
BYRON SHIRE COUNCIL

MARSHALLS CREEK FLOODPLAIN MANAGEMENT PLAN

**ADOPTED BY COUNCIL
ON 25 NOVEMBER 1997**

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GLOSSARY - Terms and Abbreviations

Australian Height Datum (AHD): a common national plane of level corresponding approximately to mean sea level.

Reduced Level (RL): a measured height above Australian Height Datum.

Nearshore Zone: Inshore zone (extending through breaker zones) and including areas of nearshore currents.

Significant Wave Height: A parameter used to define the characteristics of ocean waves within a real sea. Normally defined as the average height (from crest to trough) of the one third highest waves.

Flood Probability

Annual Exceedence Probability (AEP): the probability of an event (say a flood) occurring or being exceeded in any one year.

Probable Maximum Precipitation (PMP): the rainfall calculated to be the maximum that is likely to occur.

Probable Maximum Flood (PMF): the flood resulting from the PMP Storm.

Flood Classifications

Flood Hazard: potential for damage to property or risk to safety of persons due to flooding.

High Hazard: possible danger to life and limb, evacuation by trucks difficult; potential for structural damage; social disruption and financial losses could be high.

Low Hazard: able-bodied adults would have difficulty wading, evacuation by trucks not difficult.

Floodways: areas of significant flood flow which, even if only partially blocked, cause significant redistribution of flow, the product of depth and velocity of floodwaters exceeds 1.0 m²/sec.

Flood Storage: areas of the floodplain used principally for temporary storage of floodwaters, flow velocity less than 0.3 m/sec.

Flood Fringe: remainder of land affected by flooding which is not classified Floodway or Flood Storage.

Flood Damages

Direct Damage: damage caused by contact with flood water eg. structural damage to building, water damage to furniture or house contents or damage caused by silt and debris.

Indirect Damage: damage caused by flooding though not directly eg. loss of trade, cost of alternative accommodation or loss of wages.

Tangible Damage: damage that can be quantified in monetary terms, includes direct and indirect damages.

Intangible Damage: damage that occurs but is difficult to quantify eg. increased stress in the community or disruption to community life.

Potential Damages: an estimate of the flood damage that represents the maximum damage loss ie no action is taken to reduce the damage.

Actual Damage: an estimate of the flood damage that makes allowance for any action taken to reduce the damage.

Mean Annual Damage: an estimate of the annual average damage from the full range of floods. It is obtained by summation of the product of damage and probability over the full range of flood

Floodplain Development

Manual or Floodplain Development Manual: The New South Wales Government publication "Floodplain Development Manual", 1986.

Development: the erection of a building or carrying out of work on the subdivision of land.

Infill Development: the development of vacant lots which are generally surrounded by developed properties.

Compatible Development: development which is appropriate to both the flood hazard at the site and the impact of the development on flood levels and flows.

Floodplain Filling: the removal of air-space available for the temporary storage of floodwaters by the placement of solid material or construction of an impermeable barrier.

Minor Addition: an increase in the existing ground floor area of 10% or 30 sq m, whichever is the lesser.

Government Departments/Bodies

BOM - Commonwealth Bureau of Meteorology
FWCC - Flood Warning Consultative Committee
DLWC - Department of Land and Water Conservation
SES - New South Wales State Emergency Service

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FOREWORD

The New South Wales Government's Flood Policy is directed at providing solutions to existing flooding problems in developed areas as well as ensuring that new development is compatible with the flood hazard and that it does not create additional flooding problems in other areas.

Under the policy, the management of flood-prone land remains the responsibility of local government. The state government subsidises flood mitigation works to alleviate existing problems, providing specialist technical advice to assist councils in the discharge of their floodplain management responsibilities.

The flood policy provides for technical and financial support by the government through the following four sequential stages:

*** Stage 1 - Flood study:**

Determines the nature and extent of the flood problem.

*** Stage 2 - Floodplain management study:**

Evaluates management options for the floodplain in respect of both existing and proposed development.

*** Stage 3 - Floodplain management plan:**

Involves formal adoption by council of a plan of management for the floodplain.

*** Stage 4 - Implementation of the plan:**

Involves construction of flood mitigation works to protect existing development and includes use of local environmental plans to ensure new development is compatible with the flood hazard.

The Marshalls Creek Floodplain Management Plan constitutes completion of the third stage of the management process for the Marshalls Creek tributary of the Brunswick River. It has been prepared for Byron Shire Council to formulate an appropriate floodplain management strategy.

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1. PREAMBLE

Flooding is a natural phenomenon with random characteristics. Floods of any size can occur at virtually any time, particularly during the summer wet season. Floods can cause damage to property and affect the lives, livelihoods and life-styles of residents.

Floodplain management aims to reduce the impact of floods on individuals and the community as a whole. This requires an integrated approach which takes into account the risk and consequences of flooding as well as the social and environmental issues relating to flooding and flood mitigation/management.

The primary objective of the Government's Flood Policy is to reduce the impact of flooding and flood liability on individual owners and occupiers and to reduce private and public losses resulting from floods. The Policy requires that a merit approach be followed when dealing with planning, development and building on flood-labile land.

The floodplain management process as defined in the NSW Floodplain Development Manual (Ref.1) is presented schematically in Exhibit 1. The principal activities are:

- A. Establishment of a floodplain management committee;
- B. Drafting of an interim local floodplain policy;
- C. Completion of a flood study to define flood behaviour and risk;
- D. Selection of an appropriate flood standard, based on assessment of relevant social, economic and environmental factors;
- E. Completion of a floodplain management study to assess structural works and non-structural measures and identify a preferred management strategy;
- F. Preparation of a draft Floodplain Management Plan; and
- G. Implementation of the Floodplain Management Plan.

This draft Floodplain Management Plan represents Activity F above and draws on information presented in the Marshalls Creek Floodplain Management Plan Report (Ref.2).

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2. PLAN AIMS AND OBJECTIVES

The Marshalls Creek Floodplain Management Plan seeks to reduce the impact of flooding and flood liability on individual owners and occupiers and to reduce private and public losses from flooding.

The Plan aims to achieve the objectives by:

- * Alerting the community to the extent and hazard of flood-labile land in the Marshalls Creek area.
- * Informing the community of Council's policies in relation to the development and use of flood liable land.
- * Definition of a flood standard to be used for planning purposes.
- * Reduction of the risk to human life and damage to property caused by flooding by appropriate works and measures and by controlling development on flood prone land.
- * Adoption of requirements for development and for the use of land which is compatible with the land's flood hazard.
- * Reduction of the impact of flooding on existing development by a series of works and measures.
- * Prevention of flood losses in future development areas by application of effective planning and development controls.
- * Provision of controls with regard to flooding such that applications for development (including sub-division, rezoning, development and building applications) can be assessed both consistently and on merit in accordance with the NSW Floodplain Development Manual (published by NSW Government, 1986).
- * Incorporation of plan provisions into planning policy provisions.

Ecologically sustainable development (ESD) principles are now embodied through government policy (in particular the Environment, Planning and Assessment Act, Regulations 1994).

The Plan seeks to satisfy ESD principles of:

- * Intergenerational equity, that is the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations;
- * Conservation of biological diversity and ecological integrity;

- * Active and meaningful community participation in identifying issues, responses and strategies and decision making;
- * Precautionary principle in that lack of scientific certainty is not a reason for the lack of amelioration measures to prevent environmental degradation where a threat of serious or irreversible environmental damage exists; and
- * Inclusion of valuations of environmental costs of activities and the costs of changes to biodiversity, ecological and cultural values.

Changes in land use within the upper catchment area of Marshalls Creek can alter flood behaviour on the lower floodplain. This Plan seeks to promote the adoption of an integrated approach to the management of all lands within the Marshalls Creek catchment.

3. THE PLAN AREA

The Marshalls Creek Floodplain Management Plan covers the floodplain of Marshalls Creek, its tributaries and the "North Arm of the Brunswick River", as follows:

- Marshalls Creek from Billinudgel to its confluence with the Brunswick River.
- Yelgun Creek, east of the Pacific Highway and south of Byron Shire boundary.
- Billinudgel Creek, east of the Pacific Highway and south of Byron Shire boundary.

The boundaries of the Plan area are shown on Exhibit 2.

Flooding in the Management Plan area can be affected by activities north of the Byron Shire boundary. Thus, the Plan extends north to Wooyung Road (see Exhibit 2).

The Plan provides recommendations for the floodplain management of the Wooyung area. The recommendations include the development of appropriate floodplain management measures, in consultation with Tweed Shire Council.

The Plan includes general provisions, which are applicable to all land within the Plan Area and local provisions, which are applicable to different sectors within the Plan Area.

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4. DESIGNATED FLOOD LEVELS

The Designated Flood Level at a particular site is the flood level adopted for planning purposes and represents the minimum level of flood protection considered appropriate for the nature of development at the site.

Council has adopted the 1% AEP flood level as the appropriate "flood standard" for development within the Plan area. Following completion of the 1986 flood study, Council adopted a set of "Designated Flood Levels" for fixing of floor levels within the Plan area. These Designated Flood Levels have not been altered since being adopted. The Designated Flood levels throughout the Plan Area are shown on Exhibit 2.

The Designated Flood Levels are nominally higher than the design 1% AEP flood event. In the Floodplain Management Plan report there was found to be little reason for reduction of the Designated Flood levels.

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5. GENERAL MANAGEMENT PRACTICE

5.1 Preamble

The North Coast Regional Environmental Plan (1988), North Coast Urban Planning Strategy, Council's LEP (1988), the NSW Floodplain Development Manual and other planning instruments actively discourage further development of flood-prone land.

The management practices and controls contained in this management plan have been developed in accordance with the principles contained in the above documents.

The plan is structured into two levels of management practice. The first level, "General Management Practice", applies throughout the whole study area unless such practice is modified in specific identified localities by "Local Area Practices".

The general structure below is intended to be applied throughout the whole study area.

The bulk of the sub-divided land in the floodplain has been developed. Flood hazard, defined in accordance with the NSW Government "Floodplain Development Manual", is predominantly "High Hazard - Flood Storage" and "High Hazard - Flood Fringe" with some "Low Hazard - Flood Storage".

Flood hazard and extents are based on the best topographical information available at the time of preparation of the management plan. Actual conditions at any site should be determined with reference to the Marshalls Creek Floodplain Management Plan Report and surveyed ground levels at the site.

Removal of existing development from the floodplain is not seen as practicable nor socially acceptable.

The large structural works investigated in preparation of this Plan do not create major reductions in flood levels nor do they reduce flood hazard. This result is a function of the low lying nature of the Marshalls Creek floodplain and its proximity to the ocean.

The Plan does not incorporate structural flood mitigation works, as these were found to provide minor benefits for existing development. However, any of the structural works may be undertaken at some time in the future, if it can be proved that such works are required in order to protect a large number of houses from flooding, there is a major change in the flood regime of the catchment, the works can be carried out with minimal impact to the environment, and the cost-effectiveness of the works is acceptable to the community.

The Floodplain Management Plan allows for continued occupation of the floodplain with improvements to public information and flood warning procedures to ensure the community is aware of the flood risks and can act appropriately.

The Plan comprises the following general controls, with the local controls detailed in the following chapter.

5.2 New Sub-division of Flood-liable Lands

Issues:

- Development of flood liable land increases the damages and social disruption caused by floods.
- Development on flood liable land simply places greater numbers of people at risk.
- Analysis using the flood models indicates that further large scale sub-division and filling of such sub-divisions will create significant increases in flood levels at existing buildings.
- The North Coast Regional Environmental Plan (1988), North Coast Urban Planning Strategy, Council's LEP (1988), the NSW Floodplain Development Manual and other planning instruments actively discourage further development of flood-prone land.

Management Practice:

1. Development of flood-liable land shall not be encouraged.
2. Further sub-division and filling of the flood liable lands shall not be permitted other than outlined later in this Plan.

Controls:

1. A moratorium be placed on further large scale sub-division and filling on the floodplain.

5.3 Development of Existing Lots and Existing Sub-divisions

Issues:

- While development of existing lots and sub-divisions on flood liable lands will maintain the number of properties at risk, new buildings, extensions and re-development should be located above the Designated Flood levels by at least a freeboard of 0.5 metres. This provision will provide flood protection in events up to the Designated Flood but would not render the buildings as totally flood free.
- Continued use of buildings will require use of flood compatible materials, construction and detailing below the defined flood levels.

Management Practice:

1. Floor level control so that new buildings, extensions and re-developments are above the Designated Flood and a freeboard of 0.5 m.
2. Building controls to ensure that flood compatible materials are used below set floor levels.
3. Building controls to ensure building detailing and uses are flood compatible (eg Building controls to ensure electric wiring is flood protected, control over storage of materials that create significant nuisance if dispersed by flooding).
4. Encouragement of building forms and construction that can be easily raised in the future (eg clad timber framed houses on stumps).
5. Where considered to be the appropriate method of effluent disposal, effluent disposal mounds are to be located where they will provide minimal obstruction to local drainage and flood flows.

Controls:

1. Building application process should include:
 - minimum required floor levels
 - requirements for flood compatible materials
 - requirements for building detailing to ensure flood compatibility
 - building structure control to ensure buildings are stable and safe during floods
2. Effluent disposal mounds, where appropriate, shall be located to provide minimal obstruction to local drainage and flood flows.

5.4 Public Information and Education Programs*Issues:*

- The Plan allows for the continued occupation of existing sub-divisions on the floodplain of Marshalls Creek.
- The flood hazard in the Marshalls Creek floodplain varies from "Low Hazard" to "High Hazard" in accordance with NSW Floodplain Development Manual.
- Continuing information and education is required to maintain flood awareness in the community as to the risks involved in continued occupation of the flood liable areas. The need for public information and locally relevant flood information was raised as a significant community concern during the consultation process adopted during this study.

- Whilst the SES has a role in the area of public information and education, the organisation appears under-funded and under-resourced to adequately undertake the public information role.

Management Practice:

1. Byron Shire Council and the SES to jointly develop locally specific and detailed public information outlining:
 - flood risk
 - flood warning procedures
 - flood evacuation routes
 - flood evacuation centres
2. Public information be distributed annually throughout the flood liable area and to new owners when properties change ownership. Inclusion of public information with rate notices may be an appropriate mechanism.
3. Regular displays of the public information on flooding be arranged in public places to inform those groups of the community who do not receive Council "rate notices".
4. Council amend the wording on Section 149 Certificates as to accurately identify flood liability in particular flood events.

Controls:

1. Byron Council and the SES should monitor the distribution of public information.
2. Public information should be reviewed after each major flood and amended where necessary.

5.5 Flood Warning

Issues:

- The Marshalls Creek system has an operational flood warning system controlled by the SES.
- Marshalls Creek has a short response time to rainfall and thus improvements to the flood warning system will provide benefits in allowing the community more time to take "Flood Fighting" measures.
- A number of improvements are seen as possible within the flood warning system,

Management Practice:

1. Improvements to the warning system be investigated principally covering:
 - water level gauges to provide public information
 - use of local area "Wardens" to assist in distribution of warnings
2. Review of the Flood Plan be undertaken to ensure:
 - consistency of damage and risk areas between all documents
 - flood evacuation centres are located on flood free sites
3. Investigation if established computer models can be used to improve flood prediction systems downstream of Billinudgel.
4. Funding be sought to improve SES capacity to manage flood emergencies.

5.6 Individual Lot Landscaping Provisions*Issues:*

- The Plan allows development of existing individual lots within the flood liable areas.
- The common practice of defining property boundaries and parts of individual properties using solid fencing can cause major re-distributions of flow that would affect other users of the floodplain.
- The re-distribution may be significant at individual property level though the scale of resolution of the floodplain hydraulics models is such that the impacts of work on individual properties will not be defined by such models.
- There is a need to assist local communities on a block by block basis to reduce flood impacts rather than on a precinct by precinct basis.

Management Practice:

1. Communities be encouraged to use landscaping and plantings to separate properties rather than fencing.
2. The practice of solid panel fencing (eg wooden, steel, fibre cement, masonry and brick) be discontinued.
3. Fencing of properties be undertaken with open wire fences.

Controls:

1. Building and development application provisions to be modified to promote open fencing and prevent traditional high "closed" style fencing.
2. Building and development controls such that flood protection measures on any particular block do not adversely affect the drainage and flooding characteristics on the surrounding blocks.

5.7 Trunk Drainage Operations

Issues:

- The community consultation process indicated widespread concern regarding water quality in the river system, blocking of the trunk drainage system with debris and general overland runoff causing inundation and damage.
- The above issues generally relate to frequent flows while this Floodplain Management Plan is directed to larger, less frequent events.
- The issue of trunk drainage operations has been included in the Floodplain Management Plan as a recognition of community concern and to ensure it is not overlooked by government.

Management Practice:

1. A trunk drainage plan through the study area is required to identify works and measures to improve the efficiency of the system and to improve water quality. The review could be undertaken by Council as their funding and priorities permit.
2. Council's building and development conditions be reviewed to ensure they require and enforce the provision of overland flow paths for safe discharge of runoff if the trunk drainage system should become blocked.

5.8 Infrastructure Crossings

Issues:

- Major infrastructure crossings of the Marshalls Creek Floodplain have the potential to increase flood levels (normally called "afflux") caused by either the bridges required for the crossings, the embankments forming part of the crossings or site works at the crossing.

- Given the large amount of development on the Marshalls Creek floodplain, the potential for small flood level increases to affect significant numbers of properties and community concerns, there is a need for a strict assessment and approval procedure.

Management Practice:

1. Byron Council should develop a set procedure for assessing the impact of infrastructure crossings of the floodplain.
2. The established procedure should be applied to all works including those undertaken by Council.
3. Byron Council should notify the various government bodies, authorities and construction groups of the intention to apply the principles of the Floodplain Management Plan to all land within the study area.

5.9 Integrated Catchment Management

Issues:

- Continuing development of the catchment outside the area covered by this Plan may affect the quality and quantity of runoff through the Plan Area.
- Further deterioration of the creek environment is not acceptable to the residents or wider community.

Management Practice:

1. Future development, including changes in land use, shall not result in increased flood flows or pollution loading in the creek system.
2. Appropriate Total Catchment Management strategies will be supported by Council.

Controls:

1. Applications for development approval or change in land use shall be required to demonstrate that such development or change in land use will not increase runoff flowrates or pollution loadings within the Plan Area.

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6. LOCAL PROVISIONS

The Local Provisions of this Plan relate to site-specific conditions in particular localities. The intent of this Plan is that the General Provisions above will apply to all areas while Local Provisions may vary from area to area.

The Local Provisions are presented on a locality basis and are shown on Exhibits 3 to 9.

6.1 Billinudgel

Issues:

- Potential flood damages in Billinudgel exceed the potential damages for the remainder of the Marshalls Creek floodplain for all flood events except for floods larger than the Designated Flood Event.
- All the existing lots within the Billinudgel village area with the exception of the recently constructed "El Dorado" industrial estate are flood liable.
- Flood liable land in and around Billinudgel is predominantly classed as "High Hazard - Flood Storage" with the exception of the Mogo Place industrial area, which is classed in part as "Low Hazard - Flood Storage".
- Toxic and hazardous substances may be stored in industrial buildings on flood-labile land.
- Filling of flood liable lots within existing subdivisions, but not outside of these lots, is possible without creating significant changes in flood behaviour in other parts of the floodplain.

Management Practice:

1. Permit filling of existing lots to 0.5 metres above the Designated Flood levels
2. Building controls to minimise risk of pollution of floodwaters by stored chemicals or other substances.

Controls:

1. Building controls allowing setting of minimum floor levels for new buildings, infill development and building extensions.
2. The storage of all toxic or hazardous substances or other products which in the opinion of Council may be hazardous or pollute floodwaters, must be a minimum of 0.5 m above Designated Flood Level.
3. Development controls to allow filling of existing sub-divisions within the village.

4. Prohibition of further sub-division of flood liable land adjacent to the existing village boundaries.

6.2 South Golden Beach and Ocean Shores North

Issues:

- A levee has been constructed to protect existing development on flood liable land.
- The levee provides protection against the Designated Flood Event but has not been tested as yet against a significant flood event.
- There is community concern that the levee has affected local drainage paths such that ponding now occurs in protected areas.

Management Practice:

1. Use of building controls to set minimum floor levels for habitable floors
2. Require high set construction styles to provide some flood refuge should the levee overtop or fail.
3. Place a moratorium on filling of individual lots until sufficient investigation has been undertaken to identify and quantify appropriate stormwater ponding points.

Controls:

1. Building controls allowing setting of minimum habitable floor levels for new buildings, infill development and major building extensions at RL 3.6 m AHD.

6.3 New Brighton

Issues:

- There are significant numbers of existing dwellings (42 off) that are flood liable.
- The village area is predominantly classified as "High Hazard - Flood Fringe".
- There are vacant lots within the existing sub-division which if filled may affect the flood behaviour on surrounding properties.
- New Brighton also has the threat of ocean wave inundation created by waves breaking through the frontal dune.

Management Practice:

1. Promote voluntary house raising for approximately 25 flood liable houses.
2. Promote flood proofing (via stop boards) to approximately 25 additional houses that are unsuited to raising.
3. Seek funding from government sources for house raising and flood proofing.
4. Building controls to set minimum habitable floor levels at 0.5 m above the Designated Flood level. Minimum floor levels would be set for all new buildings, re-development and major extensions to existing buildings.
5. Building controls covering the form of building, building materials and building details for the structure below the specified minimum floor level.
6. Limited filling may be permitted but only under the building footprint and access from the street and subject to the provision that local drainage patterns shall not be adversely affected.
7. Promote high-set construction with suitable design and material details.
8. Promote use of guide posts and local aids to indicate the best access routes for use during floods.
9. Promote a dune restoration and management program to improve the ability of the dune system to resist wave attack.
10. Appropriate building design guidelines and listing of appropriate materials to ensure flood compatibility.
11. Limiting the building footprint on any one block to that required for a single dwelling.

Controls:

1. Building controls to be developed to:
 - minimum habitable floor levels
 - flood compatible building materials to be used for construction
 - design of buildings to promote flood compatibility
 - prevention of storage of hazardous materials within the flood liable areas

2. Landscaping directions to be developed regarding:
 - fencing
 - flood access indicators
 - effluent disposal mounds

3. As an interim measure:
 - adopt the building material and detail guidelines provided by Appendix F in the NSW Floodplain Development Manual

6.4 Ocean Shores

Issues:

- "High Hazard - Flood Storage" conditions exist over most of the golf course and creek-bank areas.
- Ocean Shores contains some 8 flood liable houses together with an another 88 without adequate freeboard above the Designated Flood Level.
- The houses are generally brick veneer with slab-on-ground construction.
- The Floodplain Management Plan Report opines that they cannot viably be protected to the Designated Flood Level plus an appropriate freeboard (0.5 m) by structural works.

Management Practice:

1. Introduce a flood proofing programme for existing individual buildings to provide protection up to the Designated Flood Level plus a 0.5 m freeboard.
2. Building floor level control for all new building works.
3. Retain existing zoning and development controls for creek-bank areas and golf course.

Controls:

1. Building controls to set:
 - minimum floor levels
 - flood compatible building materials
 - design of buildings to promote flood compatibility

2. Prohibit subdivision or filling of undeveloped "High Hazard" areas.

6.5 Ocean Shores North/South Golden Beach/New Brighton Non-Urban Area

Issues:

- The area is currently zoned as "Rural", "Deferred", "Special Uses - High Hazard (Flood Liable)" or has no zoning.
- The area is predominantly classed as "High Hazard - Flood Storage" in accordance with the NSW Floodplain Development Manual.
- Investigations in the Marshalls Creek Floodplain Management Report indicate that widespread filling will create significant flood increases for the existing development at New Brighton, reduce the freeboard available to the South Golden Beach levee and reduce the freeboard to the Ocean Shores North development area.

Management Practice:

1. Retain existing land use and controls or allow only changes which neither increase exposure to flood losses nor reduce the safety of persons, on the land, adjacent properties or elsewhere on the floodplain.

Controls:

1. Prohibit non-compatible development of "High Hazard - Flood Storage" classed land.
2. Prohibition of further fill or sub-division of the area.

6.6 Yelgun/Wooyung Area

Issues:

- The Billinudgel Creek - Yelgun Creek floodplain, east of the Pacific Highway, is predominantly classified as "High Hazard - Flood Storage" in accordance with the NSW Floodplain Development Manual, due to excessive depth of floodwaters.
- Most of this land is included in the Billinudgel Nature Reserve and is expected to remain undeveloped.
- The Wooyung area lies outside the area administered by Byron Shire Council and is administered by Tweed shire Council.
- During flood times, floodwaters at Wooyung can be connected to the Marshalls Creek floodplain.

- Activities in the Marshalls Creek floodplain can affect flood behaviour at Wooyung (eg the impact of changes to the Kallaroo Circuit bund).
- Similarly activities in the Wooyung area could affect flood levels in the Marshalls Creek area. Principal concern is directed to possible increases in flood levels if widespread filling and sub-division is permitted.
- There is a need to develop a floodplain management system with Tweed Shire Council such that development at Wooyung does not dis-advantage the Marshalls Creek floodplain.

Management Practice:

1. Byron Shire and Tweed Shire to develop a joint floodplain management plan for the Wooyung area which is compatible with this Plan.
2. Prior to development of an effective floodplain management plan, widespread filling of the floodplain should not be permitted.
3. Rural housing to be constructed on flood mounds.

Controls:

1. Building controls to set:
 - minimum floor levels
 - flood compatible building restraints
 - design of buildings to provide flood compatibility
 - flood mounds to provide adequate flood refuge area

7. REVIEW PROVISIONS

The Floodplain Management Plan is not intended to be a fixed provision but subject to regular review and updating and/or modification as flood experience develops with time.

It is proposed to review the Plan on the basis of:

- regular review after each 10 year period
- review after each flood larger than a 10% AEP event

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8. IMPLEMENTATION OF THE PLAN

The Plan contains floodplain management measures which aim to reduce the impact of flooding on existing development and to reduce the risk of flooding of future development on the floodplain.

8.1 Existing Development

The measures to be implemented for existing development comprise:

- raising of 28 houses in New Brighton and 1 house in Ocean Shores which do not have adequate freeboard above the 1% AEP flood
- flood-proofing of 21 houses in New Brighton and 95 houses in Ocean Shores which do not have adequate freeboard above the 1% AEP flood and are unsuited to raising

Funding for house raising may be available through the joint Federal and State Governments and Council funded Flood Mitigation Programme to cover the full cost of house raising. However, funding under the programme is subject to prioritisation on a state-wide basis.

Alternatively, a 2:1 State government - Council grant may be available to subsidise the costs incurred by individuals who raise their houses in compliance with an approved Floodplain Management Plan.

At the present time, there is no government funding provided for flood-proofing. However, as this option is significantly less costly than a levee to provide an equivalent level of protection, a case for a special funding allocation could be argued.

The estimated costs of the measures for existing development area:

house-raising (29 houses)	\$ 1,015,000
flood-proofing (114 houses)	\$ 342,000

It is proposed to implement the house-raising programme over a four year period, based on the depth of flooding in the 1% AEP design event, as shown in Table 1 below.

Table 1**Timetable for House-raising**

Year	Criteria	Number of Houses	Cost \$
1	Depth of flooding greater than 0.4 m	9	315,000
2	Depth of flooding greater than 0.2 m	9	315,000
3	Remaining flood-liable houses	5	175,000
4	Houses with less than 0.5 m freeboard	6	210,000

It is proposed to implement the flood-proofing programme over a three year period, based on the available freeboard in the 1% AEP design flood event, as shown in Table 2 below.

Table 2**Timetable for Flood-proofing Houses**

Year	Criteria	Number of Houses	Cost \$
1	Freeboard less than 0.2 m	32	96,000
2	Freeboard less than 0.4 m	37	111,000
3	Freeboard less than 0.5 m	45	135,000

8.2 Future Development

The floodplain management measures for future development on the floodplain comprise site filling and building controls. The costs of these options are borne by the individual landowners.

It is proposed that the development and building controls related to site filling, minimum floor levels, building design and construction materials be enforced from the date of adoption of this Plan.

8.3 Emergency Management

The SES is responsible for emergency management during flood periods. The SES is generally under-funded and under-resourced to provide optimal emergency management.

Byron Shire Council

Marshalls Creek Floodplain Management Plan - November 1997

Adopted by Council on 25 November 1997

R37/95049FMP.V4

The floodplain management process, as outlined in the NSW Floodplain Development Manual, is completed when this Plan is implemented. However, a general need has been identified within the SES for additional work to be undertaken in order to link floodplain management and emergency management.

The additional work required to enable the SES to provide improved emergency management during flood periods includes, but is not limited to:

- information on the flood-liability of access routes
- relative timing of inundation of different areas of the floodplain
- descriptive information of flood behaviour related to critical flood levels at specific locations, particularly predicted flood behaviour based on flood levels at upstream locations
- interpretation of data available from flood warning systems
- forecast lead times available from flood warning systems

Much of the information required by the SES in order to provide the most effective emergency management is not available from historical flood records or completed flood studies. Therefore, it is generally necessary to undertake additional hydrologic and hydraulic modelling over a broad range of flood scenarios in order to provide the necessary information to complete the "flood card" database operated by the SES.

This information is vital for the safe evacuation of residents from the separate localities on the Marshalls Creek floodplain. New Brighton, South Golden Beach, Ocean Shores North and Billinudgel can all be isolated by floodwaters. Access within parts of Ocean Shores can be affected by floodwaters. Ocean Shores becomes isolated when the Brunswick River floods the Pacific Highway at Brunswick Heads.

It is recommended that funding be sought to enable the necessary investigations to be undertaken to provide the vital link between floodplain management and emergency management and to improve the flood warning system for Marshalls Creek.

8.4 Public Information

The Plan contains provisions relating to on-going public information and education programmes.

Funds for these activities will be requested to be included in Council's annual Budget.

It is recommended that an initial allocation of \$10,000 be provided for the development of on-going flood awareness information and education programmes and that additional necessary funding be provided in each Budget for the on-going programmes.

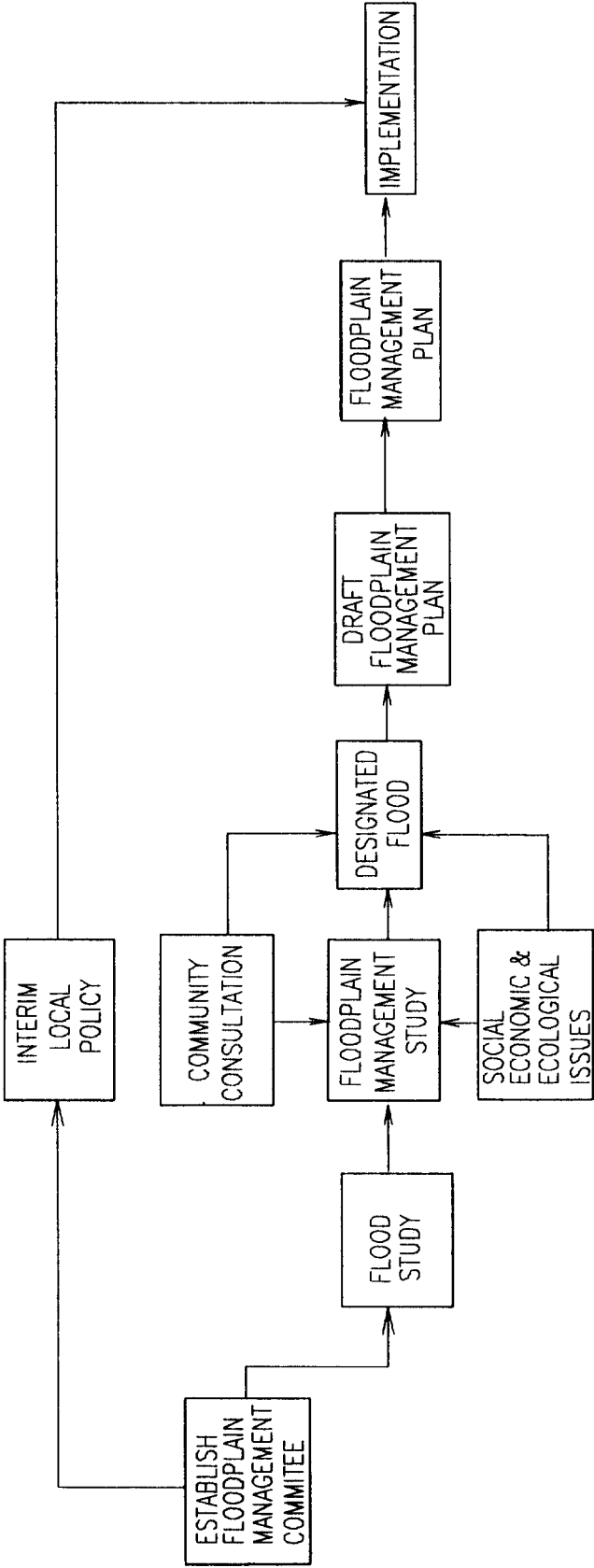
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REFERENCES

1. 'Floodplain Development Manual', New South Wales Government, Dec. 1986.
2. 'Marshalls Creek Floodplain Management Plan Report', Paterson Consultants, Oct 1996

EXHIBITS

MARSHALLS CREEK
FLOODPLAIN MANAGEMENT PLAN



DISK REF: DCAD 95049 7/11/97
FIGURE REF: 95049P-1 (REV 2)

MARSHALLS CREEK
FLOODPLAIN MANAGEMENT PLAN

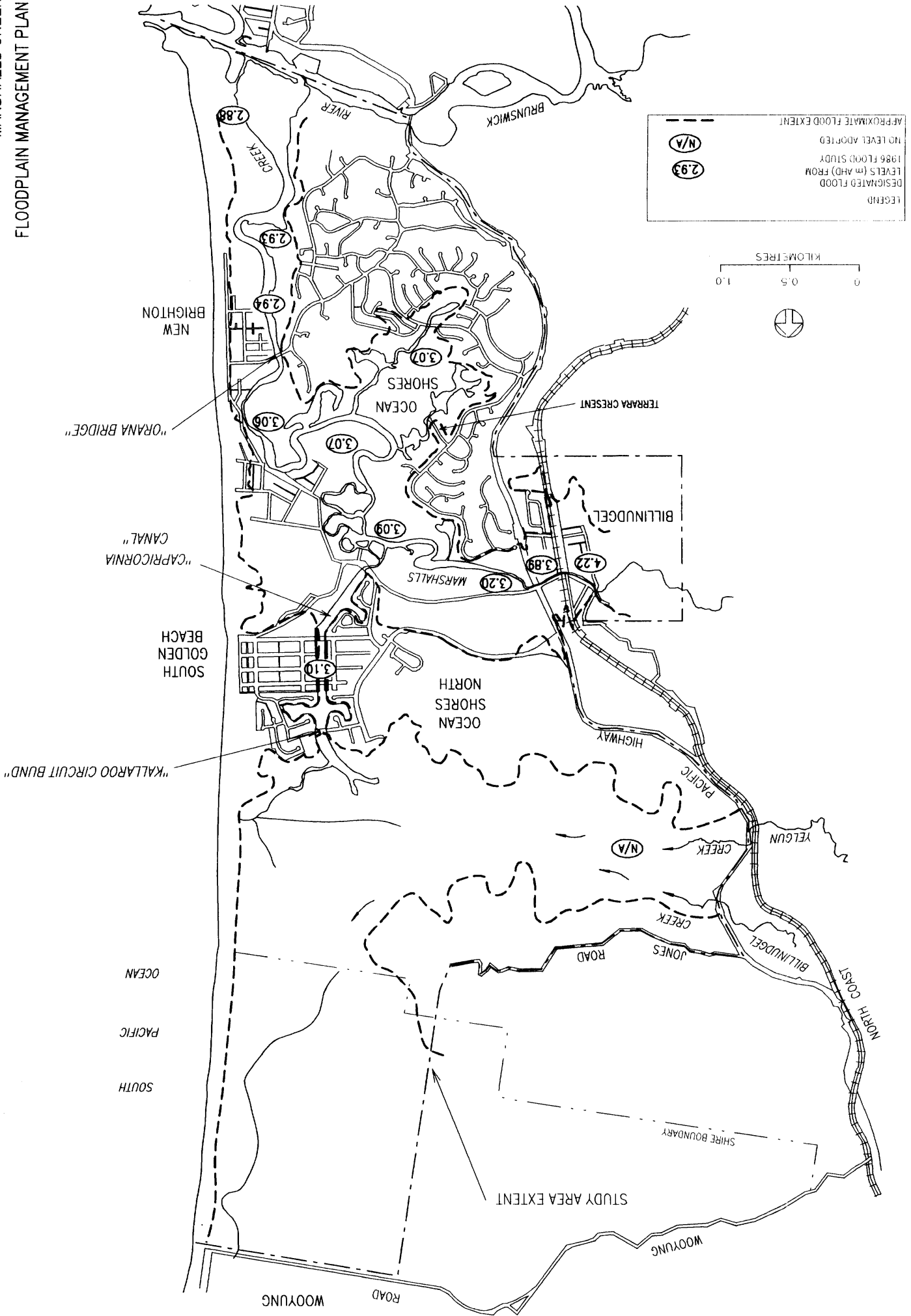
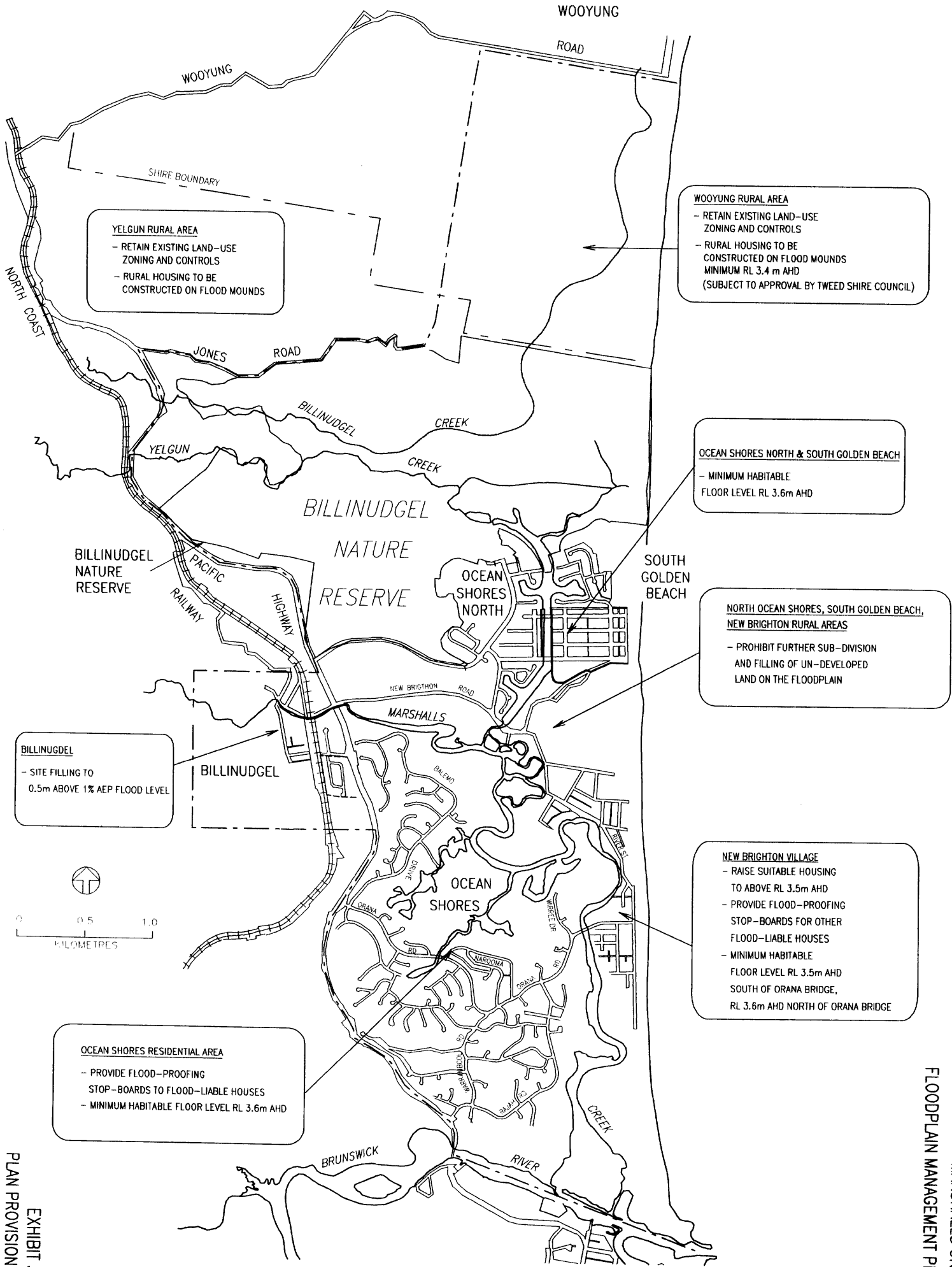


EXHIBIT 2
DESIGNATED FLOOD LEVELS



YELGUN RURAL AREA
 - RETAIN EXISTING LAND-USE ZONING AND CONTROLS
 - RURAL HOUSING TO BE CONSTRUCTED ON FLOOD MOUNDS

WOYUNG RURAL AREA
 - RETAIN EXISTING LAND-USE ZONING AND CONTROLS
 - RURAL HOUSING TO BE CONSTRUCTED ON FLOOD MOUNDS MINIMUM RL 3.4 m AHD (SUBJECT TO APPROVAL BY TWEED SHIRE COUNCIL)

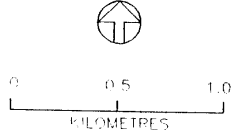
OCEAN SHORES NORTH & SOUTH GOLDEN BEACH
 - MINIMUM HABITABLE FLOOR LEVEL RL 3.6m AHD

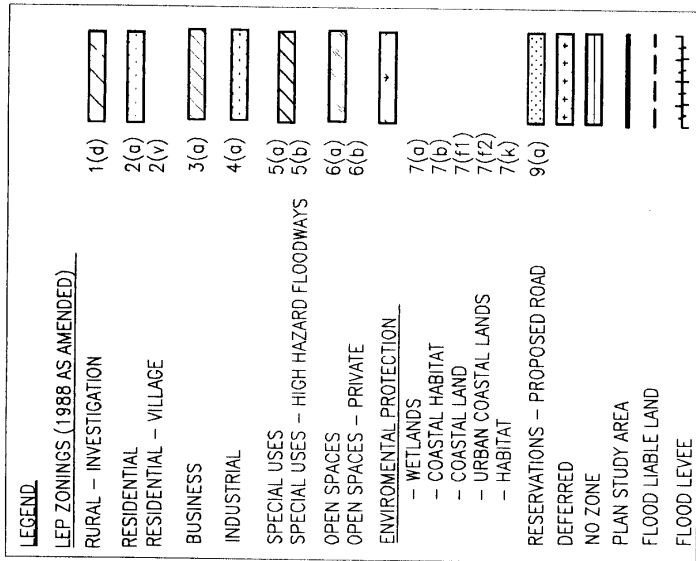
NORTH OCEAN SHORES, SOUTH GOLDEN BEACH, NEW BRIGHTON RURAL AREAS
 - PROHIBIT FURTHER SUB-DIVISION AND FILLING OF UN-DEVELOPED LAND ON THE FLOODPLAIN

BILLINUGDEL
 - SITE FILLING TO 0.5m ABOVE 1% AEP FLOOD LEVEL

NEW BRIGHTON VILLAGE
 - RAISE SUITABLE HOUSING TO ABOVE RL 3.5m AHD
 - PROVIDE FLOOD-PROOFING STOP-BOARDS FOR OTHER FLOOD-LIABLE HOUSES
 - MINIMUM HABITABLE FLOOR LEVEL RL 3.5m AHD SOUTH OF ORANA BRIDGE, RL 3.6m AHD NORTH OF ORANA BRIDGE

OCEAN SHORES RESIDENTIAL AREA
 - PROVIDE FLOOD-PROOFING STOP-BOARDS TO FLOOD-LIABLE HOUSES
 - MINIMUM HABITABLE FLOOR LEVEL RL 3.6m AHD

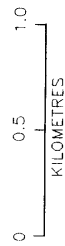
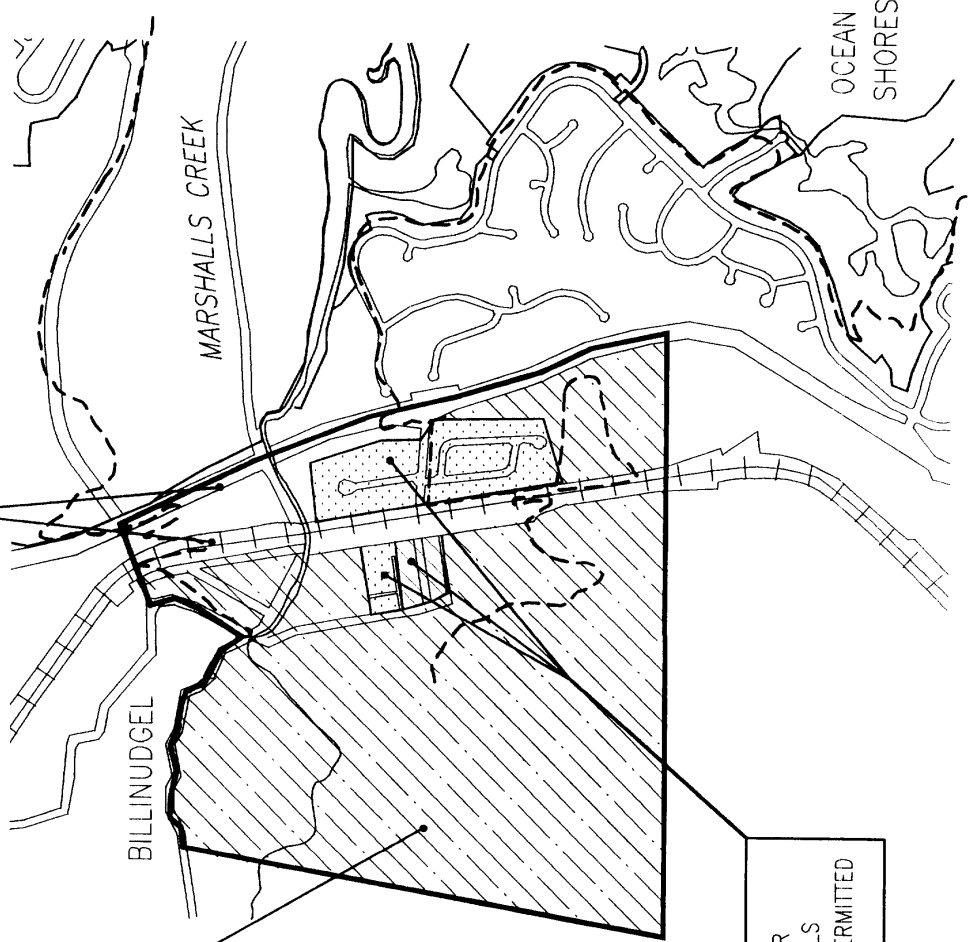




HIGHWAY AND RAILWAY
CONSTRUCTION SUBJECT
TO APPROVAL

PROHIBITION ON
FURTHER
FILLING
AND / OR
SUBDIVISION

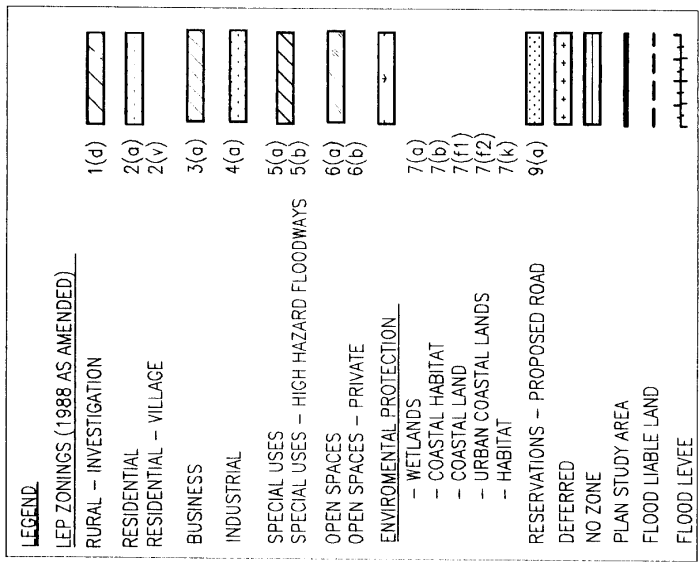
MINIMUM FLOOR
LEVEL CONTROLS
SITE FILLING PERMITTED



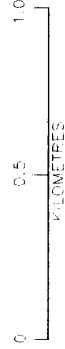
MINIMUM FLOOR
LEVEL CONTROLS

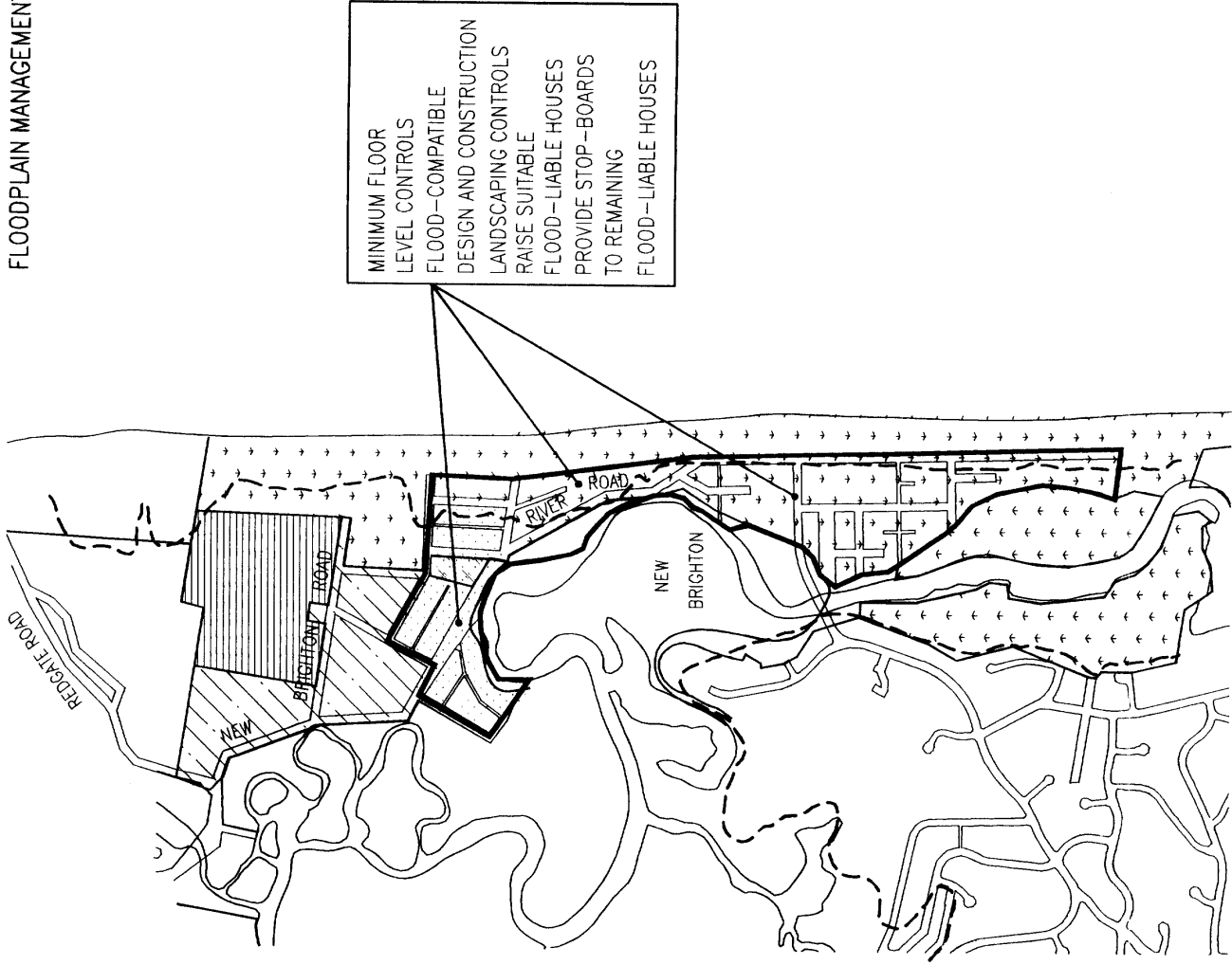


SOUTH
GOLDEN
BEACH

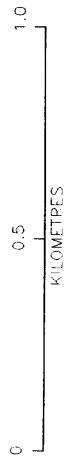
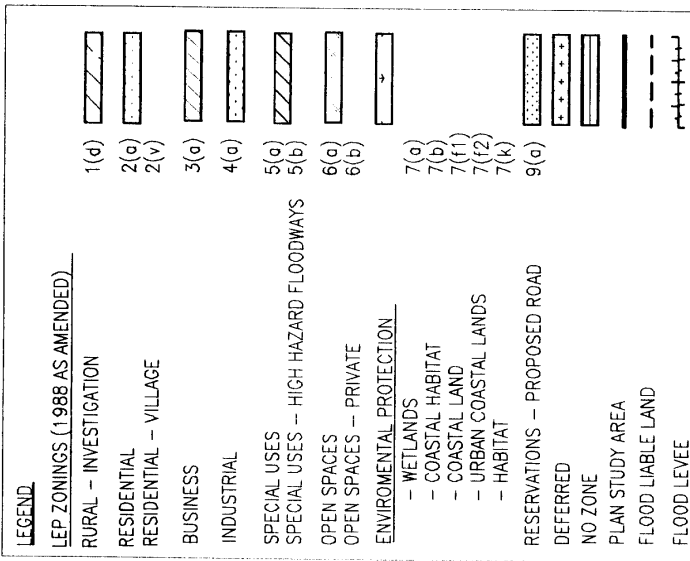


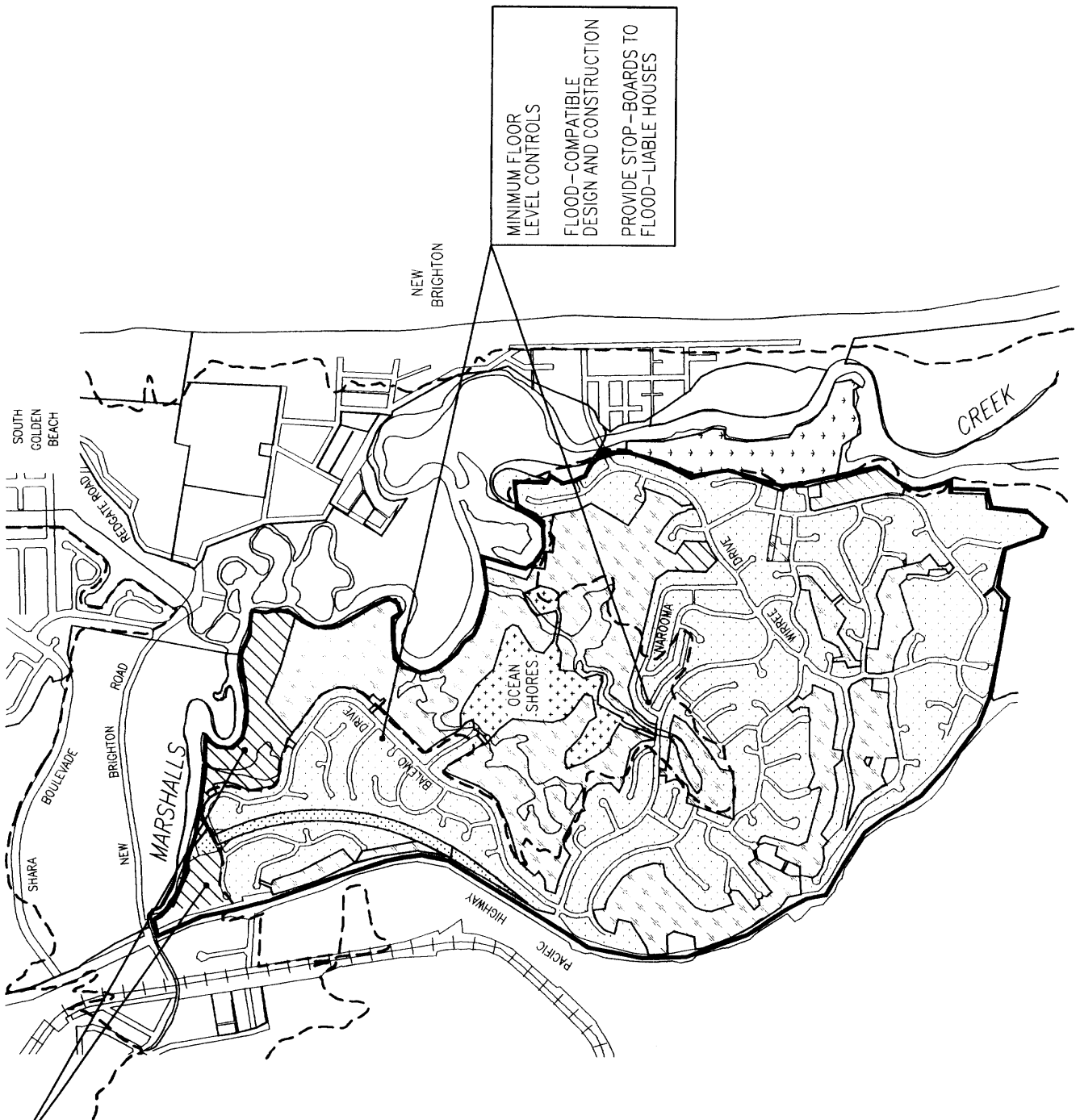
OCEAN
SHORES
NORTH





MINIMUM FLOOR
LEVEL CONTROLS
FLOOD-COMPATIBLE
DESIGN AND CONSTRUCTION
LANDSCAPING CONTROLS
RAISE SUITABLE
FLOOD-LIABLE HOUSES
PROVIDE STOP-BOARDS
TO REMAINING
FLOOD-LIABLE HOUSES





PROHIBITION ON
FURTHER
FILLING
AND / OR
SUBDIVISION

LEGEND

LEP ZONINGS (1988 AS AMENDED)

- 1(d) [diagonal lines]
- 2(a) [horizontal lines]
- 2(v) [vertical lines]
- 3(a) [diagonal lines]
- 4(a) [dotted pattern]
- 5(a) [diagonal lines]
- 5(b) [diagonal lines]
- 6(a) [diagonal lines]
- 6(b) [diagonal lines]
- 7(a) [diagonal lines]
- 7(b) [diagonal lines]
- 7(f1) [diagonal lines]
- 7(f2) [diagonal lines]
- 7(k) [diagonal lines]
- 9(a) [diagonal lines]

RURAL - INVESTIGATION

RESIDENTIAL

RESIDENTIAL - VILLAGE

BUSINESS

INDUSTRIAL

SPECIAL USES

SPECIAL USES - HIGH HAZARD FLOODWAYS

OPEN SPACES

OPEN SPACES - PRIVATE

ENVIRONMENTAL PROTECTION

- WETLANDS
- COASTAL HABITAT
- COASTAL LAND
- URBAN COASTAL LANDS
- HABITAT

RESERVATIONS - PROPOSED ROAD

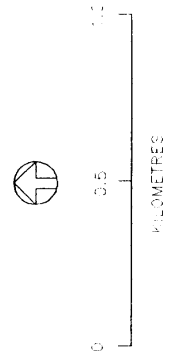
DEFERRED

NO ZONE

PLAN STUDY AREA

FLOOD LIABLE LAND

FLOOD LEVEL

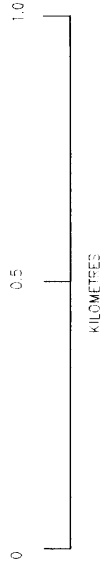
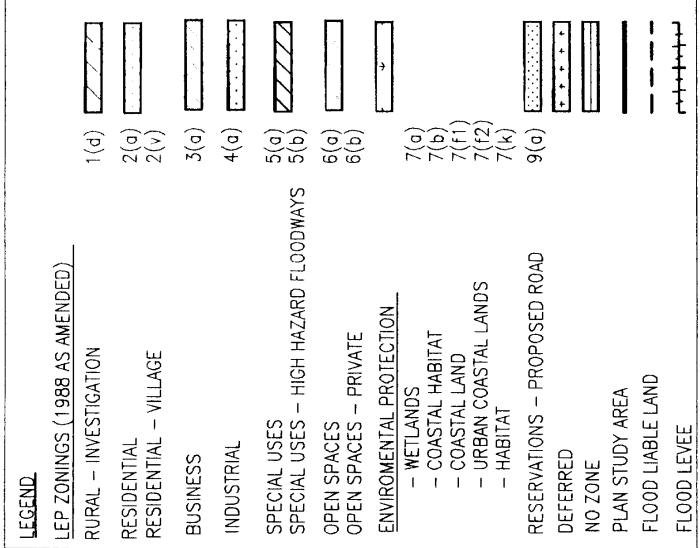


SOUTH
GOLDEN
BEACH

OCEAN
SHORES
NORTH

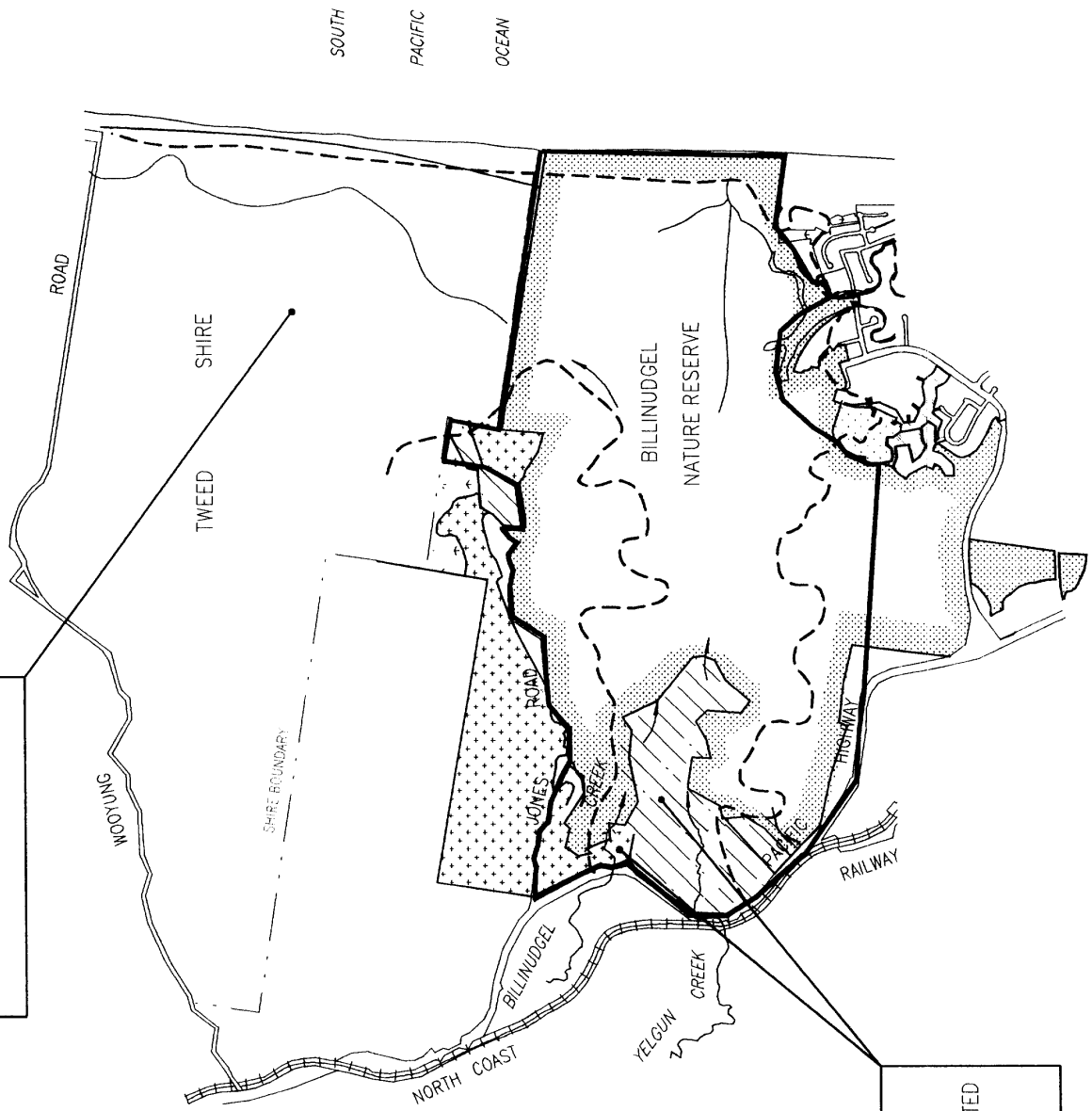
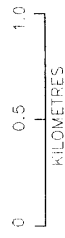
PROHIBITION ON
FURTHER
FILLING
AND / OR
SUBDIVISION

PROHIBITION ON
FURTHER
FILLING
AND / OR
SUBDIVISION



CONSULT
WITH TWEED SHIRE
TO RETAIN EXISTING
ZONING AND CONTROLS
RURAL HOUSING TO BE
CONSTRUCTED ON FLOOD MOUNDS

LEGEND	
<u>LEP ZONINGS (1988 AS AMENDED)</u>	
1(d)	RURAL - INVESTIGATION
2(o)	RESIDENTIAL
2(v)	RESIDENTIAL - VILLAGE
3(o)	BUSINESS
4(o)	INDUSTRIAL
5(o)	SPECIAL USES
5(b)	SPECIAL USES - HIGH HAZARD FLOODWAYS
6(o)	OPEN SPACES
6(b)	OPEN SPACES - PRIVATE
<u>ENVIRONMENTAL PROTECTION</u>	
7(o)	- WETLANDS
7(b)	- COASTAL HABITAT
7(f1)	- COASTAL LAND
7(f2)	- URBAN COASTAL LANDS
7(k)	- HABITAT
9(o)	RESERVATIONS - PROPOSED ROAD
<u>DEFERRED</u>	
NO ZONE	
PLAN STUDY AREA	
FLOOD LIABLE LAND	
FLOOD LEVEL	



RETAIN EXISTING ZONINGS
AND DEVELOPMENT CONTROLS
RURAL HOUSING TO BE CONSTRUCTED
ON FLOOD MOUNDS
WITH FLOOR LEVEL CONTROLS