ENGINEERS
AUSTRALIA
Sydney Division

## Australian Historic Engineering Plaquing Program

NOMINATION OF THE

# SWAN HILL – MURRAY RIVER ROAD BRIDGE

FOR THE AWARD OF AN

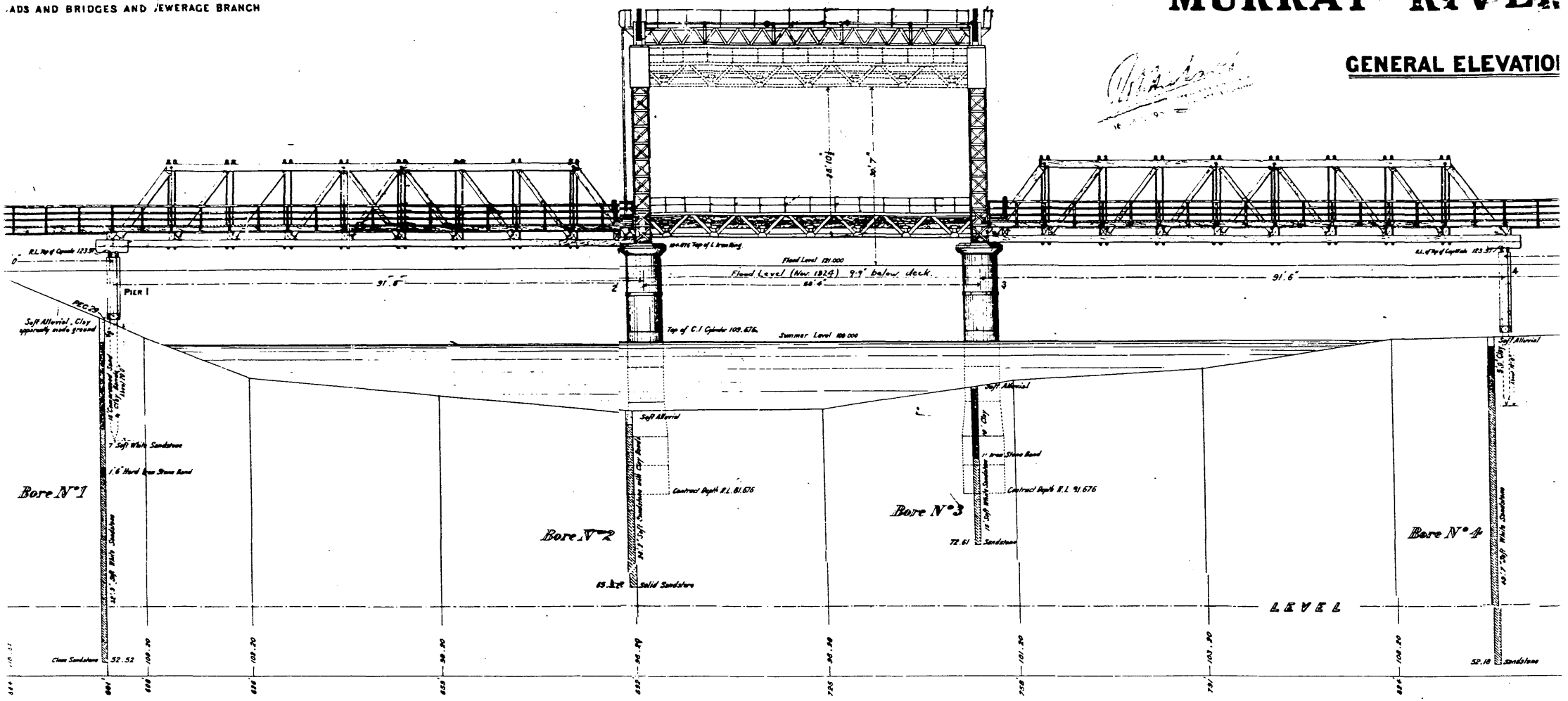
# HISTORIC ENGINEERING MARKER

**Prepared by**
**Engineering Heritage Australia (Canberra)**
**for the Engineering Heritage Committee, Sydney**
**December 2003**

ARTMENT O. BLIC WORKS
ADS AND BRIDGES AND EWERAGE BRANCH

# MURRAY RIVER

## GENERAL ELEVATIO



# CONTENTS

# INTRODUCTION

Murray-Darling river trade was underway at the time of the Victorian gold rushes in the 1850s with the first paddle steamers arriving at Swan Hill in 1853. When the river transportation industry reached its peak some 200 paddle steamers were actively engaged in the trade.

In the earlier days much of the cross-river transportation was by punts and ferries and as traffic grew, so did local pressure for their replacement by bridges. When designing these structures, engineers needed to make provision for a movable span to allow the passage of river traffic.

The six basic types of movable span bridges are the pontoon, sliding, transporter, swing, bascule and lift bridges. Eighteen movable span bridges were built in the Murray-Darling system between 1858 and 1969, one pontoon, one swing, one push-up, three bascule and twelve lift bridges.

Several designs of the lift bridge were used in the Murray-Darling system. In 1894 NSW Public Works engineer Percy Allan produced a design which was of combined metal and wooden construction, cheaper to build and easier to operate and maintain than existing movable span bridges in the system. Two bridges of this design were built, one at Swan Hill 1896 and the other at Tooleybuc 1925. The Swan Hill Lift Bridge is still operational.

This nomination proposes the Swan Hill Bridge receive an Historic Engineering Marker award under Engineers Australia's Historic Engineering Plaquing Program.

**Statement of Significance**

- The Swan Hill Bridge is significant under all four principal heritage criteria – Historical, Aesthetic, Technical and Social.
- The Bridge is on the State Heritage Register as an item of State Significance.
- The Bridge is important for its association with eminent PWD bridge engineer Percy Allan.
- The timber truss spans are the oldest surviving examples of Percy Allan's innovative 1893 redesign of timber truss road bridges.
- Subsequent lift bridges followed the pattern set by the Swan Hill Bridge.
- The Bridge is a gateway structure to the town and district of Swan Hill. It is a dominant component of the river scene and history which are the focus of the township. It is an extension of the Riverside Heritage Precinct.

**Engineering Heritage Committee**
**Sydney Division**
**Engineers Australia**
**Eagle House**
**118 Alfred Street**
**MILSONS POINT NSW 2061**

December 2003

The Administrator
Engineering Heritage Australia
Engineers Australia
Engineering House
11 national Circuit
BARTON ACT 2600

**The Australian Historic Engineering Plaquing Program**

**Nomination for the Award of an**
**HISTORIC ENGINEERING MARKER**

**Name of Work:**

Swan Hill - Murray River Road Bridge.

**This Work is nominated to be awarded an:**

Historic Engineering Marker.

**Location of Work:**

MR 67, McCallum Street Swan Hill - see the location maps at Attachment A.

**Owner:**

Roads and Traffic Authority, NSW.

**Approval to Plaque:**

Granted - see the RTA letter at Attachment B.
The Swan Hill Rural City Council and town community are providing high profile support for honouring their local icon.

**Access to Site:**

There is free access to the site it being a public bridge.

**Nominating Body:**

Engineering Heritage Committee, Sydney.

**Nomination Documentation prepared by:**

Engineering Heritage Australia (Canberra) using material supplied by Dr D J Fraser, Engineering Heritage Committee,Sydney.

**Glenn Rigden**

**Chairman**
**Engineering Heritage Committee Sydney** **Date: December 2003**

The following documents comprise the formal nomination and supporting material.

| | | |
|---|---|---|
| **Appendix:** | A | Plaquing Nomination Assessment Form |
| **Attachment:** | A | Location Maps |
| | B | RTA letter "Plaquing Swan Hill and Tooleybuc Bridges" dated 25 July 2003 |
| | C | Biosketch *Percy Allan* |
| | D | Paper *Lift Bridge over the Murray at Swan Hill*, Percy Allan, Assoc. M, Inst, C .E., Assoc. M. Am. Soc. C.E. |
| | E | NSW Heritage Office document – *Listing Heritage Items, Swan Hill-Murray River Road Bridge* |
| | F | Document *Swan Hill – Murray River Road Bridge.* |
| | G | GHD Pty Ltd sourced document commencing *History of Swan Hill area* |
| | H | Extract from *Traces of the Past – A Pictorial History of Swan Hill and District from Federation to the Present 1901 – 2001 by* Graham Gardner |
| | I | Paper *Development of Movable Span Bridges in the Murray – Darling Basin with Particular Reference to the Riverina of NSW* by Don Fraser, Engineering Heritage Committee, Sydney |
| | J | Extract from *Town and Country Journal* 12 Dec 1896 re opening of the bridge |

**APPENDIX A**

# Plaquing Nomination Assessment Form

## 1. BASIC DATA

**Item name:** Swan Hill-Murray River Road Bridge.

**Other/Former Names:** Swan Hill Lift Bridge.

**Location:** MR 67, McCallum Street, Swan Hill - see maps at Attachment A.

**Address:** See above.

**Suburb/Nearest Town:** Swan Hill.

**State:** New South Wales (spans the NSW-Victoria border).

**Local Government Area:** Shire of Wakool.

**Owner:** Roads and Traffic Authority of NSW.

**Current Use:** Road bridge with lifting span for pleasure craft.

**Former Use:** Road bridge with lifting span for the passage of commercial river traffic.

**Designer:** Mr Percy Allan, MICE, MAM, Soc CE – see biosketch at Attachment C.

**Maker/Builder:** Messrs J B & W Farquharson of Melbourne.

**Year Started:** 1895 **Year Completed:** 1896.

**Physical Description:** The bridge is composed of a steel center lift span 58' 4" between centers of bearings over piers, flanked by two 91' timber truss spans and four 35' timber approach spans. The timber sections are of the truss design that bears Percy Allan's name. His use of these timber sections and other cost saving innovations enabled the bridge to be built economically. The lifting deck and the towers of the Allan design were significant improvements on previous designs being lighter, less likely to jam and able to be operated by one man from a more accessible deck-level location. The bridge was therefore cheaper to construct and easier and more reliable in its operation. For further information see Attachment D.

**Physical Condition:** Good – still in use with its lift span operational.

**Modifications and Dates:** The timber truss spans have been strengthened by the attachment of steel straps and rods to the timber bottom chords and the replacement of the timber stringers by steel beams. Neither affects the integrity and fabric of the trusses. The last major repair was in 1998.

**Historical Notes:**

Surveyor General Major Thomas Mitchell named Swan Hill when he passed through the area in 1836. Pastoral development followed and a punt was in use on the Murray River at Swan Hill as early as 1846. After the arrival of the first two steamboats *Lady Augusta* and *Mary Ann* in 1853, the village grew as a port of the blossoming river trade .By the time the Victorian railway reached Swan Hill in 1889 the need for a road bridge which could cater for the river steamer traffic was very apparent.

**Heritage Listings:**

| | |
|---|---|
| **Name:** | NSW State Heritage Inventory. |
| **Title:** | Swan Hill – Murray River Road Bridge. |
| **Number:** | 01481. |
| **Date:** | 20 June 2000. |

See listing documents at Attachments E and F.

## 2. ASSESSMENT OF SIGNIFICANCE

**Historic Phase:** In the second half of the 19th Century up until Federation in 1901, Victoria and NSW were separate colonies and there were not only custom barriers between them but great rivalry for the income from export and import trade. Swan Hill was declared a port in 1864 and became a Port of Entry and Clearance with a customs house. Wool, wheat and beef crossed the river on a punt, a system which became increasingly inefficient as river trade grew to a high point in the 1880s. Growth in cross-border trade led to pressure for the replacement of the punt with a bridge. Public meetings held in this regard also expressed the border community's strong support for the federation of the Australian colonies. In 1896 the Swan Hill lift bridge designed by Percy Allan, was opened.

**Historic Association:** The bridge is historically associated with Major Mitchell's 1836 journey through the district; the competition between NSW and Victoria for the southwestern NSW rural trade; the blossoming of the river trade in the second half of the 19th Century; and the extension of the Victoria railway system to the Murray, providing links to the riverboats. It is also associated with one of NSW's foremost colonial civil engineers Percy Allan.

**Creative or Technical Achievement:** Percy Allan's design for the Swan Hill bridge had a number of improvements over existing designs, which he promoted in a paper *Lift Bridge over the Murray at Swan* Hill which he read to the Engineering Section of the Royal Society of NSW on 18 November 1896 – see Attachment D. He summarized the advantages of the lift configuration as "

- economy;
- uninterrupted headway unnecessary in the absence of masted vessels;
- maximum headway only required in times of high water hence partial lifts; and
- narrow main channels make central pivot piers objectionable.

"

**Research Potential:** High, due to the combination of different structures and materials, steel for the lift span and towers, and mostly timber for the approach trusses.

**Social:** The provision of the lift bridge at Swan Hill enabled the efficient transport of rural produce across the Murray to link with railway, road and riverboat transport to other destinations. This added to the prosperity of the town and district and encouraged community unity. Public meetings held to agitate for its construction also provided venues for the support for the campaign for Federation. The bridge soon became a gateway symbol of the town.

**Rarity:** Rare, one of only two of this type.

**Representativeness:** As the first of its type built, the Swan Hill bridge is a good example of Percy Allan's design which had several advantages over similar designs including cost and ease of operation. It set the pattern for subsequent lift bridges.

**Integrity/Intactness:** Still in use. Over the years various modifications have been made to strengthen the load capacity of the bridge, nevertheless the bridge is essentially in its original configuration.

**References:**


| **Author** | **Title** |
|---|---|
| Don Fraser | Development of Moveable Span Bridges in the Murray-Darling Basin with Particular Reference to the Riverina of NSW (Attachment I) |
| Percy Allan | Lift Bridge over the Murray at Swan Hill (Attachment D). |
| Don Fraser | Evolution of the Timber Truss Bridge in NSW *Multi-Disciplnary Trans., I E Aust, GE9, Oct 1985.* |
| Don Fraser | Biosketch "Percy Allan" (Attachment C). |
| GHD Pty Ltd | Paper commencing "History of Swan Hill Area" (Attachment G). |
| *Town & Country Journal* | Extract 12 December 1896 re the opening of the bridge |


**Statement of Significance;**

**Historical.** Surveyor General Major Thomas Mitchell named Swan Hill when he passed through the area in 1836. Pastoral development followed and a punt was in use on the Murray River at Swan Hill as early as 1846. After the arrival of the first two steamboats in 1853, the village grew as a port of the blossoming river trade .By the time the Victorian railway reached Swan Hill in 1889 the need for a bridge capable of catering for the river steamer traffic, was apparent.

**Technical.** The Swan Hill Murray River bridge was designed by the eminent NSW Public Works engineer Percy Allan MICE, MAM, Soc. CE., in 1894 and was opened in 1896. It is composed of a steel center lift span 58' 4" between centers of bearings over piers, two 91' timber truss spans and four 35' timber approach spans. The timber sections are of the truss design that bears Allan's name. His use of these timber sections and other cost saving innovations enabled the bridge to be built economically. The lifting deck and the towers of the Allan design were significant improvements on previous designs being lighter, less likely to jam and able to be operated by one man from a more accessible deck-level location. The bridge was therefore cheaper to construct and easier and more reliable in its operation.

**Assessed Significance:** State

**Additional Information:** Additional supporting documents appear at Attachments G History of Swan Hill
H Pictorial History of Swan Hill
I. Movable span bridges, and Bridges and the River Trade.
J. Opening of bridge newspaper article, 1896

**Proposed Plaque Citation:**

IEAust Logo

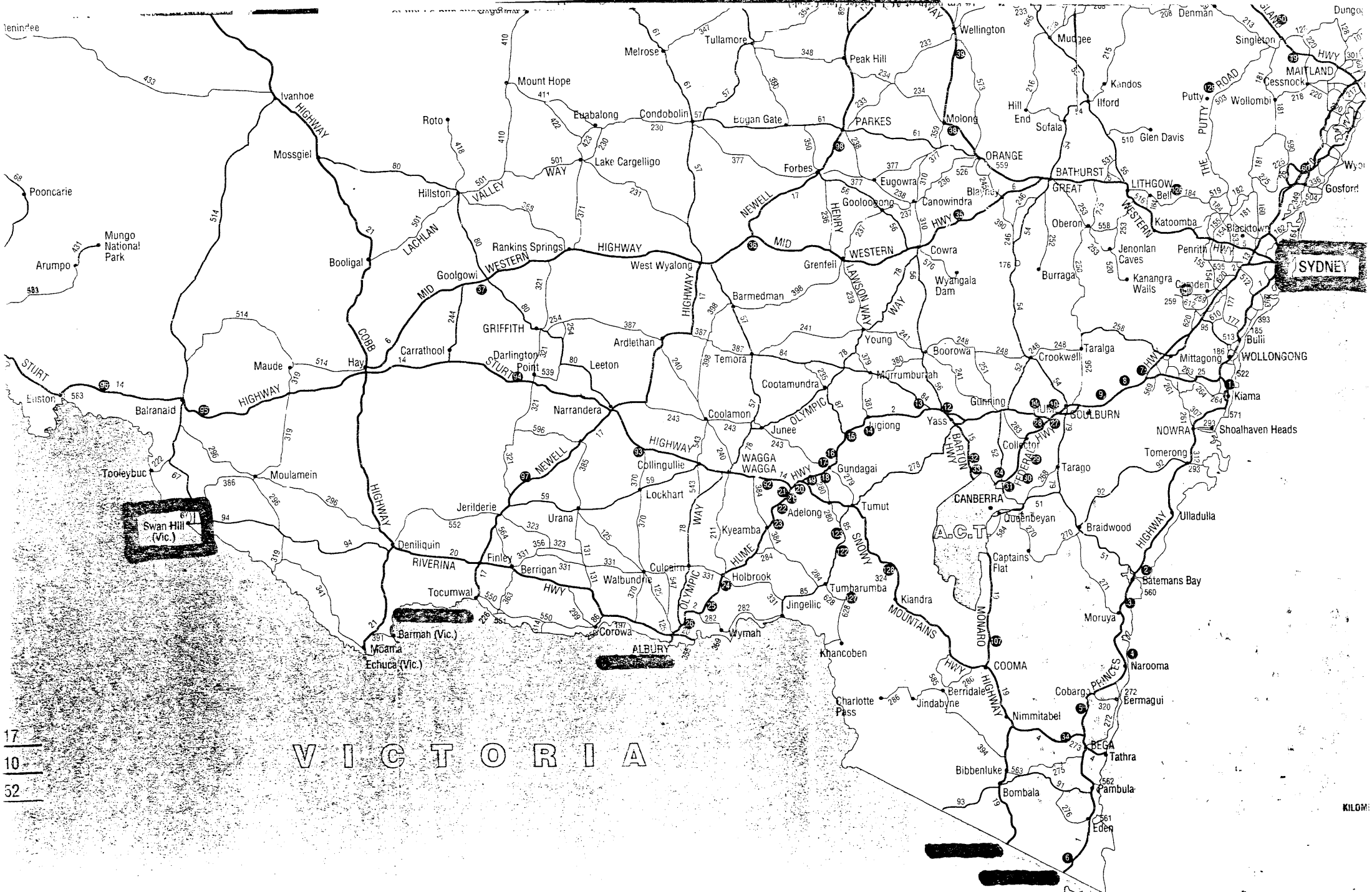
**HISTORIC ENGINEERING MARKER**

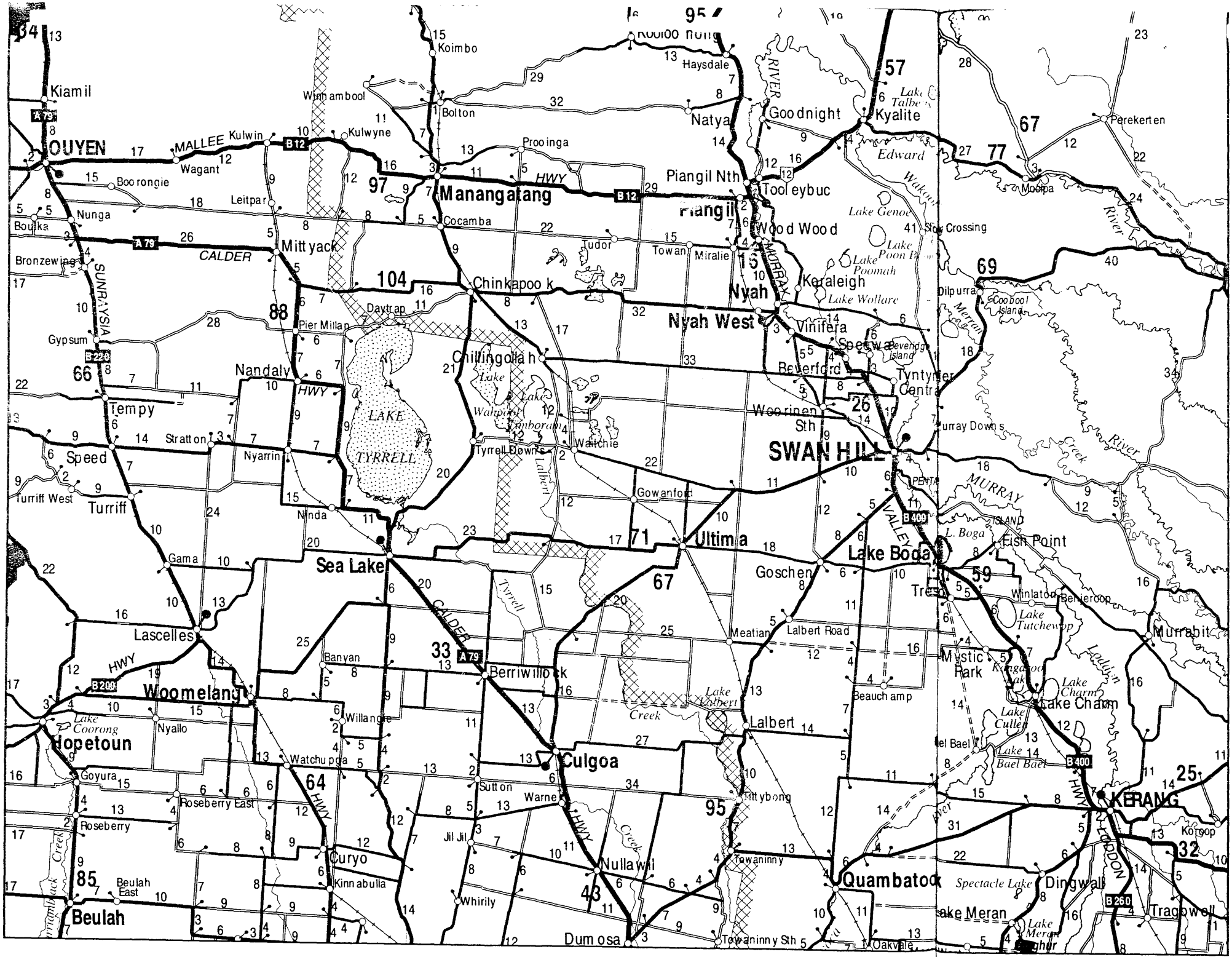
**Swan Hill – Murray River Road Bridge**

**Designed by NSW Public Works engineer Percy Allan MICE and built by Messrs J B and W Farquharson of Melbourne, this lift-span bridge was opened in 1896. Built to cater for paddle steamers of the river trade, it was cheaper, more reliable and easier to operate than earlier lift bridges. It enhanced Swan Hill as a centre of river trade and rural commerce, contributing to the prosperity of the town and district of which it has become a symbol.** (77 words)

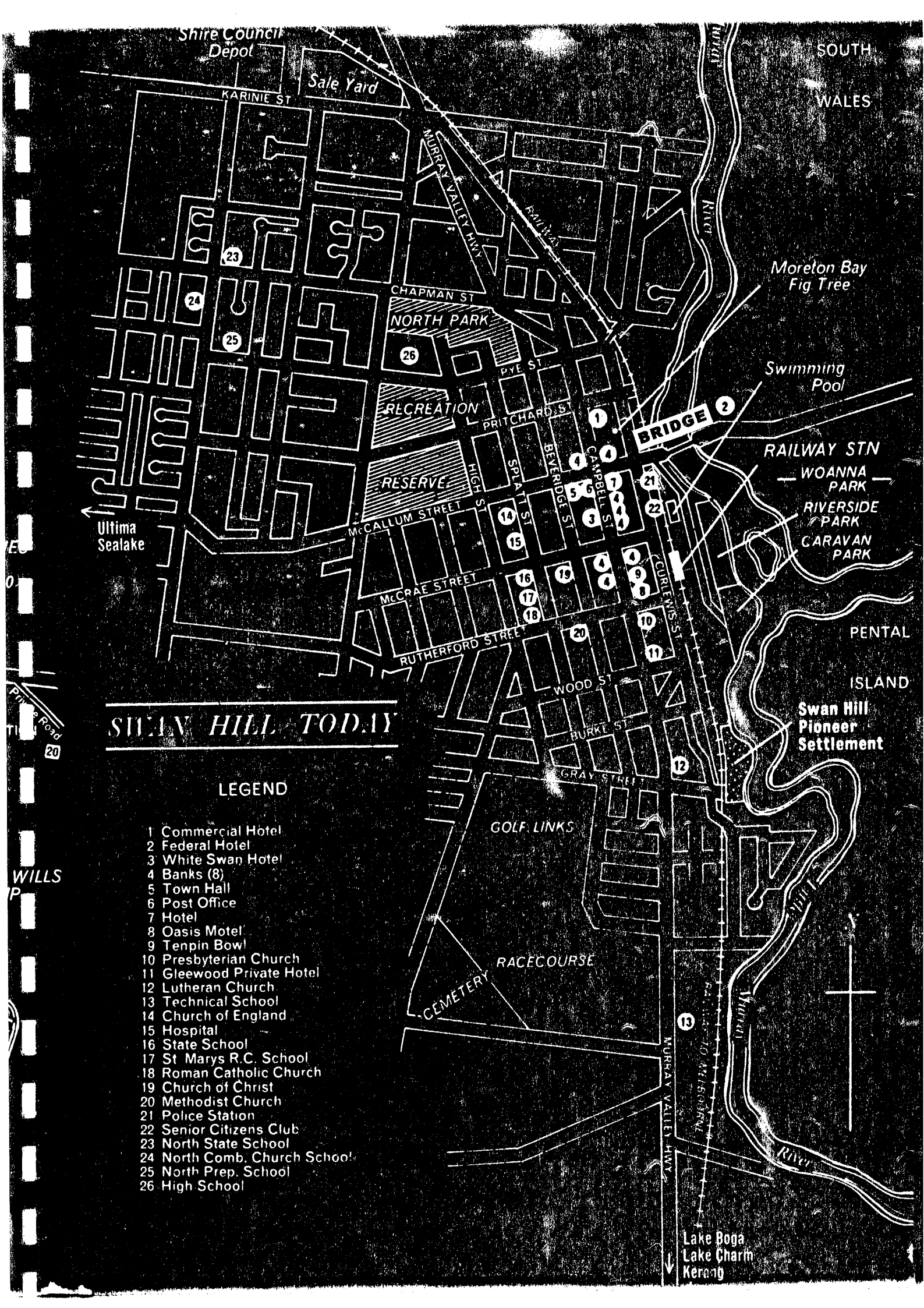
**The Institution of Engineers Australia**
**Roads and Traffic Authority, NSW**
**Swan Hill Rural City Council, 2004.**

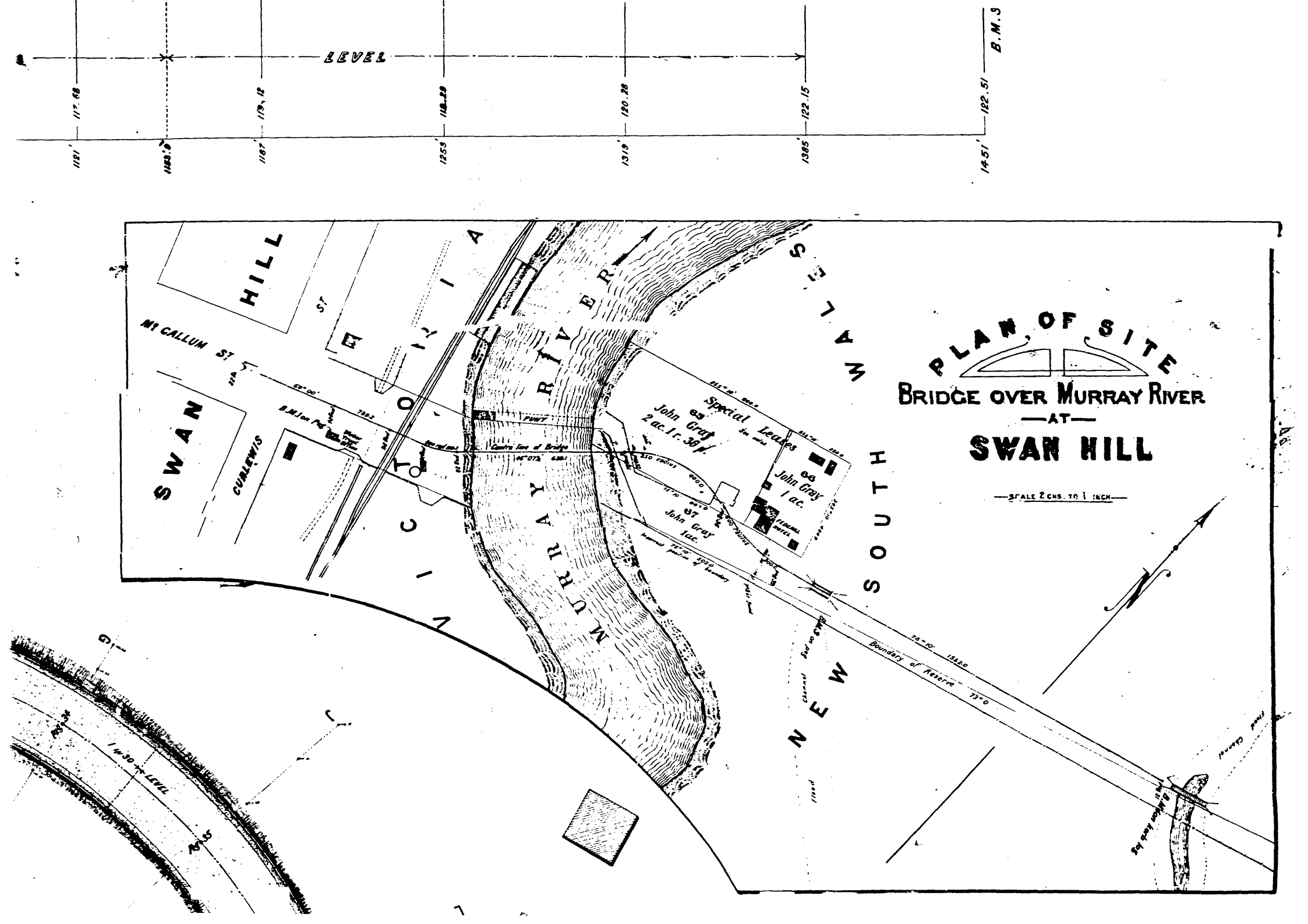
# ATTACHMENT A


Ivanhoe
Mossgiel
Hillston
Booligal
Roto
Mount Hope
Euabalong
Condobolin
Lake Cargelligo
Melrose
Tullamore
Peak Hill
Bogan Gate
Forbes
Parkes
Molong
Wellington
Orange
Eugowra
Gooloogong
Canowindra
Blayney
Cowra
Grenfell
Wyangala Dam
West Wyalong
Rankins Springs
Goolgowi
Barmedman
Griffith
Carrathool
Darlington Point
Leeton
Ardlethan
Temora
Young
Boorowa
Harden
Murrumburrah
Cootamundra
Narrandera
Coolamon
Junee
Yass
Gunning
Crookwell
Taralga
Oberon
Burraga
Jenolan Caves
Kanangra Walls
Katoomba
Blackheath
Penrith
Camden
Sydney
Wollongong
Mittagong
Bulli
Kiama
Shoalhaven Heads
Nowra
Goulburn
Tarago
Collector
Gundagai
Tumut
Adelong
Batlow
Wagga Wagga
Collingullie
Lockhart
Urana
Jerilderie
Deniliquin
Finley
Berrigan
Tocumwal
Barmah (Vic.)
Moama
Echuca (Vic.)
Corowa
Albury
Wymah
Culcairn
Walbundrie
Holbrook
Tumbarumba
Jingellic
Khancoben
Kiandra
Canberra
A.C.T.
Queanbeyan
Captains Flat
Braidwood
Batemans Bay
Moruya
Narooma
Cooma
Berridale
Jindabyne
Charlotte Pass
Cobargo
Bermagui
Nimmitabel
Bega
Tathra
Bibbenluke
Bombala
Pambula
Eden
Tooleybuc
Swan Hill (Vic.)
Moulamein
Balranald
Euston
Maude
Hay
Pooncarie
Arumpo
Mungo National Park
Ulladulla
Tomerong
Putty
Singleton
Cessnock
Maitland
Gosford
Denman
Muswellbrook
Scone
Kandos
Ilford
Sofala
Hill End
Glen Davis
Bathurst
Lithgow
Bell
Wyong
Newell Highway
Mid Western Highway
Lachlan Valley Way
Henry Parkes Way
Olympic Highway
Sturt Highway
Cobb Highway
Barton Highway
Federal Highway
Hume Highway
Snowy Mountains Highway
Monaro Highway
Princes Highway
Great Western Highway
Putty Road
Pacific Highway
VICTORIA
KILOM




Map base supplied courtesy of the RACV.


Shire Council Depot
Sale Yard
KARINIE ST
MURRAY VALLEY HWY
RAILWAY
SOUTH WALES
Moreton Bay Fig Tree
CHAPMAN ST
NORTH PARK
RECREATION
RESERVE
PYE ST
PRITCHARD ST
HIGH ST
SPLATT ST
BEVERIDGE ST
CAMPBELL ST
BRIDGE
Swimming Pool
RAILWAY STN
WOANNA PARK
RIVERSIDE PARK
CARAVAN PARK
Ultima Sealake
McCALLUM STREET
McCRAE STREET
RUTHERFORD STREET
CURLEWIS ST
PENTAL ISLAND
Swan Hill Pioneer Settlement
WOOD ST
BURKE ST
GRAY STREET
GOLF LINKS
RACECOURSE
CEMETERY
MURRAY VALLEY HWY
Lake Boga
Lake Charm
Kerang
SWAN HILL TODAY
LEGEND
1 Commercial Hotel
2 Federal Hotel
3 White Swan Hotel
4 Banks (8)
5 Town Hall
6 Post Office
7 Hotel
8 Oasis Motel
9 Tenpin Bowl
10 Presbyterian Church
11 Gleewood Private Hotel
12 Lutheran Church
13 Technical School
14 Church of England
15 Hospital
16 State School
17 St Marys R.C. School
18 Roman Catholic Church
19 Church of Christ
20 Methodist Church
21 Police Station
22 Senior Citizens Club
23 North State School
24 North Comb. Church School
25 North Prep. School
26 High School


LEVEL
B.M.3
117.68
119.12
120.28
122.15
122.51
1181'
1187'
1253'
1319'
1385'
1451'
PLAN OF SITE
BRIDGE OVER MURRAY RIVER
—AT—
SWAN HILL
—SCALE 2 CHS. TO 1 INCH—
NEW SOUTH WALES
VICTORIA
MURRAY RIVER
SWAN HILL
McCALLUM ST
CURLEWIS
Centre line of Bridge
PUNT
Special Leases
83 John Gray 2 ac. 1 r. 39 p.
84 John Gray 1 ac.
85 John Gray 1 ac.
Boundary of Reserve
Flood Channel
1 in 30 to LEVEL

# ATTACHMENT B

98M2034
Liam Terris
Phone 9218 6960

25 JUL 2003

Mr Don Fraser
Secretary
Engineering Heritage Committee Sydney
The Institution of Engineers Australia
PO Box 2044
Rose Bay North NSW 2030.

**Roads and Traffic Authority**
www.rta.nsw.gov.au

Centennial Plaza
260 Elizabeth Street
Surry Hills NSW 2010
Telephone (02) 9218 6888
PO Box K198
Haymarket NSW1238
DX 13 Sydney

Dear Mr Fraser,

**Plaquing Swan Hill ~~and Tooleybuc~~ Bridge**

Reference is made to your letter dated 20 June 2003 addressed to the General Manager, Infrastructure Maintenance regarding the commemorative plaquing of both the Swan Hill Bridge and Tooleybuc Bridge over the Murray River.

I agree in principle to the Institution of Engineers' proposal for the commemorative plaquing of these bridges during the 2004 RTA Heritage Festival Program.

Mr Andrew Cramp, Area Maintenance Manager Bridges, South West Region is nominated as the contact officer for this project. He will advise on a suitable location and will arrange for installation of the plaque. Further, he will be the contact regarding the timing and any arrangements regarding the unveiling ceremony for the plaque.

Mr Cramp's contact details are given below:

Address: PO Box 484
Wagga Wagga NSW 2650

Telephone: (02) 6938 1153
Facsimile: (02) 6938 1183

Yours sincerely

Paul Forward
Chief Executive

CC: Bridge Maintenance Planner, South West Region

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# ATTACHMENT C

# Percy ALLAN

Percy Allan (1861-1930) is regarded as one of Australia's foremost bridge engineers being associated in the design and construction of 583 bridges during his 49-year career (1878-1927) in the NSW Department of Public Works (PWD). Among his best known works are the 1894 redesigned timber truss road bridge (the Allan truss), the 1896 lift bridge and timber trusses over the River Murray at Swan Hill, the 1902 Pyrmont and the 1903 Glebe Island swing bridges (among the earliest electrically operated moveable span bridges in the world) and the 1930 Georges River Bridge. All survive as at 2002.

Born in Sydney and trained by tutorage under senior PWD engineers, Percy Allan was among the early group of Australian-born engineers at a time dominated by expatriates from Britain. After establishment of the School of Engineering, under Professor W H Warren, at the University of Sydney in 1883, Allan was joined by an increasing number of local graduates including J J C Bradfield, J W Roberts and Harvey Dare.

In 1896 Percy Allan was appointed engineer-in-charge of bridge design and from 1900 to 1908 had the added responsibility for rivers, artesian bores, water-supply and drainage which included parts of Sydney's sewerage system. He was District Engineer, Newcastle from 1908 to 1911 from which he was later to present a paper "Port Improvements at Newcastle, NSW" to the Institution of Civil Engineers, London, being awarded their Telford Premium in 1921.

He returned to Sydney in 1912 and resumed supervision of bridge projects becoming Chief Engineer, National Works and Local Government Works in 1918. He retired in that position in 1927. In his youth he was a rugby representative and was a keen golfer throughout his life. Professionally, he was a member of and contributor to local and international engineering societies. He died in 1930 and is buried at South Head Cemetery, Sydney. (*Australian Dictionary of Biography, 1891-1939, pp36-37*)

# ATTACHMENT D

# LIFT BRIDGE OVER THE MURRAY AT SWAN HILL.

By PERCY ALLAN, Assoc. M. Inst. C.E., Assoc. M. Am. Soc. C.E.

[With Plates 1 - 4.]

[*Read before the Engineering Section of the Royal Society of N. S. Wales, November 18, 1896.*] Vol 30

THE Lift Bridge over the Murray River at Swan Hill having just been completed, and the author having in 1894, under Mr. Hickson, M. Inst. C.E., then Engineer-in-Chief for Public Works for New South Wales, designed the structure, has the honour of placing before the members of the Section a description of the work—before entering on the subject of the paper, it seems desirable to briefly refer to the character of the river traffic to be provided for, and the considerations leading to the adoption of lift bridges—whilst a short resumé of the lift bridges previously erected in the Colony, may be of interest.

The report by Mr. Darley, M. Inst. C.E., Engineer-in-Chief for Harbours and Rivers in 1890, on the Locking of the Darling, conveys an idea of the large traffic using the great rivers of the Colony, the number of steamers and barges trading on the Darling and Murray Rivers being given as two hundred and twenty-two, with a total net tonnage of 20,358. The traffic consists mostly of steamer with barge in tow carrying in some cases 1,000 bales of wool. The largest steamer of which the author has a record is 123′ long, carrying a width of 33′ 6″ over sponsoons, and requiring a minimum headway of 28′ when flying light, this vessel trading between Swan Hill and Mildura on the Murray River.

The considerations leading to the adoption of lift bridges for the Darling, Murray and Murrumbidgee Rivers my be summarised thus:—

1. Economy.



2. The absence of masted vessels doing away with the necessity of an uninterrupted headway, as afforded by a swing span or basoule.

3. Narrowness of "low rivers" rendering pivot pier in centre of stream objectionable.

4. The necessity of providing the maximum headway in the highest floods.

5. The low lying land on either side of river necessitating long approaches to a fixed bridge with the required headway.

6. Heavy wool teams on a narrow bridge making long graded side spans inadmissible.

The first two lift bridges in the Colony were erected in 1880 at Bourke and Balranald, on a design by Mr. J. H. Daniels, Assistant Engineer, acting under the late Mr. W. C. Bennett, M. Inst. C.E., Commissioner and Engineer-in-Chief for Roads and Bridges, and in 1885 the author acting for Mr. J. A. McDonald. M. Inst. C.E., Engineer for Bridges, then absent in England on leave, designed under the late Mr. W. C. Bennett, the lift bridge over the Barwon River at Brewarrina, erected by day labour under the supervision of the late Mr. John Coleman, Resident Engineer at Bourke, at a total cost of £7,700. The bridge consists of a steel lift span on iron cylinder piers, giving a clear fairway of 47′ 6″ with timber side spans, making a total length of 267′ between centres of abutments, the clear headway provided when lift is raised to its full height being 22½′ above highest flood.

The two steel main girders of lift span are of light construction, the booms being each formed of two angle bars back to back riveted to 9″ × ⅜″ boom plates, the web being formed of diagonal channel struts and flat diagonal bars, the steel web plate cross girders 1′ 6″ deep pitched 4′ 6″ apart, are riveted to bottom flange of main girders, whilst steel web plate frames are placed between the cross girders to shorten the span of the 3″ sawn planking forming the floor of bridge. A lateral system of diagonal tie rods is secured to bottom booms of main girders which materially "stiffens" the lift span when being raised or lowered.

A provision for such adjustments (*Plate* 3, fig. 1) is of considerable importance in this type of bridge, the correct centring of towers being specially necessary for the satisfactory working of lift span. Over each pier are seated two transverse girders spaced 17″ apart, the webs being connected with four diaphragms, and the top and bottom flanges, with chequered plates and flat diagonal bars respectively. Between the transverse girders over each pier, are fitted, two longitudinal girders spaced 13′ 7″ apart. A lateral strut at centre of longitudinal girders with four diagonal tie rods completes bracing of the tops of the four towers. (*Plate* 4)

The lift span is counter weighted with four cast-iron balance boxes, working on steel V guides bolted to the outside angles of towers. (*Plate* 3, fig. 2) The balance boxes (each in eight sections, filled with lead) are carried by wrought iron adjustable suspension rods, to which are spliced the sixteen 2½″ steel galvanised wire ropes—four to each box—which pass over the rope wheels placed over the top of towers and are then connected to steel suspension brackets bolted to the four corners of lift span. The lift span "hangs" clear when being raised, but provision is made for "swaying" by placing two rollers at each corner of span to take bearing on a bull headed rail bolted to angle irons of towers. The machinery platform (*Plate* 3, fig. 2) is placed downstream at the same level as kerb of side spans.

Although provision is made for working with two men, the bridge as a rule, will be operated by one man working a winch-handle (*Plate* 3) on a horizontal shaft inside the towers, carrying a pinion gearing into a spur wheel keyed to a second horizontal shaft which is connected by mitre wheels to a vertical shaft passing up the inside of and through the top of towers, the vertical shaft being connected by bevel wheels with a short horizontal shaft at the top of towers, (*Plate* 4) carrying a pinion gearing into a spur wheel keyed to the downstream longitudinal driving shaft, to which is keyed at each end a pinion gearing into teeth cast on the inside of rim of the two rope wheels over down-stream towers, pinions are also keyed to ends of upstream longitudinal shaft,



gearing into the two rope wheels over upstream towers, whilst the two longitudinal shafts driving the four rope wheels are connected by mitre wheels keyed to a transverse shaft, the uniform working of lift span being thus ensured.

The total weight of the lift span is thirty-four and a-quarter tons, and is so far counterweighted that a maximum weight of 1800lbs. has to be raised or lowered, one man with ease raising or lowering span through 25′ 10″ in 5½ minutes or at the rate of 4·7′ per minute.

It may be here noticed that the Brewarrina bridge with its "endless" chain is balanced in all positions, but at Swan Hill the lift span is only in balance when opposite the counterweights, necessitating provision being made in the latter bridge for lifting the unbalanced ropes, this weight however is more than compensated for by the reduction in frictional resistance obtained with ropes in lieu of chains and sprocket wheels.

The Swan Hill bridge differs from previous lift bridges in this Colony, in which wire ropes have been adopted, in the following respects—the lift is 5′ 10″ higher, the machinery platform is placed at deck level thus avoiding the time lost by man climbing towers and making his way to an overhead winch, whilst the disposition and design of lifting gear is altogether new, again the absence of an overhead machinery platform relieves the deep longitudinal girders in the Swan Hill bridge of considerable weight, thus preventing any deflection in the girders, with the accompanying "pinching" of the shafts.

The gearing and shafting throughout the author's design is very much lighter, the pitch of teeth of pinion on the shaft driving rope wheels being only 1½″ as against 2½″ and on the first motion shaft ⅞″ as against 1¼″ in previous bridges.

Again the adoption in the Swan Hill bridge of eight cast-iron boxes filled with lead for each counterweight, in lieu of a balance weight formed of a cast-iron bottom section weighing four and three-quarter tons with a cast-iron top section filled with lead, facilitates

live load of 84 lbs. per square foot of floor space, and a concentrated load of 16½ tons on a 10′ 4″ wheel base, with 9½ tons on a pair of wheels, 5′ centres. The wire ropes carrying counterweights are 2½″ circumference composed of six strands round a core of hemp, each strand containing seven wires of mild crucible steel, having after galvanising, an ultimate strength of 87 tons per square inch, and a twisting strength of 34 turns in a length of 8″.

Prof. Warren, M. Inst. C.E., has carried out at the University of Sydney for the Bridges Branch of the Public Works Department, a number of tests on rope of the same section, the results (given in appendix A.) showing the ultimate strength of a full size "laid" rope to be 90% of the strength of the forty-two wires tested individually, and the strength of a turned and spliced end to be 83% of the ultimate strength of the rope. As the ultimate strength of the sixteen ropes in Swan Hill bridge is 266 tons, and the weight of lift span only 34½ tons the ropes have a "factor" of 7¾, an ample margin in view of the slow speed and large diameter of the rope wheels, the wheels being seventy-seven times the diameter of the ropes.

The steel used in the superstructure is of a mild quality, having an ultimate strength of 26 to 29 tons per square inch, with an elongation of from 20% to 26% in a length of 10″. The main girders of steel lift span stand 16′ 4″ apart and have sliding bearings at each end, whilst the timber trusses are 21′ 7″ apart centre to centre. The 4″ sawn tallow wood planking on the lift span rests on longitudinal ironbark girders secured to steel web plate "fish-bellied" cross girders pitched 8′ 4″ apart.

The planking on truss spans and approach spans rests on ironbark longitudinal girders. The carriage way is 14′ between the sawn ironbark kerbs on lift span, and 18′ 3″ and 21′ 11″ between kerbs on truss and approach spans respectively, one 4′ 6″ foot way being provided on the upstream side of truss and approach spans.

The two river piers each consist of a pair of cast-iron cylinders 18′ 4″ centre to centre, founded on rock and extending to a height



of 1′ 8″ above summer level, supporting two wrought iron cylinders 6′ diameter, connected with stiff wrought iron diaphragm bracing, so designed as to ensure pier acting as a whole. The cylinders are filled with concrete composed of five parts of 2½″ granite, two parts of sand and one part of Portland cement, richer concrete being used in the top and bottom of cylinders. The maximum pressure on the rock foundation with bridge fully loaded and neglecting any assistance from flotation being 4¾ tons per square foot.

The superstructure of lift span is similar to that adopted for the Tocumwal and Wilcannia bridges, the two steel main girders are 4′ 2″ deep with top and bottom boom of trough section, formed of two angle bars riveted to 12″ × 7/16″ plates, the web consisting of vertical struts at ends and channel bars set to an angle of 45°. The steel web plate cross girders are placed at the apices, being carried on steel saddle plates riveted to bottom boom of main girder, two main girders being connected by a lateral system of adjustable diagonal flat bars. The side spans are of the 1893 standard type design, a description of which has already been given by the author in a paper read before this Section.[1]

The four hollow towers (similar in general design to Tocumwal bridge) 3′ square, 40′ 2″ long, are formed each of four vertical angle irons, braced with horizontal T iron and flat diagonal tie bars. The base of each tower is continued 6′ down inside wrought iron cylinder and bolted to four 6′ lengths of vertical angle iron, these vertical angle irons being bolted to diaphragm plates, which in turn are connected to the shell of cylinder by 3″ × 2″ × ⅜″ angle irons with ¾″ rivets, the base of the tower being then filled in with concrete to the level of cylinder caps; the bolt holes in the 6′ vertical angle irons and in the diaphragm plates were drilled *in situ*, thus permitting of the adjusting of the slight difference in the sinking of cylinders, which amounted to ⅛″ in the centres of the upstream and 7/16″ in the centres of the downstream cylinders.

[1] Journ. Roy. Soc. N. S. Wales, Vol. xxix., 1895.

The iron hollow towers at the four corners of the lift span let 3′ into cylinders and surrounded for this depth with concrete, are connected at the top by transverse and longitudinal girders, thus preventing the tops of towers approaching one another and jamming lift span when being raised. Four short galvanised link chains attached to the top boom at each end of main girders, pass over chain wheels placed at the top of each tower, and are then secured to cast-iron balance boxes inside the towers adjusted with lead filling; chains are attached to the bottom of balance weights, pass under sprocket wheels at the foot of towers and are secured to bottom corner of each main girder, thus making practically an endless chain and leaving bridge balanced in any position, the weight to be lifted being only that due to friction.

The bridge was designed to be operated by two men each working a winch placed on a platform on the downstream side of each pier, driving a transverse shaft to which are keyed the two sprocket wheels in the bottom of each pair of towers, whilst uniform lifting of ends of span is ensured by connecting the chain wheel at top of tower with bevel gearing. The ratio of gearing is sixteen and a-half revolutions of handle to one of chain wheel; permitting of bridge being lifted to its maximum height of 19′ by two men in four and a-half minutes, or at the rate of 4·22′ per minute.

In 1895 the Bourke bridge was altered so as to permit of one man instead of two, working the lift span. Contracts being subsequently let for similar alterations at Brewarrina and Balranald. The alterations consist in the substitution of wire ropes for the four suspending chains, the arrangement of the ropes being designed by Mr. de Burgh, M. Inst. C.E., and may be shortly described as follows:—

From each corner of lift span a wire rope passes over and around a rope wheel at top of tower, thence across the span and over the rope wheel on the opposite tower, the end being then connected to balance weight, the ropes from each corner of lift span thus crossing one another at centre of span. The bridge is



raised and lowered by means of one winch driving the two sprocket wheels, working two chains attached to the bottom of the two weights (over one pier) and is then secured (after passing under sprocket wheels) to bottom corners of lift span.

In 1889 Mr. J. A. McDonald, M. Inst. C.E., Engineer for Bridges for New South Wales, introduced a new design for the Mulwala Bridge over the Murray River, the author working out under Mr. McDonald the details in connection with the structure, this design being repeated for the Wentworth Bridge over the Darling River, the clear fairway provided is 46′ 3″ and the clear headway above highest flood being 23′ 4″. The leading features of this design were—the stiffening of superstructure by the better disposition of the materials, the substitution of wire ropes for the cumbersome chains previously used, the placing of the operating winch overhead at the centre of the lift span, and the arranging of the winch so that the one main longitudinal shaft geared directly with the two transverse shafts carrying the rope wheels. The design was far in advance of previous lift bridges but difficulties were met with owing to the untwisting of ropes causing the weights working in the towers to brush, inducing considerable friction, which it was thought advisable to avoid when the Wilcannia and Tocumwal Bridges, designed by Mr. J. A. McDonald, under Mr. Hickson, were being considered.

In the design for these two bridges the driving shaft was placed transversely and geared into two longitudinal shafts carrying the rope wheels placed directly over the centre of the towers, the balance boxes being placed on the outside of towers working on V guides. The clear fairway provided is 50′ 5″ and clear headway above when span is raised full height being 25′.

The Swan Hill bridge designed by the author in 1894, was the next and latest type of lift bridge to be erected. The bridge consists of one steel lift span 58′ 4″ between centres of bearings over piers, two 91′ 6″ timber truss spans, and four 35′ timber approach spans. (*Plates* 1 and 2.) The bridge is designed for a

transport and erection, whilst the substitution of load for a greater portion of the cast-iron used in previous counterweights reduces the overall length of the balance weight with a corresponding reduction in the height of the four towers.

The Tocumwal and Swan Hill bridges, being over the same river, having the same fairway, the same width of deck, the same weight of lift span, and having been erected by the same contractor, a comparison of the relative cost of the two designs may be of interest.

The Tocumwal bridge was completed in 1895 and the Swan Hill bridge in 1896, the distance from Melbourne to site of the former bridge is one hundred and fifty-seven miles (one hundred and fifty miles by rail and seven miles by road), and from Melbourne to Swan Hill two hundred and fourteen miles by rail.

The lift span, towers, overhead bracing girders at top of towers, platforms, counterweights and machinery complete fixed *in situ*, cost for Tocumwal Bridge £3,400 as against £2,600 for the Swan Hill bridge, with its 5′ 10″ additional lift.

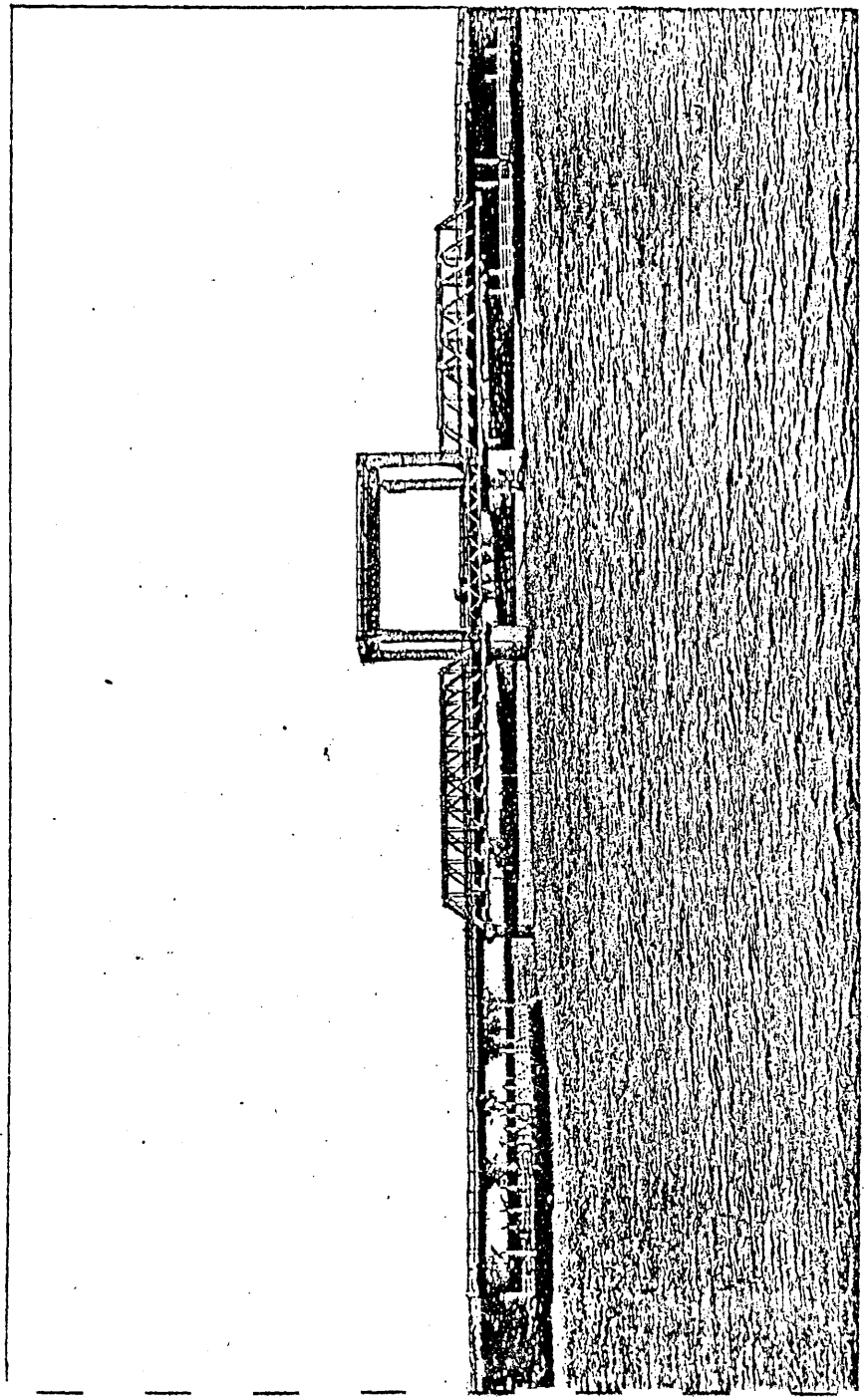
The overall length of the Tocumwal Bridge, with the iron side spans is 336′ as against 385′ the overall length of the Swan Hill bridge with timber side spans. The completed cost of the two structures including engineering expenses being £19,635 and £8,900 respectively. The large difference in cost is due to the more economical design of lift, the substitution of timber for iron side spans and the securing of foundations for the two river piers at Swan Hill at a lesser depth than at Tocumwal, again the plant used at Tocumwal bridge, was available for Swan Hill bridge and prices were lower when contract for the latter bridge was placed.

The contract for the bridge and New South Wales approaches was let on 6th June, 1895, to Messrs. J. B. and W. Farquharson of Melbourne, who placed the manufacture of the metal work with Messrs. Mephan, Ferguson & Co. of Melbourne, the whole

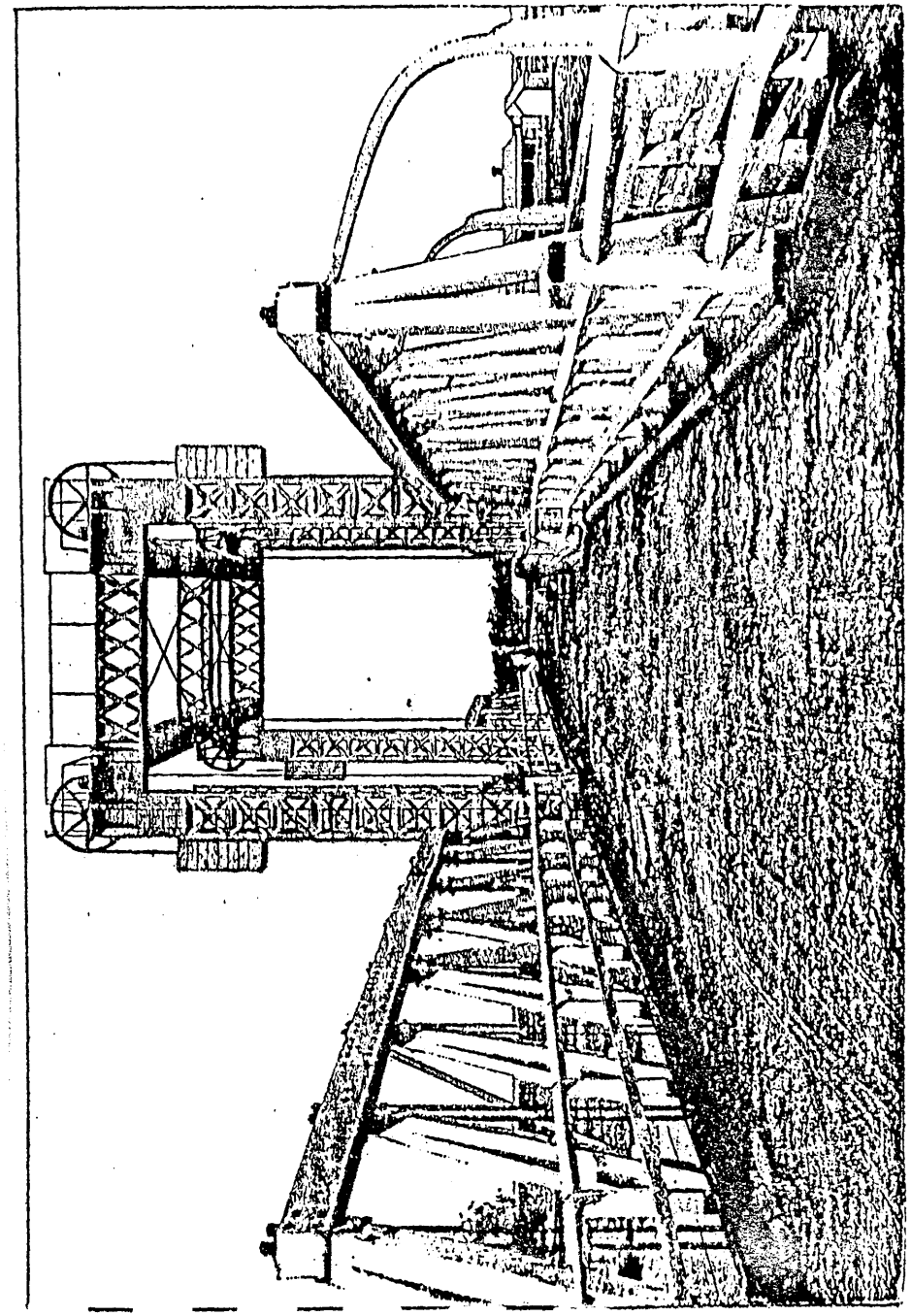


of the timber, with the exception of a few piles was obtained from the northern rivers of New South Wales, forwarded to Melbourne by sea, a distance of about 726 miles, thence to site by rail a distance of 214 miles, or a total carriage of 940 miles, the planed and framed timber in truss work being erected *in situ* at 4/- per cubic foot, which gives a clear idea of the economical character of this design of truss. Mr. D. W. Armstrong was the Resident Engineer in charge of the erection of the structure, he having previously superintended the erection of the lift bridge at Mulwala.

In conclusion the author desires to acknowledge his indebtedness to Mr. Darley, M. Inst. C.E., Engineer-in-Chief for Public Works, (under whom the Swan Hill Bridge was completed) for the courtesy extended in lending photographs and supplying plans to illustrate the several bridges referred to in the paper, and to mention the assistance of Messrs. Dare and Edgell, Assoc. Ms. Inst. C.E., who, under the author's direction were engaged on the more important detail work connected with the structure.







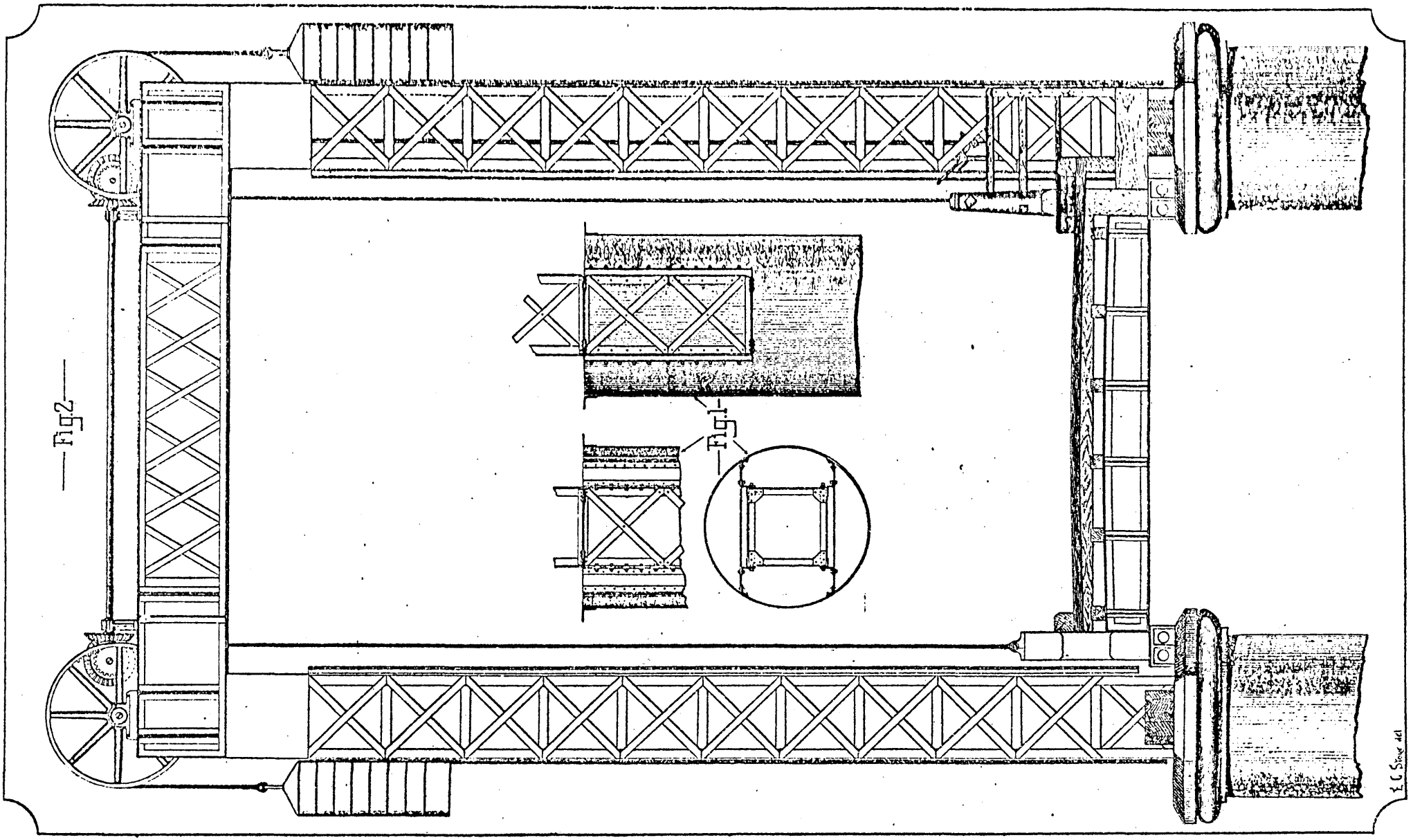
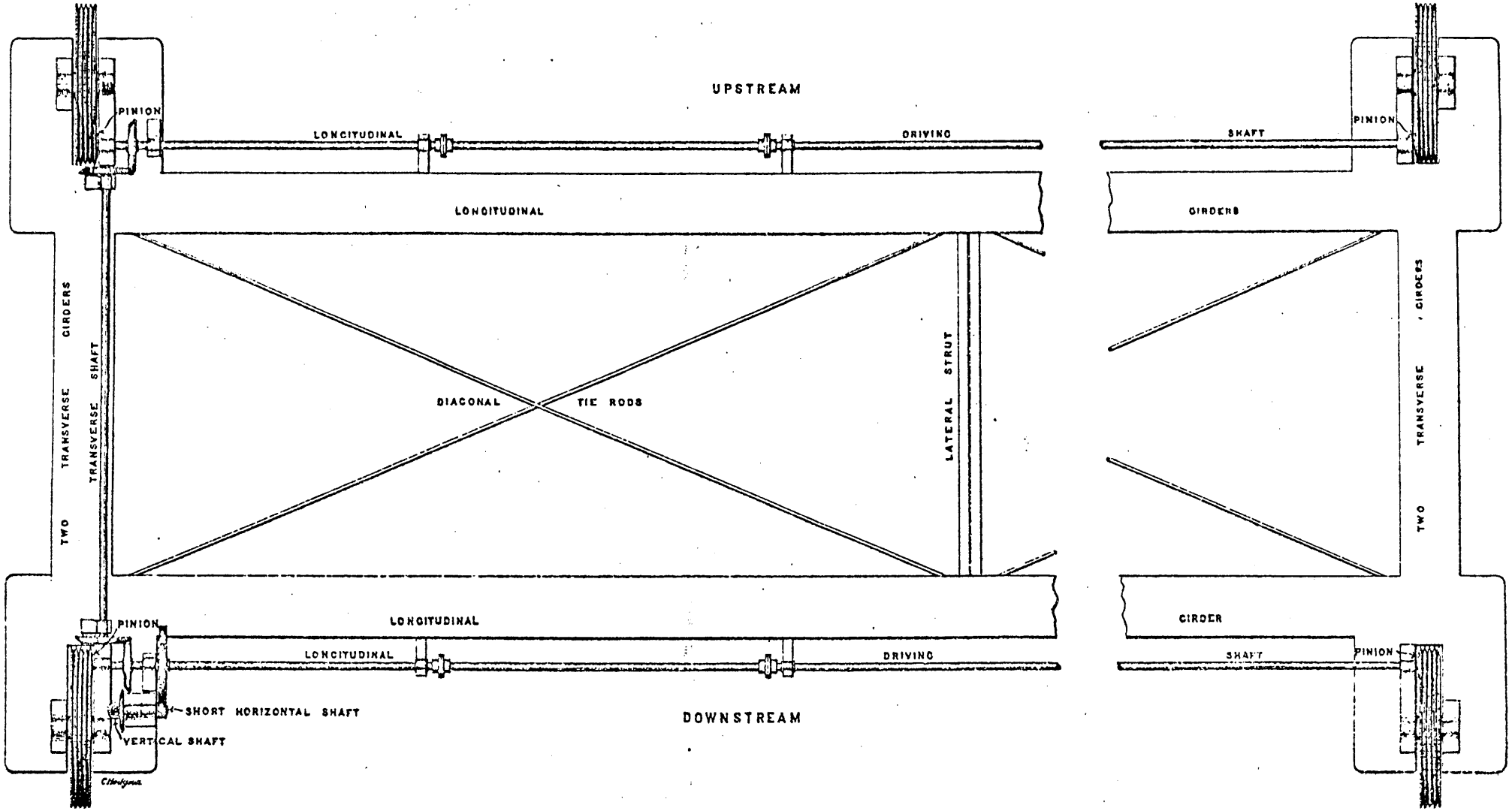


Fig2
Fig.1
E.C. Stone del

Journal Royal Society of N.S.W. Vol. XXX. 1896.
(Engineering Section.)

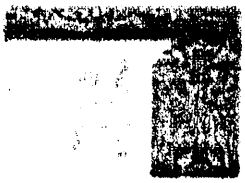
PLATE 4



# ATTACHMENT E

# Listing Heritage Items

## State Heritage Inventory Search Results



## Statutory Listed Items

Information and items listed in the State Heritage Inventory come from a number of sources. This means tha be several entries for the same heritage item in the database. For clarity, the search results have been divide sections.

- The first section contains items listed on the State Heritage Register, covered by an Interim Heritage protected under section 130 of the NSW Heritage Act. This information is provided by the NSW Heritag
- The second section contains items listed by Local Councils & Shires and State Government Agencies. may also contain additional information on some of the items listed in the first section.

Section 1. Items listed under the NSW Heritage Act.

The search results can be resorted by clicking on (sort) option at the top of each column.

| Item Name (sort) | Address (sort) | Suburb (sort) | LGA (sort) | State Heritage Register |
|---|---|---|---|---|
| Swan Hill-Murray River Road Bridge | Main Road 67 | Swan Hill (East) | Wakool | Yes |

There was 1 record in this section matching your search criteria.

Section 2. Items listed by Local Government and State agencies.

| Item Name (sort) | Address (sort) | Suburb (sort) | LGA (sort) | Information Source (sort) |
|---|---|---|---|---|

There was a total of 1 record matching your search criteria.

**Key:**
LGA = Local Government Area
GAZ= NSW Government Gazette (statutory listings prior to 1997), HGA = Heritage Grant Application, HS = Heritage Study, LGOV = Local Government, SGOV = State Government Agency.

**Note: The Heritage Office seeks to keep the State Heritage Inventory (SHI) up to date, however the la listings in Local and Regional Environmental Plans (LEPs and REPs) may not yet be included. Always che with the relevant Local Council or Shire for the most recent listings.**

NSW Heritage Office

# Listing Heritage Items

State Heritage Inventory Search Results

## Swan Hill-Murray River Road Bridge

## Item

**Name of Item:** Swan Hill-Murray River Road Bridge
**Type of Item:** Built
**Group/Collection:** Transport - Land
**Category:** Road Bridge
**Primary Address:** Main Road 67, Swan Hill (East), NSW
**Local Govt. Area:** Wakool
**Property Description:**

| Lot/Volume Code | Lot/Volume Number | Section Number | Plan/Folio Code | Plan/Folio Number |
|---|---|---|---|---|

**All Addresses**

| Street Address | Suburb/Town | LGA | Parish | County | Type |
|---|---|---|---|---|---|
| Main Road 67 | Swan Hill (East) | Wakool | | | Primary |
| McCallum Street | Swan Hill (East) | Wakool | | | Alternate |

## Owner/s

| Organisation Name | Owner Category | Date Ownership Updated |
|---|---|---|
| Roads & Traffic Authority | State Government | |

Note: There are incomplete details for a number of items listed on the State Heritage Register. The Heritage Office intends to develop or upgrade statements of significance for these items as resources become available.

**Assessment Criteria**

Items are assessed against the **State Heritage Register (SHR) Criteria** to determine the level of significance. Refer t the Listings below for the level of statutory protection.

## Listings

| Heritage Listing | Listing Title | Listing Number | Gazette Date | Gazette Number | Gazett Page |
|---|---|---|---|---|---|
| *Heritage Act - State Heritage Register* | | 01481 | 20 Jun 00 | - | - |
| *Heritage Act - s.170 NSW State agency heritage register* | Roads & Traffic s.170 | | | | |

## References

None

## Procedures /Exemptions

| Section of Act | Description | Title | Comments | Act Dat |
|---|---|---|---|---|
| 57(2) | Exemption to allow work | Standard Exemptions | I, the Minister for Planning, pursuant to section 57(2) of the Heritage Act 1977 on recommendation of the Heritage Council of New South Wales grant standard exemptions from section 57(1) of the Heritage Act, 1977 | Mar 200 |

# ATTACHMENT F

# Swan Hill - Murray River Road Bridge



## Swan Hill - Murray River Road Bridge

**Note:**

****** indicates that information is not supplied.**

### Item

| | |
|---|---|
| **Name of Item:** | Swan Hill - Murray River Road Bridge |
| **Item Number:** | 17678 |
| **Type of Item:** | Built |
| **Item Sub-Type:** | **** |
| **Roadloc:** | **** |
| **Address:** | M.R.67 McCallum Street, Swan Hill **** |
| **Local Government Area:** | Wakool |
| **Owner:** | Local Government |
| **Current Use:** | Road Bridge |
| **Former Use:** | Road Bridge |

### Statement of Significance

**Statement of Significance:**

Swan Hill Bridge is significant under all four criteria - Historical, Aesthetic, Technical, and Social.

The significance of the bridge lies in its form, setting and materials. The presence of the lift span is important. The appropriate level of significance in NSW is State but the heritage contractor rates it as being of National significance.

The form and setting have high aesthetic and social significance. The superstructure construction - Allan timber Trusses and Allan Lift Span have very high significance in the detail and materials.

The bridge is the original of its type, and extremely rare. (there is one other example at Tooleybuc).

**Date Significance Updated:** 21 December 1999

### Description

| | |
|---|---|
| **Designer:** | **** |
| **Builder:** | **** |
| **Construction Years:** | **** - 1896 |

**Physical Description:**

Swan Hill Bridge is a timber truss, steel lift span bridge across the Murray River at Swan Hill. The main axis of the bridge is East - West.

There are three main spans including one lift span supported on cast iron cylindrical piers. On the northern side there are three approach spans, and on the southern side there is one.

The two main truss spans are 27.9m Allan trusses, with timber cross girders. The main stringers have been replaced with steel I-sections. The deck is timber.

The lift span (17.8m) superstructure is constructed with riveted lattice steel. The lifting layout was also developed by Percy Allan. The deck of the lift span is also timber, and traffic is restricted to one lane across the lift span.

The approach spans (10.4m to 10.8m) timber girders supporting a timber deck. Piers are timber trestles, including the junctions with the main spans.

There is a footway added on the upstream side, using steel beams. this has resulted n modification of the top chord stabilising angles to the Allan Trusses.

**Physical Condition and/or Archaeological Potential:** The bridge is described as being in fair condition as it has had major rehabilitation in recent years. One truss span is currently (May 1998) under repair.

**Modifications and Dates:** N/A

**Date Condition Updated:** 15 May 1998

## History

**Historical Notes:**

The 'beautiful notes' of the swans, on a lagoon 'incessantly hear during the night' prompted Sir Thomas Mitchell, the Surveyor General, to name Swan Hill when he camped there in 1836 on the wide Murray plain: Mitchell's head is today the crest of Swan Hill. This area was settled in the subsequent decade in very large stations: on the New South Wales side of the river, Murray Downs under Bell and Wilson covered 60,000 hectares and by the 1860s, under H S Officer, was carrying 6000 sheep. On the Victorian side, the principal runs were Tyntynder and Mercers Vale, established by the Beveridge family as cattle stations.

Because of this pastoral development a punt was installed at Swan Hill as early as 1846. In 1853, when the first two steamers on the river, the Lady Augusta and Mary Ann raced up the river, both stopped at Swan Hill and the Campbell family mounted a ball for the passengers and crew while their wool-clip was loaded. Swan Hill developed wharfage and in the 1860s had two hotels and three stores but only eleven houses. The town continued to develop as a crucial centre for the river trade, overlanding and interstate commerce, with hotels on both sides of the river adjacent to the punt.

The Victorian railway reached Swan Hill in 1889 and the need for a bridge was more and more recognised. A lift-span bridge, allowing the passage of the river-boats, which were still numerous in this area, was planned in 1895 and opened in 1896. The bridge is still in use: Swan Hill, with good road, rail and water links, reached a population of 4000 by 1948, remains the focus of a large area of diversified farming and attracts many tourists to its open-air museum.

## Listings

| Heritage Listings | Reference Number | Gazette Number | Gazette Page |
|---|---|---|---|
| National Trust of Australia register | | | |
| Register of the National Estate | 16074 | 115 | 0004 |
| Heritage Act - s.170 NSW State agency heritage register | | | |

## Assessment of Significance

**Historical Significance:** The Swan Hill Bridge is historically very significant. It is hard to differentiate between Historical and Technical Significance in this instance as they are closely intertwined. This bridge has great importance for its

| | |
|---|---|
| | association with Percy Allan, who is respected as the outstanding bridge engineer in NSW. In his 46 yeas in the Public Service he designed over 550 bridges, including several outstanding structures. Swan Hill Bridge was one of his major works, and a significant advancement in technology. He was extremely proud of this bridge and prepared a technical paper on it. The bridge demonstrates a major step in the evolving pattern of our moveable bridge history. |
| **Aesthetic Significance:** | The Swan Hill Bridge has aesthetic significance due to its outstanding setting and landmark qualities. The bridge provides a gateway to NSW from the major urban area of Swan Hill. It is a focus of the town to the river, which it dominates by its size and mass. The setting within the town of a lift bridge is rare, being only duplicated (with RTA bridges) at Tooleybuc. |
| **Social Significance:** | The Swan Hill Bridge has high significance in the Swan Hill / Wakool District as the main urban link across the river and the focus of movements across the river, controlling access of people and commerce. The river is the centre of social and recreational region, and the Swan Hill Bridge is the centre of this area. It is considered an important element in the Region by the local people, although there is concern at its perceived traffic inadequacies. |
| **Technical Significance:** | The bridge is the earliest example of an Allan Truss and Allan Lift Span on the Murray, and one of only two remaining (the other being Tooleybuc). It is also the first Allan Lift Span constructed, and served as a pattern for all subsequent lift bridges. This form of truss was designed by Percy Allan MICE, MAM, Soc. CE. In 1893 Allan produced the design of the truss which now bears his name. These were originally of two standard spans, 70ft and 90ft but the system was eventually adopted for all spans, and also used in railway construction. It probably represents the highest point in the development of timber trusses. America had changed to steel long before this time, and Australia was soon to follow. Although the truss type is often referred to as a "Modified Howe" truss, it is as different from the original Howe as each of the American types were from one another. The features of the design were: * the omission of counter braces, i.e. the use of single diagonal webs in lieu of crossed members. * the placing of all webs on the same angle so that any shrinkage could be taken up by the tightening of suspension rods * the use of swan flitches for all braces, bowed to prevent warping and twisting * the introduction of cast iron shoes at the top and bottom of braces * the adoption of open top and bottom chords, for easier painting and obviating the decay due to the entrance of water between the members in a built up chord Floor beams were placed at panel points to eliminate bending in the bottom chord. The cast iron butting blocks at the ends of the webs served two purposes. Firstly, they eliminated the worst features of previous types which was lodgement of water in re-entrant corners. Secondly, they allowed easy removal and renewal of the webs. The whole system was designed with maintenance in mind, as any member can be renewed without staging room below. the trusses were designed for a live load of 18.8 cwt per lineal foot of span, or a 16 on traction engine. Factor of safety in timber was 7. The economy of the system was quoted by Allan: "In the superstructure of one 90ft span carrying a 15ft deck, there is a 500cub ft. less timber than in the 1886 type of truss, which, in conjunction with the greater ease in framing together (notably in the bottom chord, where no fitting is required) the fewer bolt holes to be bored, and the short length of timber employed, effects a large saving in cost of each span. The economy is more marked when it is considered that the old trusses were designed to carry a 15ft carriageway, whereas the Allan Trusses are designed to carry two 5ft footways in addition to a 15ft carriageway. Thus it will be seen that the later design of truss bridge offers greater facilities for traffic at a much reduced cost." Allan was aware of the problems found in splices in bottom chords, and |

developed a testing machine for those at Pyrmont. Nevertheless, he appears to have not properly solved the problem, as these joints are the major causes of problems in the trusses. Allan reported that his splice details was adopted in America. Longer spans (over 90ft) required overhead bracing to stabilise the to chord. This required trusses to be 21ft deep "to allow clearance under the bracing from a loaded wool wagon." Several important bridges were built by Allan using his truss. The Hampden Bridge at Wagga Wagga was built in 1895 and at the time was the largest timber structure in the colony. The Pyrmont Bridge (1902) was larger in deck area than any in the UK at the time, and its electrically opened spans were considered marvellous and daring by the English Engineers of the time. The Allan Truss remains a fine example of timber truss technology. The bridge is a fine example of its type and one of only two remaining. It was the first of its type and a significant variation to a class.

**Integrity/Intactness:** ****
**Representativeness:** ****
**Rarity:** ****
**Endorsed Significance:** State

## References

### Bibliography

| Type | Author | Year | Title |
|---|---|---|---|
| Written | W.C. Foster | 1985 | Sir Thomas Livingston Mitchell and his World, 1792-1855 |
| Written | R.B. Ronald | 1960 | The Riverina: People and Properties |
| Written | R.P. Whitworth | 1866 | Baillieres New South Wales Gazetteer and Road Guide |

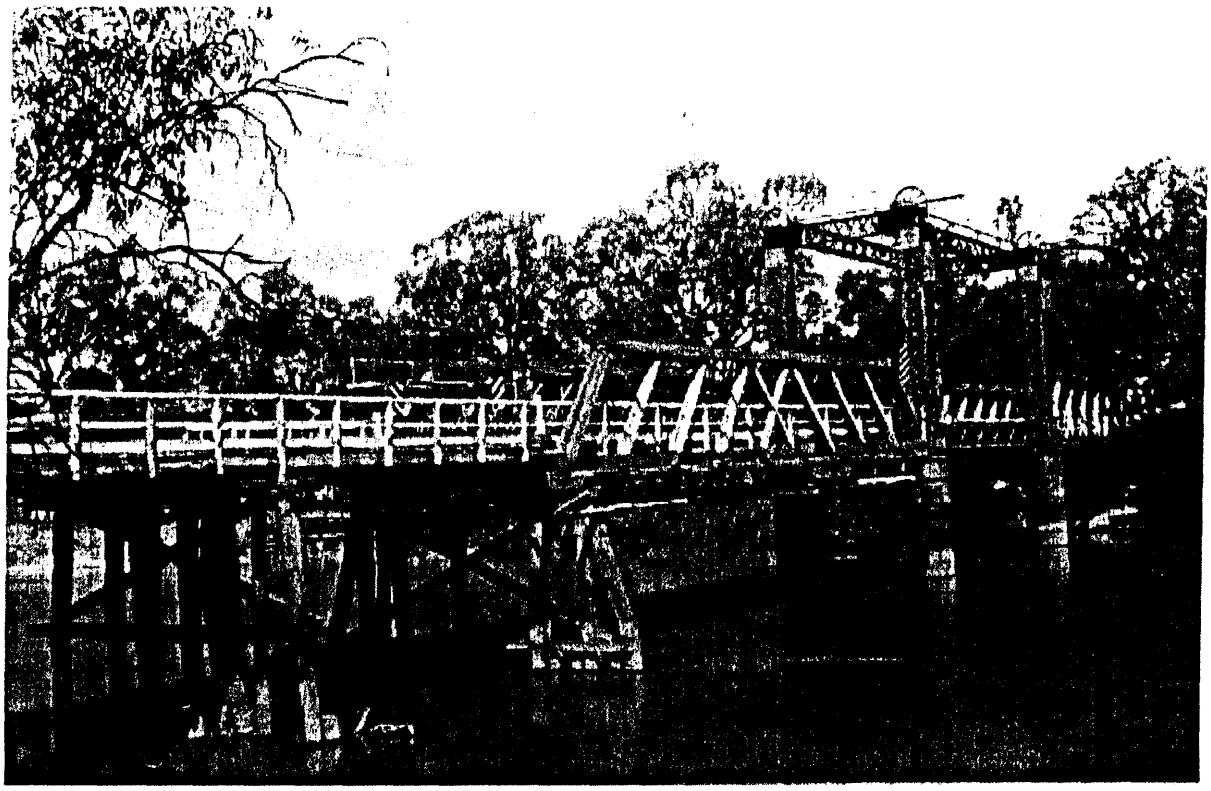
## Study Details

**Title:** Murray Crossings Heritage Study
**Year:**
**Number:** 5000090
**Author:** Hughes Trueman Reinhold
**Inspected By:**
**Guidelines Used:** No

## Custom Fields

**RTA Region:** SOUTHWESTERN
**Bridge Number:** 3215
**CARMS File Number:** 469.1339
**Property Number:** ****
**Conservation Management Plan:** ****

## Images



# ATTACHMENT G

## History of the Swan Hill area

The Murray River region provided a rich and diverse array of resources for the many Aboriginal people that occupied the river valleys. Contact between settlers and local populations at Swan Hill first occurred in 1846 when the pastoral run Tyntynder, 10 miles to the north west, was taken up (Gardner 1986: 2).

The first European explorer to the area was Major Thomas Mitchell in 1836, crossing the Murray just below the junction with the Murrumbidgee before following it upstream. He had found the mallee country to be extremely barren, but on reaching the Swan Hill area described it as:

> rich, grassy flats surrounded by shining verdure, enclosed by sheltering hills...the soil was of the richest description and the area seemed capable of being converted into good wheat land, being easily irrigated at any time by the river (Gardner 1986: 2).

Mitchell's party camped overnight near a hill close to another junction with a smaller stream. Upon encountering an abundance of noisy swans and water birds Mitchell named the spot Swan Hill.

Early settlement tended to come from pastoralists moving north from Victoria in the 1840s, rather than moving west from the Riverina and Albury, and by 1850 most of the better river locations were taken. The Murray west to Swan Hill was predominantly occupied by squatters runs by 1849 (Heritage Office 1996: 149). In 1845 a large run of 370,000 acres was established between Kerang and Swan Hill, followed by those of Tyntynder, Piangil and Swan Hill in the following year. In 1848 Murray Downs, 1.5 kms opposite Swan Hill, was a large run comprising 150,000 acres carrying sheep and cattle (Gardner 1986: 6-7).

Various factors were important in the development of the Murray River area as a supplier of wool, and meat from cattle and sheep. Markets developed to the south with the establishment first of South Australia in 1836 and the growth of Port Phillip in the 1840s. By the time of the Victorian gold rushes in the 1850s there were already large pastoral runs in place and the focus shifted from wool growing to beef cattle farming to cater for the demand from increased rural populations (HO 1996: 150).

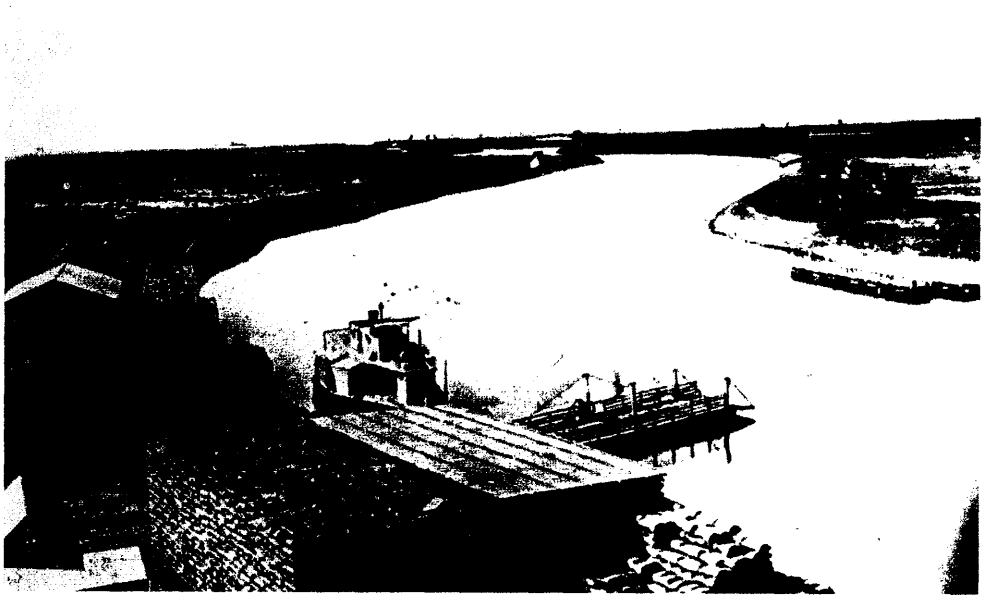
In 1851 the town site for Swan Hill was surveyed and laid out on a grid system. Already there was a punt, blacksmiths, a hotel and within 10 years a gaol, courthouse, police residence, hospital and numerous shops. By the 1860s the large properties were broken up into smaller areas and selectors moved in. The town grew slowly and in 1876 described as not much more than a hamlet with only 28 houses and the country still " largely in its virgin state' (Gardner 1986: 57).

The dominance of beef production was short lived. By the 1860s the market had declined and disease in cattle meant once more sheep became important, particularly in the Riverina area away from the main river country (HO 1996: 151). Particularly important though for the wool trade was the improved transportation offered by river boat trade from 1853 onwards, again directing trade to the south and overseas. Wool continued to be of major importance to the area until the 1890s (HO 1996: 151). Many large sheep runs developed in the interior away from the rivers and it was the high prices obtainable for wool that made long distance trade and its infrastructure a viable enterprise.

For goods going to and from the pastoral stations transport away from the rivers relied first on pack horses, bullock drays and later coaches (Grant 1970: 91). In 1849 John Lindsay Beale brought his bullock team to Swan Hill to transport wool, and noted at the time that a punt had recently been built over the Murray

guaranteeing the development of Swan Hill as a crossing place (Gardner 1986: 57).The first stock route from Moulamein to Echuca went through Deniliquin, a rather indirect route. .A more direct link was gazetted in 1868, via the property known as Thule, close to Barham (Grant 1970: 43). This was still a rather indirect way to reach their southern markets. A shorter route to the Murray River was to travel to Swan Hill, which involved one river crossing, over the Wakool near Dilpurra. In 1886 a lease for the punt and ferry at Swan Hill was sought by Mr. John Gray, and the old punt site was moved to a location adjacent to the current bridge (Nat. Trust, Vic).

Commercial trading along the Murray and its major tributaries, became vitally important for the economic success of the region. First to use paddle steamers and barges along these rivers were Captains Cadell and Randell in 1853. The growth in this trade reached a high point in 1883 when there were about two hundred river craft actively engaged in trade (Painter 1993: 13). A port had been declared at Swan Hill in 1864, becoming a Port of Entry and Clearance complete with a Customs House (Gardner 2000: xii). Initially goods, such as wheat and wool crossed the river on the punt.



View of the Swan Hill Punt c. 1896 (Source: Gardner 1986: 28).

The port developed as a major hub for the Victorian river trade. Another important transport link came with the extension of the railway from Bendigo to Echuca in 1864. The Swan Hill wharf was extended in the 1890s to include a rail siding constructed to link with the railways.

Swan Hill was a supporter of the movement for Federation, particularly as it would help to abolish the trade restrictions and duties currently in place between NSW and Victoria. At public meetings held in 1898-9 to debate the issue Federation was endorsed wholeheartedly and in the first vote on the issue, the Swan Hill electorate came out strongly in its favour (Gardner 2000: xiii).

One of the most important changes to occur along the river systems was the damming of the Murray upstream to control the erratic water flows. A tri-state agreement in 1902 between South Australia, New South Wales and Victoria led to the construction of the Hume Weir at Albury, completed in 1936. A number of irrigation areas were established such as that for the Wakool area in 1938, which meant farmers now had more security

to continue their operations (HO 1996: 153). This has eventually led to the diversification of local farming by increasing the number of different crops that could be grown. Increasing economic activity, continued population growth in the early part of the twentieth century (particularly from returned soldier settlement schemes) and the isolation of the communities made land and river transport of crucial importance for suppliers and their markets (Painter 1996: 83).

## History of the Swan Hill Bridge

### *Construction and history*

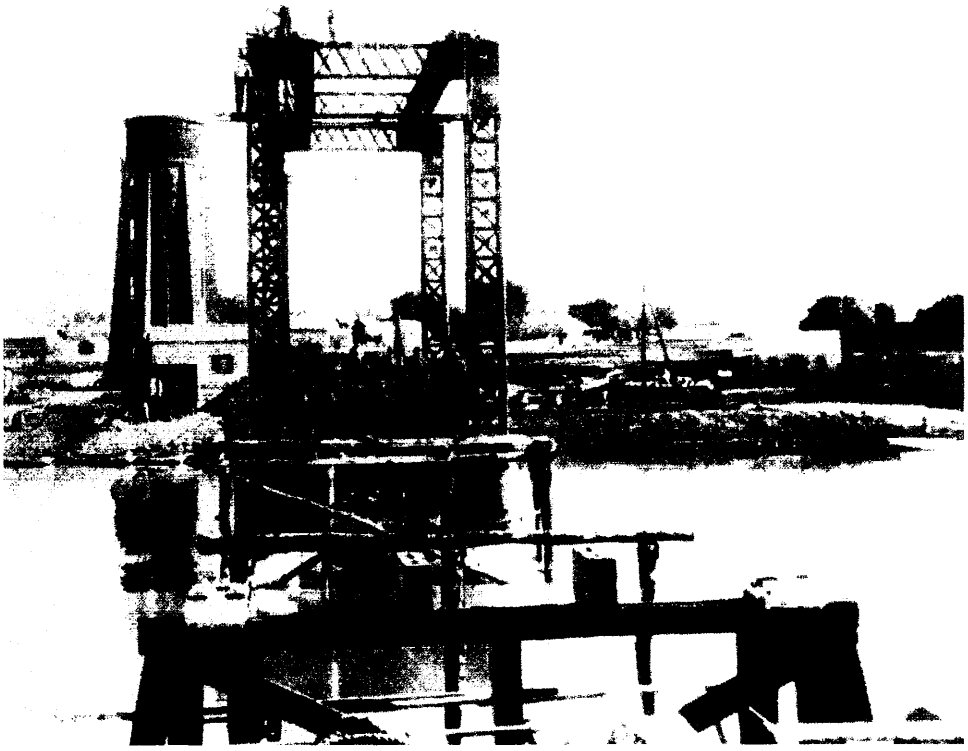
Work on the Swan Hill Bridge started in 1892 and continued until 1896. Costing a total of £8900 it was built to the innovative design of Percy Allan incorporating his new truss design, with a longer length than usual of 90 feet, and a lift span that could be operated by one person (National Trust, Vic). Previous lift spans required two operators to open and frequently jammed. This new design became the standard during the next twenty five years (Coltheart and Fraser 1987: 71).

Prior to the bridge, stock and goods, which crossed the Murray, had to do so by the punt or travel long distances to either Echuca or Wentworth. Swan Hill had been an important crossing place for stock from its earliest periods of European settlement. Punt crossings were not always easy however and the inconvenience of loading and unloading goods caused delays. Fees also had to be paid to use the ferry, levied on livestock and other produce, foot passengers, mail and horse-drawn vehicles. Takings from Government tolls averaged about £40 per day in the 1890s (Gardner 1986: 30).

Local support for a bridge was strong and in 1890 prominent pastoralists were actively lobbying both the NSW and Victorian Governments. A public meeting took place at the Royal Hotel in January 1890, organised by the proprietor of Murray Downs Station, Mr. D. Johnson and Herman Moser, a prominent citizen and pastoralist in the area, who later bought out the Tyntynder property. Moser had been instrumental in the formation of the Stony Crossing Progress Association, which sought to improve access between Swan Hill and NSW (Swan Hill Genealogical and Historical Society).

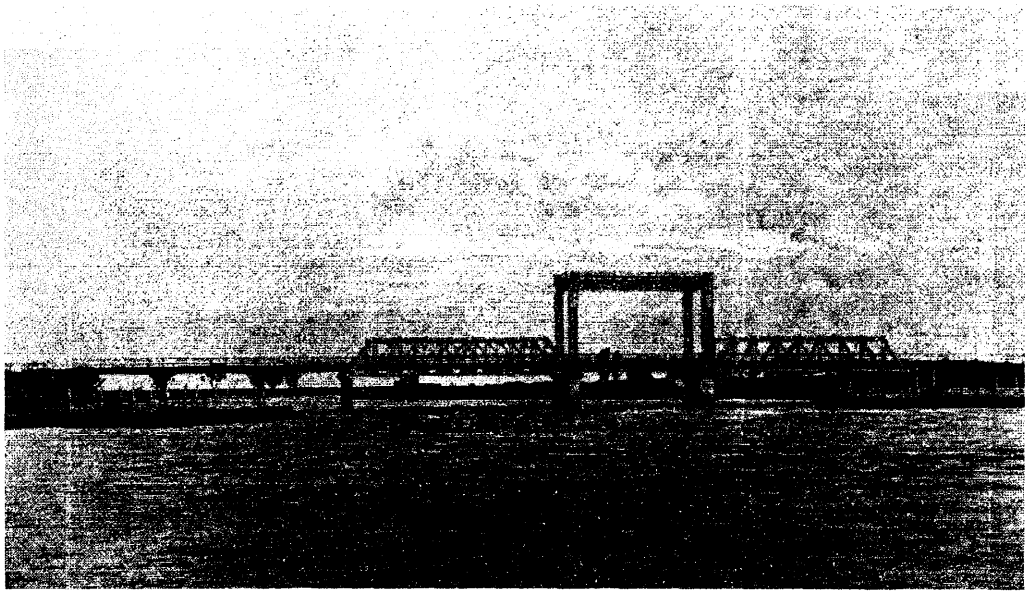
A petition was prepared and presented to the State Governments. By 1894 plans were being drawn up for a bridge at Swan Hill and invitations to tender on the proposed bridge design were advertised in May of 1895. By June the contract was let to Messrs. J. B. and W. Farquharson of Melbourne, who in turn sub-contracted a Melbourne firm for the metalwork (*TCJ* 1896). The timber used in the bridge came from north coast New South Wales and was sent by sea to Melbourne, then by rail to Swan Hill where the trusses were built in place. The *Swan Hill Guardian* questioned the wisdom of importing timbers over such a long distance insisting that local Victorian red gum was highly suitable for the job. Recent research and greater experience of timber bridge building in New South Wales had by this time recognised the superiority of tallow and iron bark for exposed areas, and innovative use of the timbers (round rather than square stringers, for example) proved more structurally efficient (Nat. Trust, Vic).

Photographs of the bridge were taken during various phases of construction. One view shows the timber truss piers as they were being built while a later view shows the lift span in place prior to the construction of the truss spans



Swan Hill Bridge Under Construction (Source: Gardner 2000: 203).

The punt was still operating and is to the right of the bridge. On completion the bridge comprised one steel lift span supported on cast iron cylinders on bedrock, with concrete filled wrought iron cylinders above this, two Allan timber truss spans and four approach spans with a total length of 385 feet

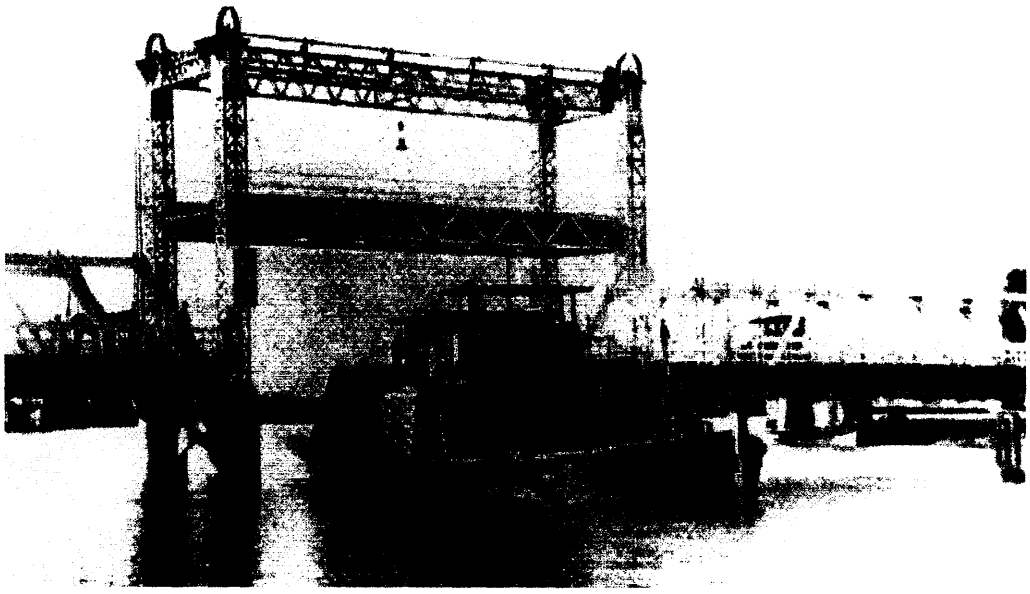


Swan Hill Bridge Following Construction (Source: *Annual Report of DPW*, 1897).

The approaches for the ferry on the New South Wales side were incorporated into the new bridge approaches (Nat. Trust, Vic).

The bridge was officially opened on 2nd December, 1896 by the Victorian Minister for Works, Mr. J. W. Taverner. and attended by a large crowd of people on both sides of the river. Most sources state that the honour of being the first to cross the bridge in a horse-drawn vehicle was given to Herman Moser (Gardner 1986: 30). Later that evening at a banquet to mark the occasion, Mr. Taverner responded to a toast made to Victoria, that he and the Victorian people were strong supporters of federation (*TCJ,* 1896). The bridge would have been tangible proof of what could be achieved by co-operation between the states.

On completion the bridge was compared to the recently built lift span bridge at Tocumwal, a shorter structure that had been considerably more expensive to build. The Swan Hill Bridge, built with timber where possible, had cost £ 8900 and that at Tocumwal, with iron side spans, had cost £19635. The saving in cost was contributed to the improved design of Mr Percy Allan incorporating a more economical lift span, greater use of timber and the shallower depth of foundations required for the piers (*TCJ,* 1896).



View of Bridge in raised position with passing paddle steamer – Date unknown (Source: Gardner 2000 194).

The bridge at Swan Hill provided an important link between New South Wales and Victoria. Until the bridge at Barham was built 8 years later it was the only permanent crossing location in the area, particularly important in moving stock from New South Wales to the wharf at Swan Hill, where goods could then be freighted by rail, river or continue by road. Pastoralists from Barham and surrounds, found it preferable to bring their stock to Swan Hill rather than have it "knocked about" in a punt crossing (McConnell *et al* 1994: 11). The bridge design with a lift span also allowed river trade to continue with minimal delays to both road and river traffic. A photograph taken early after completion shows the lift span raised for the passage of a steamer, while horse and vehicle traffic wait on the bridge.

# ATTACHMENT H

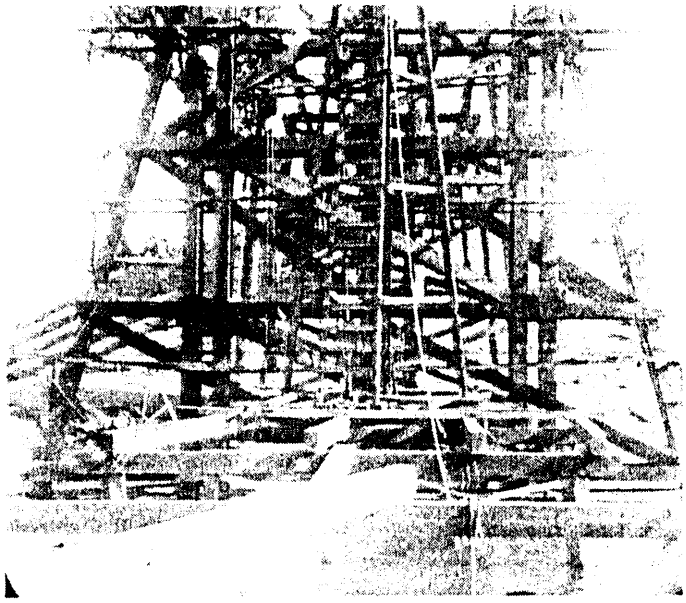
# TRACES OF THE PAST

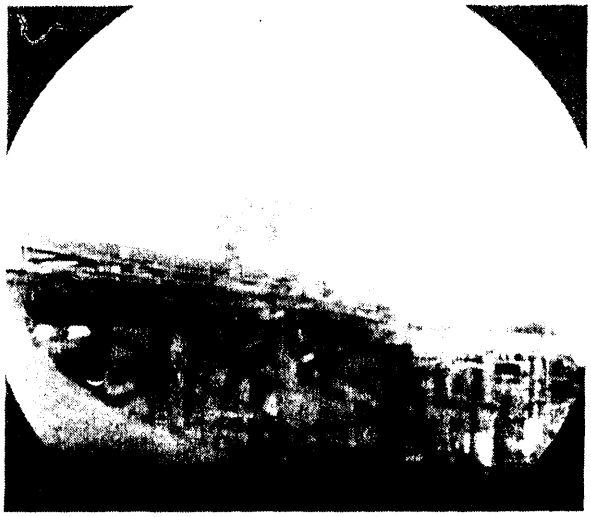
## A Pictorial History of Swan Hill and District from Federation to the Present 1901-2001


**Graham Gardner**

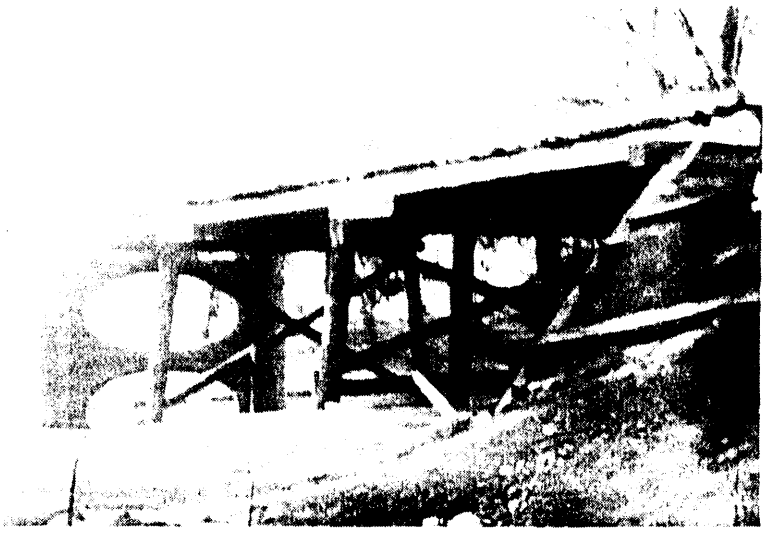
Swan Hill Genealogical and Historical Society Inc. in partnership with
Swan Hill Rural City Council with funding from the Victorian Centenary of Federation

Proudly supported by the Victorian Government

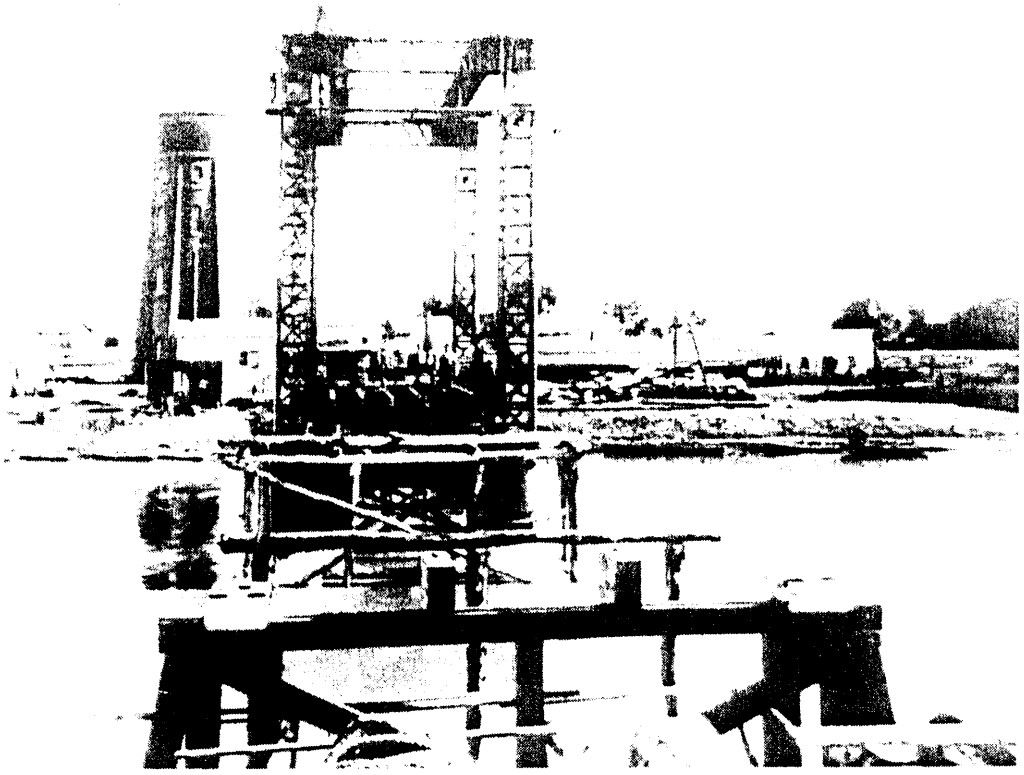




Building of the bridge over the Murray river at Swan Hill 1895-6. Top : truss piles. Centre : photo taken from NSW with Garden's Royal Hotel on right, in Swan Hill. Bottom : steel cylinder supports and wooden piles of the bridge. These three photos were developed from old square glass negatives from the 1890's era.



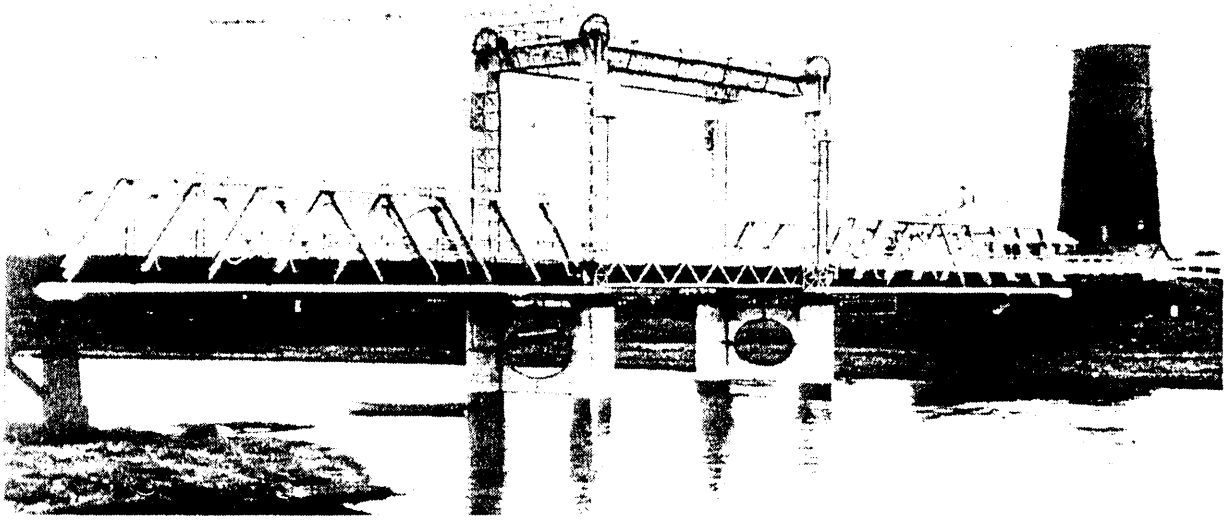
# ~ UNDER CONSTRUCTION 1896 ~



*Swan Hill bridge under construction in 1896.*

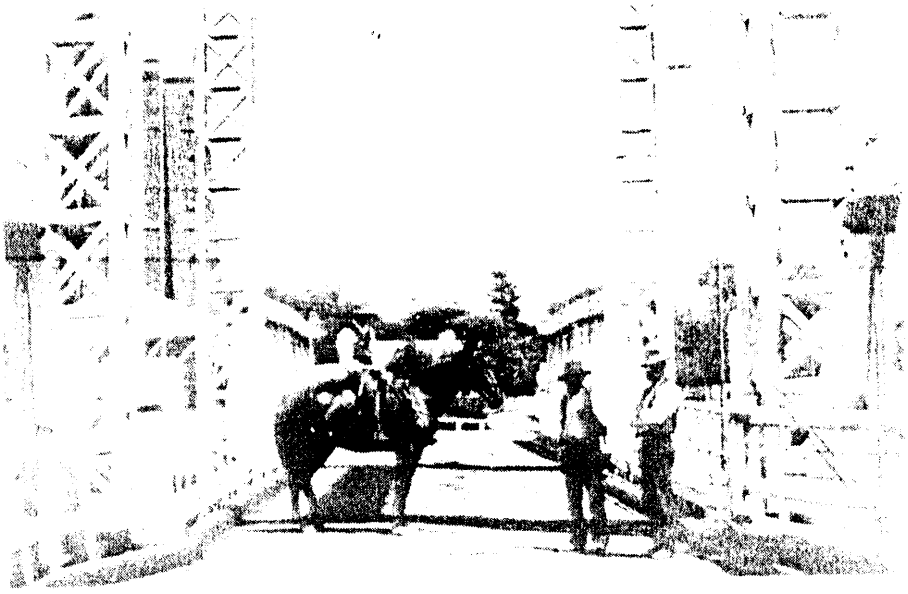
*This photograph was taken from the N.S.W. side of the Murray river and at this time the decking of the bridge had not been completed. The punt was still in operation then and is seen on the right of the bridge. The 1883 red brick water tower and pumping shed are on the left, while Garden's Royal Hotel and the double storeyed Post Office can be seen in the background. The impetus for the bridge gained momentum in the early 1890's with Herman Moser of Cobool station (NSW) being one of the major agitators. After much delay a contract for the bridge was signed by Messrs J & W. Farquharson of Melbourne.*

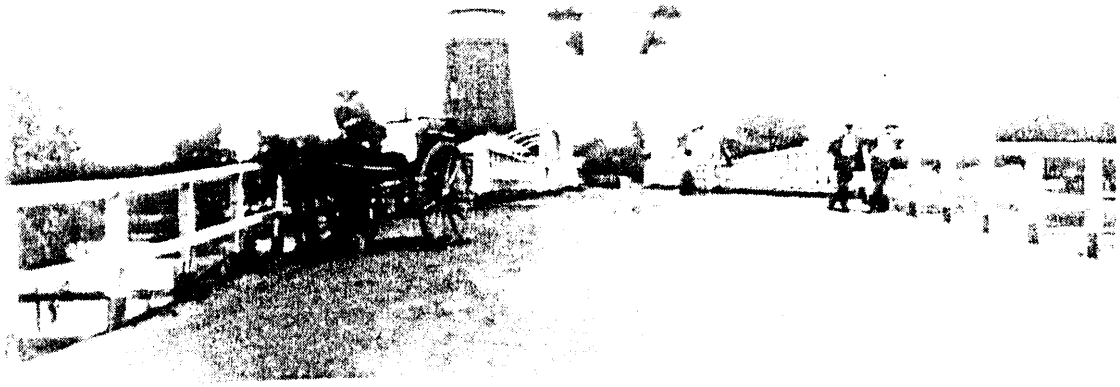
*The new structure was one with a 58 feet steel lift span to allow the passage of riverboats. The steel cylinders were cast in Melbourne . All of the timber, except a few of the piles, came from the northern rivers of NSW, shipped to Melbourne by sea, then brought to Swan Hill by rail. George McCaw (1869-1933) worked on Murray Downs station. He transported all of the wooden piles and also worked on the bridge during its construction.*

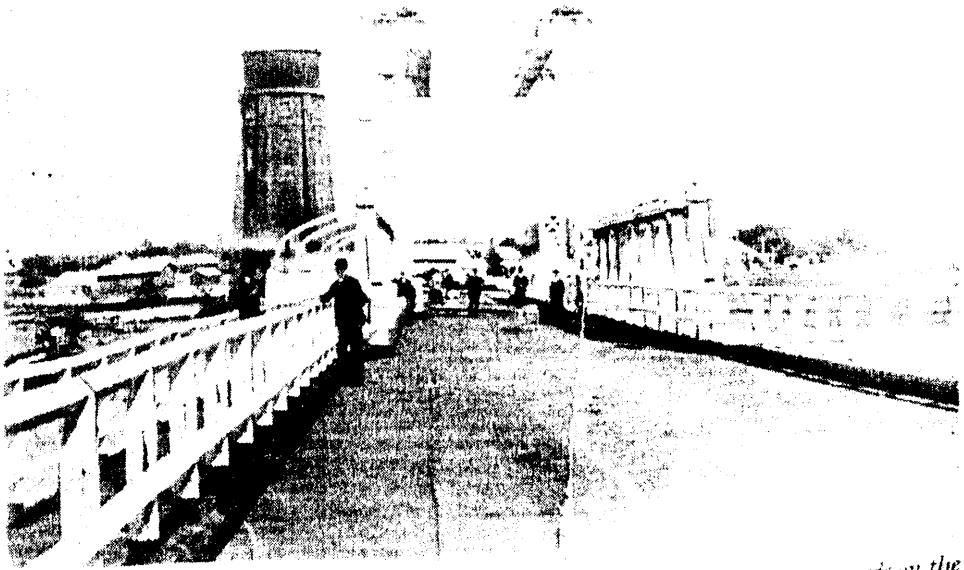


*The new hydraulic bridge at Swan Hill, photographed in 1905. The local press announced that the long awaited opening of the bridge took place on Wednesday 2nd December 1896. Mr. J.W. Taverner, local MLA, cut the ribbon and then school children walked over the bridge. Mr. Herman Moser was allowed the honour of driving the first vehicle over it on account of the tremendous effort he had put into its accomplishment...*

# ~ AFTER THE OPENING... 1896 ~

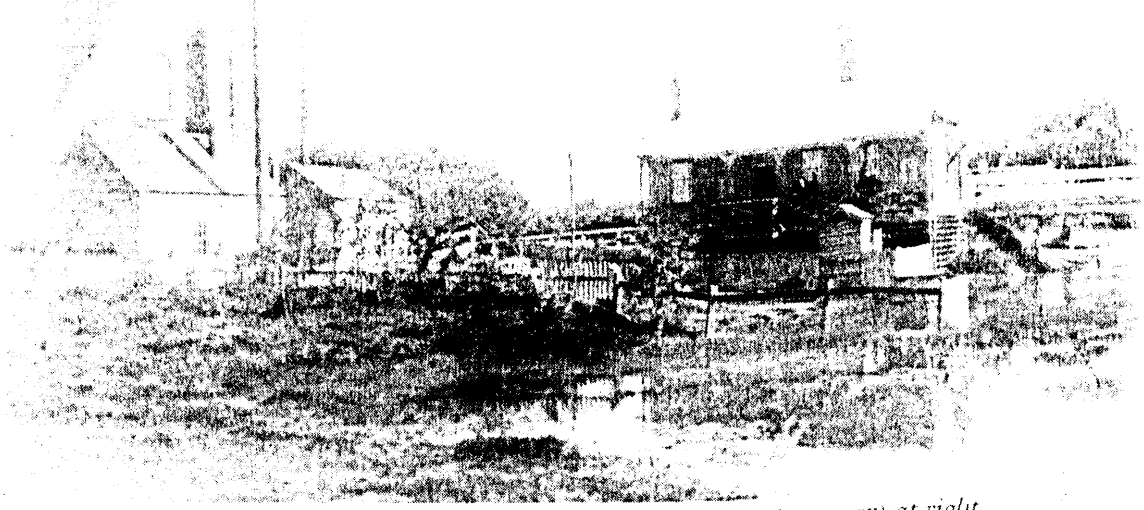




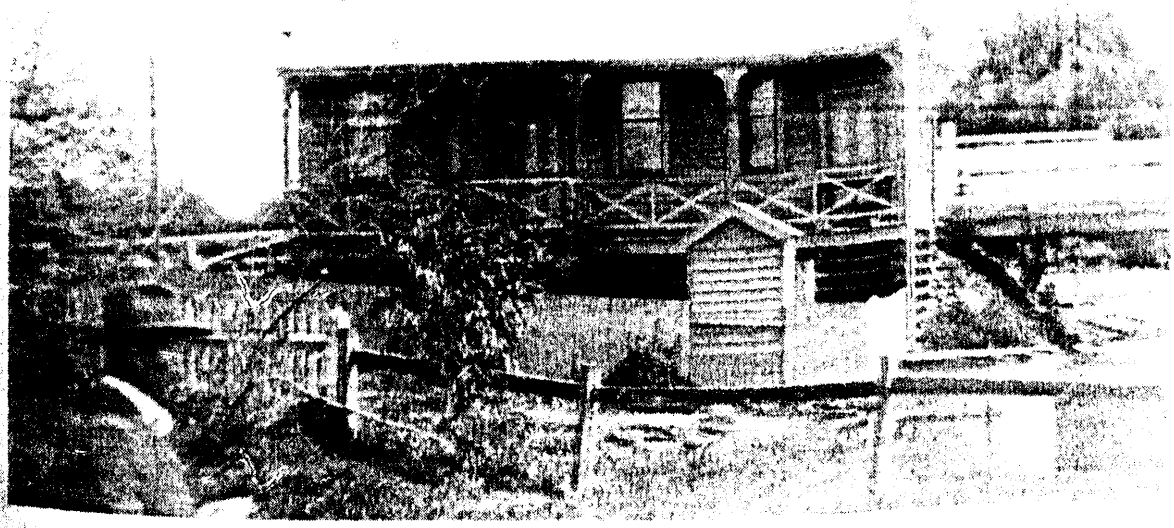


*Swan Hill Bridge, taken just after it had been officially opened in 1896. Note the tree guards on the right fo*
*the new peppercorn trees in McCallum Street, Swan Hill.*

# ~ AND NEAR THE BRIDGE WERE: ~



*Water Tower (1883), pumping sheds and Customs House (from rear) at right.*



*Customs House*

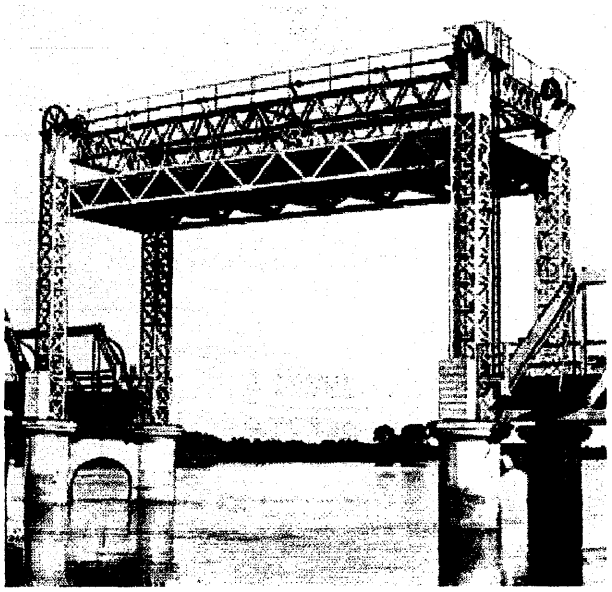
*In 1896 the new bridge over the Murray River at Swan Hill was opened. A Customs House was built on the southern side (or Victorian side) of the bridge to collect customs duties on stock and goods coming into Victoria. It was a 4 roomed building with a verandah at front and back. After Federation, the timber cottage with geraniums growing by the front gate, became a private residence until destroyed by fire in 1916. At that time it was occupied by a Mrs Bobbie Anderson (nee Fulford) and her family. It is believed that mice chewed some wax matches which set the building alight (safety matches then had not been perfected). After this episode, Mrs Anderson banned wax matches from their home!*

# ATTACHMENT I

Transporter bridges have a large overhead structure spanning full width of the waterway. A carriage, suspended from a mobile trolley running along the underside of the bridge, moves to and fro with traffic. Plenty of passageway width but practical limits on headroom may restrict some tall-masted ships.
(No transporter bridges were built in Australia).

Swing bridges rest on a central pier and spin about its vertical axis. Two passageways of moderate width can be achieved and headroom is unlimited. However, the pivot pier may be in the middle of the deepest channel with less depth each side. A problem in times of low flows. (Hay 1874)

Bascule bridges have their movable spans hinged at one end and some mechanism draws the span from the closed horizontal position into a near vertical open position. Wide passageways can be achieved, there is unlimited headroom in the open position and the main pier can be located on the edge of the deepest channel.
(Darlington Point 1905)



Lift bridges are characterised by the movable span remaining horizontal as it is raised/lifted to the desired height through the action of the counterweights moving downwards, contrary for the closing movement.

Wide passageways can be achieved and the main piers can be located on the edges of the deepest channel. However, headroom can be a problem in times of high water.

(Swan Hill 1896)

Pontoon, sliding and transporter bridges are operationally poor and have limited traffic capacity such that very few have been built, although, pontoon bridges have been widely used in temporary situations.

Swing, bascule and lift bridges are the most common movable span bridges and appear in a great many variations, particularly in industrial countries with many navigable rivers/canals such as in the USA, Europe and Gt Britain. The combination of site details and bridge characteristics determines which bridge type is used. They are operationally quick and can cope with large traffic demands except in peak hours.

Despite its feature of limited headroom, the lift bridge has proved to be the most common movable span bridge worldwide, including Australia.

The eminent Public Works bridge engineer, Percy Allan, summarised the advantages of lift bridges thus (*Lift bridge over the Murray River at Swan Hill*, Engg Section of Royal Society NSW, November 18, 1896),

- Economy
- Uninterrupted headway unnecessary in the absence of masted vessels
- Maximum headway only required in times of high water hence partial lifts
- Narrow main channels make central pivot piers objectionable.

# DEVELOPMENT OF MOVABLE SPAN BRIDGES IN THE MURAY-DARLING BASIN WITH PARTICULAR REFERENCE TO THE RIVERINA OF NSW.

by Don Fraser, Engineering Heritage Committee, Sydney

## Introduction

The two regions of New South Wales with the greatest number of movable span bridges are the Murray-Darling Basin and the North Coast. Their respective navigable rivers became the principal "highways" for travel, trade and commerce during the second half of the colonial period and lingered on until after World War I, an active, though steadily declining period of nearly eighty years.

Movable span bridges with low-level approaches were the cheapest solution for sharing the river crossings between the River Trade on the Murray-Darling-Murrumbidgee Rivers, the North Coast Shipping Trade between the Hunter and the Tweed Rivers, and the increasingly busy road networks.

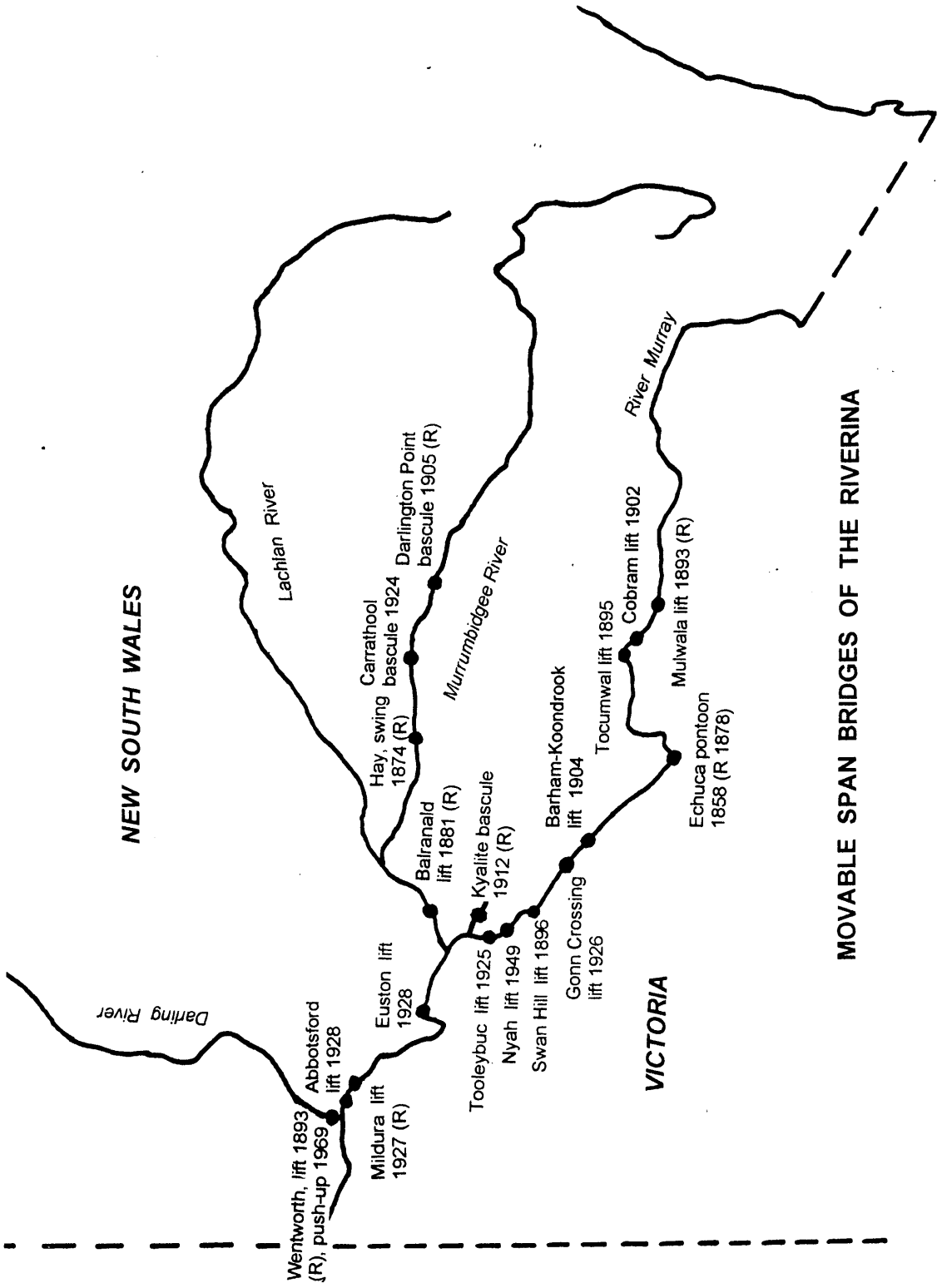
There have been six basic types of movable span bridges, worldwide,

Pontoon bridges are a series of pontoons tied end to end with all but 2 or 3 firmly moored. The non-moored pontoons can be floated out of place so as to provide a passageway for any water craft. Although a wide passageway could be achieved, there were practical limits. However, headroom for tall masts is unlimited. (Echuca 1858)

Sliding or traversing bridges have part of their structure built on top of one of the approaches with a shorter extension over the passageway so as to be in balance. The section on the approach rests on rollers on a track such that the whole unit can be drawn horizontally backwards on the approach so that the extension clears the passageway. Limited width of opening but unlimited headroom. (Dunmore 1864)

# The Murray-Darling basin – its bridges and the River Trade

The River Trade began in August/September 1853 when rival Captains Francis Cadell on the *Lady Augusta* and William Randell on the *Mary Ann* left Goolwa in South Australia and vied with each other along the River Murray to be the first to reach Swan Hill. Cadell won on September 17, three hours ahead of Randell.



The River Trade was most injurious to New South Wales with all its wool from Brewarrina, Bourke and Wilcannia shipped down the Darling River, and most of the produce from its Riverina Region being diverted into Victoria via the railhead at Echuca. With roads no better than dirt tracks, impossible to use when wet, New South Wales embarked on a program of railway extensions, to Bourke in 1885 and Hay on the Murrumbidgee River in 1882, in order to redirect as much of this valuable trade as possible to Sydney

With commercial links to Melbourne being stronger and shorter, and a lack of infrastructure in the Riverina, there was a serious move for the Riverina to secede to Victoria. The initial response from Sydney was an iron swing bridge at Hay in 1874 and an iron lift bridge at Balranald. Lift bridge were also built over the Darling River at Bourke 1883, Brewarrina 1888 and Wilcannia 1896.

By the late 1880s the Governments New South Wales and Victoria embarked on a program of movable span bridges on the River Murray, starting at Mulwala in 1893 and concluding at Abbotsford in 1928. All eleven were lift bridges, as Percy Allan had reasoned best suited to the mighty Murray and the vagaries of its flows.

The swing bridge at Hay remained the only one of its type in the Riverina. However, three bascule bridges were built at Darlington Point 1905 and Carrathool 1924 on the Murrumbidgee River, and at Kyalite 1912 on the Wakool River.

All the pre-1914 bridges were on principal inland stock routes, mostly north-south, from as far north as Queensland, to Melbourne. But as the New South Wales railway branch lines extended into the western regions, this trade was diverted to Homebush in Sydney for domestic consumption and as a valuable export to England.

The 1893 lift bridge on the Darling River at Wentworth was an exception having been built to carry an important east-west road into South Australia and cater for the river wool traffic.

# ATTACHMENT J

Extract from *Town and Country Journal*
12 December, 1896 re the opening of
the Swan Hill Bridge

T & C J 12 Dec 1896 P32

an Hill.

BRIDGE RAISED

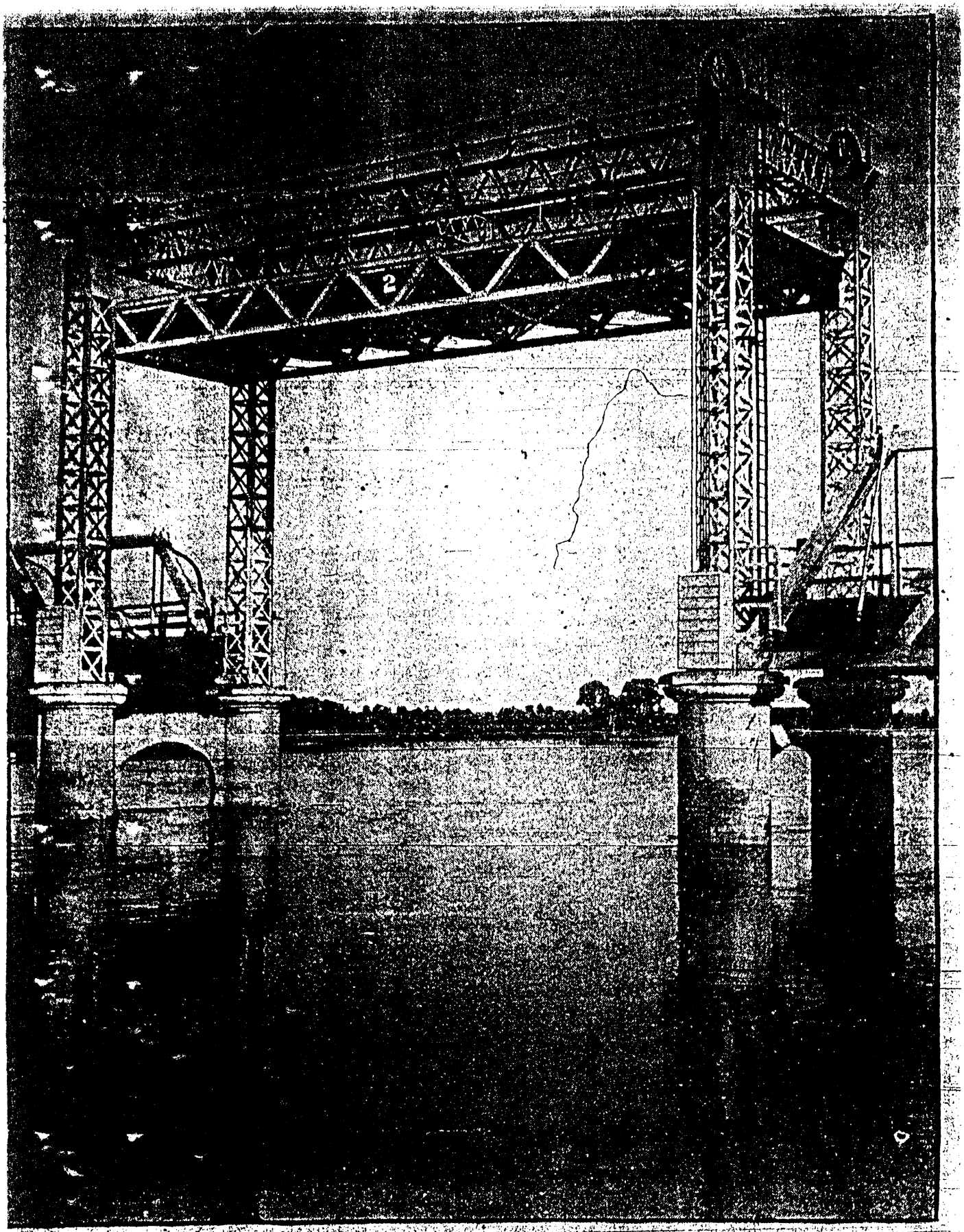
# The Swan Hill Bridge.

Mr. J. W. Taverner, the Victorian Minister for Works, officially opened the new bridge on December 2 over the Murray River at Swan Hill. Mr. J. M. Chanter, M.L.A., of New South Wales, was also present. A large number of people were present on both sides of the river. In the evening a banquet was held, Mr. Grey occupying the chair. In responding to the toast of "Victoria and the Ministry," Mr. Taverner said that the people of Victoria were strongly in favor of federation. He opposed gristing in bond, and spoke on the export of dairy produce, stating he would do his best to advance the industry. In responding to the toast of "The New South Wales Parliament," Mr. Chanter spoke regarding the land laws of that colony and Victoria.

The Swan Hill Bridge was designed by Mr. Percy Allan in 1894. The bridge consists of one steel lift span, two timber truss spans, and four timber approach spans. The bridge is designed for a live load of 84lb per square foot of floor space. The sixteen wire ropes have an ultimate strength of 266 tons; and the weight of lift span only 34¼ tons. The ropes have a "factor" of 7¾, an ample margin in view of the slow speed and large diameter of the rope wheels, the wheels being seventy-seven times the diameter of the ropes. The two river piers each consist of a pair of cast-iron cylinders founded on rock, and supporting two wrought-iron cylinders, connected with stiff wrought-iron diaphragm bracing. The cylinders are filled with concrete.

The overall length of the Tocumwal Bridge, with the iron side spans is 336ft, as against 385ft, the overall length of the Swan Hill Bridge with timber side spans; the completed cost of the two structures including engineering expenses, being £19,635 and £8900 respectively. The large difference in cost is due to the more economical design of lift, the substitution of timber for iron side spans, and the securing of foundations for the two river piers at Swan Hill at a lesser depth than at Tocumwal. Again, the plant used at Tocumwal Bridge was available for Swan Hill Bridge, and prices were lower when contract for the latter bridge was placed.

The contract for the bridge and New South Wales approaches was let on June 6, 1895, to Messrs. J. B. and W. Farquharson, of Melbourne, who placed the manufacture of the metal work with Messrs. Mephan, Ferguson, and Company of Melbourne. The whole of the timber, with the exception of a few piles, was obtained from the northern rivers of New South Wales, forwarded to Melbourne by sea, a distance of about 726 miles, thence to a site by rail a distance of 214 miles, or a total carriage of 940 miles; the planed and framed timber in truss work being erected in situ at 4s per cubic foot, which gives a clear idea of the economical character of this design of truss. Mr. D. W. Armstrong was the resident engineer in charge of the erection of the structure, he having previously superintended the erection of the lift bridge at Malwala.



The New Bridge over the River Murray at Swan Hill.

IE VIEW SHOWS THE LIFT IN THE CENTRE AND PORTION OF THE BRIDGE RAISED TO ALLOW VESSELS TO PASS UNDER.