Submission No 2

INQUIRY INTO ADEQUACY OF WATER STORAGES IN NSW

Name: Mr David D Coffey

Date received: 22/06/2012

David D Coffey
Consulting Engineer

The Director
Standing Committee on State Development
Legislative Council
Parliament House
Sydney NSW

Re: Call for submissions for Inquiry into Water Storages NSW

Dear Sir

In response to your call for submissions for the above, and in particular reference to item (d) in the Terms of Reference, I wish to submit the attached Proposal.

Please be advised that this Proposal is only a precis of a very intense and detailed study undertaken earlier, and should you wish to take this matter further, such details could readily be made available.

Yours Sincerely

David D Coffey BE, DEng (Syd Uni), FIEAust

Retired Consulting Engineer

18 June 2012

A Western River Diversion Scheme

The attached proposal is for the diversion to the Murray Darling Basin of water from some of the tributaries of the Clarence River. It was developed by me in the period 1982 to 1984. It followed a study by the then Water Conservation and Irrigation Commission (WC and IC) in 1981 for all possible river diversion schemes for easterly flowing rivers in NSW. All the WC and IC suggestions involved extensive pumping to transfer the water over the Great Dividing Range to the west. Later however I found that there was a design which was missed by the WC and IC engineers allowing water transfer to the west without pumping. Attached is copy of a pamphlet that I produced to describe the project which transfers water by gravity from the Mann, Boyd and Nymboida rivers into the Beardy River thence to the Dumaresq River which forms the border between NSW and Queensland.
I also produced a design manual detailing the methods which were used to calculate the various quantities etc shown in the pamphlet. This manual is not attached but can be made available if desired.

I should like to make the following salient critical points about the scheme~

(1) From an engineering viewpoint the scheme is as relevant and workable now as it was in 1984. It has been vetted thoroughly by the Water Resources' Commission, and by private consultants and found to be technically sound and financially viable.

(2) The annual design flow for diversion was calculated at1100 GL or 1.1 million megalitres, based on the river flow records available in 1983. Hydrologic data need to be updated now, but it could be expected that regular annual diversion flows would be somewhat less because of the recent drought years. It should be noted that the storage volumes exceed any of the dams in mainland Australia, including Warragamba. Because of the very large

volumes of water available, particularly in the Newton Boyd Storage, diversion of the same regulated design flows over an annual period would be possible even during the recent drought years.

(3) Even though the scheme was received enthusiastically in the 80's by all Local Government bodies west of the Divide, and some in the east, it was hard to promote in the east because of the vocal 'no dams at any cost' views held by many advocates. Although only 22% of the average flow of the Clarence River was to be diverted, and as well as the benefits of flood mitigation around Grafton, resistance was strong.

(4) The cost of water diverted in 1984 was about $100 per megalitre (ML). Now of course it would be higher although construction costs of large projects as this have diminished, especially tunneling costs. In 1984 irrigators were paying a very small amount for irrigation water. Then it was about $10 per ML. I am not familiar with current costs of irrigation water, but it must be well in excess of $500 a ML. Thus diversion on this scale becomes financially attractive, whereas it was not (for irrigators) in 1984.

(5) There is no other diversion scheme which has been studied or suggested on the east coast of Australia to match this one for economy, size or projected performance. It is the only one which can provide water to the Darling system free of exorbitant pumping costs. The scheme is a major infrastructure development, being roughly comparable in size to the Snowy scheme.

(6) The storage areas occupy poor quality agricultural land little of which would be arable. It does however intrude into some national parks.

(7) Relatively minor hydroelectric power generation is available, but quite massive pumped storage hydro capacity is available because there is a 600m difference in elevation between the Newton Boyd storage and a small upper dam that could be built at or near Glen Elgin. This almost unlimited capacity

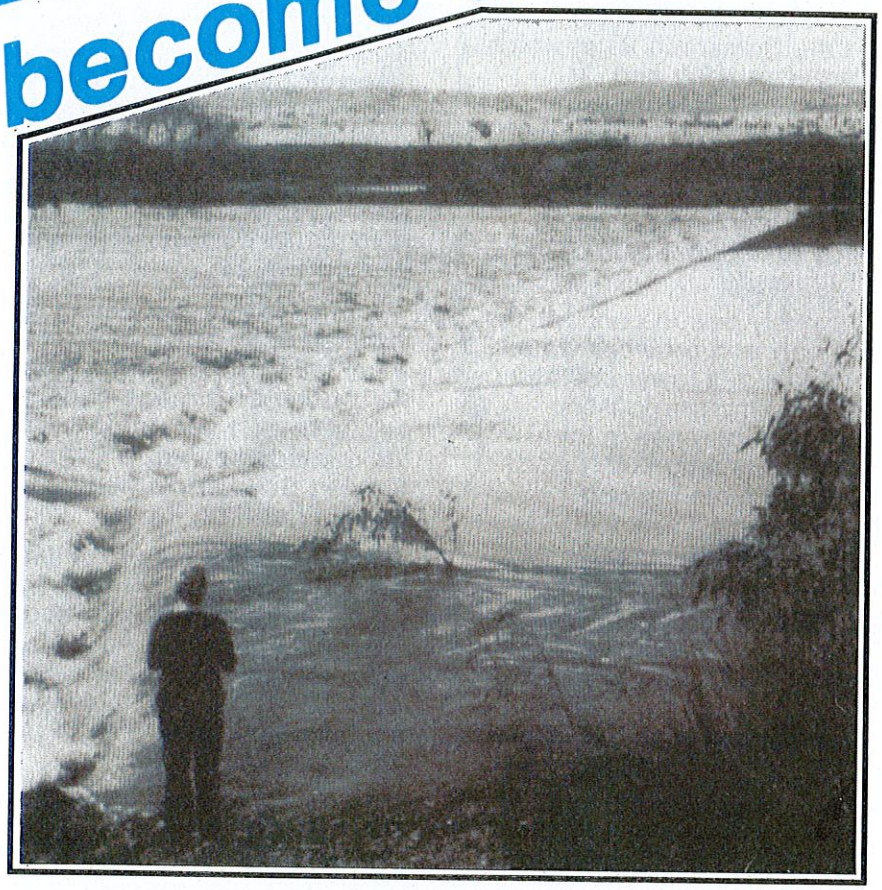
for pumped storage power could well fit in with the expansion of wind power generation that is being built or proposed for NSW.

(8) Operationally the system would be relatively maintenance free because there is no pumping required. Water could be added as needed to the Dumaresq – Macintyre – Darling rivers at rates up to 90 cubic metres per second (cms). Water could also be returned to the Mann – Clarence rivers via outlet valves in the Mann River Dam. Likewise, water could be returned to the Nymboida River from outlet valves installed in the Nymboida Dam.

(9) Detailed investigation and final design is estimated to take 1 to 2 years, construction 3 years and storage filling to operational levels up to 10 years. It would be probably best to allow for a 15 year period before the system becomes operational. This compares with the Snowy Scheme where about 20 years was needed.

(10) The diverted water enters the Dumaresq-Macintyre Rivers and these rivers form the boundary between NSW and Queensland as far west as Mungindi. It seems a possibility that Queensland and NSW could form a joint venture, sharing an agreed portion of the water and therefore each State contributing to the cost.

WESTERN DIVERSION to become a REALITY?



A Scheme to Divert Tributaries of the Clarence River to the Murray – Darling Basin

by DAVID D COFFEY BE FIEAust
Consulting Engineer, Sydney

September 1984

A Western River Diversion Scheme

This is a scheme which is capable of diverting over one million megalitres of water on a regular annual basis into the Murray-Darling System via the Dumaresq River which forms the border between NSW and Queensland. It obtains this water from tributaries of the Clarence River, stores them in a very large reservoir in a valley 50 km east of Glen Innes and gravitates this water through a tunnel under the Great Dividing Range to the Beardy River, upstream of its junction with the Dumaresq.

This scheme is entirely new in concept. It operates by gravity only and provides water in a much larger volume at a lower cost than any other diversion scheme previously described. It can be multipurpose in that there are two sites for generation of hydroelectricity, and a degree of flood mitigation is possible for the Clarence Valley, whilst minimum river flow requirements for that system can be met.

By reference to the attached figure, the scheme operates as follows:

Water from the Mann and Boyd rivers and their tributaries are impounded in a very large reservoir created by dams at points (3) and (8) on the figure. Two reservoirs are created by these dams, but these are joined by a cut (4) in a saddle near Newton Boyd.

Water from the upper Nymboida and Blicks rivers is added to this reservoir. A dam on the Nymboida (7) diverts water to the Guy Fawkes vally at (5) through a 29 km long diversion tunnel (6).

Additionally, water from the upper Timbarra River is diverted to the Newton Boyd reservoir by a dam in the Glen Elgin Valley (9) and a short diversion tunnel (10).

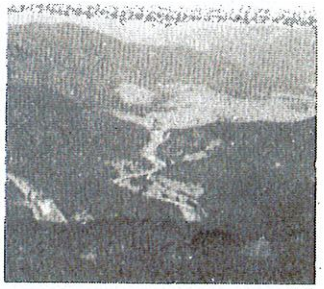
For western diversion, water in the Newton Boyd reservoir enters an 81 km tunnel at Diehard Creek (2) and emerges in the Beardy River in the Border rivers basin of the Murray-Darling System.

Hydroelectric generating stations may be installed at (5) and (10) where the diverted water falls 135 and 485 metres respectively. Also, pumped storage generating capacity is available on a very large scale because of the creation of a large low level reservoir at Newton Boyd and a nearby high level reservoir at Glen Elgin.

The essential feature of this scheme is that the Newton Boyd reservoir is so large – bigger than any storage yet built on the Australian mainland – that it will level out drought and flood flows entering it and release the same quantity of water each year. It is therefore both drought proof and flood proof at the same time.

The quantity of water capable of being diverted, although large, is only one quarter of that which flows out of the mouth of the Clarence each year, and would have little impact on the lower Clarence Valley.

(a)



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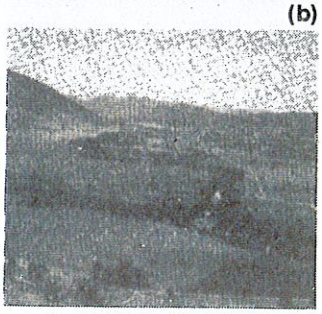

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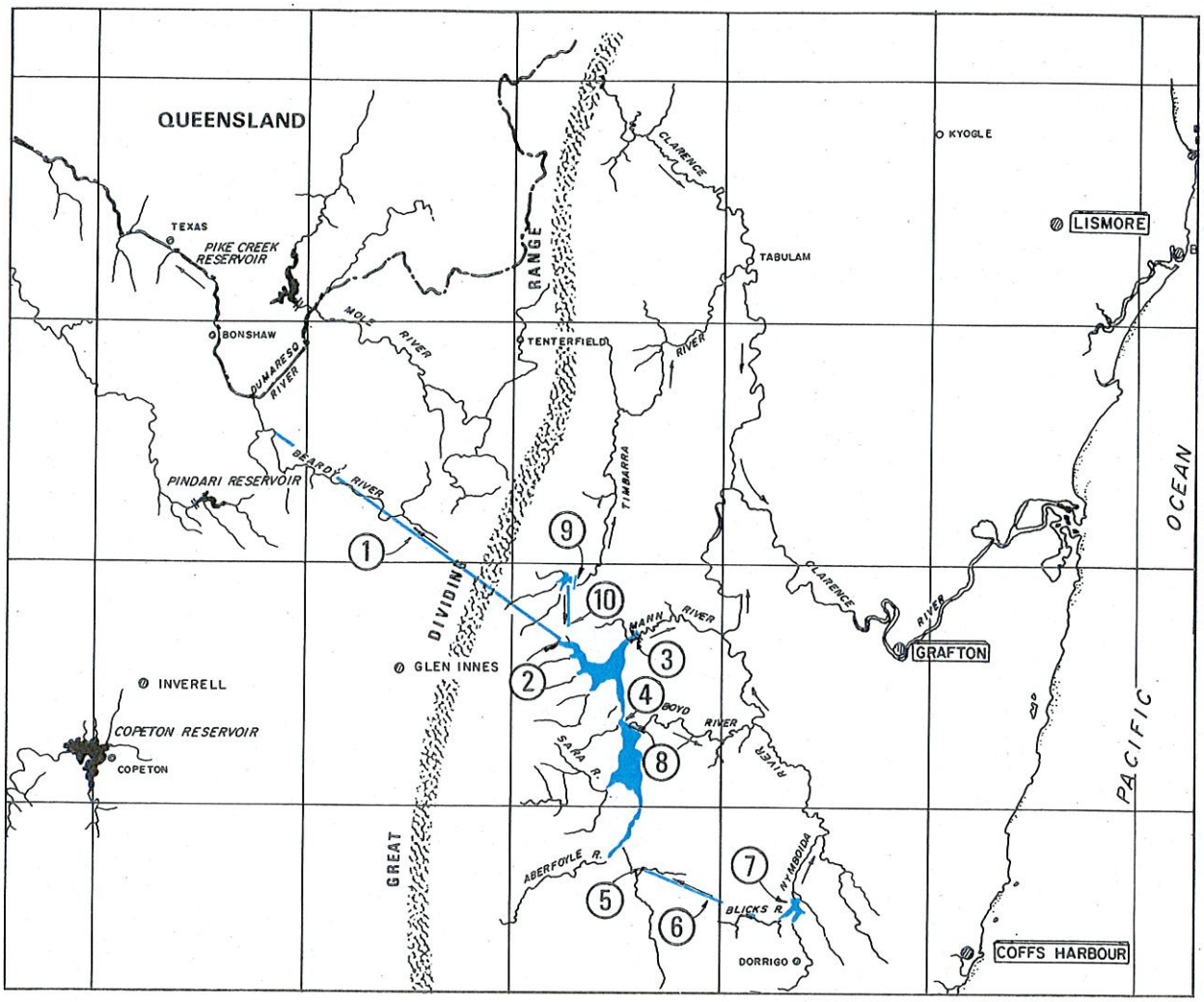

TECHNICAL DETAILS

Hydrology

Average annual water flows into the Newton Boyd reservoir are:

	MI x 10^6*
Boyd River	0.43
Mann River	0.24
Nymboida River	0.50
Timbarra River	0.05
Total	1.22

Total catchment area for the scheme is 5351 km², 23.6% of the total Clarence catchment. The scheme captures one quarter of the total Clarence outflow. Average rainfall over the catchment is 1063mm.

Operation

For regulation and release to the west or east of an average of 1.1 M1 x 10^6 in five months of each year, the sizes of the various components of the scheme are given in the tables below.

Dams

	Type	Height of Crest above Streambed (m)	Embankment Volumes (m^3 x 10^6)	Spillway
Mann	Rock fill	179	21.4	Gated – 50m long
Boyd	Rock fill	184	22.2	None
Nymboida	Rock fill	160	10.0	Ungated 400m long
Glen Elgin	Concrete weir	15		

*MI = megalitre = one million litres = 0.81 acre feet

Storages

	Operating Levels (AHD)*	Capacity between Operating levels (Ml x 10^6)
Newton Boyd	372 – 408	5.8
Nymboida/Blicks	500 – 550	0.68
Glen Elgin	850 – 860	0.03

*AHD Australian Height Datum = height above mean sea level (metres)

Tunnels

	Diameter (m)	Length (km)	Flow under min. operating head m^3/s
Newton Boyd/Beardy R.	6.9	81.1	83
Nymboida/Guy Fawkes	3.6	28.8	39
Glen Elgin/Newton Boyd	2.7	9.0	23

Major Excavations

	Maximum Depth of cut (m)	Vol. (solid) of rock (m^3 x 10^6)
Newton Boyd Saddle	52	0.61
Mann River deepening to tunnel entrance	20	0.51
Beardy River deepening to tunnel exit	28	0.84

Electric Power Generation

Power Station	Annual Energy Capacity (KWh x 10^6)	Average Output at 5% use (MW)
Marengo Creek at Guy Fawkes R.	141	320
Hartleys Creek	66	130

Unlimited pumped storage capacity exists utilising the 485m head difference the Newton Boyd and Glen Elgin reservoirs.

Costs

These costs have been estimated in mid 1981 dollars as a basis of comparison with costs of other schemes prepared by the NSW Water Resources Commission. To convert to mid 1984 dollars, the costs should be factored by 1.33.

Costs per megalitre of water are based on loan repayments over 40 years at 10.4% plus annual maintenance charges.

The project size is markedly dependant on the timing of water releases. Two costs are presented – one for releasing 1.1 Ml x 10 in 5 months, the other for 10 months.

The effect of hydro generation has not been included.

Project	Capital Cost for water release in 5 months	10 months
	($M)	
Glen Elgin Diversion	10	10
Nymboida Dam and diversion tunnel	177	177
Newton Boyd Storage including Boyd and Mann River dams, Newton Boyd Cut and Mann River Cut	483	349
Western Diversion Tunnel	379	264
Total Capital Cost $M	$1049	$800
Cost per Megalitre	$ 102	$ 78

Photos:

Cover: Bonshaw Weir on the Dumaresq River. Flow is 230 m^3/s

Inside: **(a)** Newton Boyd Storage Area

(b) Boyd River. Damsite at centre.

(c) Beardy River and Dumaresq River Junction.