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**Report on Desktop Inventory of Sites of Geological and
Geomorphological Significance in VEAC's Eastern Victorian
Forests Assessment area**

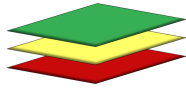
Dr Susan White

Wakelin Associates Pty Ltd

to

Victorian Environmental Assessment Council

31 March 2025



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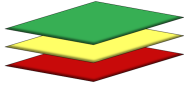
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Executive Summary

This desktop study focusses on the sites of high Geological and Geomorphological Significance on Public Land in Eastern Victoria. Specifically, it concentrated on those located in the State Forests.

This report has, using the standard protocols of the Geological Society of Australia (Victoria Division) conducted a desktop study on the known site information. This study has:

- Identified 136 sites of International, National and state significance on public land in Eastern Victoria.
- Identified 8 sites of State significance in the State Forest. This is only 5.84% of the total, a rather low number. There are sites that need to be investigated further e.g Walhalla (WR 061).
- In Victoria 41% of Crown land is in National Parks and similar reserves and 40% is in State Forests. However, in Eastern Victoria a large area of Public Land is State Forest (Figs 1 & 2), and the area of State Forest in the state in the west and central west is significantly less. However in Eastern Victoria there are no International or National sites identified in the State Forest and only 5.9 % State significance sites listed compared with 94.1 % listed in National Parks and other Reserves. This is a serious imbalance.
- Although the National and International sites have a high concentration along the coast where a lot of relevant research and documentation has occurred, there are several scattered across the more difficult access areas. This appears to indicate a bias against the reporting of appropriate features in State Forests.
- Reassessed and upgraded the location details. Some of these are still not precise due to the original data precision.
- Updated the sites' descriptions and significance statements.
- Identified sites that need further investigation.
- Suggested management actions to be considered.
- Identified that the State Forest of the Public land in Eastern Victoria has not been investigated as well as the coastal and other areas e.g. the Buchan Karst.



Introduction

This desktop study interrogated available published literature, the Victorian Division of the Geological Society of Australia (Victoria Division) (GSAV) database held and maintained by the GSAV, the Victoria Resources Online (VRO) website. The study concentrated on the state forest designated land (State Forest) in Eastern Victoria (Fig. 1), specifically VEAC's Eastern Victorian Forests Assessment area.

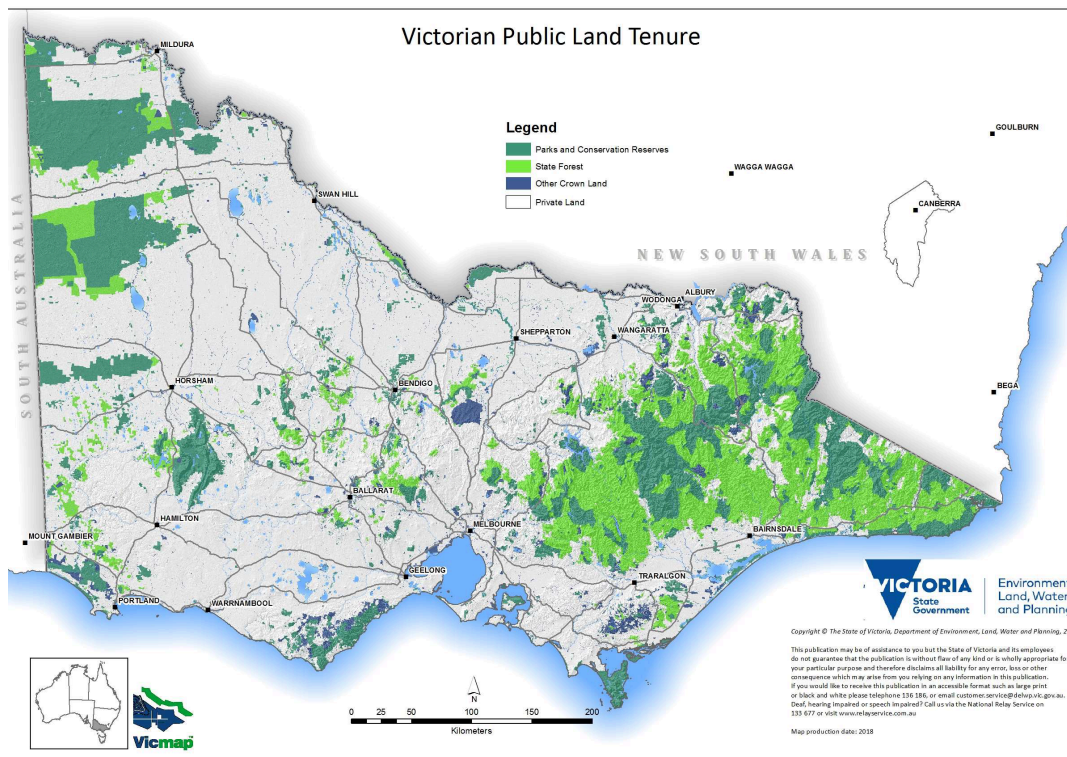


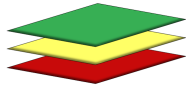
Figure 1: Victoria Public Land Tenure (Victoria, Department of Environment, Land, Water and Planning, 2018)

Background

The assigning or reviewing geological significance is undertaken in Victoria by the Geological Society (Victoria Division) (GSAV) has developed a methodology and protocol for assigning or reviewing geological significance that has been accepted as reliable and repeatable by organizations such as the Australian Heritage Council. GSAV maintains the only state-wide data base of identified sites for Victoria.

The level of geological significance is classified at local, regional, state, national or international level by documentation, assessment and comparison. The significance rating assigned to a site is periodically reassessed in the light of new information and/or site condition. Unknown and Destroyed sites are documented for heritage/historical information.

Geological and geomorphological significance does not relate to the aesthetics of a landscape. Sites of very high significance may not be aesthetic, e.g. quarry faces or road cuttings whereas aesthetically pleasing views are not relevant for a high *geological/geomorphological* significance. The criteria for significance are related to whether a site can be regarded as important with regards to it being a



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representative or outstanding example of geology and/or geomorphology. If processes are involved these can be active or relict.

The level of geological significance is classified at local, regional, state, national or international level by documentation, assessment and comparison. This report is concerned with sites of high significance only, i.e. International, National and State significant sites. For further details see Appendix 1.

Methodology

Sites were identified using the GSAV methodology attributes and spatially plotted on Google Earth Pro using Google Earth Pro and MapshareVic software. Some .kml locations were also provided to assist with location details. Location is provided as GDA94 co-ordinate system Latitude and Longitude in degrees and decimal minutes format. Latitude/Longitude is from conversion from published WGS84 grid references, hard copy maps and published material, and converted using with Google Earth Pro imagery. Imagery date is 30/8/2024. (Data SIO.NOAA.U.S.Navy,NGA.GEBCO. Images Landsat, USGS & PGC/NASA)

Sites were assessed using the GSAV methodology (see Appendix 1) but this report is concerned with sites of high significance only, i.e. International, National and State significant sites. Regional, local and unassessed sites were checked and classification re-graded if appropriate. All high-level sites were checked to see that site descriptions, significance statements and specific management recommendations were as up to date as possible and significance ratings current.

The level of geological significance is classified at local, regional, state, national or international level by documentation, assessment and comparison. This report is concerned with sites of high significance only, i.e. International, National and State sites.

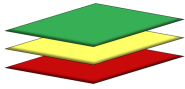
More detailed criteria for classification are:

- **International Significance:** These sites are landforms, structures, rock formations or fossils which are rare in the world, and/or by the nature of their scale, state of preservation or display, are comparable with examples known internationally. They may be global type examples and are widely known as reference sites by the international geological community. A site may be included in an international register of sites of scientific significance and would rate listing on the National Heritage List.
- **National Significance:** Sites that are rare in Australia or are important nationally by virtue of their scale or state of preservation are assigned national significance. Widely used as reference sites by the Australian geological community, they should be included in a national register of sites of scientific significance and may be considered for listing on the the National Heritage List.
- **State Significance:** These sites are important in defining the geology and geomorphology of Victoria and may be rare in Victoria, reference sites or type examples.

All the sites in State Forest have at least one of the attributes listed in Appendix 1 (Table 2).

The sites were identified as being on Public/Crown land in the Eastern Victoria (Fig. 1) and then specifically identified as being in State Forest (Fig. 2). In Victoria 41% of Crown land is in national Parks and similar reserves and 40% is in State Forests. However, in Eastern Victoria the largest area of Public Land is State Forest (Figs 1 & 2), and the area of State Forest in the west and central west is significantly less.

Some large sites, e.g. the Bogong High Plains (TL 023), have subsites, e.g. Wally's Hideout (TL 023.01) both of which have National status. In the example of the Beechworth Area Gemstones (WN 089) where there are 22 separate small sites spread over a significant area, the site is just listed with one ID number (WN 089) and the table of subsites referred to. Other sites, specifically some with access issues e.g. the Mount Cobberas Periglacial landscape complex (TL 005) the subsites need further assessment, although the overall site is assessed clearly as of National Significance. Most of these



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complex sites are not in the State Forest but there are 2 sites that are. These are the Woods Point Dyke Swarm (WR 020) and the Walhalla Gold Field (WR 061). Both are highly significant sites, are poorly researched in many ways especially with respect to their size and their geological importance. No subsites are identified and both sites have areas within the State Forest. Further field work is needed to clarify the situation, especially to identify specific subsites where the geology can be viewed.

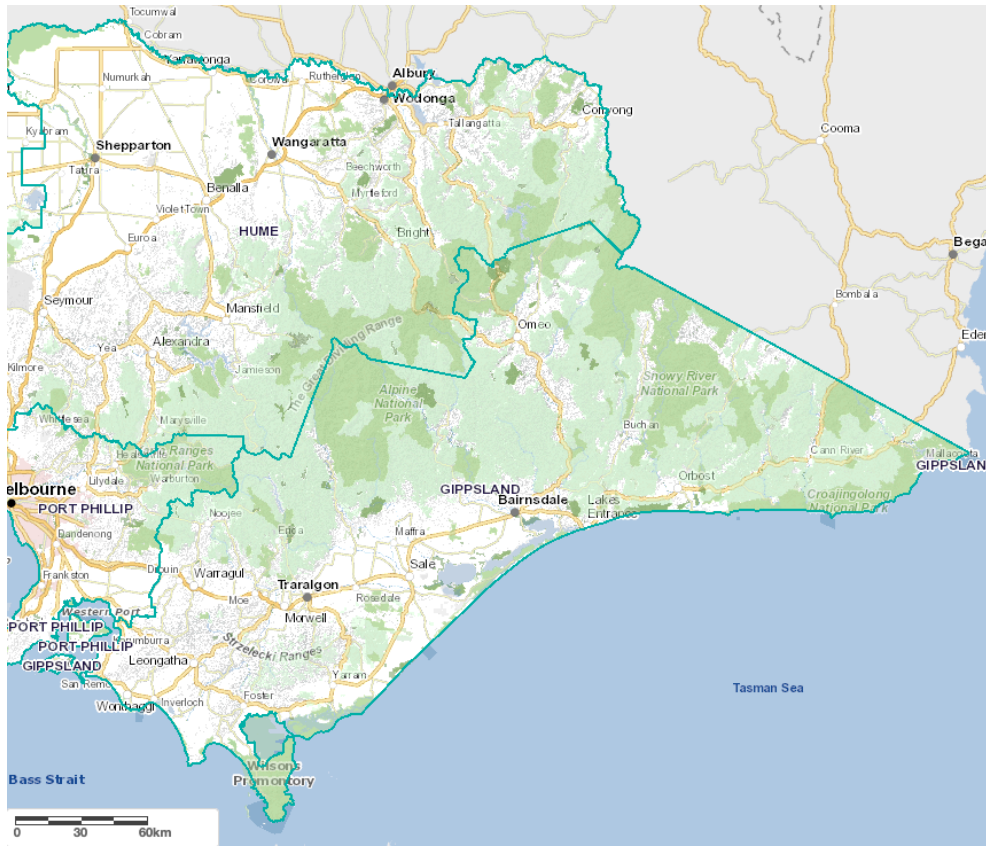


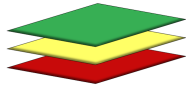
Figure 2: Crown and Public land distribution in Eastern Victoria (MapshareVic; <https://www.deeca.vic.gov.au/maps/interactive-maps/>). Pale Green is State Forest; other green and grey colours identify other park and reserve categories.

Results

A total of 136 sites of International, National and State significance are identified in Eastern Victoria, as being fully or partially on other public land in Eastern Victoria and of these only 8 sites of State significance are in State Forest. There are 3 International, 27 National and 98 State sites that are on public land other than State Forest in eastern Victoria. For the Eastern Victorian Forests Assessment area (State Forests) there are no known International or National sites of significance. The 8 State Forest sites are listed in Table 1 and their details are provided in Appendix 2. The distribution of these is indicated on Figures 3 & 4.

The non-State Forest sites that are on public land are listed with limited information (Appendix 3). However, these include over a range of different features, several geological and geomorphological sites of high significance.

The State Forests therefore hold only 5.9 % of the total sites of significance on public land for about one third of the state's area. It is not clear whether the same trend applies for regional and local sites. The absence of sites of International and/or National significance in the State Forest estate is of concern as the general geology would indicate that at least some National level sites should exist.



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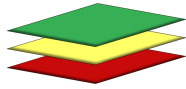
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This is possibly partially due to access problems when several studies were undertaken and reports produced with extensive field work from the late 1970 to the late 1990s (e.g. McRae-Williams et al. 1981, Rosengren and White, 1997). The area has difficult terrain, and much access has only been via logging roads. There are probably more sites, especially as important geological research has been undertaken over the past 20 years only some of which is published and accessible. Eastern Victoria has an extensive and interesting coastline and there are many coastal sites of high significance. The karst sites in the Buchan area and some areas of National Parks e.g. Bogong High Plains also are well represented. It is unfortunate that other inland and upland areas have not received the same attention.

The sites that are not located in State Forest range from large to small sites. Some sites are only partially on Crown/Public land but with natural features this is not a rare occurrence. Many of these sites are coastal and or karst sites that have a great deal of research undertaken and so their scientific significance is better known. Detailed locations have not been updated for these sites and therefore not included.

Table 1: Sites of Geological & Geomorphological Significance, VEAC's Eastern Victorian Forests Assessment Area: State Forest

Site ID	Site Name	Site location	State Forest	Short Description
BR078	Stony Creek & Nowa Nowa Caves	12 kms south-west of Nowa Nowa	Colquhoun/ Boyanga Gidi SF	Outcrops of Gippsland Limestone in McCraes quarry. Two caves (3NN-01; 3NN-02) in Gippsland Limestone.
BR143	Mount Battery	4 km N of Cobungra Hill; 22 km NW of Omeo; E of Mt Hotham Airport;	Mt Battery SF	Block slope deposits in Tertiary Older Volcanics.
TL048	The Brothers	10 km NE of Benambra McKinnon Road	Uplands SF	Exposures of Triassic Syenites and Trachytes. An alluvial basin and river gorge.
WL 033	Eaglehawk Creek Inlier	Glengarry; 6 km west of Toongabbie.	Boola Boola SF	Outcrops of Palaeozoic Walhalla Group, Mesozoic Tyers Group sediments and Haunted Hills Gravels
WL038	Rintoul Creek area,	Glengarry West, Rintoul Creek area .	Boola Boola SF	Outcrop of Tyers Group Lower Cretaceous sediments
WN020	Murmungee Basin	10 km S Yackandandah Stanley SF	Stanley SF	Differential weathering of a more erosive granite intrusive & less erosive contact metamorphic aureole.
WR020	Woods Point Dyke Swarm (WPDS)	Southern end of (WPDS) over ~20 km north of Walhalla	Aberfeldie SF to Big River SF	Southern section of the 150 km Late Devonian dyke swarm
WR061	Walhalla Goldfield	State forest areas east of Walhalla	Aberfeldie SF to Big River SF	A more or less auriferous belt extending 80km from Walhalla to Woods Point

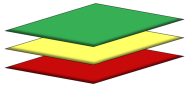


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Table 2: Geological Attributes of Sites of Geological & Geomorphological Significance, VEAC's Eastern Victorian Forests Assessment Area: State Forest

ID	Site name	Geological attribute
BR078	Stony Creek & Nowa Nowa Caves	- a fossil locality, - a representative example of a landform type. - demonstration of the effects of weathering, erosion and/or deposition on landform evolution
BR143	Mount Battery	- illustration of tectonic and/or volcanic processes - features which enable palaeoclimatic reconstruction - demonstration of the effects of weathering, erosion and/or deposition on landform evolution - a representative example of a landform type
TL048	The Brothers	- exposures of a range of features characteristic of the rock unit - demonstration of the effects of weathering, erosion and/or deposition on landform evolution
WL 033	Eaglehawk Creek Inlier	- exposures of a range of features characteristic of the rock unit, or exposures of features which are unusual in the rock unit - a representative example of a landform type
WL038	Rintoul Creek area,	- a fossil locality
WN020	Murmungee Basin	- an unusual occurrence of a particular feature - exposure of a range of features characteristic of the rock unit, or exposures of features which are unusual in the rock unit - an illustration of tectonic and/or volcanic processes - a representative example of a landform type
WR020	Woods Point Dyke Swarm (WPDS)	- an unusual occurrence of a particular feature or mineral - exposures of a range of features characteristic of the rock unit, or exposures of features which are unusual in the rock unit
WR061	Walhalla Goldfield	- an illustration of tectonic and/or volcanic processes - exposures of a range of features characteristic of the rock unit, or exposures of features which are unusual in the rock unit

More detailed information on each site is provided in the Excell Spread Sheet (Appendices 2 & 3).



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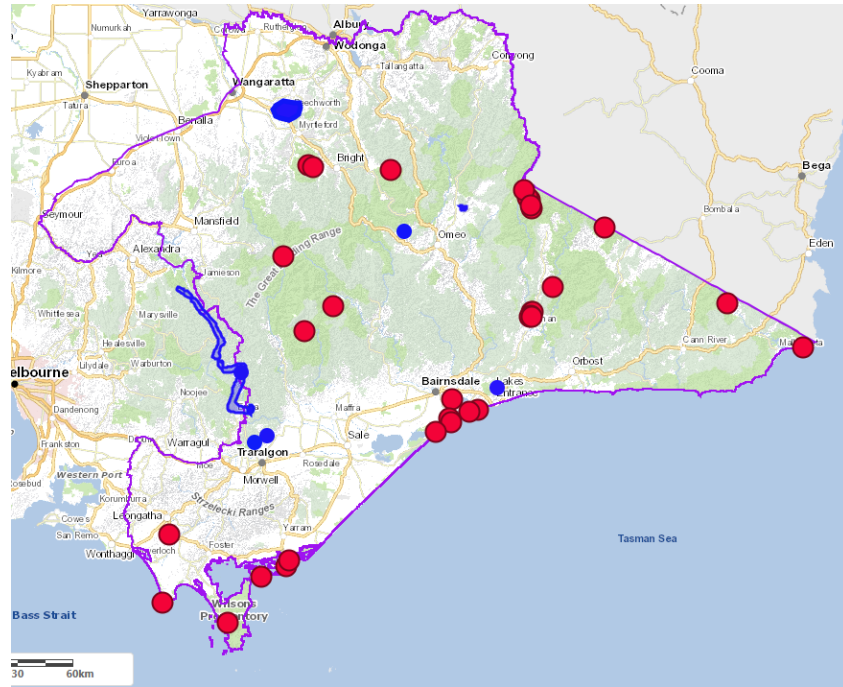


Figure 3: Distribution of Sites of Geological and Geomorphological Significance located in State Forest (Blue) in comparison to International and National sites on other public land (red). There are only 8 sites in State Forest, and all are of state significance (Source: VEAC).

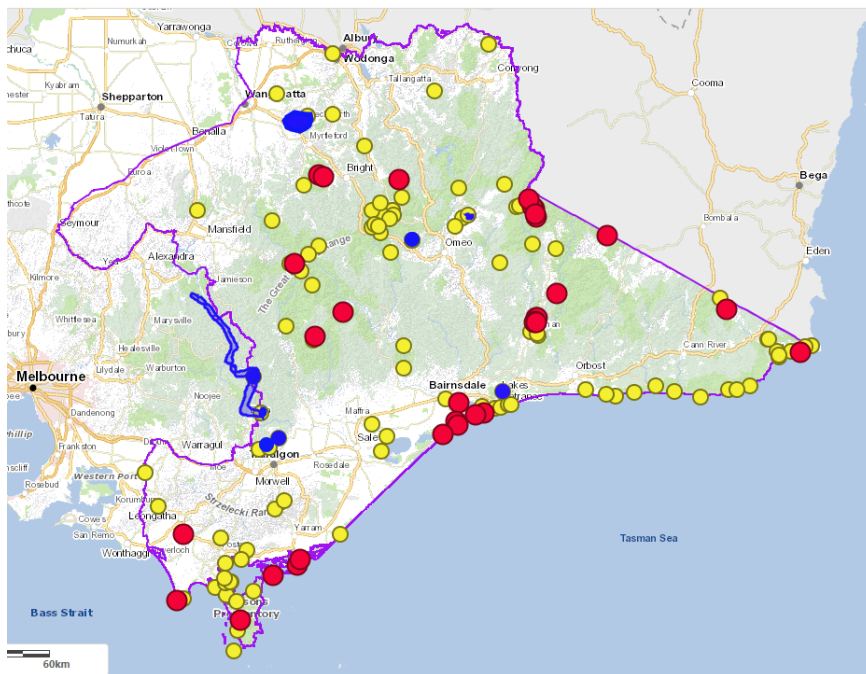


Figure 4: Distribution of Sites of Geological and Geomorphological Significance located in State Forest (Blue) in comparison to International and National sites (red) and State sites (yellow) on other public land (Source VEAC).

Management

This is a desktop study, and the sites therefore have not been visited recently. Detailed knowledge of current condition is often poorly known, and the comments should be taken as a broad guideline only. A short specific statement is provided for the 9 State Forest sites that indicates the degree to which disturbance to a site may alter its geological or geomorphological values. Specific land use proposals must be evaluated in terms of the degree of alteration they may cause to a particular site. Some sites, in fact, may be enhanced by controlled excavation, e.g. road widening, new cuttings or appropriately targeted quarrying, as these may expose new geological sections and may be compatible with the maintenance of the site's geological significance. On the other hand, the use of 'shotcrete' to stabilise road cuttings and the planting of vegetation on sites has often damaged the integrity of sites. The inappropriate construction of roads may disrupt the patterns of the landscape produced by exposures of distinctive lithologies and tectonic features. Each site needs to be assessed specifically, especially for sites of high significance.

Advice on site management issues is available from the Geological Society of Australia (Victoria) Heritage Subcommittee (gsavictoria@gmail.com).

References

Only a few references are listed here as these contain references to specific sites and contain more detailed references within them.

Rosengren, N. J., McRae-Williams, M.S., and Kraemers, S.M. 1981 *Sites of Geological and Geomorphological Significance in Central Gippsland, Victoria*, Environmental Study Series, Ministry of Conservation, Victoria 341.

McRae-Williams, M.S., Rosengren, N. J., and Kraemers, S.M. 1981 *Sites of Geological and Geomorphological Significance in East Gippsland, Victoria*, Environmental Study Series, Ministry of Conservation, Victoria 320.

Rosengren, N. J., 1984 *Sites of Geological and Geomorphological Significance in the Gippsland Lakes Catchment, Victoria*, Environmental Study Series, Ministry of Conservation, Victoria 402.

Rosengren, N. & White, S. 1997 *Sites of Geological significance in part of Northeastern Victoria*. Geological Society of Australia Inc. (Victoria Division).



Appendix 1 GSA(V) Protocol for Assigning or Reviewing geological significance.

The assigning or reviewing geological significance is undertaken in Victoria by the Geological Society of Australia Inc (Victoria Division), Heritage subcommittee. The GSA is a volunteer learned society. The GSA has developed a methodology and protocol for assigning or reviewing geological significance (White et. al 2003), which has been accepted as reliable and repeatable by organizations such as the former Australian Heritage Commission (now Australian Heritage Council). This methodology has been used in assessing significance of the various sites around Victoria and has been used by VEAC with regard to sites on public land. It is regularly updated.

The following information on sites is reviewed from personal experience, fieldwork, literature review and consultation with other geologists with specific knowledge and expertise. The GSA subcommittee has members with a wide range of geological experience and expertise. Significance rating is achieved by consensus after considerable discussion on the merits of the site. This is particularly the case for sites of International and National significance where an extensive understanding of comparable sites outside Victoria is desirable.

The international and national significance discussed here does **not equate** to World Heritage status or National Heritage Listing for these sites.

It is important to note that geological, including geomorphological, significance may not necessarily relate to the aesthetics of a landscape. Some sites of very high significance may not be at all aesthetic, e.g. quarry faces or road cuttings whereas aesthetically pleasing views may not always be assigned a high *geological* significance. If processes are involved these can be active or relict.

Geological sites should possess at least one of the following attributes to be considered for assessment on their significance:

- a type section of a geological unit,
- a fossil locality,
- exposures of a range of features characteristic of the rock unit, or exposures of features which are unusual in the rock unit,
- an unusual occurrence of a particular feature or mineral,
- an illustration of tectonic and/or volcanic processes,
- features which enable palaeoclimatic reconstruction,
- demonstration of the effects of weathering, erosion and/or deposition on landform evolution,
- a representative example of a landform type.

The criteria for significance is related to whether a site can be regarded as important with regards to it being representative or outstanding. A choice often has to be made between the most outstanding or unusual example and an excellent representative example from a group of very similar ones.

The representative approach (McRae-Williams et al., 1981; King, 1985; Davey & White, 1986; Joyce, 1995) has been found to be the most appropriate in assessing significance but outstanding examples must be considered. Criteria used in such assessment include:

- how representative is the feature?
- how adequately is each type of feature represented over a particular scale?
- which feature is the most appropriate to represent a particular type?
- how many representatives are justified?
- How far would you travel with an interstate or international visitor interested in that type of site?
- How does it compare with other similar sites - regionally, in the state, in Australia, internationally?
- Is it under threat and if so, what is the nature of that threat?
- How common or rare is the feature? National? State? Regional? or Local? Level
- Replication? Representation?
- Is it a particularly good example?
- Is it a type section or type example (for landforms).



- What use ? e.g. education, geotourism, research.

Other aspects of the site such as present and past land use, diversity of features present, access, and vulnerability to damage are also considered. Features or areas are also described according to size, physical and/or geological type and age.

The level of geological significance is classified at local, regional, state, national or international level by documentation, assessment and comparison. The significance rating assigned to a site is periodically reassessed in the light of new information and/or site condition.

More detailed criteria for classification are:

- **International Significance:** These sites are landforms, structures, rock formations or fossils which are rare in the world, and/or by the nature of their scale, state of preservation or display, are comparable with examples known internationally. They may be global type examples and are widely known as reference sites by the international geological community. A site may be included in an international register of sites of scientific significance and would rate listing on the National Heritage List. Tower Hill is an example of an internationally significant site due to the well-preserved evidence of phreato-magmatic volcanic processes.
- **National Significance:** Sites that are rare in Australia or are important nationally by virtue of their scale or state of preservation are assigned national significance. Widely used as reference sites by the Australian geological community, they should be included in a national register of sites of scientific significance and may be considered for listing on the the National Heritage List. An example is Mount Buffalo.
- **State Significance:** These sites are important in defining the geology and geomorphology of Victoria and may be rare in Victoria, reference sites or type examples. An example is Mount Kororoit, Diggers Rest.
- **Regional Significance:** These sites include landforms or geological features representative of regions of about 60km radius. An example is the Royal Park railway cuttings in Melbourne.
- **Local Significance:** These are features representative of smaller areas in a region, e.g. the Ovens Valley. Such sites are usually related to an area of a local municipality or an area with a radius of 20km. A typical example is the Stony Creek Road cuttings at Halls Gap where there is a good exposure that shows the relationship of igneous rocks to the main body of the Grampians Group sediments.
- **Unknown Significance:** Sites are assigned this rating if there is insufficient data to allow a complete assessment to be made. Typically these sites are either under investigation or subject to continual change e.g. active quarry faces.
- **Destroyed Sites:** These sites are documented as they may be locations for important geological materials lodged in museums or referred to in published material.

Documentation of sites

Sites are chosen after recommendation and assessed. However many sites are large and we have found using subsites is a satisfactory way of dealing with smaller sites within a larger one. The Site ID is based on the names of the 1:250000 geological map sheets e.g. The Organ Pipes site on the Melbourne 1:250000 sheet is ML 016. This is chronological as new sites are added. The data base is being gradually added as volunteer time permits. Some larger and more complex sites have subsites e.g. National rated Port Campbell NP CL 020, has 33 subsites 3 international, 4 National, 8 State, 13 Regional and 5 Local; but Dinosaur Cove (CL 020.28) is International.

GSA(V) maintains a data base with over 2000 entries for the state. This has the following main data fields:

- Site ID and Alpha-Numeric Reference Number:
- Feature name
- Location (Nearest Town)
- Municipality



- Mapsheets (1:100000 & 1:250000)
- Site size
- Description
- Location data
- Significance
- Significance Statement
- References

For enquiries regarding information from the database and for any other enquiries contact the convener of the GSA Victoria Heritage subcommittee and database manager, Dr Susan White OAM, <susanqwhite75@gmail.com>.

**Appendix 2: Excel Spread Sheet:
Sites of High Significance on State Forest Land; Eastern Victoria 2025**

**Appendix 3: Excel Spread Sheet:
Sites of High Significance on other Public Land; Eastern Victoria 2025**

