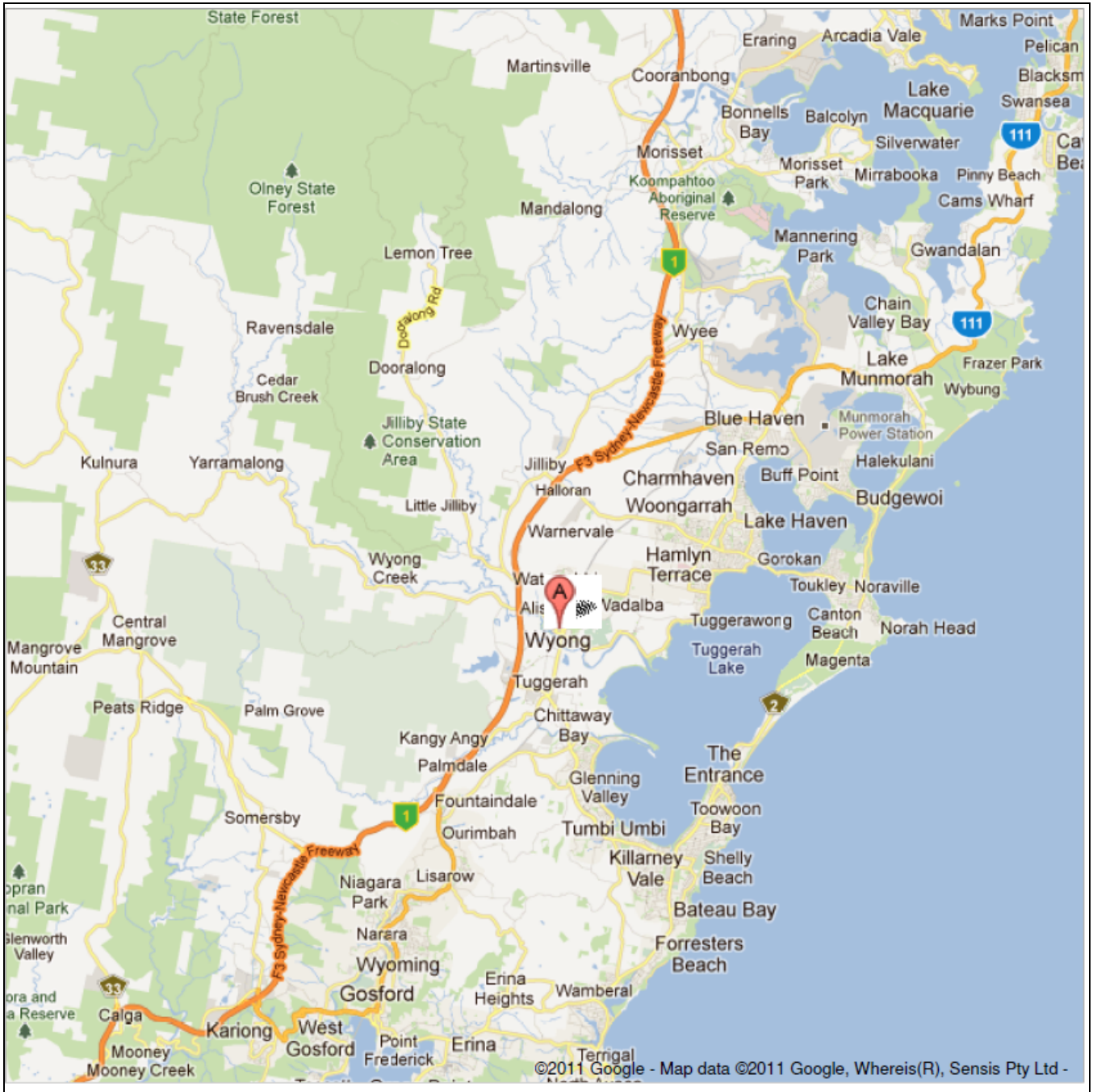


FIGURE A 2 – STUDY AREA

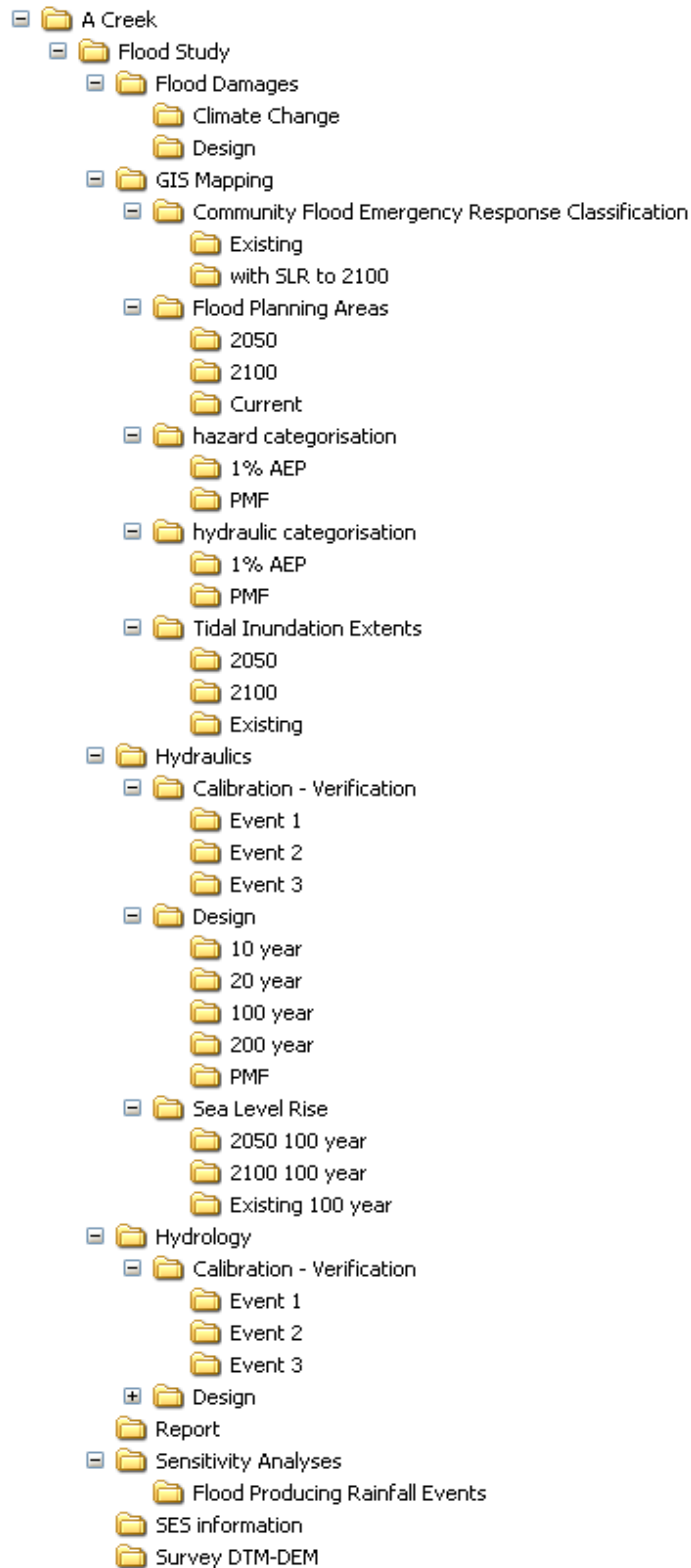
[Refer to the Attachment: Figure A2](#)

FIGURE A3 – BRIDGE/CULVERT LOCATION

[Refer to the Attachment: Figure A3](#)

FIGURE A4 – TYPICAL FILE STRUCTURE

Sample File Structure for submission of data



**ATTACHMENT A HOURLY RATES FOR STUDY TEAM
(MANDATORY)**

Wyong River catchment Flood Study

ROLE	NAME	HOURS	HOURLY RATE	BUDGET COMPONENT

Notes:

Fees will only be paid for personnel nominated on this schedule. Variations to nominated personnel will require the prior written approval of the Principal. Fees may not exceed those nominated on this schedule without the prior written approval of the Principal.

Date: _____
Signed for the _____
Consultant by: _____
(Authorised Officer)

In the Office
Bearer capacity of: _____

Name (*in block letters*): _____

ATTACHMENT B

COST SCHEDULE (MANDATORY)

WYONG RIVER CATCHMENT FLOOD STUDY

Stage 1 – Data Collection, Assessment and Community Consultation	DETAILS REQUIRED
1.1) Data collection and review 1.2) Site inspection(s) 1.3) Survey (including cost of preparing and managing survey Brief) 1.4) Community Consultation – Prepare , distribute brochures, questionnaires etc and process, analyse of returned surveys including preparation of summary report 1.5) Prepare and present progress report for Stage 1	Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost
TOTALS FOR STAGE 1	Estimated hours for each team member and cost
Stage 2 – Model Calibration and Validation	
2.1) Hydrology 2.1.1) Flood Frequency Analysis 2.1.2) Establish Hydrologic Model(s) 2.1.3) Calibrate/Validate Hydrologic Model(s) 2.1.4) Develop design hydrographs 2.1.5) Prepare and present progress report for Hydrological model 2.2) Hydraulics 2.2.1) Establish Hydraulic Model(s) 2.2.2) Calibrate/Validate Hydraulic Model(s) 2.2.3) Prepare and present progress report for Hydraulic model	Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost
TOTALS FOR STAGE 2	Estimated hours for each team member and cost
Stage 3 – Modelling and Mapping	
3.1) Model Design Flood Events 3.2) Determining and Mapping Hydraulic and Hazard Categories 3.3) Sensitivity Analyses including Climate Change 3.4) Sensitivity Analysis for culvert Blockage (15nos) 3.5) Determining and Mapping Preliminary Residential Flood Planning Areas for existing, 2050 and 2100 scenarios 3.6) Prepare and present progress report for Stage 3	Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost Estimated hours for each team member and cost
TOTALS FOR STAGE 3	Estimated hours for each team member and cost
Stage 4 – Draft Flood Study Report	
4.1) Prepare and present draft Flood Study Report	Estimated hours for each team member and cost
TOTALS FOR STAGE 4	Estimated hours for each team member and cost
Stage 5 – Final Flood Study Report	
5.1) Collate and review all comments/submissions regarding the draft Flood Study report. 5.2) Prepare Final Report (including all printing)	Estimated hours for each team member and cost Estimated hours for each team member and cost
TOTALS FOR STAGE 5	Estimated hours for each team member and cost
Stage 6 – Completion of Contract	
6.1) Handover of all study materials	Estimated hours for each team member and cost
TOTALS FOR STAGE 6	Estimated hours for each team member and cost
Disbursements (to be itemised) including 7 meeting	Estimated cost of each item

GST Allowance	Cost
TOTAL PROPOSAL COST	\$
ADDITIONAL COSTS (not included in TOTAL COST)	
A1) Additional Meetings at Civic Center, Wyong Shire Council (see Part A, Section A7).	Cost per meeting
A2) Re-familiarising with suspended project (see Part B, Section B3.8).	Cost
A3) Itemised cost of work NOT detailed in this brief Estimates only - not included in total cost of proposal	Estimated hours for each team member and cost
A4) additional hydraulic model runs for one events excluding PMF	
A4) additional hydraulic model runs for six events excluding PMF	