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WBM OCEANICS AUSTRALIA

16 September 1999

McGlashan and Crisp Pty Ltd
117 Victoria St.
TAREE NSW 2430

Attn: Greg Crisp

Dear Sir

RE: GLACKEN STREET FLOOD IMPACT ASSESSMENT FOR THE ROCHE GROUP

Please find enclosed three (3) copies of WBM Oceanics Australia's report on the flood impact assessment for the proposed sub-division at Glacken Street, Harrington.

It should be noted that this report supersedes our previous report number N0208.1.0 of the same title (dated 2/7/97). This current report differs from this older report as it:

- assumes that the works proposed for Harrington Waters Estate are constructed;
- includes a detailed assessment of the culvert crossing of Jabiru Driver proposed;
- addresses the issues relating to access across Jabiru Drive in times of flood.

Please call me if you have any queries on this report.

Yours faithfully
WBM Oceanics Australia

Greg Rogencamp
Newcastle Manager

FLOOD IMPACT ASSESSMENT
GLACKEN ST. SITE
HARRINGTON

Prepared for: The Roche Group Pty Limited

Prepared by: WBM Oceanics Australia
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Original Date of Issue: 17th September, 1999

Project Manager: Greg Rogencamp

Library Ref: N0401.1.0

Title:	Flood Impact Assessment - Glacken St Site, Harrington
Author:	Greg Rogencamp
Client:	The Roche Group
Client Contact:	Bob Walsh
Client Reference:	

Synopsis: WBM Oceanics Australia was commissioned by McGlashan and Crisp Pty Ltd (on behalf of The Roche Group Pty Ltd) to assess the impacts to flooding processes associated with filling of a parcel of land in Glacken Street, Harrington. This report describes the existing flooding characteristics of the area and quantifies the impacts of the proposed works.

REVISION/CHECKING HISTORY

REVISION NUMBER	DATE	CHECKED BY	ISSUED BY	DISTRIBUTION - NO. OF COPIES			
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0	17/9/99	JRB	GJR	1		1	

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1 INTRODUCTION

WBM Oceanics Australia was commissioned by McGlashan and Crisp Pty Ltd (on behalf of The Roche Group Pty Ltd) to assess the impacts to flooding processes associated with filling of a parcel of land in Glacken Street, Harrington.

This report describes the existing flooding characteristics of the area and quantifies the impacts of the proposed works. The work in this study draws upon the results of the Manning River Flood Study (PWD, 1991) and the Manning River Floodplain Management Study (Willing and Partners, 1996).

2 EXISTING FLOOD CHARACTERISTICS

2.1 Flood Behaviour

The Glacken Street site is in the floodplain of the Manning River which has an area of approximately 8,100 km^2. The site is located in a low lying area near the mouth of the river's entrance at Harrington. Consequently, the flooding characteristics of the site are dominated by the flooding behaviour in the mouth of the river.

In large Manning River flood events, elevated river levels result in elevated water levels in the Harrington Back Channel. These higher levels drive flow up Wards Creek and flood the flat swampy land to the north of the site. This flooding behaviour is demonstrated by an analysis of historical flood levels and by numerical modelling of synthetic design flood events.

In rare flood events (eg. those that occur on average every century) the elevated river levels in this lower reach of the Manning River are dominated by elevated ocean water levels. These elevated ocean water levels are the result of low pressure weather systems causing storm surge and wave-setup.

North of the site is a large flat swampy area including the Great Swamp, Harrington Lagoon and Crowdy Lagoon. However, the local drainage in the vicinity of the site is dominated by Wards Creek. Its catchment is most probably (without the benefit of detailed ground survey) defined by the fire trail road running from Harrington Road to the north-east. The majority of this area is flat and swampy.

The flooding of the site resulting solely from runoff from this local catchment with no back-up flow from Wards Creek and Harrington Back Channel has not been considered by this study. However, it is unlikely that local runoff would produce higher flood levels than that resulting from back-up flow from the Manning River.

2.2 Flood Model

A numerical model of the Manning River system was developed by WBM Oceanics Australia (then trading as Oceanics) as part of the Manning River Flood Study (PWD, 1991).

The model has two parts; a hydrologic model and a hydraulic model. The models aim to simulate the flooding characteristics and behaviour of the Manning River system and floodplains over the duration of a flood event.

The hydrologic model simulates the process of rainfall on the catchment becoming flow in a river. The hydrologic model is made up of a number of sub-catchments which are represented by parameters such as the area, length, vegetation cover and steepness of each sub-catchment. The inputs to the hydrological model are rainfall patterns (over the duration of the flood event) and the outputs are flows (over the duration of the flood event).

The hydraulic model uses as input the flows from the hydrologic model as well as the variations in ocean water levels (over the duration of the flood event). The hydraulic model simulates the relationships between flows and water levels in the rivers and creeks and on the floodplain. The hydraulic model represents over 350 flowpaths with parameters such as the size (width and area of flow), slope and roughness of the waterway. There are over 40 flowpaths within the study area represented in the model. It also simulates the capacity of

over 170 storage areas on the floodplain.

Hence, using rainfall as input into the hydrologic model and in conjunction with the hydraulic model, the models can reproduce flood level behaviour anywhere on the floodplain or in the river system.

2.3 Existing Conditions

It has been assumed for the purposes of this assessment that the Harrington Waters Estate development has been approved and constructed. Hence, the existing conditions described below are those of the developed case of Harrington Waters Estate.

In detail, this assumes that the following features are constructed:

- filling of Stages 1 to 4 as per the Harrington Waters Estate Flood Impact Assessment (WBM Oceanics Australia, 1998) to above the 1% AEP flood level plus a freeboard;
- flap-gating of Harrington Road culverts at the central creek and raising of Harrington Road to above the 1% AEP flood level plus a freeboard;
- construction of the lakes associated with the proposed golf course.

Hence, an effective barrier to flood flows is created between the Manning River and the land to the north of Harrington Road and the west of Wards Creek.

2.4 Flood Levels

As described in Section 2.1, the flood levels during large and infrequent flood events on the site are dominated by elevated ocean water levels. The flood levels on the site for the 100, 50 and 20 year ARI (Average Recurrence Interval) are shown in Table 2.1.

Table 2.1 - Design Flood Levels

Flood Event (ARI)	Flood Level (mAHD)	Ocean Level (mAHD)
100	2.04	2.26
100 (with 20 year ARI ocean level)	1.87	1.90
50	1.86	2.18
20	1.53	1.90

The Flood Standard, as prescribed by the Manning River Floodplain Management Study is the 100 year ARI flood event combined with the 20 year ARI ocean levels, with a proviso in the Harrington area that no peak flood levels should be below 2.26 mAHD (ie. the 100 year ARI peak ocean level). Hence, the design flood level for the site is 2.26 mAHD.

3 IMPACT OF PROPOSAL

3.1 Description of Proposal

The proposal involves filling of land adjacent to Wards Creek for the purposes of creating an area of approximately 5 ha suitable for residential development. In regard to flooding characteristics, the proposal will result in:

- a minor loss of flood storage in this area of approximately 5 ha;
- a reduction in the overland flow conveyance capacity of Wards Creek;
- a constriction in Wards Creek associated with the road access (Jabiru Drive) to the property which will result in a minor head loss. The creek crossing is proposed to have 2 x 1.0m high x 1.8m wide rectangular box culverts and a road deck with a minimum level of 1.6 mAHD.

These changes to the hydraulic characteristics of the area were simulated in the ESTRY hydraulic model. Simulations of the four design flood events were then carried out to quantify the impacts and these are discussed below.

3.2 Impacts To Flood Behaviour

The primary impact of the proposal is to impede the flow of flood waters from the Manning River (and the Harrington Back Channel) through Wards Creek and onto the large swampy area to the north of Harrington. The road crossing across Wards Creek is the major reason for this impedance of flow.

The filling associated with the proposal will have negligible impact due to the site representing a very small fraction of flood storage available north of Harrington Road.

The reduction of the overland flow conveyance capacity is also negligible in relation to the extensive area remaining to accommodate overland flow.

3.3 Impacts To Flood Levels

The impacts to flood levels for the area in the immediate vicinity of the site are shown in Table 3.1 (impacts are rounded to the nearest 5mm).

Table 3.1 - Impacts to Flood Levels

Flood Event (ARI)	Flood Level (mAHD)	Increase (mm)
100	2.05	5
100 (with 20 year ARI ocean level)	1.87	0
50	1.86	5
20	1.54	15

It is apparent from the results presented in Table 3.1 that the impacts to peak flood levels in Wards Creek are minimal. This magnitude of increase is considered to be negligible in relation to the existing depths of inundation on the floodplain of 1 to 2m. It can also be considered negligible in relation to other common occurrences during flooding including boat and wind waves that can result in flood level increases of similar magnitudes.

The impacts listed above are the largest impacts predicted in the area. The location of this maximum increase is in Wards Creek to the south of the site. This region experiences an increase due to the obstruction in Wards Creek (ie. the culvert crossing for the road access) resulting in a head loss as water flows from the Harrington Back Channel to Wards Creek and the low-lying floodplain storage areas to the north.

3.4 Level of Flood Access

The increase is highest for the 20 year ARI flood as this flood will not result in overtopping of Jabiru Drive. Hence, Jabiru Drive crossing of the creek will become inundated for floods greater than the 20 year ARI flood.

In the 100 year ARI flood event (with a 20 year ARI ocean level), the depth of water over Jabiru Drive will be approximately 250mm. The peak velocity of flow will be approximately 0.6 m/s. Based on data presented in the NSW Floodplain Development Manual (1987), this combination of depth and velocity would cause unstable driving for some cars. However, wading would be safe.

It should be noted that Jabiru Drive would be inundated to similar levels along its existing length to the south-east of the site. Hence, the proposed development would have a similar access to evacuation routes as the existing urban areas nearby.

4 CONCLUSIONS AND RECOMMENDATIONS

This study considered the impacts of changes to the land form of a site in Glacken Street, Harrington to the flooding characteristics of the surrounding area. The study focussed on the impacts to flood events dominated by Manning River flows.

The filling and works associated with the proposed residential development (ie. the culvert crossing of Wards Creek) will have a minimal effect on surrounding flood levels. The main reasons for this are:

- the minor area of filling in relation to the floodplain storage area available in the vicinity;
- the nature of the area as a flood storage area and not a floodway;
- the minor changes to Wards Creek's conveyance capacity.

The level of flood immunity of the Jabiru Drive crossing of the creek would be the same as that for the existing sections of Jabiru Drive.

5 REFERENCES

Australian Water and Coastal Studies - AWACS (1989) *Elevated Ocean Levels - Manning River Entrances* Report No. 89/05

Greater Taree City Council (1996) *Draft Manning River Floodplain Management Study*

NSW Floodplain Development Manual (1987) *Floodplain Development Manual*

Public Works Department (1991) *Manning River Flood Study* Report No. 90029

WBM Oceanics Australia (1998) *Harrington Waters Estate Flood Impact Assessment*

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Original Date of Issue: 2 July, 1997

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Library Ref: N0208.1.0

Title: Flood Impact Assessment - Glacken St Site, Harrington

Author: Greg Rogencamp

Client: Peakhurst Properties Pty Limited

Client Contact: Bob Walsh

Client Reference:

Synopsis: WBM Oceanics Australia was commissioned by Peakhurst Properties Pty to assess the impacts to flooding processes associated with filling of a parcel of land in Glacken Street, Harrington. This report describes the existing flooding characteristics of the area and quantifies the impacts of the proposed works.

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FLOOD IMPACT ASSESSMENT
GLACKEN ST. SITE
HARRINGTON

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The proposal involves filling of land adjacent to Wards Creek for the purposes of creating an area of approximately 5 ha suitable for residential development. In regard to flooding characteristics, the proposal will result in:

- a minor loss of flood storage in this area of approximately 5 ha;
- a reduction in the overland flow conveyance capacity of Wards Creek;
- a constriction in Wards Creek associated with the bridge/culverts to the property which will result in a minor head loss.

These changes to the hydraulic characteristics of the area were simulated in the ESTRY hydraulic model. Simulations of the four design flood events were then carried out to quantify the impacts and these are discussed below.

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The primary impact of the proposal is to impede the flow of flood waters from the Manning River (and the Harrington Back Channel) through Wards Creek and onto the large swampy area to the north of Harrington. The road crossing across Wards Creek is the major reason for this impedance of flow.

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50	1.95	15
20	1.65	5

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4 CONCLUSIONS AND RECOMMENDATIONS

This study considered the impacts of changes to the land form of a site in Glacken Street, Harrington to the flooding characteristics of the surrounding area. The study focussed on the impacts to flood events dominated by Manning River flows.

The filling and works associated with the proposed residential development (ie. the culvert crossing of Wards Creek) will have a minimal effect on surrounding flood levels. The main reasons for this are:

- the minor area of filling in relation to the floodplain storage area available in the vicinity;
- the nature of the area as a flood storage area and not a floodway;
- the minor changes to Wards Creek's conveyance capacity.

The size of the culverts under the road access crossing to the site should be sufficiently large as to not significantly impede the flow of water either from the local catchment to Wards Creek or from the Back Channel up Wards Creek to the flood storage area (in times of elevated Manning River levels).

As a guide, the degree of restriction from bank full flow in Wards Creek through the culverts should not be more than 50%. This sizing could be refined with more detailed survey data obtained at the time of detailed design of the structure. However, it is feasible to construct such a structure to have a negligible impact on the flooding characteristics of Wards Creek.

5 REFERENCES

Australian Water and Coastal Studies - AWACS (1989) *Elevated Ocean Levels - Manning River Entrances* Report No. 89/05

Greater Taree City Council (1996) *Draft Manning River Floodplain Management Study*

Public Works Department (1991) *Manning River Flood Study* Report No. 90029