An Environmentally Sustainable Irrigation Scheme for Central Queensland Agriculture and Mining

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Summary: Below is a staged plan and preliminary costing for an environmentally beneficial water supply scheme for the central Queensland areas of Charters Towers and Muttaburra/Aramac, pipeline to new mine developments in the Galilee Basis, and potentially to St George in the Murray-Darling Basin.

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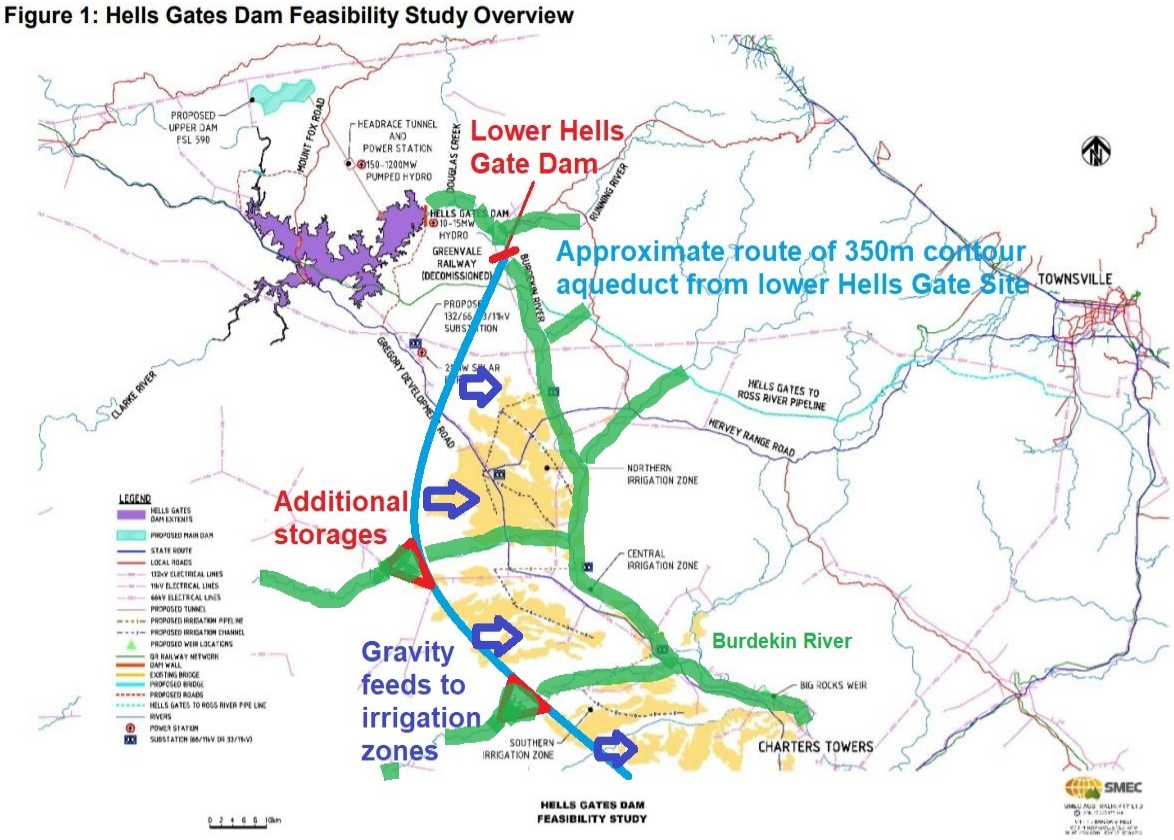
1. A lower cost alternative for the Burdekin River Region Irrigation Area

Figure 1: Hells Gates Dam Feasibility Study Overview



otated of SMEC current plan with sustainable improvements - stage one of a larger Bradfield Scheme.

Low water delivery costs are critical to the potential return on investment for government and private sector investors. The fully pumped irrigation schemes would only be viable in circumstances

of high prices or high-value products.

The Hells Gates Dam Feasibility Study by the Snowy Mountains Engineering Company (SMEC) is examining a $5.35 billion irrigated agricultural and power project on the upper Burdekin River. However, is it the best design? Here I have annotated their current plan with what I think is a sustainable improvement, and also could be stage one of a larger Bradfield Scheme.

Water is released from the Hells Gates Dam (purple) into the Burdekin River (green) and captured in low on-river weirs adjacent to the agricultural zones (yellow). Pumps raise the water to temporary storages at the top of the bank (SMEC).

Instead of pumping water up to the hill from weirs in the river, irrigation zones could be fed from an aqueduct (light blue) at about the 350m contour. Irrigation channels (blue) could then follow an approximate downhill path within the existing terrain to use gravity as the driver for water delivery, thereby avoiding pumping costs.

Finally, additional storages (red) associated with the aqueduct could capture flows from the Basalt and Hann Rivers providing extra flood storage or water capture.

The economic and environmental benefits of a gravity fed aqueduct are many:

1. Locating the dam lower on the Burdekin (red) at the Mt Foxton site would avoid inundation of the Gregory Development Road bridge over the Clarke River avoiding road relocation works.
2. The lower location is below the confluence with the Running River, providing additional stream capture.
3. The cost of water would be considerably lower.
4. The weir pools at each zone of the SMEC design would potentially impede migrating fish. The alternative plan would not interfere with the natural Burdekin River downstream of the main dam wall.
5. Run-of-river power stations may potentially be installed along the aqueduct depending at fall locations. Power generation would likely take place over most of the year.
6. The aqueduct could continue on past Charters Towers and the Flinders Highway, providing water to mines of the Galilee Basin including Adani, town water and irrigation to the Mitchell Grass Downs, and even further to Blackall, St George and the Murray Darling Basin.
7. Constructed stage by stage, the scheme would establish revenue centers at each stage and require lower startup financing.

Another significant difference between this and the current SMEC design is the location of the dam lower on the Burdekin at the Mt Foxton Site (height 375m AHD) versus Hells Gate site (height 392m AHD). The relative costs/benefits of these two sites have been tabulated in the study Table 1: Dam Location Options Analysis. The Hells Gate was thought to have fewer environmental and cultural heritage concerns but had a more significant potential impact on the road infrastructure. An aqueduct delivery system may influence the optimal dam/weir location.

Alternatively, the aqueduct could originate from an upper Hells Dam site instead of Mt Foxton, at a higher location, and follow a contour above 350m. The dam wall may also be raised to the maximum height, creating a mega-dam as proposed by Sir Leo Heischler and Leon Ashby.

Frequently, environmental and cultural heritage concerns are overblown, as there are well-established mechanisms for dealing with them, including offsets and agreements. Particularly in the case of projects of national significance, these would not present insurmountable impediments to projects.

In summary, the first financially viable stage of a Bradfield Scheme may be the development of a weir and aqueduct in the upper Burdekin supporting 50,000 ha of irrigated horticulture, including fruit, vegetables, pulses/legumes, and broad-scale agriculture of both perennial and annual crops. Various factors increase the cost and the environmental impact of the SMEC proposal that are not present in this proposal – the impact to downstream water flows, the Gregory Development Road inundation, and the cost of weirs and pumping that are mitigated by delivering water in a gravity-fed aqueduct.

2. Schematic Overview

Illustration 2: Schematic diagram of a gravity-fed mini-Bradfield Scheme transporting water from the coastal rivers via a levy/pipeline combination (blue) to the storage and distribution lakes on the Great Dividing Range (green).

Above is the schematic diagram of a gravity-fed mini-Bradfield Scheme transporting water from the coastal rivers via a levy/pipeline combination (blue) to the storage and distribution lakes on the Great Dividing Range (green).

The levy would source water from the Burdekin River at Hell's Gate or Mt Foxton (note a dam may not be needed) and acquire the additional water en route at the Basalt, Campaspe and Cape Rivers (purple). These are headwater collections and so would not impact the regular flows significantly, and help to mitigate flood flows downstream.

The storage lakes of Lake Buchanan and Lake Galilee are currently dry salt lakes whose capacity

would be significantly expanded by dams at a few strategic locations. The lakes are uniquely positioned at intermediate elevations on the Great Dividing Range allowing stored water to be gravity fed to the destinations.

From the storage lakes, channels or pipelines would distribute the water where and when needed – to industrial uses east of the Divide such as the Adani Mine, and new irrigation areas west of the Divide around Muttaburra, Aramac, Barcaldine, and Longreach.

3. A safer alternative to the Adani Mine Groundwater Plan

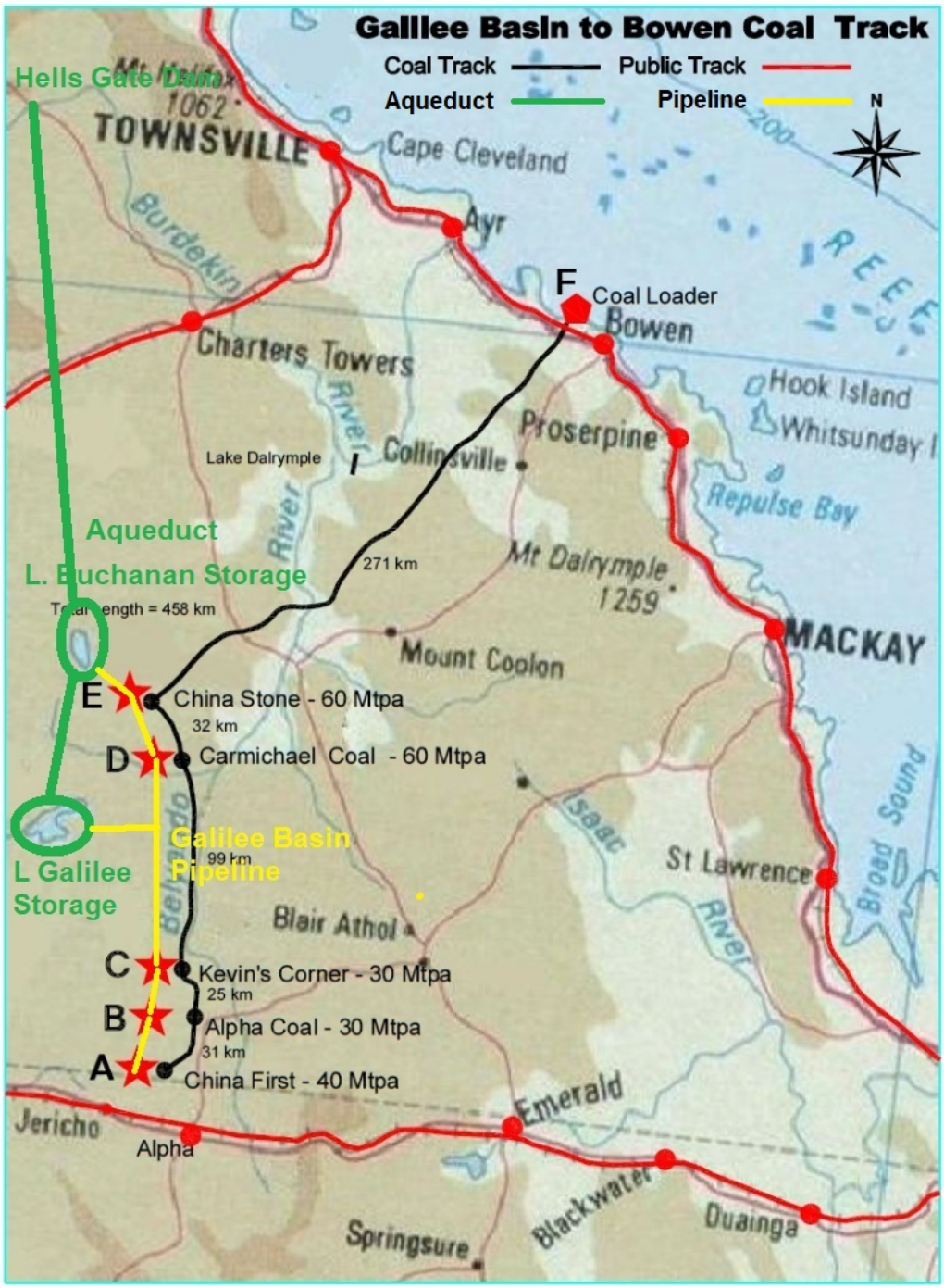


Illustration 3: A Galilee pipeline could be constructed to pipe water from storages and so mitigate the environmental impact of these mines on ground and surface waters.

Ongoing concerns with the groundwater plan have delayed the approval of the massive Adani (Carmichael Coal) Mine. What if the mine did not have to use groundwater at all, but drew water from large storages created nearby at Lake Buchanan and Lake Galilee? The salt lakes perched on the Great Dividing Range could be filled with flood water from an aqueduct to Hells Gate Dam on the headwaters of the Burdekin River.

Low-cost gravitational flow is viable, as it is downhill from the headwaters of the Burdekin, providing the weir is built to a sufficient height.

Not only Adani, but 5 mines have been approved for the Galilee Coal Basin (see image). Are they going to run into the same water sourcing problems too? A Galilee pipeline should be constructed to pipe water east from one the two storages and so mitigate the environmental impact of these mines on ground and surface waters.

The mines in the Bowen Basin draw water from the Burdekin Falls Dam via a pipeline—why not build the same river saving infrastructure for the Galilee Basin?

Also, the storage could also be used for town water supply and irrigation of the fertile Mitchell Grass Downs to the west of the Great Dividing Range. Use a renewable amount of flood waters and leave the limited groundwater source alone.

Renewable hydropower generation is also possible at and between Lake Buchanan and Lake Galilee, as well as locations along the aqueduct route. The power generated could be sold to the mines, generating carbon-free revenue.

4. Preliminary estimates of the cost of stages and returns of the New Bradfield Scheme

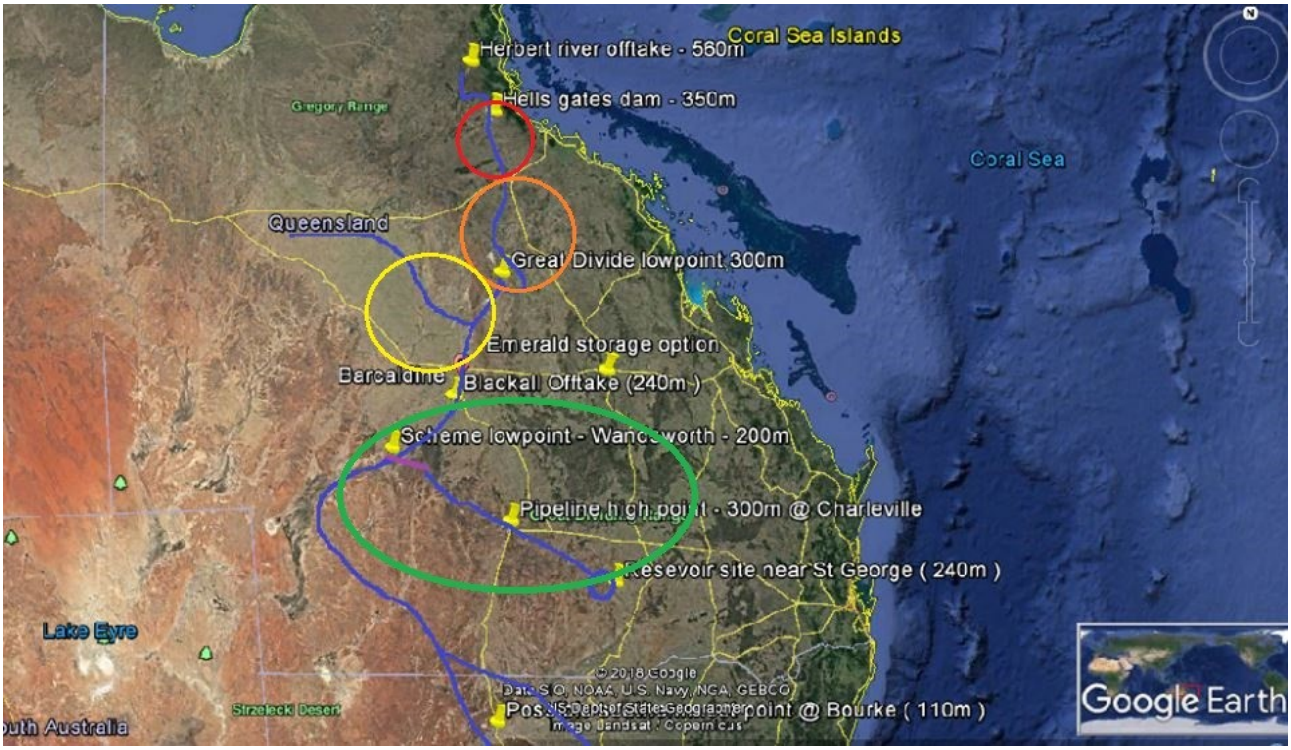


Illustration 4: The stages of the plan are shown as stage 1 (red), 2 (orange), 3 (yellow) and 4 (green). The figures below are very approximate and may change over time as estimates become more precise (Note 1).

The internal rate of return for the scheme including the supply of North Queensland flood water to the Murray -Darling Basin is between 5-10%, based on capital expenditure of $12.75 billion, and annual agricultural revenue between $2 and $4 billion. Supply of water for mines and towns and hydropower generation would provide additional income.

The stages of the plan are 1 (red), 2 (orange), 3 (yellow) and 4 (green). The figures below are very

approximate and may change over time as estimates become more precise (Note 1). The cost of the main stages are as follows (Note 2):

1.Burdekin River Irrigation Area Mt Foxton to the Flinders Hwy. This stage captures flood flows and provides gravity-feed irrigation to 50,000ha north of Charters Towers.
125km of 5m aqueduct ($1.25B), 75m weir ($0.5B) TOTAL $1.75B (Note 3)

2.Lake Galilee Basin Supply Flinders Hwy to Lake Galilee. This stage transfers flood flows to Lake Galilee Storage on the Great Dividing Range and supplies the Galilee pipeline to 5 mines in the Galilee Basin.
250km of 5m aqueduct ($2.5B), 20m storage ($0.5B) TOTAL $3B,

3.Aramac/Muttaburra/Longreach Irrigation Area. Lake Galilee to Longreach. This stage is one arm of western Mitchell Grass Downs distributor providing 50,000ha of new gravity-fed irrigation area. 200km of 5m HDPE lined aqueduct and local storage ($2B)

4.Murray Darling Basin. Lake Galilee to St George. This stage conveys water from the Lake Galilee Storage to the cotton growing regions around St George. 600km of 5m HDPE lined aqueduct and short pumped pipeline ($6B)

These first four stages could provide the water for the three new irrigation areas of approximately 50,000ha each – 150,000ha and five new coal mines in the Galilee Basin. Based on efficiencies of 10ML per hectare of the irrigated crop, plus an additional 500GL for mine and other usage, losses, and environmental flows, 2000GL of water would be required per annum. Based on stream monitoring records a weir at the Mt Foxton site could provide over 3000GL per annum, enough for the scheme and additional regular stream flow (Note 4).

With an expected return on the crops of between $6,000 and $25,000 per ha, this would produce a total output of between $1B and $4B per annum. As the water is gravity fed the operational costs are meager (Note 5). At a water cost of 10% of production, the water purchases would be $100M to $400M pa covering operational expenses. The economic modeling done for the Burdekin River Irrigation Scheme is scaled up x3.

CONSTRUCTION OUTPUT (4 stages)

- $12.75 billion.
- $8.1 billion contributions to GRP
- $2.4 billion in household income
- 25,000 FTE jobs

AGRICULTURAL OUTPUT (3 stages)

- $1-5 billion in total output
- $2.4 billion in contributions to GRP
- $0.75 billion in household income
- 15,000 FTE jobs

IRR between 5% and 10%

Notes

1.Each stage produces additional revenue so that the costs of the scheme are not entirely front-loaded but could progress in a self-funded manner.

2.The cost of the aqueduct would depend on the height - assumed at $1million per km. Prices for dams are guesses only. Resumption costs included.

3.The estimate is half of the similar Upper Burdekin River Irrigation Scheme proposed by SMEC due to the absence of hydropower, lower weir, and relocation of road infrastructure on Gregory Development Road (-$0.69B). The water would be gravity-fed from the aqueduct delivering water at a considerably lower cost.

4.Additional stages of the scheme could supply an additional 2000GL of water from the Herbert and Tully Rivers into the Mt Foxton weir.

5.The generation of hydropower, mine, and town water usage and forestry would provide additional revenue.