The historic Bradfield Scheme

In 1938 engineer Dr John Bradfield proposed an inter-catchment water diversion scheme to expand agriculture in central western Queensland by moving water inland from the north Queensland coast. Known as the Bradfield Scheme, the proposal, and Dr Bradfield's 1942 variation, have been analysed in a desktop study. It found that while technically feasible, the scheme is not commercially viable.

This study focused on the hydrology and technical feasibility of the scheme using contemporary information and methods to verify key assertions and to assess contrasting claims.

The 1938 scheme was based on building four new dams and 170 km of tunnel to divert east-draining rivers of north Queensland to the Flinders River and Thomson River. The Hell's Gates scheme, which included a 122-metre high dam at Hell's Gate on the Burdekin River, is estimated to cost between $17 billion and $39 billion in today's terms.

A variation to the scheme proposed by Bradfield in 1942 instead moved the water south through twin pipes to Lake Webb and then to the headwaters of Torrens Creek, flowing into the Thomson River. CSIRO developed an alternative version of the 1942 variation which sought the optimal way to divert water via gravity to the Thompson River. It replaced twin pipes with a channel and included a 98m dam at Hell's Gates, at an estimated current cost of $10 billion to $20 billion.

About this project

CSIRO was commissioned by the National Water Grid Authority to undertake this analysis of the original Bradfield Scheme. A summary report and supporting technical report are available at www.csiro.au/bradfield.

The report focuses on the issues of most relevance to the inter-catchment transfer of water, and the costs provided are consistent with a 'scoping level study'.

A second stage of this project involves investigating modern proposals to divert water into Queensland's interior and the Murray-Darling Basin to supply agricultural and primary industries.

Hell's Gates dam site on the Burdekin River is the centrepiece of the Bradfield Scheme.

Key findings

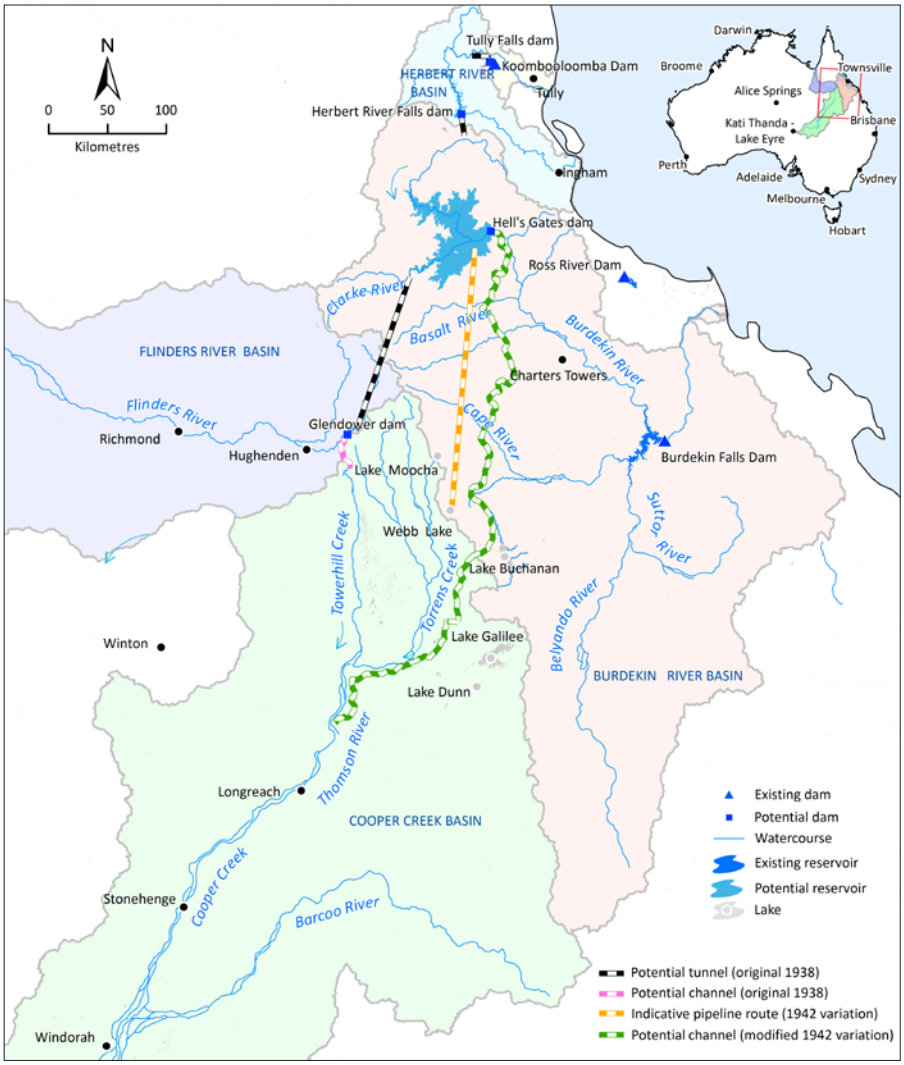
- Dr Bradfield estimated the annual flow of water (streamflow) coming from the upper Tully, Herbert, Burdekin and Flinders catchments was 7190 GL. This was double the 3305 GL of streamflow estimated in this study, which used climatic and hydrological information and tools that weren't available to Bradfield in 1938.
- The study found that the cost per megalitre of water released from Bradfield's 1938 scheme would be about three times more than other large dam options in the Flinders catchment.
- The 1942 variation involved changing the height of the Hell's Gates dam to 152 metres, which would create a reservoir capacity of 142,350 GL. But the study found it would never fill because the net evaporation from the large reservoir surface area would be more than the average annual flow of water into the reservoir.
- A modified version of Bradfield's 1942 variant that involves a 98-m high dam at Hell's Gates and a 680-km long channel (instead of more expensive twin pipelines) could deliver about 1880 GL in 75% of years to farms along the Thomson River, after losses.
- This is only half the amount of water estimated by Dr Bradfield that could be diverted to inland Australia.
- The modified version of Bradfield's 1942 variant would take 7 to 10 years for approvals, a 5-year minimum construction time, and additional time to establish productive crops.
- This study found that diverting water inland adds cost without discernible benefit by moving water to areas where it could be used less efficiently and at higher cost. This is only likely to be viable when water users, such as industries or towns, are prepared to pay a high price for the water.
- Diversion infrastructure costs alone would far exceed future net crop revenues.

Challenges

Although it is technically feasible that modified the Bradfield Scheme could divert large quantities of water inland, water resource development requires trade-offs. These trade-offs become more contentious when water is transferred from one basin to another because the benefits accrued by one community occur at the expense of another.

The range of challenges for consideration include:

- High evaporative demands and low annual rainfall means that inland irrigation requirements are often higher, and so water is used less efficiently, than closer to the coast.
- High transport costs to and from inland Australia put new irrigation developments at a competitive disadvantage to existing farming areas. Dr Bradfield proposed moving water from locations where the transport and input costs are lower, to locations where the transport and input costs are higher.
- The challenges of identifying financially viable opportunities for dam-based irrigation developments are already considerable; they are increased where proposals include the requirement for long distance water diversion infrastructure.
- There are limitations to large-scale irrigation along the Thomson River. Subject to additional work confirming soil suitability, there may be between 100,000 to 160,000 ha of moderately suitable land for irrigated broadacre and industrial crops such as cotton. Also, the impact of diverting large volumes of water into existing drainage lines without causing river bank erosion or disrupting farming logistics would need to be considered.
- Opportunities for the original Bradfield Scheme to supply water to high-value non-agricultural users are limited. For example, there is limited potential for the Scheme to recoup costs via in-line hydro-electric power generation along the water supply line. The feasibility of electricity generation is reduced by the modest elevation differences and releases of water that are timed to meet agriculture demands, rather than energy market price fluctuations.
- The catchments within the Bradfield Scheme area include highly diverse habitats ranging from tropical rainforests streams to parched arid floodplains. Parts of the study area are recognised as biodiversity hotspots. Diversions proposed by Bradfield would result in reduced flows downstream which would likely result in changes to water-dependent species and habitats, with environmental changes likely to extend considerable distances from the source of the impact.
- Since Bradfield first proposed his scheme there have been major legal and legislative changes. Indigenous people have secured an important range of legally recognised native title rights and interests in land and waters which would need to be considered in potential development in the study area.
- This study did not take into consideration existing water users or the current regulatory environment, such as environmental flow objectives stipulated in state government water plans.



Bradfield's original scheme (1938) proposed diverting water from the Tully, Herbert and Burdekin catchments to the Flinders River and then Skeleton Creek, a tributary of the Thomson River. Bradfield's variant (1942) proposed piping water from the Tully, Herbert and Burdekin catchments to Webb Lake and then into Torrens Creek, a tributary of the Thomson River.

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