
KINHILL

**FLOODPLAIN MANAGEMENT PLAN
FOR BRADYS GULLY CREEK**

FINAL REPORT

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SUMMARY

Bradys Gully Creek is a tributary of Lower Narara Creek and has a total catchment area of 2.2 km². The majority of the creek flows are contained within the channel, but there are sections of the creek where the undersized culverts or restrictive channel cross-sections have caused flooding. This flooding is compounded by the high downstream water levels in Narara Creek.

The Bradys Gully Creek study area has been divided into five distinct regions for the preparation of a Floodplain Management Plan as shown in Figure BG1. These regions are:

- Laycock Street lining area – Pacific Highway to Henry Parry Drive (Area BG1)
- Cary Street reach – Henry Parry Drive to Cary Street (Area BG2)
- Catholic School pipeline – Cary Street to Glennie Street (Area BG3)
- Jarrett Street channel – Glennie Street to Bradys Gully Road (Area BG4)
- Kirkness Avenue Creek – Tributary 1 (Area BG5).

These are shown schematically in Figure BG1.

In addition, a catchment based strategy has been considered for Bradys Gully Creek (BG6) and for the future development areas (BG7).

Various flood mitigation options were examined in order to provide a basis for the formulation of the Bradys Gully Creek Floodplain Management Plan and these have been discussed in detail in the Floodplain Management Study.

Key features of the plan are:

- by the formalizing of channels and culvert upgrades no buildings in habitable areas will be flooded by the designated flood;
- provision for limited development on flood fringe land subject to strict controls;
- lands within the floodway will be maintained in perpetuity for the passage of flood water and a drainage easement dedicated where appropriate;
- a staging of works;
- controls for future development of the upstream catchment.

The recommended works for the plan are shown on Figure BG1 and the Management Plan is shown in Figure BG2 (Council Drawings 4/116/A1 and 4/117/A1). The flood contours shown on the plan are for existing conditions. Flood contours at the completion of proposed works are shown in Figure BG3 (Council Drawings 4/118/A1 and 4/119/A1). Typical channel cross-sections are shown in Figure BG4.

Benefit-cost ratios have been calculated and included where possible. Where the proposed works do not specifically prevent flooding of houses, rather solve other problems such as scour and erosion of the creek bed, benefit-cost ratios cannot be calculated.

BG1 LAYCOCK STREET LINING AREA**BG1.1 DESCRIPTION OF THE PROBLEM**

This reach presently consists of a natural earth channel with thick vegetation along the banks. There is no existing drainage easement for the creek between the Pacific Highway and Henry Parry Drive. The creek passes through the backs of the properties in Laycock Street, dividing some of the properties in two. Over the years, the alignment of the creek has been altered by some of the property owners to maximize land availability. This is shown by the excessive amounts of debris along the bed, suggesting that the area might have been filled. The loosely compacted debris is now slowly being exposed and washed down due to bank and bed erosion.

Some of the sections of the creek have been severely eroded, and bank protection works consisting of sandstone blocks laid on the banks have been undertaken. In places these rocks have been dislodged and have fallen onto the channel bed. There is an existing access bridge across Bradys Gully Creek on Lot 33, Laycock Street and downstream of the bridge the sandstone blocks are in good condition and the creek is of a reasonable size. Upstream of the bridge the creek is narrow, as it has been restricted by development along Laycock Street. There is a steep grade along this section of creek, falling 2 m from Henry Parry Drive to the Pacific Highway, which has resulted in supercritical flow along sections of the creek exacerbating the problems of scour and erosion.

No houses are flood liable along this section of the creek although the Pacific Highway is overtopped by approximately 300 mm due to the high downstream water levels in Narara Creek. Enlarging of the culverts would not lower flood levels because of the downstream effect.

BG1.2 RECOMMENDATIONS

It is recommended that in order to improve the flow conditions and prevent erosion, to fully line the creek from Henry Parry Drive to the Pacific Highway. Upstream of the access bridge on Lot 33, Laycock Street, a concrete lined channel is proposed which is considered more appropriate in order to reduce the required channel width. Downstream of the access bridge, stacked rock lining may be more acceptable as there is less restriction of available land.

Typical channel cross section are shown Figure BG4.

It is also possible that in the formalization of the creek, the alignment may be adjusted to minimize the loss of land to the property owners in Laycock Street. The status of the

land can then be formalized and a drainage easement or reserve obtained. This would be in accordance with Council's existing setback policy. The exact alignment and channel size should be determined after a detailed ground survey of the area.

The estimated cost of the work is \$340,000.

The only tangible benefit provided to this reach by the lining is the prevention of scour and erosion, but it does contribute to improving conditions upstream of Henry Parry Drive.

BG1.3 CONCISE DESCRIPTION OF THE PLAN

- Line channel from Henry Parry Drive to Pacific Highway to prevent excessive scouring and erosion.
- Any access bridges or service crossings are to be a minimum of 500 mm above the 1% AEP design flood level. The supports, piers or abutments of such crossings should not be within the channel flow area unless a detailed analysis has been conducted to assess their impact on the flow regime.
- Approval to be obtained from relevant land owners for construction work to proceed.
- Channel lining material to be selected according to land availability.
- Drainage easement obtained after formalizing creek.

BG2 CARY STREET REACH

BG2.1 DESCRIPTION OF THE PROBLEM

Between Henry Parry Drive and Cary Street, Bradys Gully Creek is narrow and heavily vegetated. It turns through a sharp 90° bend before passing under Cary Street. The Henry Parry Drive culverts are undersized and the road regularly overtops. The backing up of the water behind these culverts, combined with the high water levels created by the dense vegetation in the channel, has resulted in one house being flood affected during a 1% AEP event and two more are potentially threatened. A 1% AEP flood would overtop Henry Parry Drive by 600 mm–700 mm.

In addition, the high flood levels in this section of the creek affect the discharge through the Catholic School pipeline, upstream of Cary Street.

BG2.2 RECOMMENDATIONS

It is proposed to reduce the incidence of flooding by adding one more cell to the existing Henry Parry Drive culvert. This combined with the channel lining between Henry Parry Drive and the Pacific Highway will reduce the flood levels at Henry Parry Drive such that no houses are flood liable for the 1% AEP event.

To further reduce flood levels and to improve the situation, the creek from Henry Parry Drive to Cary Street should be lined. This proposal would also significantly reduce the tailwater depth at Cary Street culvert which in turn will increase the flow capacity of the existing three 1500 mm diameter pipelines between Cary Street and Glennie Street. A rock-lined channel is considered the most appropriate for this section of creek. Near Cary Street, there is a drainage easement between Lots 11,12, 13 and Lot 14 of DP528705 and the alignment and formalization of the creek should be such that it is contained within this easement.

However, in the construction of the access track adjacent to the lined channel, provision should be made to allow the overland flow from upstream of Cary Street to pass back into Bradys Gully Creek.

A typical cross-section of the creek between Henry Parry Drive and Cary Street is shown in Figure BG4.

No significant earthworks are anticipated as the proposed lined channel generally conforms to the existing section. The estimated cost for lining between Henry Parry Drive and Cary Street is \$210,000 and \$55,000 for adding one more cell to the culvert under Henry Parry Drive.

BG2.3 CONCISE DESCRIPTION OF THE PLAN

- Line channel from Cary Street to Henry Parry Drive.
- Increase culvert size under Henry Parry Drive.
- Any access bridges or service crossings are to be a minimum of 500 mm above the 1% AEP design floor flood level. The supports, piers or abutments of such crossings should not be within the channel flow area unless a detailed analysis has been conducted to assess their impact on the flow regime.
- Approval is to be obtained from relevant land owners for construction work to proceed.
- Drainage Reserve to be obtained after formalizing creek.
- Provision to be made for overland flow from Catholic School to re-enter creek at Cary Street.

BG3 CATHOLIC SCHOOL PIPELINE

BG3.1 DESCRIPTION OF THE PROBLEM

Downstream of the Glennie Street foot-bridge, Bradys Gully Creek is confined to three 1,500 mm diameter pipes passing under the Catholic School. The pipes discharge into an open pit before passing under Cary Street through two 2.4 m by 1.5 m box culverts. The undercapacity of the 1,500 mm diameter pipes is compounded by the high water levels downstream of Cary Street. During floods, flows overtop the channel upstream of the Glennie Street foot-bridge. This combined with the overflow from the pipelines, inundates the school's car park and playing fields. Significant damage has occurred to the car park fences during recent flood events due to flows backing up against the fences. The overland flow returns to the creek downstream of the Cary Street culverts.

At the inlet to the pipes, significant scour has occurred between the pipe inlet and the existing formalized channel upstream of Glennie Street due to the two 90° bends in the creek. No buildings are flood liable in this reach.

BG3.2 RECOMMENDATIONS

As a result of the works recommended downstream, the water level at Cary Street is lowered, resulting in an increased capacity of the pipelines. Overland flow still occurs and the recommended works are to make the carpark and fences flood compatible with minimal resistance to flows.

In addition, at the inlet to the pipes, a stacked rock transition section should be constructed between the pipe inlets and the existing formalized channel.

The estimated cost for this work is \$10,000.

BG3.3 CONCISE DESCRIPTION OF THE PLAN

- Remove carpark fence above the culvert entrance and replace by minimum obstruction fence.
- Construct stacked rock transition section between inlet to pipes and existing formalized channel.
- Suitable warning signs should be erected on site to warn motorists and school children of flash flooding which can peak within an hour of intense rainfall.
- Car park should be washed and cleared of debris after floodwater has receded.

BG4 JARRETT STREET CHANNEL

BG4.1 DESCRIPTION OF THE PROBLEM

Bradys Gully Creek between Glennie Street and Bradys Gully Road, has already been formalized from the existing footbridge over Glennie Street up to Compton Street, under Council's existing maintenance programme. The majority of the channel is a pumped concrete mattress on the creek invert and part way up the channel sides. However, a major sewer main, which is parallel to Jarrett Street, has meant that some sections have had to be concrete lined. Similarly, just upstream of the Glennie Street foot-bridge, the channel turns through two 90° bends before passing under the bridge. Realignment of this section of channel is not possible because of the water main that runs along Glennie Street.

Upstream of this formalized channel, the creek reverts back to its natural heavily vegetated state. Five units in Compton street are flood prone due to the high water levels created by this undersized section of the creek.

BG4.2 RECOMMENDATIONS

The recommendation is to fast track the ongoing channel work carried out by Council. As soon as this is complete, that is, between Compton Street and Bradys Gully Road, the 1% AEP event flood levels will be lowered, resulting in no houses being flood liable.

A typical cross-section of this new section of creek is shown in Figure BG4. It is recommended that the pumped concrete mattress lining be continued up to Bradys Gully Road although at the culverts, stacked-rock would be more suitable for when Bradys Gully Road overtops.

The pumped concrete mattress has been shown in Figure BG4 to extend the full height of the channel sideslopes. Where bank stability is not a problem, it may be considered more acceptable to only line partway to the bank. In this situation, the channel sideslope should be suitably battered back.

The estimated cost for this work is \$110,000.

BG4.3 CONCISE DESCRIPTION OF THE PLAN

- Continue and complete channel work up to Bradys Gully Road.
- Keep channel clear of undergrowth and silt.
- Avoid costly diversions of services during new channel work.

BG5 KIRKNESS AVENUE CREEK—TRIBUTARY 1**BG5.1 DESCRIPTION OF THE PROBLEM**

Upstream of Bradys Gully Road, a tributary of Bradys Gully Creek passes under Kirkness Avenue through a 1,200 mm diameter culvert. This culvert has insufficient capacity and results in localized flooding of Kirkness Avenue. No houses upstream of the culvert are flood liable.

BG5.2 RECOMMENDATIONS

The recommended works are to upgrade the 1,200 mm diameter culvert to three 1,200 mm pipes. These pipes will reduce the frequency of inundation of Kirkness Avenue, but as this flooding problem is only localized the works are considered low priority.

The estimated cost of the works is \$76,000.

BG5.3 CONCISE DESCRIPTION OF THE PLAN

- Upgrade culverts under Kirkness Avenue.

BG6 BRADYS GULLY CREEK FLOODWAY**BG6.1 DESCRIPTION OF THE PROBLEM**

Bradys Gully Creek is a reasonably well defined creek that discharges into Narara Creek. The majority of the creek flows are contained within the channel but there are sections of the creek where undersized culverts or restrictive channel cross-sections have caused flooding. Mitigation measures to alleviate these problem areas are discussed in other sections; however the maintenance of the creek as a whole is described here.

A major problem associated with flooding in the Narara Creek tributaries is the heavy vegetation within the creek and the dense bush on the flood plains, resulting in higher than normal flood levels. Removing vegetation and obstructions from the channel can often improve the conveyance of the stream, thus reducing design flood levels. However, any channel clearing and maintenance works should be carefully undertaken so that erosion of channel banks is minimized.

Another common problem in the Narara Creek tributaries is the erosion and scour that occurs. This is as a result of the narrow creek rapidly changing direction as it runs off the steep catchment.

The Bradys Gully Creek floodway can generally be defined as the full extent of the flood liable land. Land use in floodways must also be carefully controlled to ensure that the conveyance of the floodway is not reduced. Neither buildings nor hazardous uses, obstructions or operations likely to impede floodwaters should be permitted in floodways: only land use that is flood compatible or likely to enhance floodway capacity should be allowed.

Some areas of the floodplain could be filled without significantly affecting flood levels. These areas, if assessed to have no other detrimental effects, may be allowed to fill to a predetermined alignment beyond which a significant effect occurs. If filling were allowed, the land owner would be required to set aside the remaining land as floodway.

Floodways may need to be crossed by service installations, such as water, sewer, power, and gas mains. These should be permitted in the floodway provided they are investigated adequately and designed in a manner that does not significantly affect floodflow capacity or flood levels. They should also be designed so as to reduce damage potential to the services to the absolute minimum.

BG6.2 RECOMMENDATIONS

A regular maintenance programme is to be established for the creek to ensure that there is no reduction in the conveyance of the creek and in consequence an increase in flood levels. Also the creeks should be regularly inspected to detect any signs of increasing erosion.

The floodway is to be permanently maintained so that there would be no significant development within the floodway to reduce the future capacity of the floodway.

BG6.3 CONCISE DESCRIPTION OF THE PLAN

The proposed plan for the Bradys Gully Creek floodway is as follows:

- No work that would impair the passage of floodwaters would be permitted in the floodway.
- Fences of rigid paling, chain wire or similar construction likely to collect debris and/or impair floodwaters would not be permitted.
- All land uses are to be flood compatible.
- A regular creek maintenance programme would be established.
- Proposals to cross the floodway with services would be permitted provided that the proposals were adequately investigated and designed in a manner that did not significantly affect flood-flow capacity and levels.

BG7 FUTURE DEVELOPMENT**BG7.1 GENERAL**

One of the main findings in this study indicates that the present creek system will not be able to sustain any significant increase in flow volumes generated by future developments in the upstream areas. As a result, all future development applications must incorporate suitable water detention facilities before such developments will be approved by Council.

The design of detention facilities requires input of the stage-storage-discharge relationship into an overall established hydrologic model for the whole creek system. The normal method of stipulating that peak developed discharge must not exceed pre-developed discharge may not be entirely applicable for all cases as it does not take into consideration the effect of time. Also, depending on the complexity of the network of basins in a catchment, the positive effects of one basin may be partially or completely neutralised by another basin instead of complementing each other. It is recommended that detention facilities are to be designed by experienced hydrologic and hydraulic professionals in order to realise the full benefits of a network of basins within a catchment.

BG 8 PRIORITIES OF WORK**BG8.1**

The proposed staging of works is consistent with the provision of a reduced flood hazard and implementation of the plan while being conscious of financial constraints. The proposed priority of works is given in Table BG1. This table is given as a guide—should Council have money available at any time then the lower priority works could be undertaken to make use of the financial resources available.

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Table BG1

Recommended works and priority ranking for Bradys Gully Creek

Location	Description	Cost	Priority
Laycock St lining area (Ch7 to Ch240)	Lined channel between Ch7 and Ch240	\$340,000	2
Cary St reach (Ch240 to Ch375)	Add a new culvert to the Henry Parry Drive culvert, after completion of Laycock St lining	\$55,000	3
	Lined channel between Ch240 and Ch375 after completion of Laycock St lining and upgrade of Henry Parry Drive culvert	\$210,000	4
Catholic St pipeline (Ch375 to Ch551)	Improve overland flowpath and line inlet to pipes	\$10,000	5
Jarrett St channel (Ch551 to Ch900)	Continue planned channel works up to Ch900	\$110,000	1
Kirkness Ave creek – Tributary No 1	Upgrade the Kirkness Ave culvert	\$76,000	6

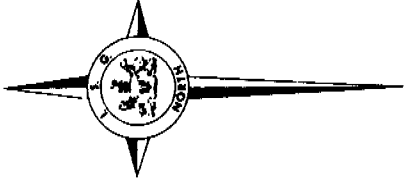


Figure BG1

RECOMMENDED WORKS FOR BRADYS GULLY CREEK

WYOMING CREEK, WINGELLO CREEK & BRADYS GULLY CREEK
FLOOD PLAIN MANAGEMENT STUDY

GOSFORD CITY COUNCIL



JARRETT STREET TO RAINFOREST RESERVE LINING AREA

- STRAIGHTEN ALIGNMENT AND LINE MEANDERING NATURAL CREEK FROM JARRETT STREET TO CH 593 (NEAR ROSSELANDS AVENUE)
- UNDERTAKE DETAILED AND ENVIRONMENTAL STUDY TO IDENTIFY THE BEST ALIGNMENT AND LINING MATERIAL THROUGH RAINFOREST RESERVE.
- SELECTION OF LINING MATERIAL DEPENDENT ON LAND AVAILABILITY.
- APPROVAL NEEDS TO BE SOUGHT FROM ADJOINING LAND OWNERS FOR CREEK RE-ALIGNMENT.
- FUTURE BUILDINGS SHOULD BE CONSTRUCTED TO AN APPROPRIATE COUNCIL SPECIFIED MINIMUM FLOOR LEVEL.

REPTILE PARK REACH

- ESTABLISH REGULAR MAINTENANCE OF FENCE GATES.
- LOWER CONCRETE WEIR CREST LEVEL FROM RL 3.7 TO RL 2.7.
- REPLACE EXISTING LOW LEVEL BRIDGE WITH A MORE FLOOD COMPATIBLE STRUCTURE.
- CONSULTATION WITH THE REPTILE PARK IS NEEDED TO ENSURE AN ACCEPTABLE SOLUTION.
- FUTURE BUILDINGS SHOULD BE CONSTRUCTED TO AN APPROPRIATE COUNCIL SPECIFIED MINIMUM FLOOR LEVEL.

WINGELLO CREEK FLOODWAY

- NO WORK THAT WOULD IMPAIR THE PASSAGE OF FLOODWATERS WOULD BE PERMITTED IN THE FLOODWAY.
- FENCES OF RIGID PALING, CHAIN WIRE OR SIMILAR CONSTRUCTION LIKELY TO COLLECT DEBRIS AND/OR IMPAIR FLOODWATERS WOULD NOT BE PERMITTED.
- ALL LAND USES ARE TO BE FLOOD COMPATIBLE WOULD BE ESTABLISHED.
- A REGULAR CREEK MAINTENANCE PROGRAMME WOULD BE ESTABLISHED.
- PROPOSALS TO CROSS THE FLOODWAY WITH SERVICES WOULD BE PERMITTED PROVIDED THAT THE PROPOSALS WERE ADEQUATELY INVESTIGATED AND DESIGNED IN A MANNER THAT DID NOT SIGNIFICANTLY AFFECT FLOOD- FLOW CAPACITY AND LEVELS.

BRADYS GULLY CREEK FLOODWAY

- NO WORK THAT WOULD IMPAIR THE PASSAGE OF FLOODWATERS WOULD BE PERMITTED IN THE FLOODWAY.
- FENCES OF RIGID PALING, CHAIN WIRE OR SIMILAR CONSTRUCTION LIKELY TO COLLECT DEBRIS AND/OR IMPAIR FLOODWATERS WOULD NOT BE PERMITTED.
- ALL LAND USES ARE TO BE FLOOD COMPATIBLE WOULD BE ESTABLISHED.
- A REGULAR CREEK MAINTENANCE PROGRAMME WOULD BE ESTABLISHED.
- PROPOSALS TO CROSS THE FLOODWAY WITH SERVICES WOULD BE PERMITTED PROVIDED THAT THE PROPOSALS WERE ADEQUATELY INVESTIGATED AND DESIGNED IN A MANNER THAT DID NOT SIGNIFICANTLY AFFECT FLOOD- FLOW CAPACITY AND LEVELS.

LAYCOCK STREET LINING AREA

- LINE CHANNEL FROM HENRY PARRY DRIVE TO PACIFIC HIGHWAY TO PREVENT EXCESSIVE SCOURING AND EROSION.
- ANY ACCESS BRIDGES OR SERVICE CROSSINGS ARE TO BE A MINIMUM OF 500mm ABOVE THE 1% AEP DESIGN FLOOD LEVEL.
- APPROVAL IS TO BE OBTAINED FROM RELEVANT LAND OWNERS FOR CONSTRUCTION WORK TO PROCEED.
- CHANNEL LINING MATERIAL TO BE SELECTED ACCORDING TO LAND AVAILABILITY.
- DRAINAGE EASEMENT OBTAINED AFTER FORMALIZING CREEK.

CARY STREET REACH

- LINE CHANNEL FROM CARY STREET TO HENRY PARRY DRIVE.
- INCREASE CULVERT SIZE UNDER HENRY PARRY DRIVE.
- ANY ACCESS BRIDGES OR SERVICE CROSSINGS ARE TO BE A MINIMUM OF 500mm ABOVE THE 1% AEP DESIGN FLOOD LEVEL.
- APPROVAL IS TO BE OBTAINED FROM RELEVANT LAND OWNERS FOR CONSTRUCTION WORK TO PROCEED.
- DRAINAGE EASEMENT TO BE OBTAINED AFTER FORMALIZING CREEK.
- PROVISION TO BE MADE FOR OVERLAND FROM CATHOLIC SCHOOL TO RE-ENTER CREEK AT CARY STREET.

CATHOLIC SCHOOL PIPELINE

- REMOVE CAR PARK FENCE ABOVE CULVERT ENTRANCE AND REPLACE BY A MINIMUM OBSTRUCTION FENCE.
- CONSTRUCT STACKED ROCK TRANSITION SECTION BETWEEN WILET TO PIPES AND EXISTING FORMALIZED CHANNEL.
- SUITABLE WARNING SIGNS REQUIRED IN CAR PARK TO WARN OF FLASH FLOODING.
- CARPARK WILL NEED TO BE WASHED AND CLEARED OF DEBRIS AFTER FLOODING.

JARRETT STREET CHANNEL

- CONTINUE AND COMPLETE CHANNEL WORK UP TO AT LEAST BRADYS GULLY ROAD.
- KEEP CHANNEL CLEAR OF SILT AND UNDERGROWTH.
- AVOID COSTLY DIVERSIONS OF SERVICES DURING NEW CHANNEL WORK.

- NOTES**
1. FLOOD LEVELS HAVE BEEN CALCULATED AT CROSS SECTION LOCATIONS ONLY. FLOOD CONTOURS BETWEEN CROSS SECTIONS HAVE BEEN LINEARLY INTERPOLATED.
 2. FLOOD CONTOURS DEFLECT APPROXIMATE WIDTHS OF FLOODING ONLY.
 3. FLOOD LIMITS SHOULD BE VERIFIED BY GROUND SURVEY.
 4. FLOOD LEVELS ARE GIVEN IN METRES TO AUSTRALIAN HEIGHT DATUM.
 5. DIMENSIONS SHOWN ON THIS PLAN ARE APPROXIMATE ONLY AND DETAILS SHOULD NOT BE SCALED FROM THIS DRAWING FOR DETAILED DESIGN PURPOSES.

- LEGEND**
- 1% AEP flood extent
 - CS 570 Flood contour at survey cross section
 - 6.5 Flood contour interpolated between cross sections
 - 6.6 Flood contour interpolated between cross sections
 - House floor levels

212A	212B	213A
212C	212D	213C
228A	228B	228A
228C	228D	228C

KEY TO ADJOINING SHEETS
 Gosford Shire Authority
 Map Reference: GOSFORD U2797 - 52

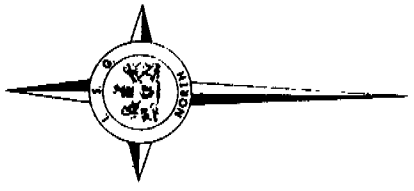


FLOODPLAIN MANAGEMENT PLAN OVERLAY
 Produced by
 GOSFORD CITY COUNCIL - Revised January 1993
 Consulting Engineers - KINSHILL ENGINEERS
 Consulting Surveyors - JTS RYAN FIRTH & CO

FLOODPLAIN MANAGEMENT PLAN FOR WYOMING, WINGELLO AND BRADYS GULLY CREEKS

MANAGEMENT PLAN FOR BRADYS GULLY CREEK — EXISTING CONDITIONS CONTOURS
 SHEET 1 of 2 Figure BG2

GOSFORD CITY COUNCIL



- NOTES**
- 1 FLOOD LEVELS HAVE BEEN CALCULATED AT CROSS SECTION LOCATIONS ON THE PLAN.
 - 2 FLOOD LEVELS AND FLOOD CONTOURS BETWEEN CROSS SECTIONS HAVE BEEN LINEARLY INTERPOLATED.
 - 3 FLOOD CONTOURS REPRESENT APPROXIMATE WRITING OF FLOODING ONLY. FLOOD LIABILITY SHOULD BE VERIFIED BY GROUND SURVEY.
 - 4 FLOOD LEVELS ARE GIVEN IN METRES TO AUSTRALIAN HEIGHT DATUM.
 - 5 REEF SHOWS ON THIS PLAN ARE APPROXIMATE ONLY AND DETAILS SHOULD BE OBTAINED FROM THE DRAFTER FOR THE PROJECT'S PURPOSES.

- LEGEND**
- 1% AEP flood extent
 - 6.5 Flood contour at survey cross section
 - 6.6 Flood contour interpolated between cross sections
 - House floor levels

212A	212B	213A
212C	228A	228B
228C	228D	229C

KEY TO ADJOINING SHEETS
 Gosford Mapping Authority GOSFORD U2797 - 54



FLOODPLAIN MANAGEMENT PLAN OVERLAY
 Produced for
 GOSFORD CITY COUNCIL - Revised January 1993
 Consulting Engineers - WIMMEL ENGINEERS
 Consulting Surveyors - JTS RYAN FIRTH & CO

FLOODPLAIN MANAGEMENT PLAN FOR WYOMING, WINGELLO AND BRADYS GULLY CREEKS

MANAGEMENT PLAN FOR BRADYS GULLY CREEK - EXISTING CONDITIONS CONTOURS
 SHEET 2 of 2 Figure BG2



JARRETT STREET CHANNEL
 • CONTINUE AND COMPLETE CHANNEL WORK UP TO AT LEAST BRADYS GULLY ROAD.
 • KEEP CHANNEL CLEAR OF SILT AND UNDERGROWTH.
 • AVOID COSTLY DIVERSIONS OF SERVICES DURING NEW CHANNEL WORK.

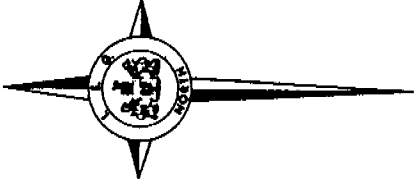
KYRNNESS AVENUE CREEK - TRIBUTARY 1
 • INCREASE SIZE OF CULVERTS UNDER KYRNNESS AVENUE.

BRADYS GULLY CREEK FLOODWAY
 • NO WORK THAT WOULD IMPAIR THE PASSAGE OF FLOODWATERS WOULD BE PERMITTED IN THE FLOODWAY.
 • FENCES OF RIGID PALING, CHAIN WIRE OR SIMILAR CONSTRUCTION LIKELY TO COLLECT DEBRIS AND/OR IMPAIR FLOODWATERS WOULD NOT BE PERMITTED.
 • ALL LAND USES ARE TO BE FLOOD COMPATIBLE. A REGULAR CREEK MAINTENANCE PROGRAMME WOULD BE ESTABLISHED.
 • PROPOSALS TO CROSS THE FLOODWAY WITH SERVICES WOULD BE PERMITTED PROVIDED THAT THE PROPOSALS WERE ADEQUATELY INVESTIGATED AND DESIGNED IN A MANNER THAT DID NOT SIGNIFICANTLY AFFECT FLOOD-FLOW CAPACITY AND LEVELS.

RITZLS FOR PUBLIC RECREATION AND PRESERVATION OF SCENERY

RESERVE
 R 89975
 PUBLIC WATER SUPPLY
 R 755227
 RECREATION

GOSFORD CITY COUNCIL



- NOTES**
- 1 FLOOD LEVELS HAVE BEEN CALCULATED AT CROSS SECTION LOCATIONS ONLY.
 - 2 FLOOD LEVELS AND FLOOD CONTOURS BETWEEN CROSS SECTIONS HAVE BEEN INTERPOLATED.
 - 3 FLOOD LIABILITY SHOULD BE VERIFIED BY SURVEY AS ACCURACY ONLY.
 - 4 FLOOD LEVELS ARE GIVEN IN METRES TO AUSTRALIAN HEIGHT DATUM. CROSS SECTIONS ON THIS PLAN ARE APPROXIMATE ONLY AND DETAILS SHOULD NOT BE SCALED FROM THE DRAWING FOR DETAILED DESIGN PURPOSES.

LEGEND

- 1:5 AEP flood extent
- CS 520 Flood contour at survey cross section
- 6.6 Flood contour interpolated between cross sections
- 1:8 House floor levels

212A	212B	213A
212C	212D	213B
228A	228B	228C
228C	228D	229C

KEY TO ADJOINING SHEETS
 Central Hawke's Bay Regional Council
 Gosford U2797 - 52



FLOODPLAIN MANAGEMENT PLAN OVERLAY
 Produced for
 GOSFORD CITY COUNCIL - Revised January 1993
 Consulting Engineers - KIMBALL ENGINEERS
 Consulting Surveyors - JTS RYAN FIRTH & CO

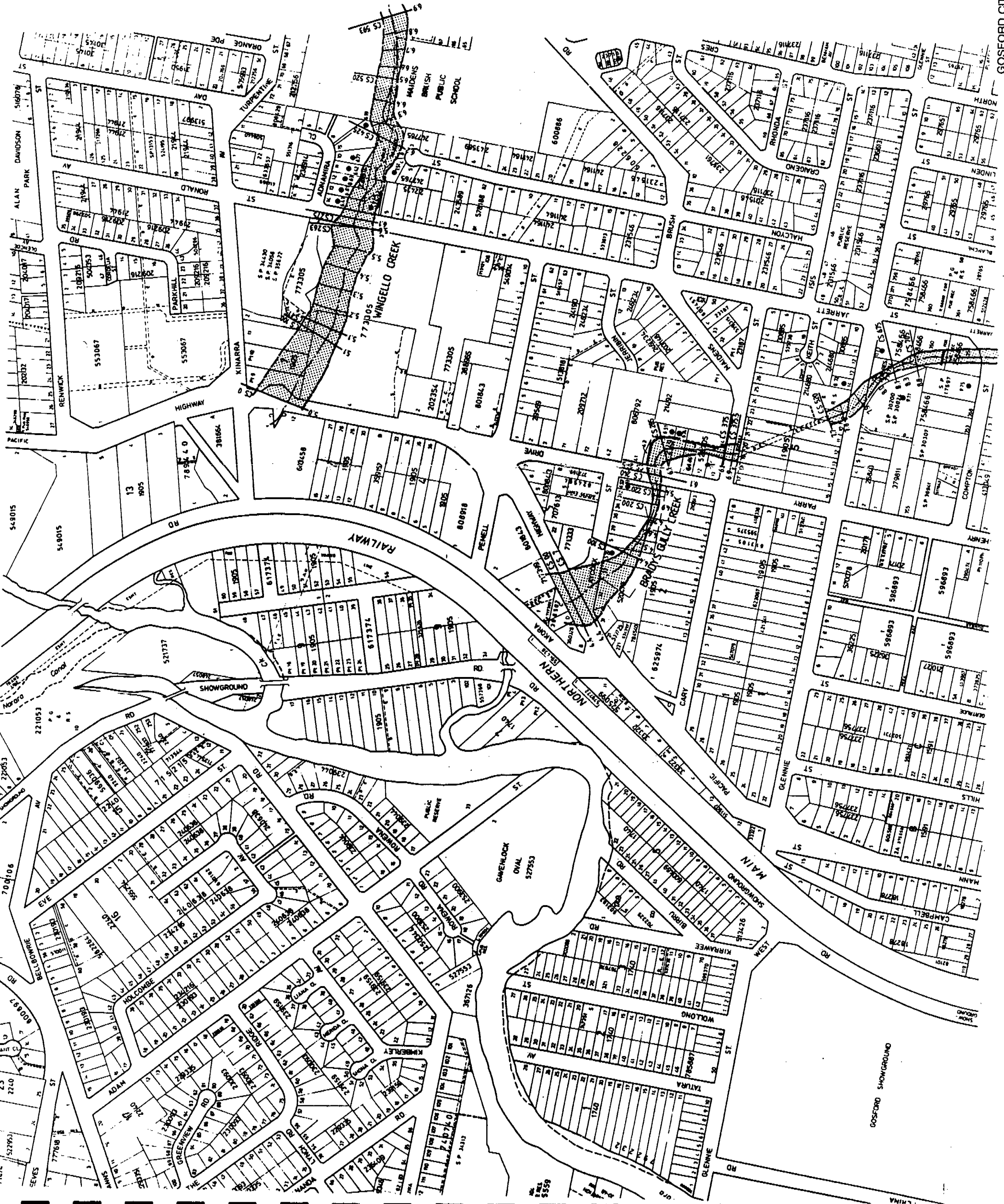
FLOODPLAIN MANAGEMENT STUDY FOR WYOMING, WINGELLO AND BRADYS GULLY CREEKS

FLOOD CONTOURS AT COMPLETION OF
 PROPOSED WORKS FOR BRADYS GULLY
 CREEK

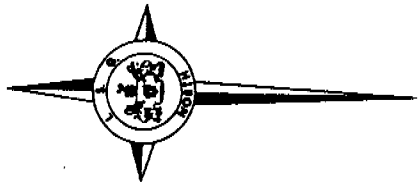
SHEET 1 of 2

Figure BG3

GOSFORD CITY COUNCIL DRAWING NUMBER 4/118/A1



GOSFORD CITY COUNCIL



- NOTES**
- FLOOD LEVELS HAVE BEEN CALCULATED AT CROSS SECTIONS LOCATIONS ONLY.
 - FLOOD LEVELS AND FLOOD CONTOURS ARE INTERPOLATED BETWEEN CROSS SECTIONS.
 - FLOOD LEVELS HAVE BEEN INTERPOLATED.
 - FLOOD LEVELS WILL BE WITHIN 0.1 METRE OF FLOODING ONLY.
 - FLOOD LEVELS ARE GIVEN IN METRES TO AVERAGE SEA LEVEL DATUM.
 - SEAS SHOWN ON THIS PLAN ARE APPROXIMATE ONLY AND SHOULD NOT BE RELIED UPON FOR DETAILED DESIGN PURPOSES.

- LEGEND**
- 1:1 ASP Road section
 - 1:50 Flood contour at survey cross section
 - 1:50 Flood contour interpolated between cross sections
 - House floor levels

212A	212B	213A
212C	212D	213C
228A	228B	228A
228C	228D	228C

KEY TO ADJOINING SHEETS
 Gosford Mapping Authority
 Gosford U2797 - 84

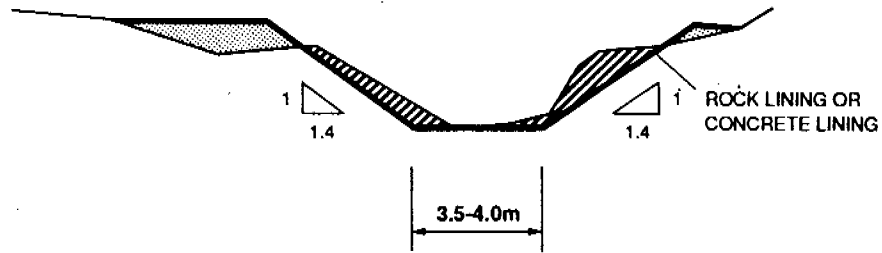


FLOODPLAIN MANAGEMENT PLAN OVERLAY
 Produced for
 GOSFORD CITY COUNCIL - Revised January 1983
 Consulting Engineers - KIRKALL ENGINEERS
 Consulting Surveyors - JTS RYAN FRITH & CO

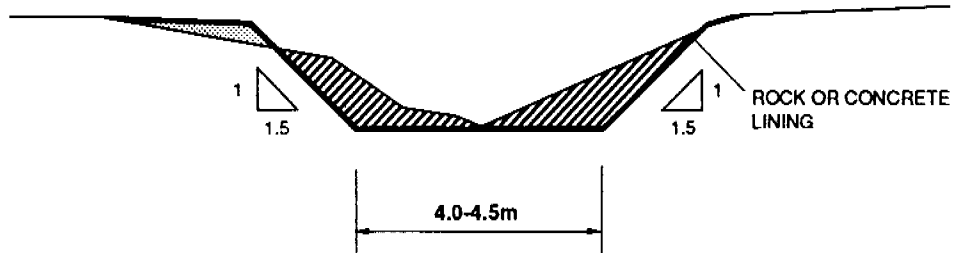
FLOODPLAIN MANAGEMENT STUDY FOR WYOMING, WINGELLO AND BRADYS GULLY CREEKS

FLOOD CONTOURS AT COMPLETION OF
 PROPOSED WORKS FOR BRADYS GULLY
 CREEK

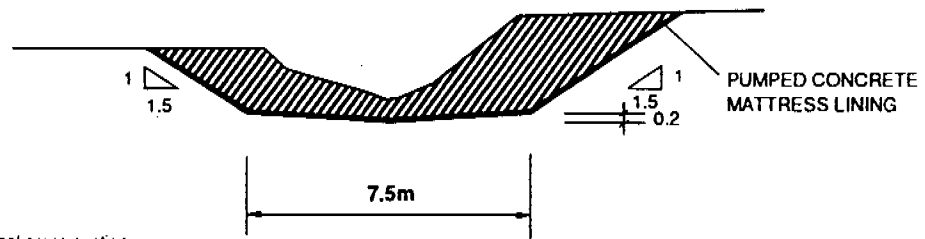




LAYCOCK STREET LINING AREA



CARY STREET REACH



- Legend
- Existing channel cross-section
 - Proposed channel cross-section
 - ▨ Fill
 - ▩ Excavation

JARRETT STREET CHANNEL

Note: Channel invert to be determined by average invert along reach.

Scale 1:200
Natural

Figure BG4
TYPICAL CROSS-SECTIONS FOR
BRADYS GULLY CREEK

End of Report