

# An atlas of pumped hydro energy storage - Figures

## The Complete Atlas

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*Australia has many potential sites for pumped hydro energy storage (PHES). In our initial survey, we have found about 22,000 sites – the State and Territory breakdown is shown in the table below. Each site has an energy storage potential between 1 and 200 Gigawatt hours (GWh).*

*The sites identified so far have a combined energy storage potential of around 67,000 GWh. To put this into perspective, to transition to a 100 per cent renewable electricity system 450 GWh of PHES storage would be needed. The potential PHES resource is almost 150 times more than required. Developers can afford to be choosy since only about 20 sites (the best 0.1% of sites) would be required to support a 100% renewable electricity grid.*

|                    | Approximate number of sites | Approximate energy storage capacity (GWh) | Minimum head (m) |
|--------------------|-----------------------------|-------------------------------------------|------------------|
| NSW/ACT            | 8600                        | 29,000                                    | 300              |
| Victoria           | 4400                        | 11,000                                    | 300              |
| Tasmania           | 2050                        | 6,000                                     | 300              |
| Queensland         | 1770                        | 7,000                                     | 300              |
| South Australia    | 195                         | 500                                       | 300              |
| Western Australia  | 3800                        | 9,000                                     | 200              |
| Northern Territory | 1550                        | 5,000                                     | 200              |
| <b>TOTAL</b>       | <b>22,000</b>               | <b>67,000</b>                             |                  |

*For comparison, the proposed Snowy 2.0 pumped hydro system would have a storage capacity of about 360 GWh. The Tesla battery to be installed in South Australia has a storage capacity of 0.13 GWh. Pumped hydro has a lifetime of 50 years compared with 8-15 years for batteries. About 36 km<sup>2</sup> of lake is required to support a 100% renewable electricity system, which is a small fraction of existing artificial reservoirs.*

*Virtually all sites are away from rivers, and none intrude on national parks or urban areas. The large number of potential sites provides some confidence that there will be a good number of technically feasible PHES sites. Site searching and development of a PHES cost model are being explored as part of an ARENA funded project.*

## Website

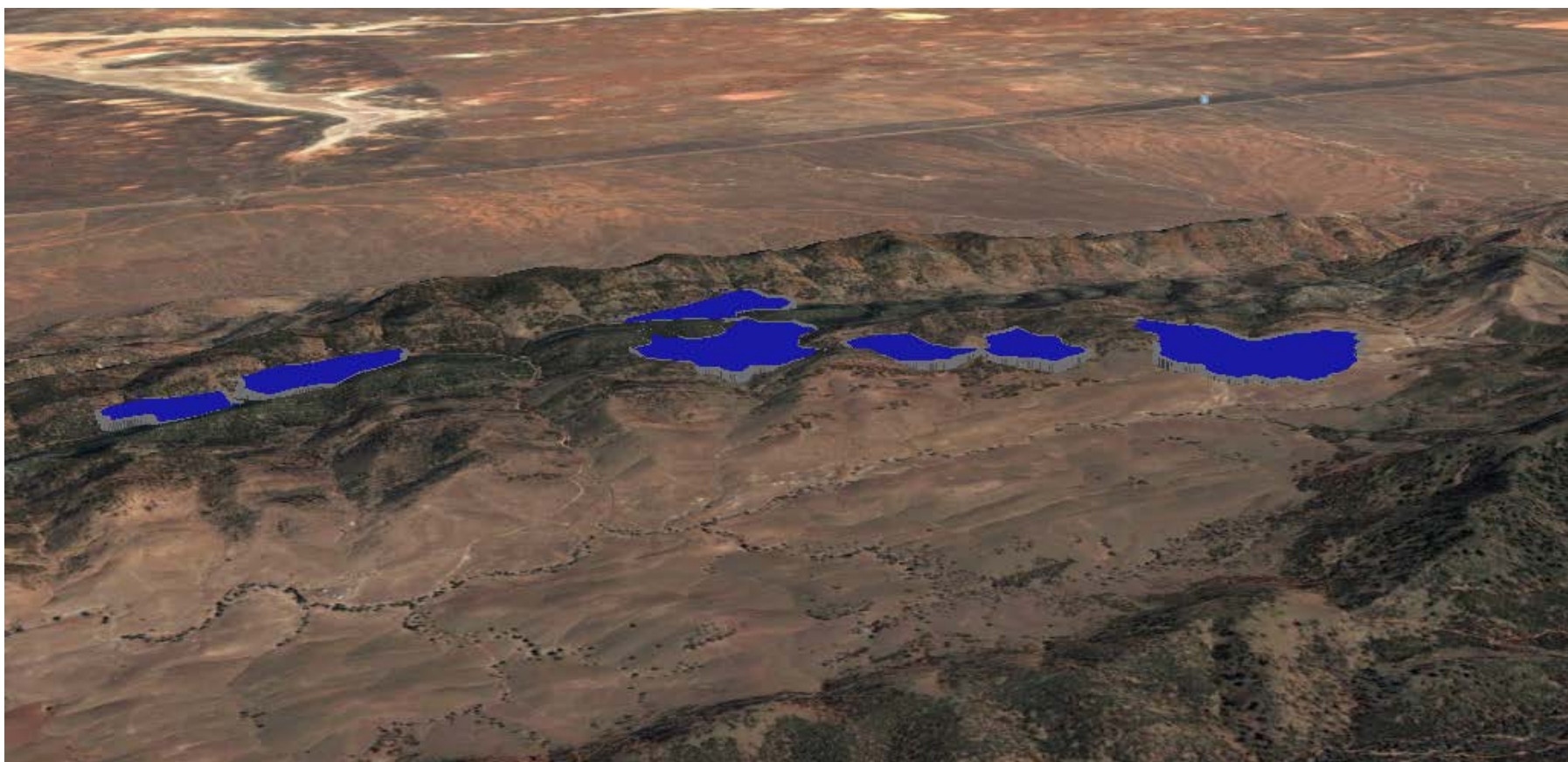
Data is regularly updated at <http://re100.eng.anu.edu.au/research/phes/>

## Disclaimer

*None of the PHES sites discussed in this study have been the subject of geological, hydrological, environmental and other studies, and it is not known whether any particular site would be suitable.*

*There has been no investigation of land tenure apart from exclusion of national parks and urban areas, and no discussions with land owners and managers. Nothing in this list of potential site locations implies any rights for development of these locations.*

*The commercial feasibility of developing these sites is unknown. As with all major engineering projects, diligent attention to quality assurance would be required for safety and efficacy.*



*Figure 1: Potential PHES upper reservoir sites east of Port Augusta. The lower reservoirs would be at the western foot of the hills (top of the image).*



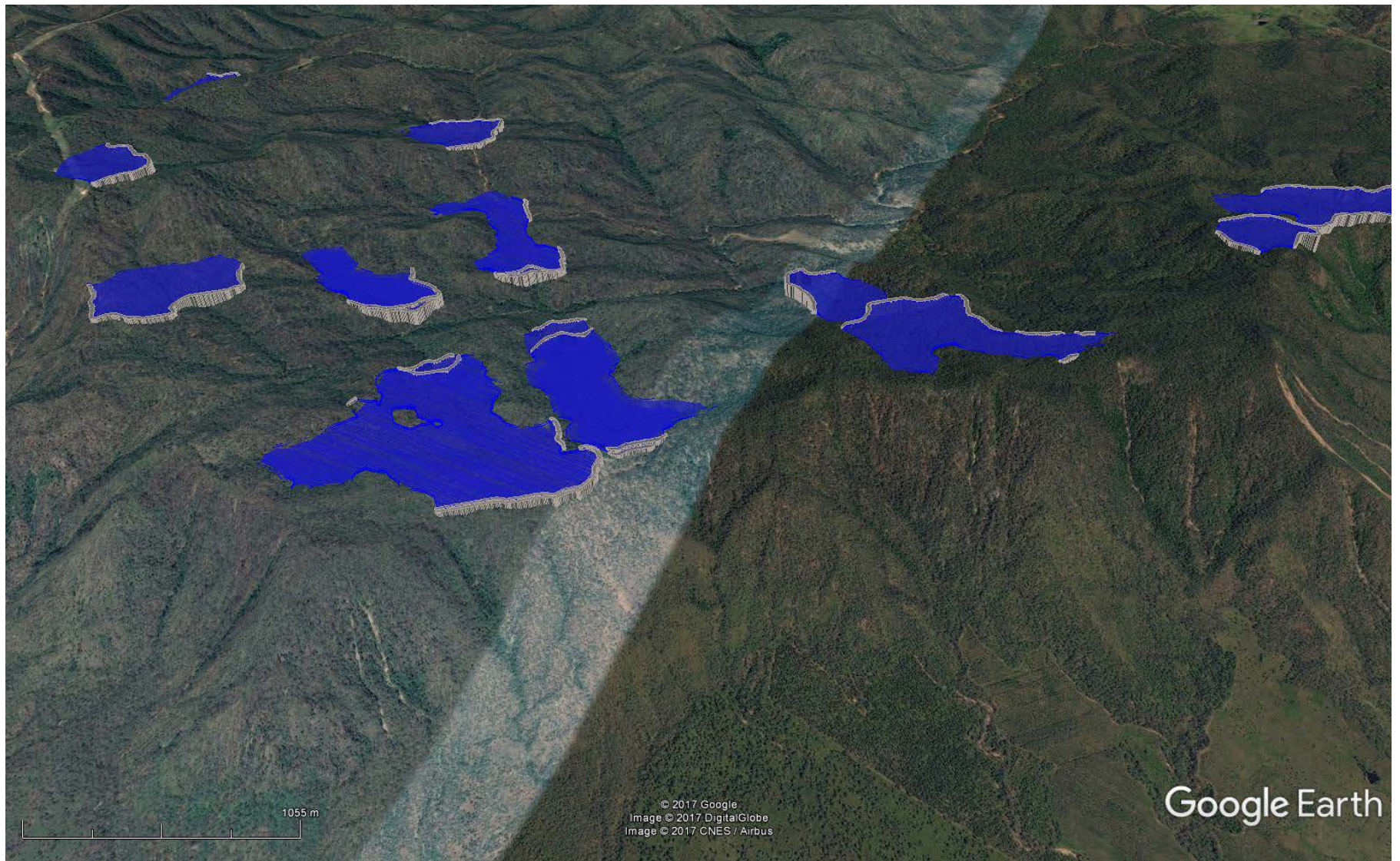
*Figure 2: Potential PHES upper reservoir sites in Region A, east of Port Augusta. The lower reservoirs would be at the western foot of the hills (bottom of the image).*



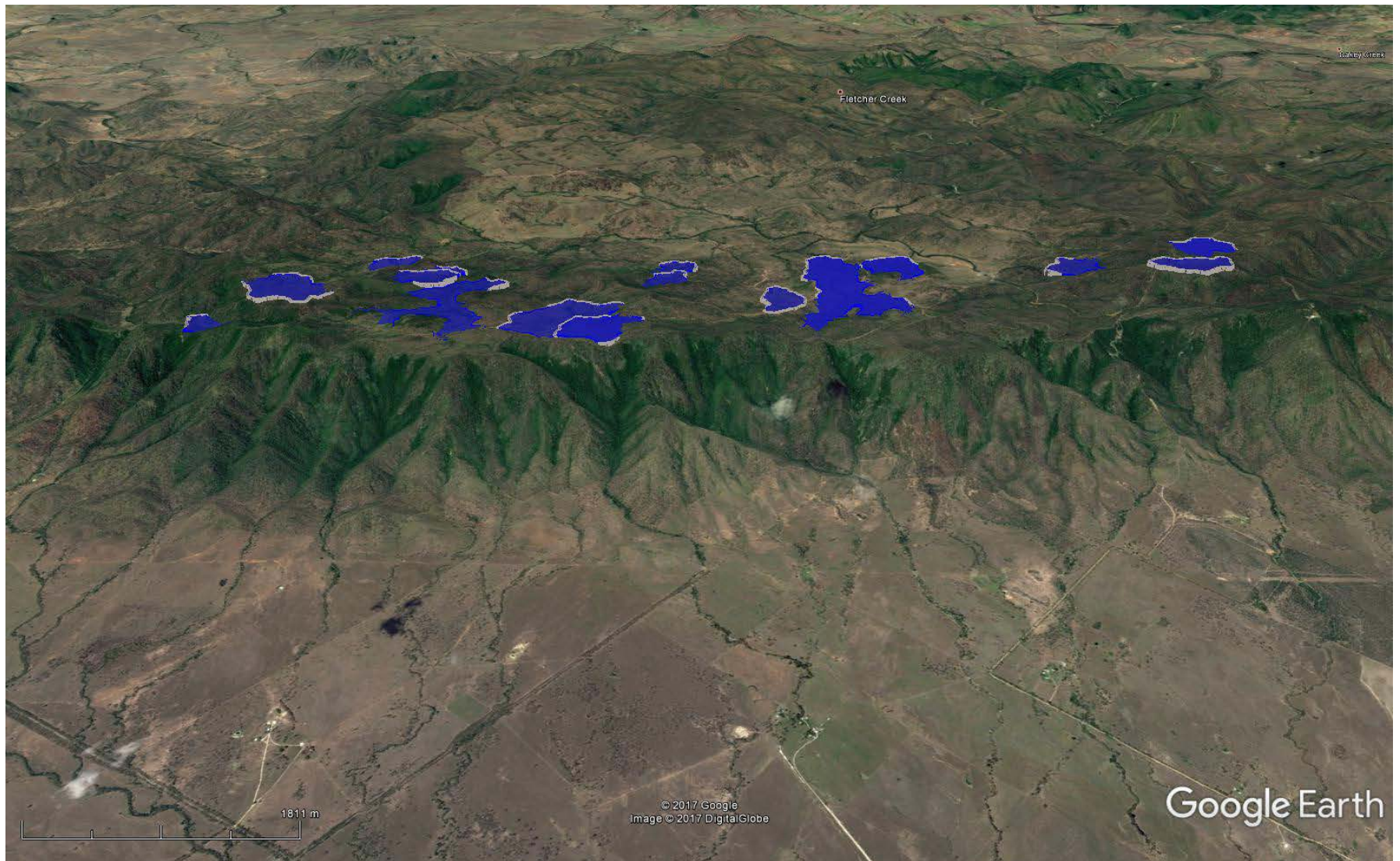
*Figure 3: Potential PHES upper reservoir sites in Region B, east of Port Augusta. The lower reservoirs would be at the western foot of the hills (bottom of the image).*



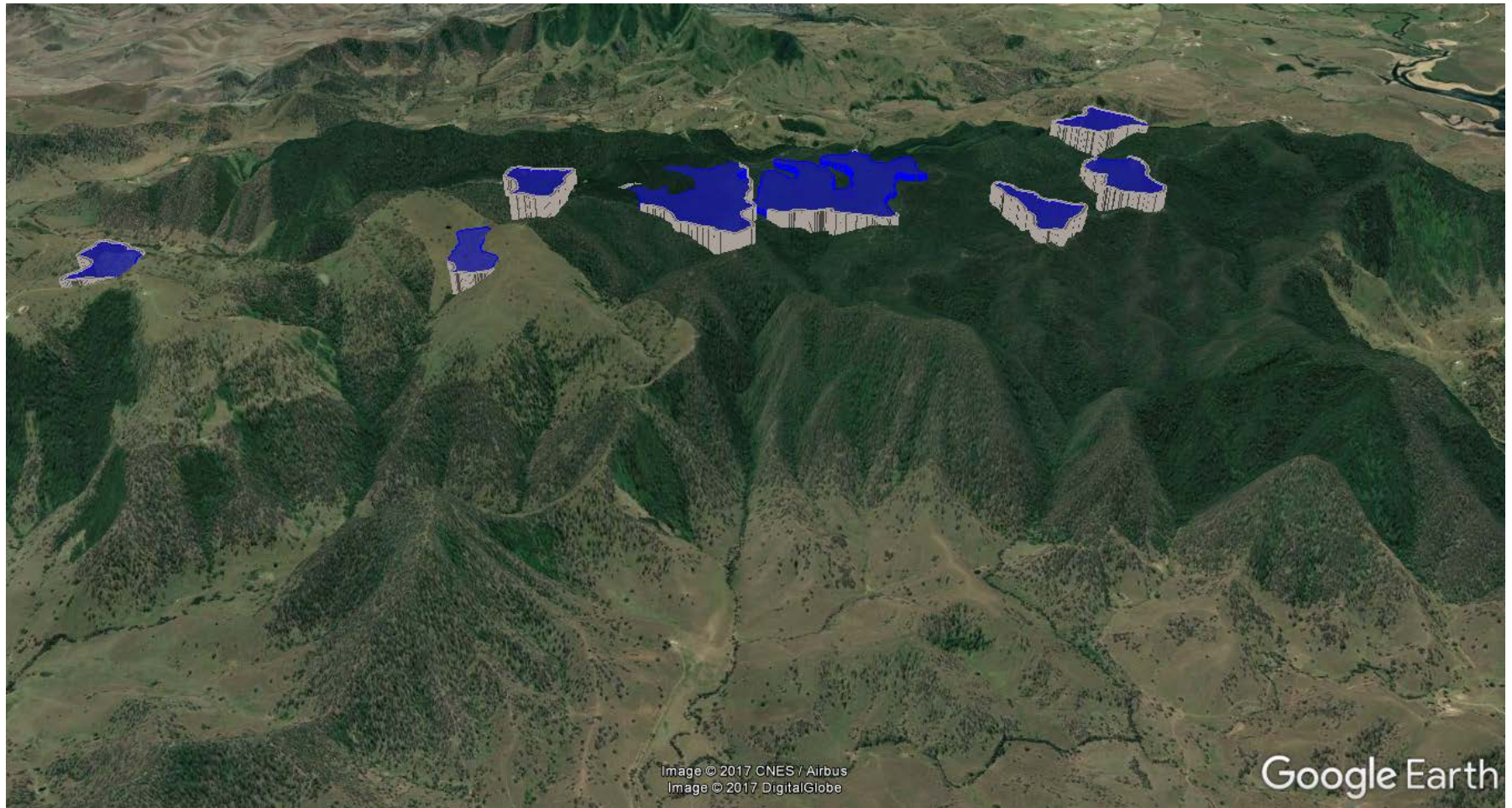
Figure 4: Potential PHES upper reservoir sites in Region C, east of Port Pirie. The lower reservoirs would be at the western foot of the hills (top of the image).



*Figure 5: Potential PHES upper reservoir sites north east of Biloela (Qld). The lower reservoirs would be at the foot of the hills.*



*Figure 6: Potential PHES upper reservoir sites near Rockhampton (Qld). The lower reservoirs would be at the foot of the hills, close to transmission lines.*



*Figure 7: Potential PHES upper reservoir sites west of Lake Wivenhoe (Qld). The lower reservoirs would be at the foot of the hills.*



*Figure 8: Potential PHES upper reservoir sites near Shannons Flat south of the ACT. The lower reservoirs would be at the foot of the hills (head of 400 m).*



*Figure 9: Potential PHES upper reservoir sites on Mt Macdonald near Cotter (ACT). The head is about 100 m rather than the 300-600 m head available elsewhere.*



*Figure 10: Potential PHES upper reservoir sites near Naas, ACT. The head is about 300 m.*



*Figure 11: Potential PHES upper reservoir sites near Corin Forest, ACT. The head is about 400 m. This area is problematical for several reasons.*



Figure 12: Potential PHES upper reservoir sites above Lake Cethana (Tasmania).

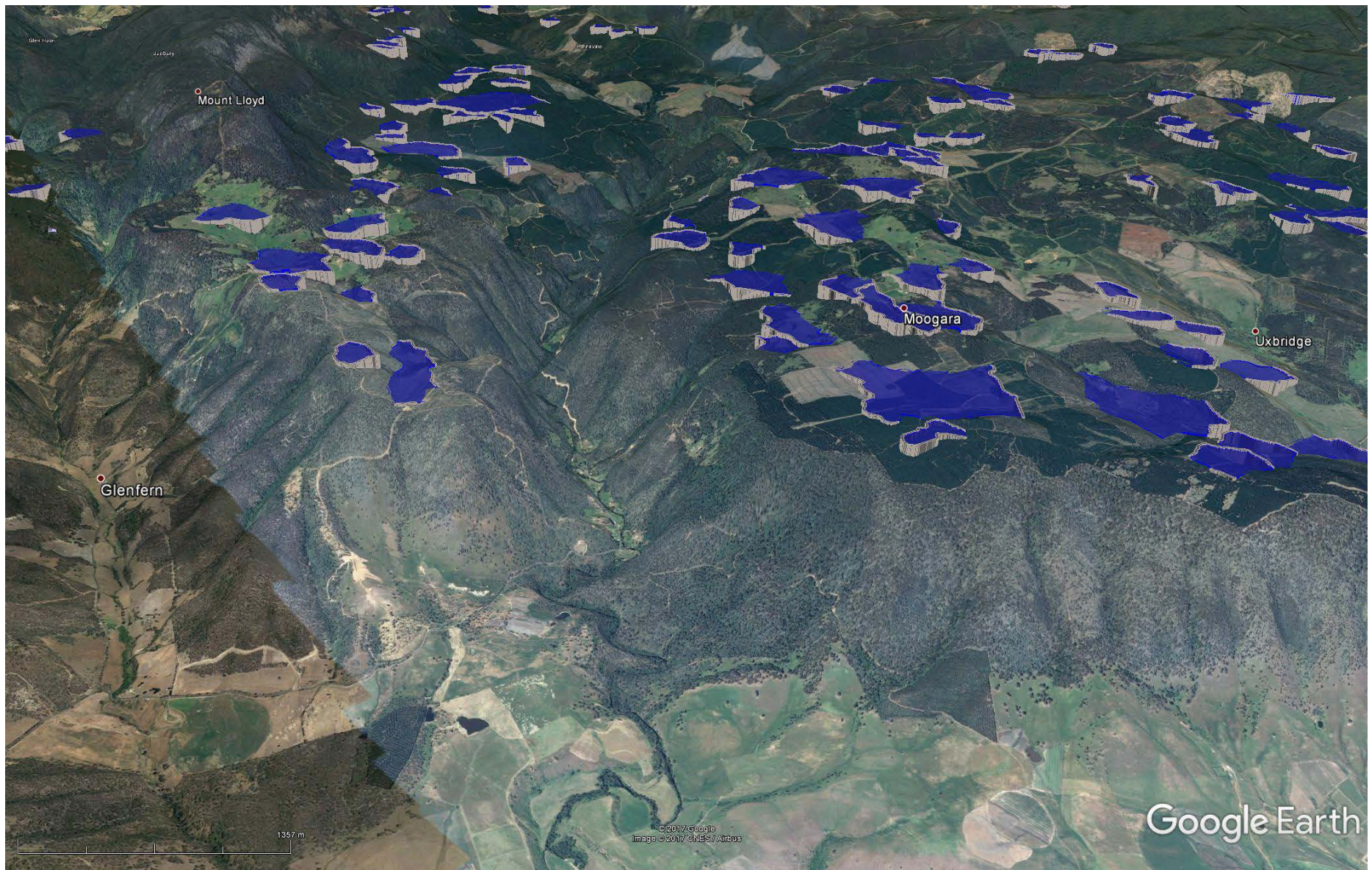
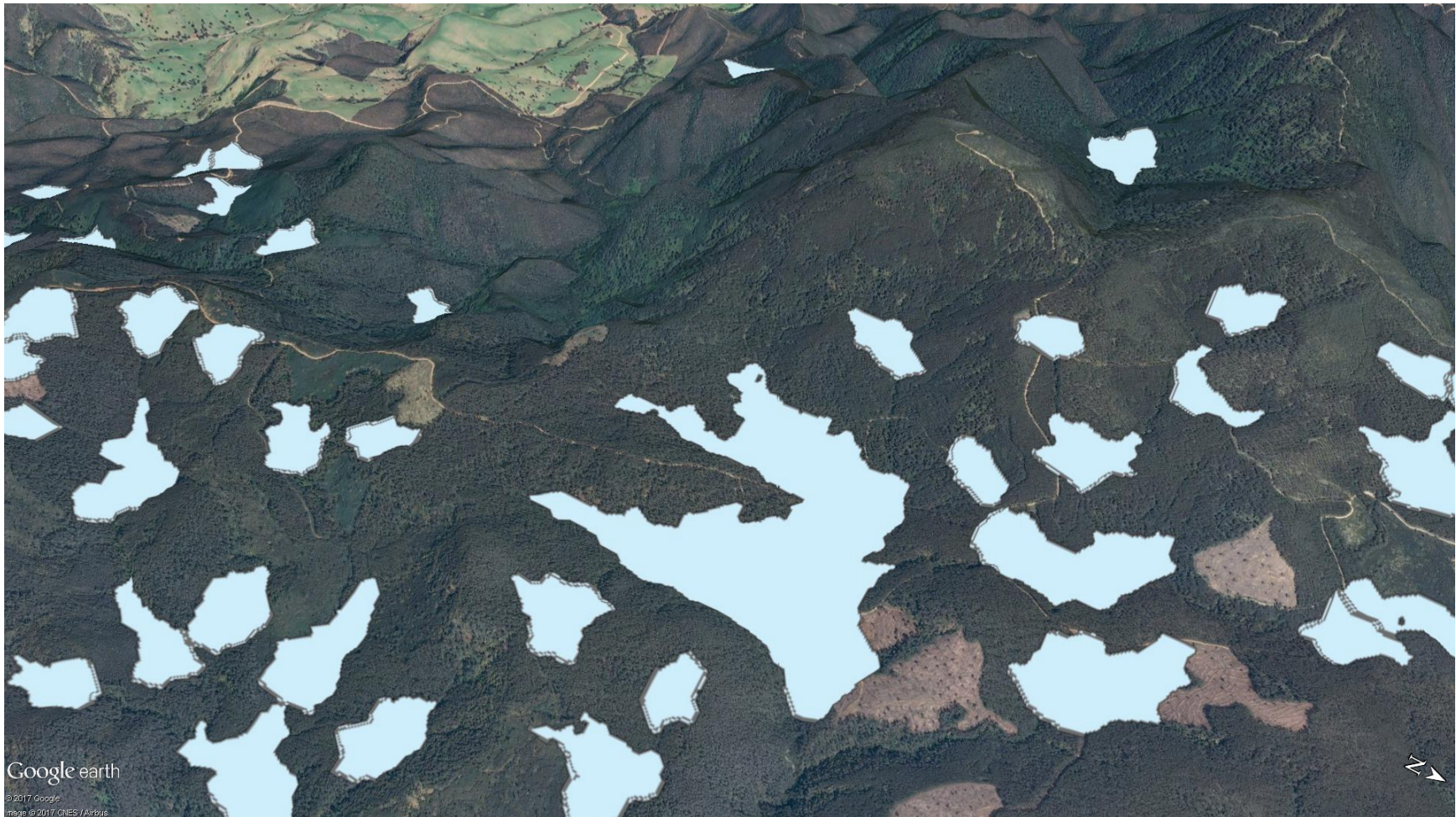


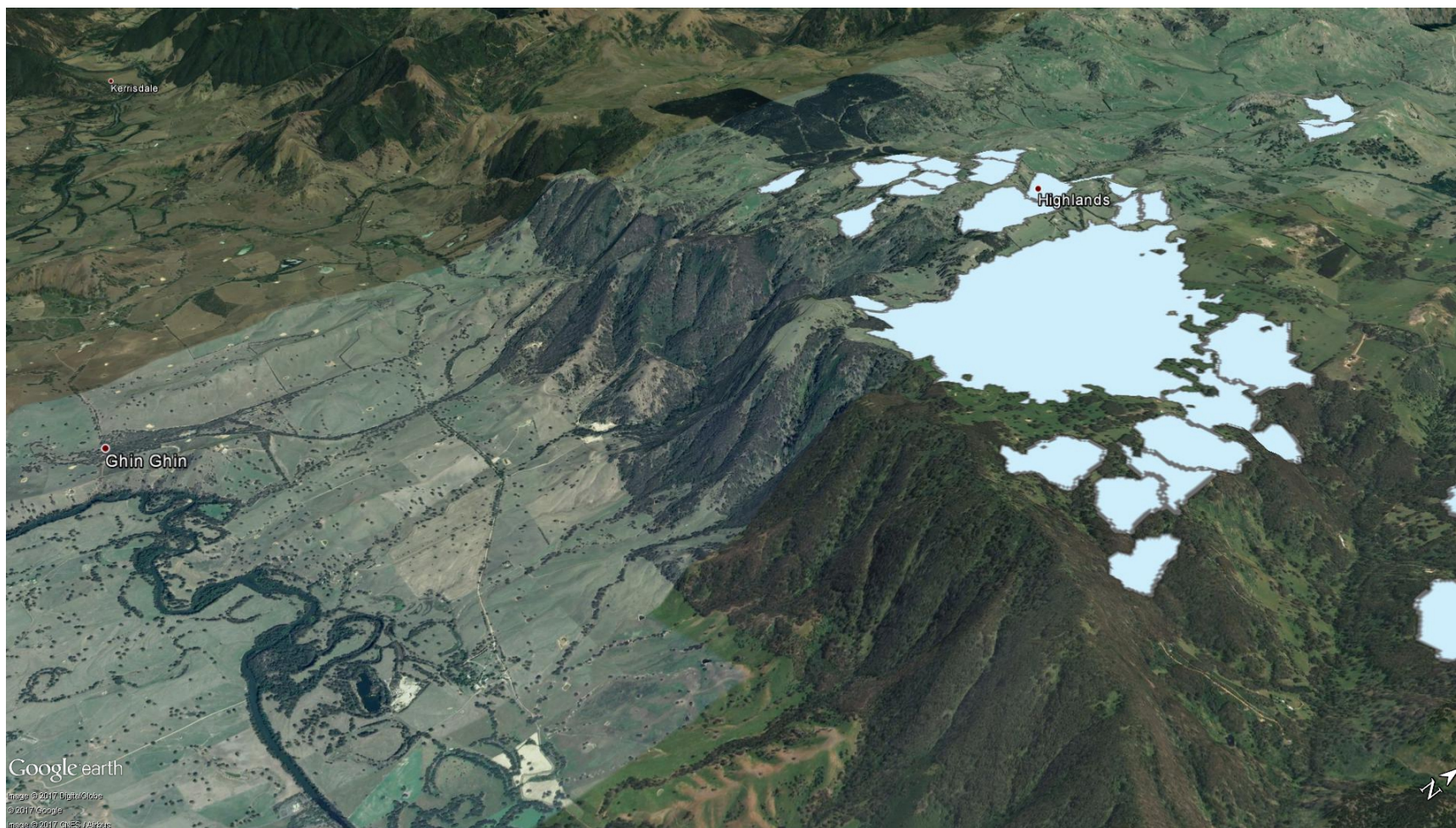
Figure 13: Potential PHES upper reservoir sites near New Norfolk (Tasmania).



*Figure 14: Potential PHES upper reservoir sites near Nunniong (Victoria) The site in the centre has a very good water to rock ratio.*



*Figure 15: Potential PHES upper reservoir sites near the Tallangatta Valley (Victoria) The easement corridor for the 330 kV transmission line can be seen in this image.*



*Figure 16: Potential PHES upper reservoir sites near Highlands (80 km North East of Melbourne, Victoria). The central reservoir is the largest in Victoria, and has a 84 GL capacity*



Figure 17: Potential PHES upper reservoir sites at Collie, WA, with 200 m head into the pit and a good volume of stored water.



Figure 18: Potential PHES upper reservoir sites near Harvey, WA. The existing reservoir at the bottom of the image could be incorporated into a PHES system.