Preliminary stage - details subject to change

Borumba Pumped Hydro Energy Storage Project

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Powerlink Queensland

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Overview

Presentation will discuss the following:

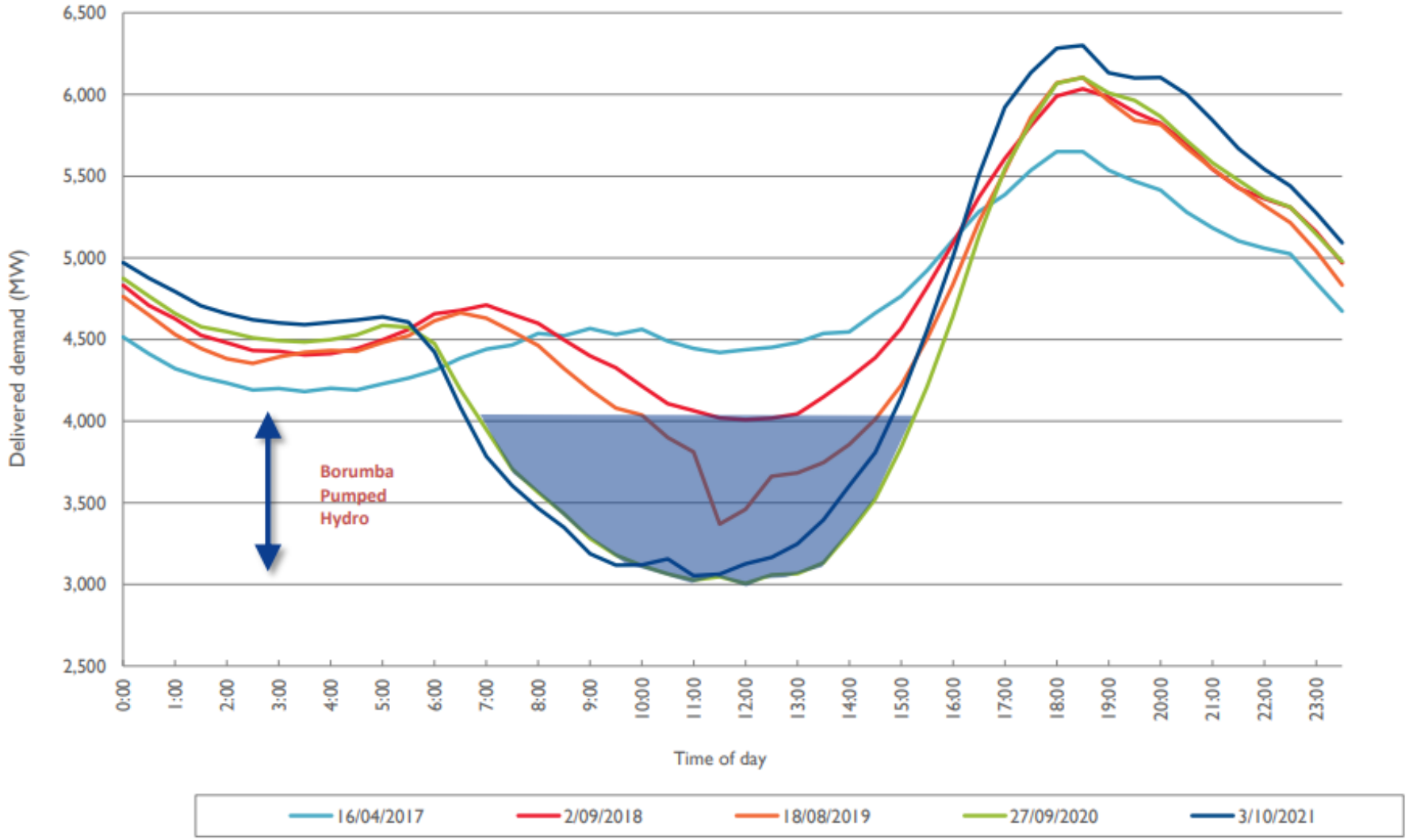
1. Why pumped hydro?
2. Why the Borumba site?
3. Borumba Dam and lower reservoir
4. Upper reservoir and scheme layout
5. Scheme operations
6. Transmission
7. Engagement scope

Why Pumped Hydro Energy Storage (PHES)?

- Queensland is well on its way to achieving its 50% renewable energy target by 2030
- However, we need long duration large-scale energy storage as we progress towards this target

Why Pumped Hydro Energy Storage (PHES)?

- Longer-term fluctuations require longer duration storage
- Battery storage will help, but only in the short-term



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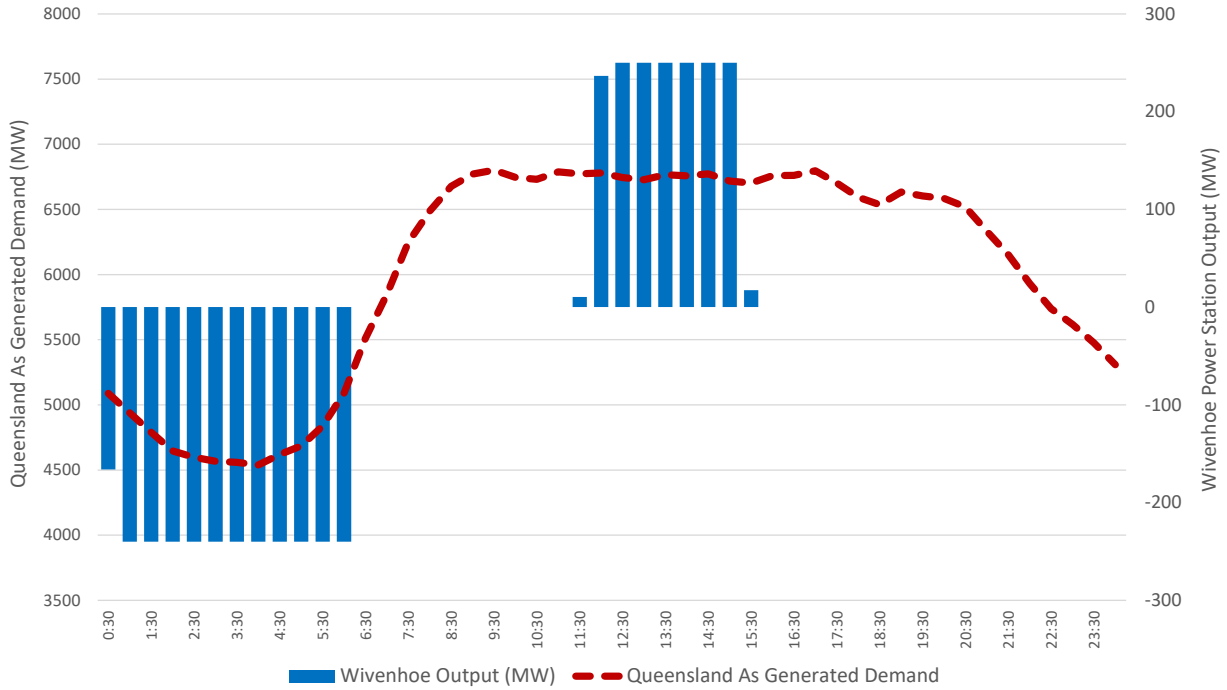
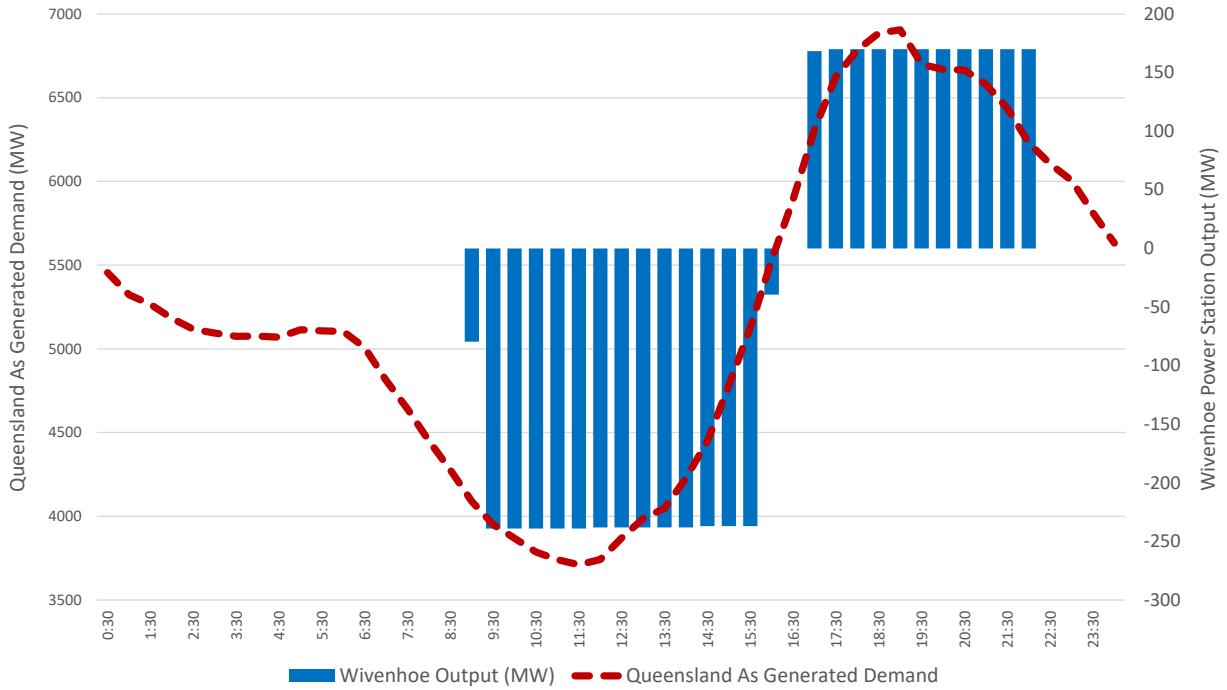
Why Pumped Hydro Energy Storage (PHES)?

2010 Wivenhoe Typical Summer Day



Snapshot for 1 December 2010. Note Queensland As Gen Demand > QLD Delivered from the Grid Demand.

2021 Wivenhoe Typical Spring Day



Snapshot for 3 October 2021 (ie: day with lowest day time minimum demand)..

Why Borumba?

From initial State-wide studies Borumba was identified by the Queensland Government as one of the best potential sites for long-duration PHES in Queensland

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Location

Why Borumba?


Powerlink
FUTURE POWER STATION SITE
POWERLINK QUEENSLAND HAS AQUIRED THIS LAND IN THE INTEREST OF QUEENSLANDERS FOR A FUTURE PUMPED - STORAGE POWER STATION SITE.
THE PROPERTY HAS BEEN LEASED UNTIL CONSTRUCTION COMMENCES AND ACCESS TO THIS LAND IS SUBJECT TO THE CONSENT OF THE LESSEES CONCERNED CAMPING & ACCESS STRICTLY PROHIBITED
ALL CORRESPONDENCE TO:
PROPERTY MANAGER
POWERLINK QUEENSLAND
PO BOX 193
PH (07) 3860 2869

Borumba Dam

- Owned by SeqWater
- Constructed 1964
- Rockfill embankment dam
- Raised by 2.5m (1998)
- 43 metres high
- 343 metres long
- 46.0 Mm^3 storage
- 480 ha surface area
- Maximum depth 6.6m
- Full Supply Level = 135.0m AHD (spillway)
- Dam crest = 144.4m AHD
- Parapet wall = 147.2m AHD
- Recreation uses include boating (no restrictions), water-skiing, fishing (stocked), camping

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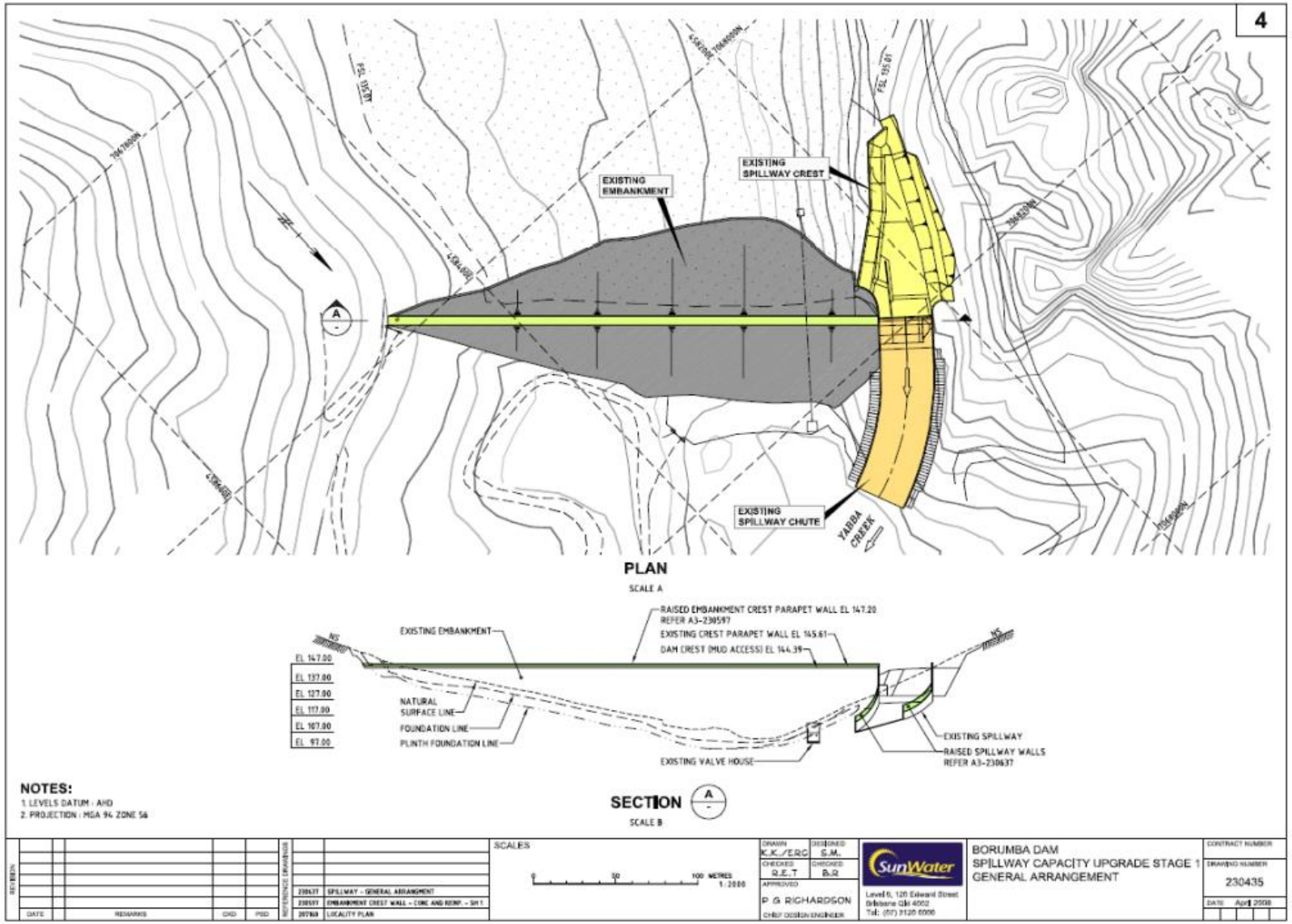
Borumba Dam



Lower Reservoir

- Need to construct a new dam wall immediately downstream of current dam wall
- Various heights being considered:
  - Scheme must be highly reliable
  - Not at expense of existing allocations & environmental flows
- Trade-offs:
  - Higher dam - increased reliability and capacity, enhanced water supply, lower daily water level fluctuations
  - Lower dam - smaller inundation area, environmental approvals, lower cost

Lower Reservoir

Preliminary stage - details subject to change

Lower Reservoir

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Key Study Areas

Hydrology
Mary Water Plan and Catchment

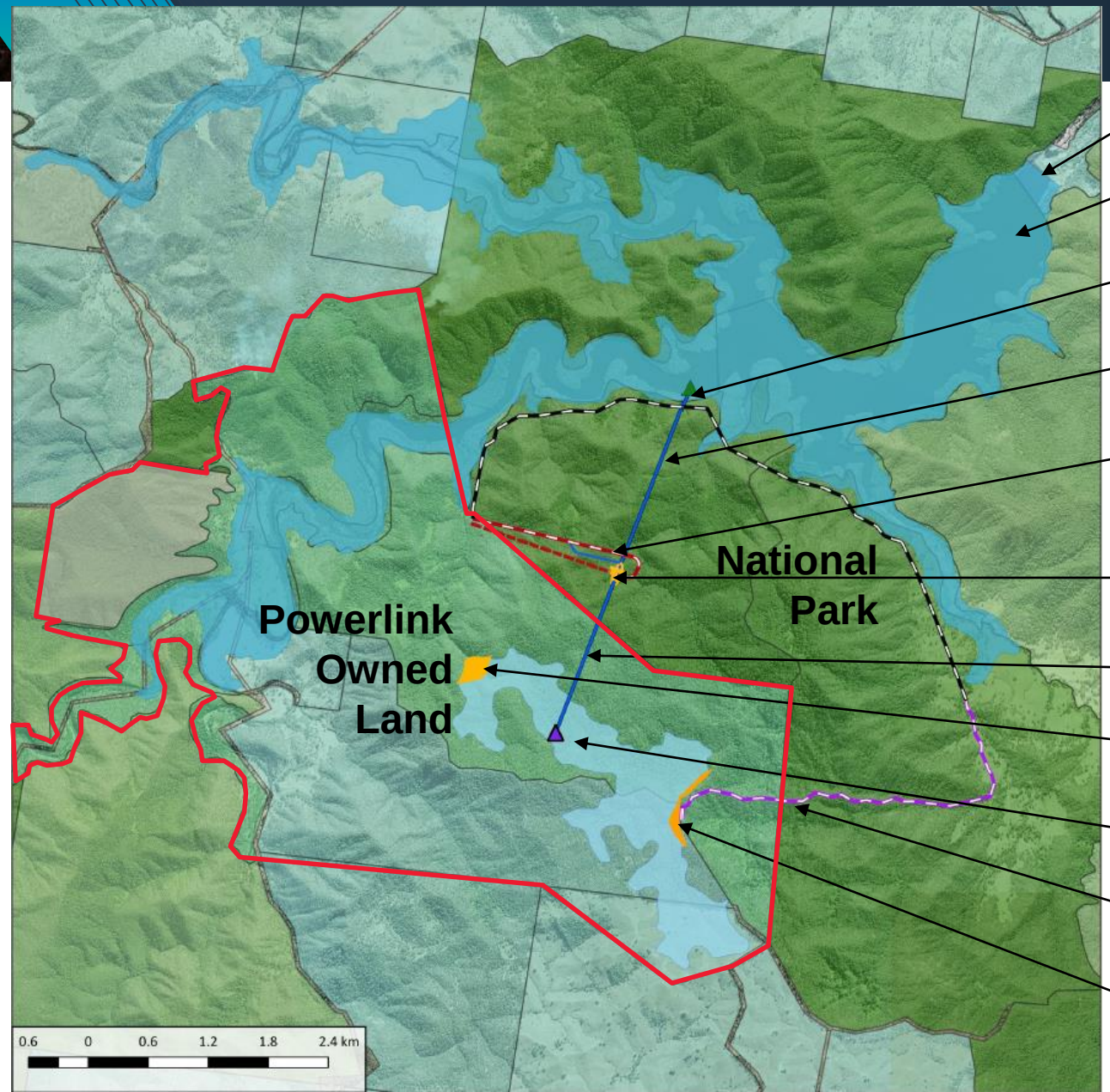
Socio-economic
Recreation and Social Impacts

Environment
National Park, Terrestrial and Aquatic Ecology

Dam Infrastructure
Geology and Engineering Design

Preliminary stage - details subject to change

Borumba Pumped Storage Hydro Scheme – Concept Design



- Borumba Dam
- Increased impoundment area
- Tailrace outlet
- Underground tailrace tunnel
- Power station access tunnel (and emergency access)
- Underground power station
- Underground headrace tunnel
- Main dam
- Tunnel inlet
- Access Road
- Saddle dam

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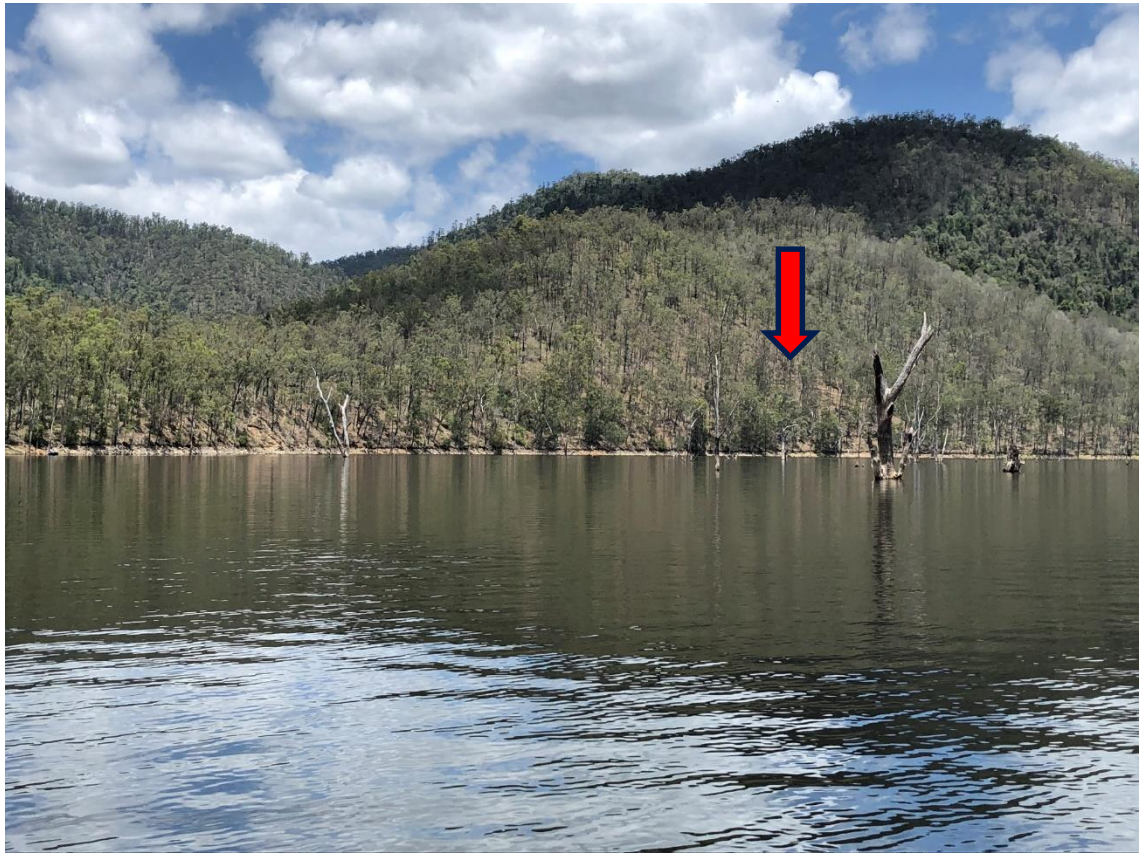
Tunnel Outlet (Concept)



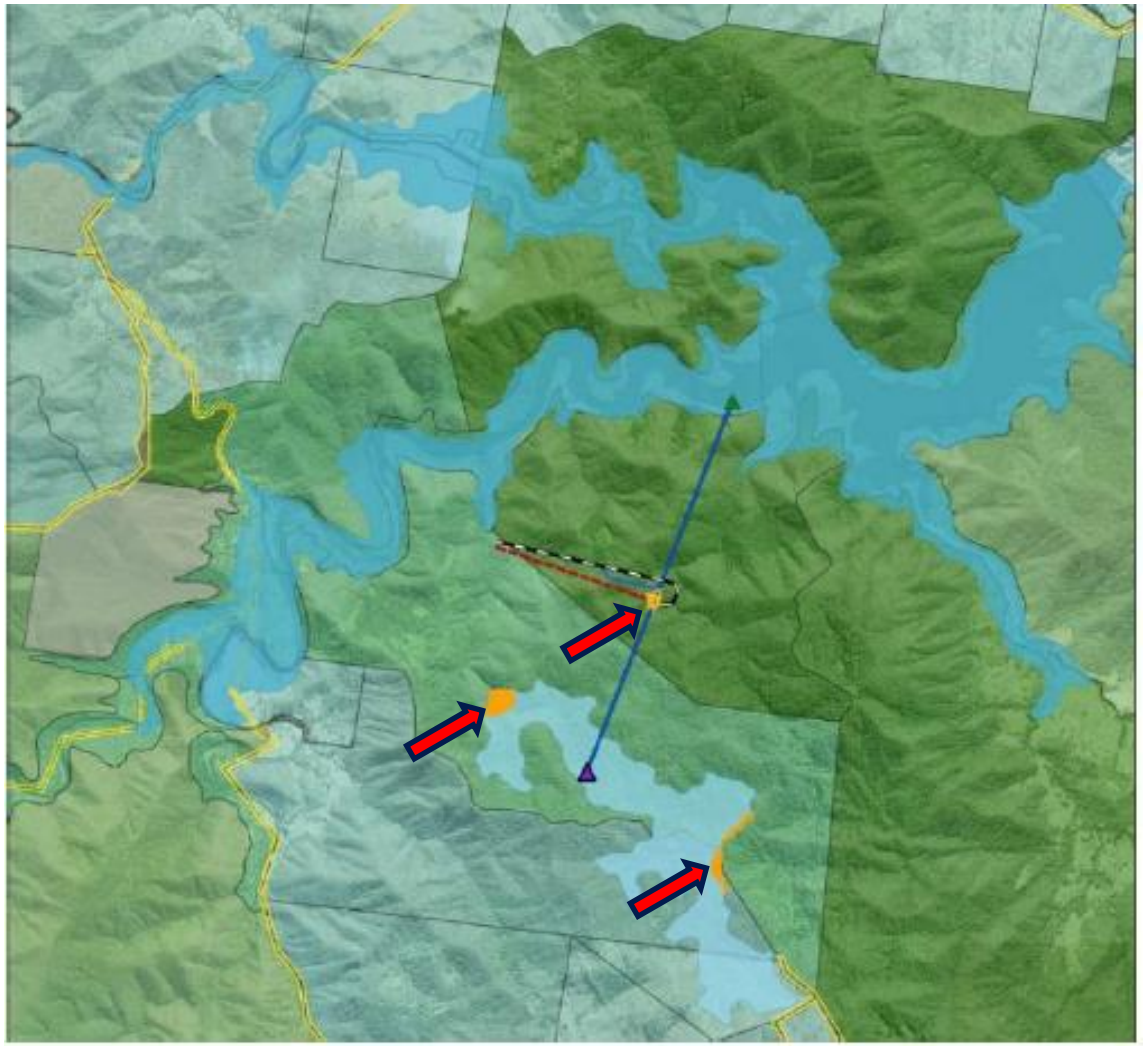
Upper Reservoir – Concept Design

Potential Structures

- 83m high main dam, 480m crest length
- 28m high saddle dam, 870m crest length
- Concrete faced rockfill dam or roller compacted concrete
- Upper reservoir located entirely on Powerlink owned land

Generation

- 1,500MW capacity (TBC)
- 30,000 MWh storage (TBC)



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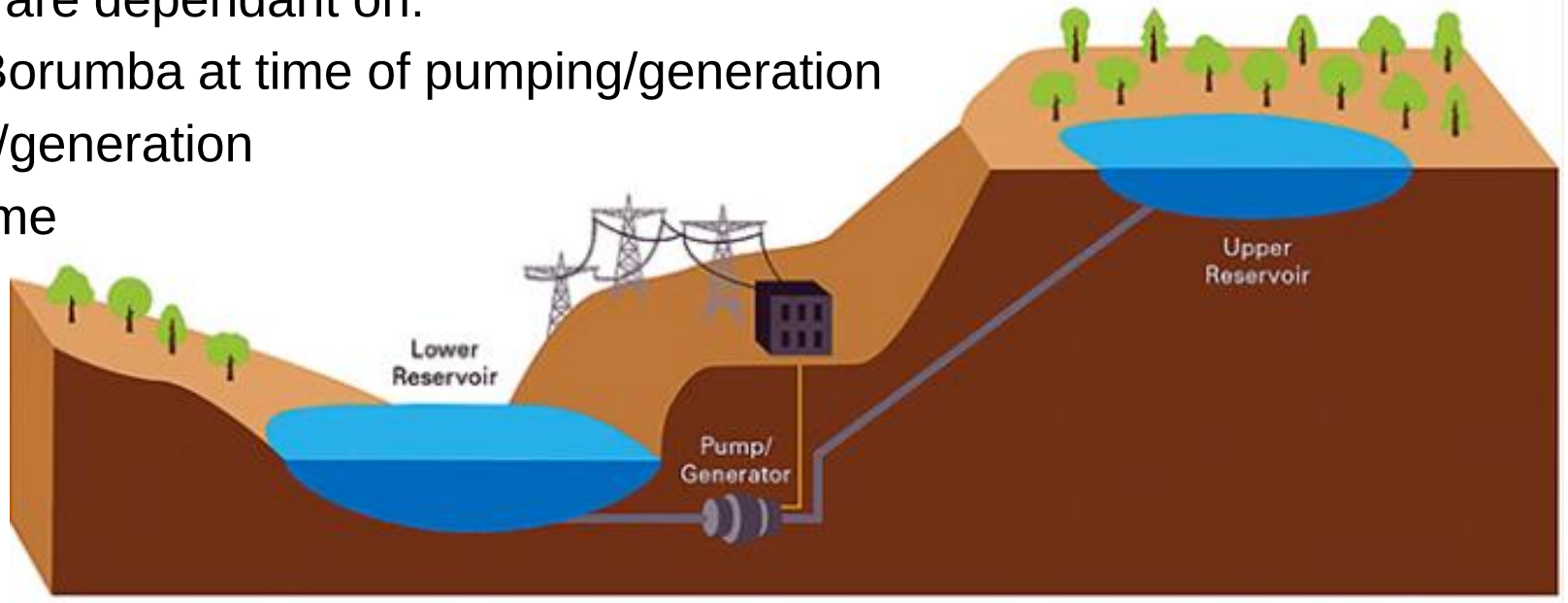
Upper Reservoir

Scheme Operation – Concept Design

- Rated gross head = 333m
- Power rated = 1,500MW (TBC)
- Typically pumping at times of high solar generation
- Typically generating when no or limited solar (night or poor solar days)

- Daily fluctuation in water levels are dependant on:
  1) Volume of water in Lake Borumba at time of pumping/generation
  2) Daily duration of pumping/generation
  3) Installed capacity of scheme



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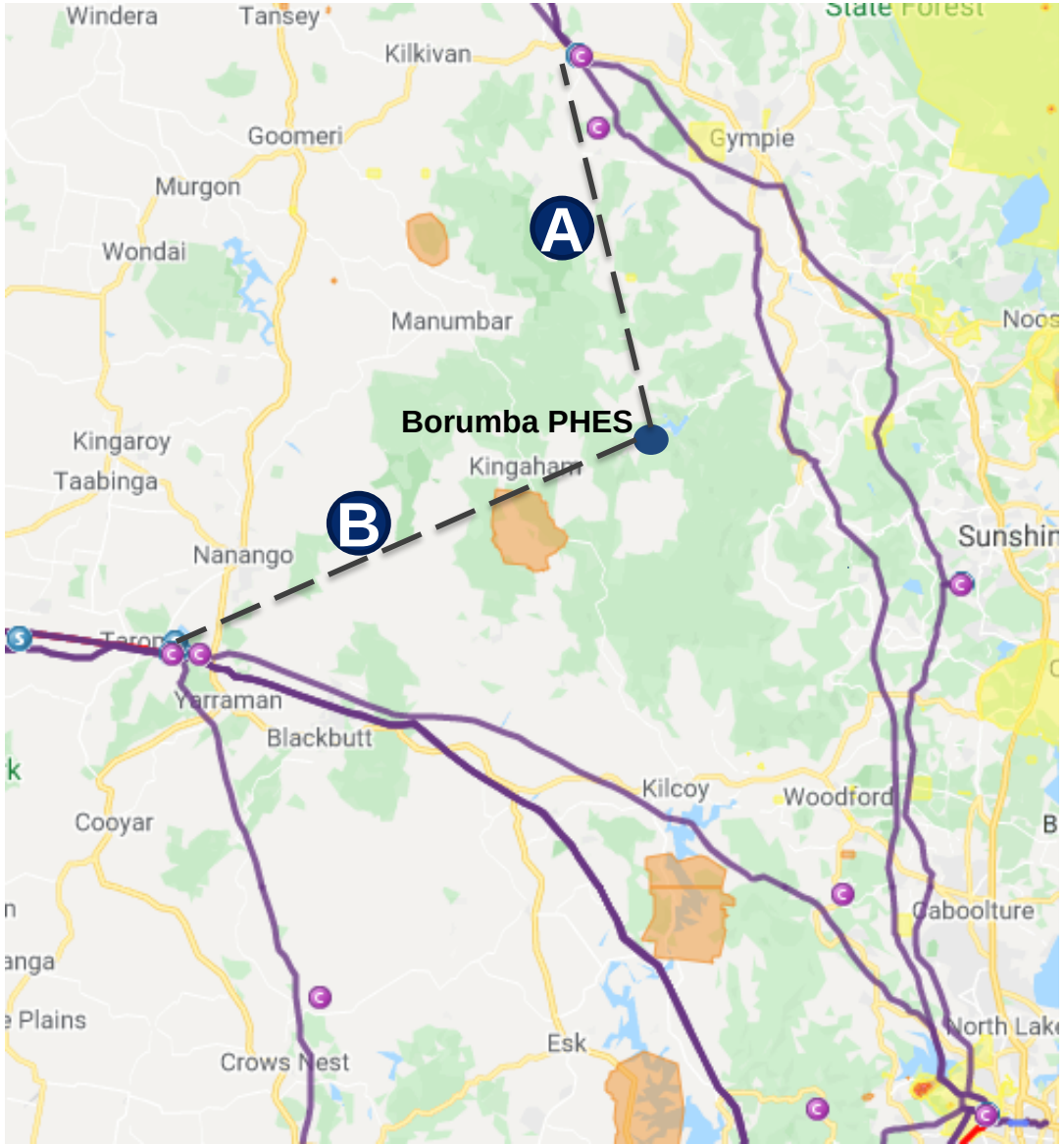
Potential Transmission Connection Points



A To Woolooga Substation
- Approx. 50 km

B To Tarong Substation
- Approx. 65 km

Connection and alignment considerations:

- Highly reliable scheme
- Land and easements
- Community acceptability
- Support Renewable Energy Zone development
- 2050+ network requirements
- Process to define alignment to occur through 2022

Project Prerequisites

- Need for deep storage
- Location of the upper reservoir
- Initial fill of the upper reservoir from Lake Borumba
- Location of tunnels and power house
- Design needs to facilitate development of additional renewable generation
- Storage of the lower dam needs to be increased – more capacity
- A new lower Borumba Dam wall structure
- Dam safety
- Will not impact existing water allocations or environmental low flows
- Transmission infrastructure to connect the pumped hydro project to the grid

Engagement Focus

Throughout the project, we will gather community views on:

- Transmission line easement alignment
- Community social infrastructure – like-for-like boat ramp, camp ground, etc
- Ability of the project to support additional water for potable supply and irrigation
- Minimise construction impacts on the community, i.e. project traffic (now and through construction) through certain times of day – optimal technical/construction access
- Opportunities for post-project construction community benefits (i.e. workers accommodation)
- Others?

Hydrology

Hydrology

Water balance assessment

- Lake Borumba is located in the Yabba Creek sub-catchment of the Mary Basin water plan area
- The study team will:
  - Evaluate the current water planning arrangements for the Mary Basin water plan area, including:
    - Opportunity for the project to access unallocated water (currently 150,000 ML)
    - Environmental flow requirements
    - Water entitlements/allocations and water security objectives
  - Use the Queensland Government's calibrated model for the Mary Basin to assess the impact of the project on catchment water balance
  - Work with Department of Regional Development, Manufacturing and Water to align with the Mary Basin Water Plan
  - Consider the potential for the project to provide additional irrigation and town water supply
- The project will be scaled and operated so that:
  - Any water take does not exceed the sustainable yield for the catchment
  - Environmental flows and water security downstream of the dam can be sustained

Hydrology

Flood hydrology assessment

- The study team will:
  - Determine the new boundaries of Lake Borumba following installation of the new dam wall
  - Build a calibrated hydraulic model that reproduces the behaviour of water in the local catchment (including Borumba dam, Yabba Creek and tributaries)
  - Use the hydraulic model to simulate large floods to understand the effects of the new dam wall on the upstream and downstream environment
  - Model the potential changes in the level of Lake Borumba due to the transfer of water between the upper and lower reservoir
  - Comply with legislated dam safety requirements to make sure that downstream population is not put at undue risk

Dam infrastructure & engineering

Lower Reservoir

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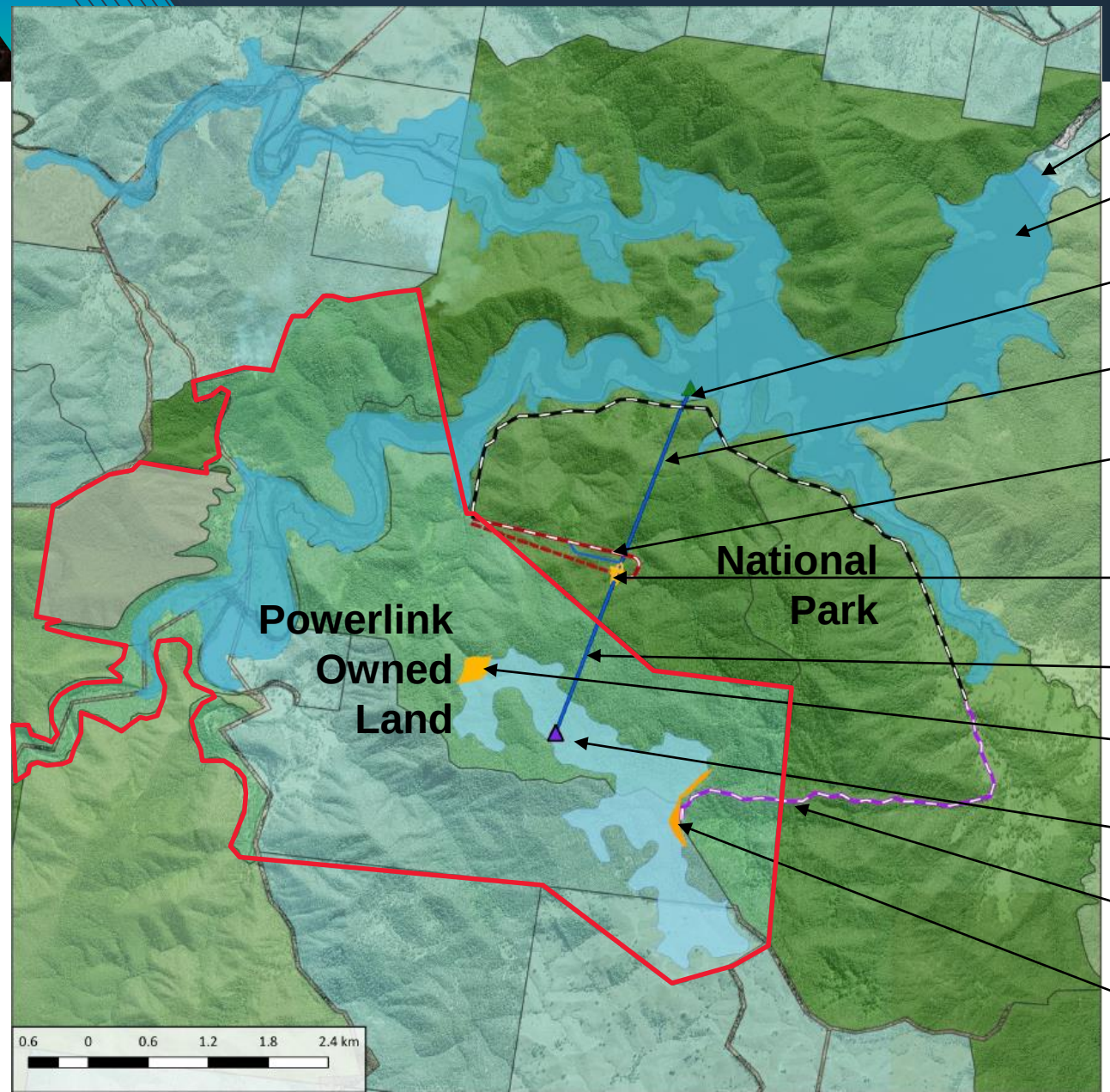

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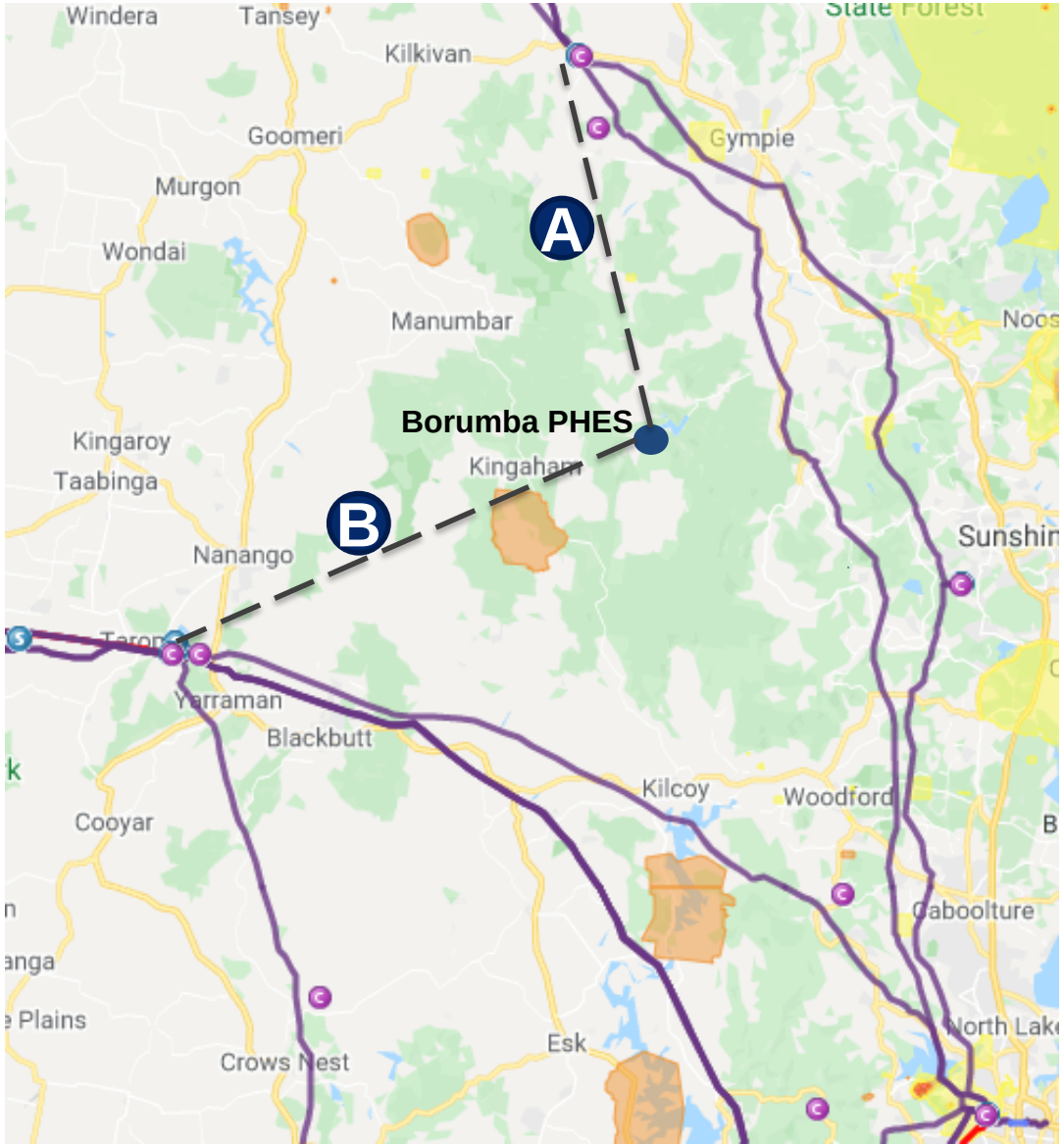

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Environment

Environment

Environmental assessment

- The study team will consider a broad range of issues including (but not limited to):
  - Water resources
    - Effects on water quality in Lake Borumba and downstream (including loads to coastal areas)
    - Changes to sediment levels and river morphology
    - Changes in catchment flows (flow volumes and seasonal patterns), and effects on environmental flows and water security
  - Ecology (including Matters of National, State and Local Environmental Significance):
    - Fish passage
    - Impacts to aquatic and terrestrial species, including protected species such as koala, southern snapping turtle, lungfish, platypus, and Mary River cod
    - Loss of habitat, including threatened ecological communities and protected areas such as Conondale National Park

Environment

Environmental assessment (cont…)

- Cultural Heritage and Native Title
  - Potential impacts on Indigenous and historic Cultural Heritage
  - Potential implications for native title
- Groundwater
  - Changes in groundwater levels, and impacts to vegetation (including National Park)
  - Seepage loss from upper reservoir and tunnel
- Soil and land resources
  - Hazards such as contaminated land, potential acid sulphate soils, naturally-occurring asbestos
  - Erosion and slope stability
  - Spoil and waste management
- Air, noise, vibration, greenhouse gases

Environment

Environmental field survey activities

- Aquatic flora and fauna surveys
- Terrestrial flora and fauna surveys
- Water quality monitoring
- Indigenous cultural heritage survey
- Historic heritage
- Groundwater monitoring

Socio-economic (local benefits)

Local benefits

Socio-economic impact assessment

- The study team will:
  - identify potential social and economic impacts as a result of the project
  - include identification and assessment of potential local and wider economic advantages
  - investigate management or enhancement measures for any identified impacts

- Feedback from stakeholder engagement will play a role in informing the social component of the assessment

- Results of the assessment will inform both financial and economic analysis and the environmental impact assessment

Local benefits

Socio-economic impact assessment – categories

- Traffic and transport
- Economic and business, both local and regional
- Amenity and access
- Tourism, including tourism operators
- Property and land use
- Effects on amenity, aesthetics and access
- Community health and wellbeing
- Culture and heritage, and effects on values, heritage, and customs
- Way of life, including effects on community cohesion and business.

Source: https://www.seqwater.com.au/dams/borumba

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