#14677063

SA Water Corporation
Solar energy generation plant and associated infrastructure

Cnr Main South Road and Black Road, O'Halloran Hill
145/V020/19

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OVERVIEW

Application No	145/V020/19
Unique ID/KNET ID	APPIAN 4434, Knet 2019/10640/01
Applicant	SA Water Corporation
Proposal	Installation of an electricity generating plant in the form of a solar photovoltaic array (9MW), battery storage and associated infrastructure and earthworks.
Subject Land	Cnr Main South Road and Black Road, O'Halloran Hill
Zone/Policy Area	Open Space Zone
Relevant Authority	Minister for Planning
Lodgement Date	12 August 2019
Council	City of Onkaparinga
Development Plan	Onkaparinga Council Development Plan Consolidated 20 December 2018
Type of Development	Crown application
Public Notification	Section 49: Development exceeds $4 million
Representations	Two (2), two (2) wishing to be heard
Referral Agencies	Department for Environment and Water, Commissioner of Highways (DPTI), Essential Services Commission
Report Author	Brianna Fyffe, Senior Planning Officer

EXECUTIVE SUMMARY

The Happy Valley Reservoir Reserve solar electricity generation project is a 9MW facility to be located within the reservoir on approximately 11.2 hectares of land, approximately 21km south-west of the Adelaide CBD. SA Water Corporation is a government business enterprise, established under the *South Australian Water Corporation Act 1994*. For the purposes of section 49 of the *Development Act 1993*, SA Water Corporation is considered to be a state agency.

The development site is located within the Happy Valley Reservoir Reserve which spans approximately 625 hectares with the water body totalling 178 hectares at full capacity. Existing water infrastructure is scattered across the subject site, including the Water Treatment Plant. The reservoir has a capacity of 11,500ML and supplies more than 40% of Adelaide's water. Beyond water provision operations, other existing activities on site include Forestry SA undertaking commercial softwood timber production within the pine plantation areas.

The development is located within the north-western corner of the reservoir landholding to take advantage of the relatively flat topography and proximity to the existing Water Treatment Plant. The proposal forms part of SA Water's *Zero Cost Energy Future* project which aims to reduce the operating costs and improve reliability of energy supplies to SA Water's critical water infrastructure.

The application was referred to the local Council and relevant state agencies. No objection was raised. Public notification was undertaken between Wednesday 2 October and Friday 1 November 2019. Two (2) representations were received during the notification period. Planning concerns raised included the industrial nature of the development, local amenity impacts, long term screening costs, noise emissions and decommissioning.

SA Water responded that any impacts from the development, such as loss of amenity and a potential heat island effect, have been addressed by maintaining an existing tree buffer, additional screen plantings and setbacks. Stormwater will be managed through swales to

direct water run-off to existing watercourses, with site disturbance to be minimised during construction.

Whilst the development will result in some change to the local landscape, including the removal of 18 hectares of Forestry SA pine plantation, the operation of the development is expected to be fairly benign. Impacts during construction can be appropriately managed through a Construction Environmental Management Plan (CEMP).

The Onkaparinga Council Development Plan promotes the preservation of the open space character to provide a visual contrast to the surrounding urban area. The zone is envisaged to accommodate a range of public and private activities in an open and natural setting including recreation land uses and habitat conservation and restoration. While the focus is on the natural state, carefully managed departures from this are considered to occasionally be necessary for the benefit of the community.

The Development Plan is silent in respect to large-scale solar developments, with these facilities being relatively new to South Australia, however the principles related to Wind Farms can be applied as the solar electricity generation is for the sole purpose of supporting the onsite water infrastructure operations. On balance, the proposal is supportable subject to appropriate conditions.

ASSESSMENT REPORT

1. BACKGROUND

The development application was lodged on 12 August 2019.

2. DESCRIPTION OF PROPOSAL

Application details are contained in the Attachments.

The proposal is for the installation of an electricity generating plant in the form of a solar photovoltaic array (9MW), battery storage and associated infrastructure and earthworks. The project will be located on 11.2 hectares of land, approximately 21km south-west of the Adelaide CBD. The site is located within the Happy Valley Reservoir Reserve and consists of four parcels of land located to the east of Main South Road and to the south of Black Road in O'Halloran Hill (refer Figure 1).

The solar array will be located in the northern portion of the subject land, currently leased by Forestry SA and undertaking commercial softwood timber production (refer Figure 2). To facilitate the installation of the array, approximately 18ha of Aleppo pine plantations were cleared in November 2019. Note, the clearance of these did not require approval under the *Development Act 1993* as this is excluded by regulation.

Components of the proposal include:

- Installation of approximately 37,895 solar PV cells (refer Figure 3), measuring approximately 1960mm long x 911mm wide and 40mm thick on a low-profile concertina framework (refer Figure 4);
- Four inverter stations, measuring approximately 2.8m high x 2.4m wide x 5.8m long;
- Battery Energy Storage System (BESS) located nearby the existing electricity substation (refer Figure 2);
- Groundworks, levelling and provision of a construction lay-down area;
- Surface upgrades to existing access tracks;
- Upgrades to existing security fencing as needed; and
- Provision of a landscaping buffer to the north and west of the proposed solar array.

The solar panels will be mounted on a low-profile concertina framework arranged east-west linearly, facing north-south. The prefabricated 5B MAVERICK™ solar array system will be installed to conform to the terrain profile and be an approximate maximum height of 1m from the finished ground level (refer Figure 4).

The solar array will be installed across three separate portions, separated by existing forestry access tracks onsite. The array will align with the extent of pine plantation growth areas. To provide a buffer and visual amenity for neighbouring residents in the north-east, a 40m zone of the existing pine plantation is proposed to be retained along the length of the northern boundary fronting Black Road. The existing Aleppo pines will be retained in this area. A further 20m offset planting zone is proposed south of the 40m forest zone, creating a 60m vegetation buffer from Black Road (secondary arterial road). A 10m clearance zone is proposed in between the offset planting zone and the solar array to ensure vegetation overshadowing does not limit the solar gain opportunities. On the western boundary, fronting Main South Road (primary arterial road), a 10m offset planting zone and 10m clearance zone is proposed to prevent glare and visual impacts.

For the installation of the panel array framework, the MAVERICK™ system does not require percussion piling and thereby minimises potential noise impacts. The detailed layout of the solar facility is yet to be finalised. Final design details should be confirmed with a condition of approval.

It is anticipated that four inverters will be require to be installed, each with a capacity of 2.25MW to cater to the overall target of generating 9MW. Indicative dimensions for each inverter are approximately 2.8m high x 2.m wide x 5.8m long. These will be distributed throughout the solar array.

The BESS will be installed near to the existing substation (refer Figure 2) and will provide electrical stability with an anticipated capacity of 3.78MW. Model specifications of the inverters and BESS will be confirmed through the detailed design phase, however Figures 5 and 6 illustrate the proposed indicative equipment.

Site access is proposed from Black Road, through an existing security gate and utilising the existing access tracks. There is an extensive network of gravel sealed access tracks which will be utilised during the construction phase and for ongoing maintenance purposes.

Public access is currently restricted at the Reservoir Reserve with high security fencing surrounding the site, topped with two strands of barbed wire. The main gate, located on Chandler's Hill Road, is staffed by a security guard. Other perimeter gates are locked at all times. The detailed design phase of the project will determine the location of any required security fencing upgrades.

The construction phase of the development is expected to be 6 months in duration. The main construction activities include:

- earthworks, including minor levelling and remediation post removal of pines;
- drainage works to manage stormwater run-off and some upgrades to the existing drainage network potentially required;
- trenching works and the installation of new high-voltage and low-voltage electrical cabling, consisting of both aboveground and underground cable routes;
- upgrades to the SA Water electrical infrastructure to facilitate connecting the array to a high voltage switchboard;
- installation of the support framework and panel array; and
- installation of the BESS.

The solar facility is expected to have an operating life of 25 years.

Figure 1: *Site context, including the Reservoir Reserve boundary (dark blue) and subject site parcels (light blue);*
Source: PLB Pro, retrieved 30 September 2019

Figure 2: *Indicative location of solar PV panels (green) and BESS location (yellow) within site boundary (blue);*
Source: PLB Pro, retrieved 30 September 2019

Figure 3: *Site layout*
Source: Submitted documentation (Site Plan)

Figure 4: *Example of 5B* MAVERICK™ *concertina framework to be installed*
Source: Submitted documentation (Development Application document, originally sourced from 5B website)

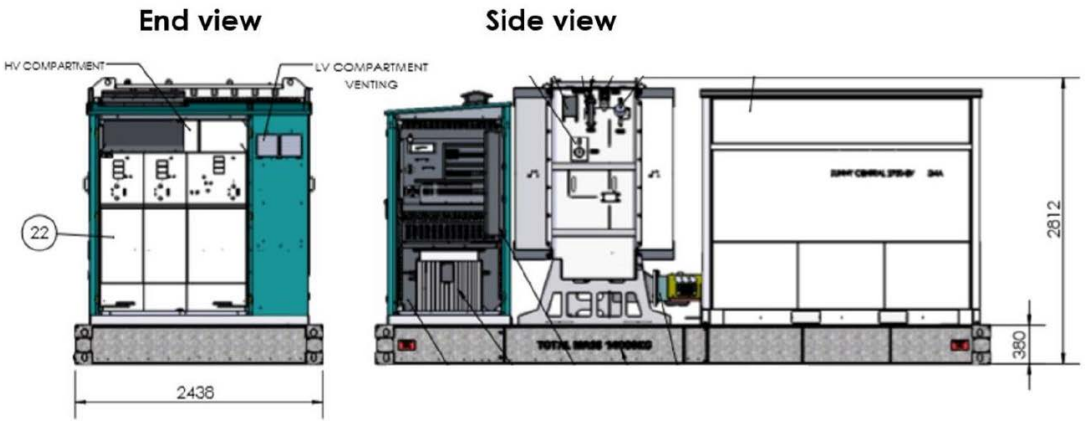


Figure 5: *Indicative inverter elevation*
Source: Submitted documentation (Development Application document)

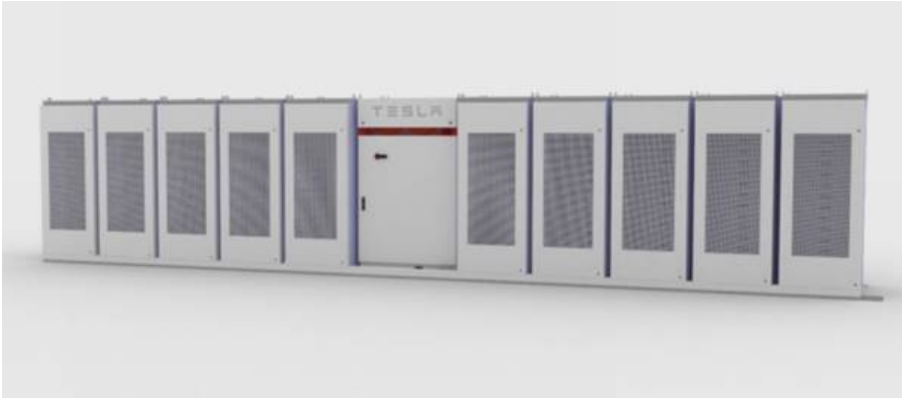


Figure 6: *Indicative BESS equipment*
Source: Submitted documentation

3. SITE AND LOCALITY

3.1 Site Description

The subject land consists of four (4) allotments, described as follows:

Lot No	Street / Suburb	Hundred	CT Reference
H105500 S74	Lot 7 Chandlers Hill Rd Happy Valley	Noarlunga	CT 5412/953
F205351 A94	Lot 7 Chandlers Hill Rd Happy Valley	Noarlunga	CT 5412/975
F209648 A92	Lot 7 Chandlers Hill Rd Happy Valley	Noarlunga	CT 5516/144
H105500 S466	Lot 7 Chandlers Hill Rd Happy Valley	Noarlunga	CT 6089/962

The subject land is located approximately 21km south of the Adelaide CBD and within the Happy Valley Reservoir Reserve (refer Figure 1). The reservoir was constructed in the 1890s to assist in the provision of Adelaide's water supply, has a capacity of 11,500ML and supplies more than 40% of Adelaide's potable water.

The Reservoir Reserve contains approximately 120 hectares of remnant vegetation, 100 hectares of revegetation and approximately 63 hectares of pine plantations. A Memorandum of Understanding (MOU) exists between SA Water and Forestry SA, enabling Forestry SA to have ongoing access to specific areas within SA Water's reservoir reserves for commercial softwood timber production. Existing water infrastructure is scattered across the subject site, including the Water Treatment Plant, located south of the proposed BESS location (refer Figure 2).

The allotments of the subject site are rectilinear in shape. The subject site spans across four parcels, totalling approximately 114.78 ha, though only approximately 11.2ha is required for the proposed development. Two parcels front Black Road and Main South Road and will accommodate the solar array, inverters and landscaping buffer areas. The BESS is situated on the boundary of two parcels (F209648, A92 and H105500, SE466), located south of the proposed solar array location. All parcels are held in SA Water Corporation ownership.

By design, the reservoir landholding is situated within undulating terrain, allowing for the effective capture and storage of water (refer Figure 7). Ground elevations are highest towards the northern outer extent of the Reservoir Reserve and the terrain then falls away from the outer perimeters to form a central depression which contains

the reservoir waters. The entire Reservoir Reserve, including the subject site is zoned Open Space within the City of Onkaparinga development plan (refer Figure 8). The site is within a High Bushfire risk area.

Figure 7: *Subject site topography*
Source: Submitted documentation (Project Environmental Management Plan)

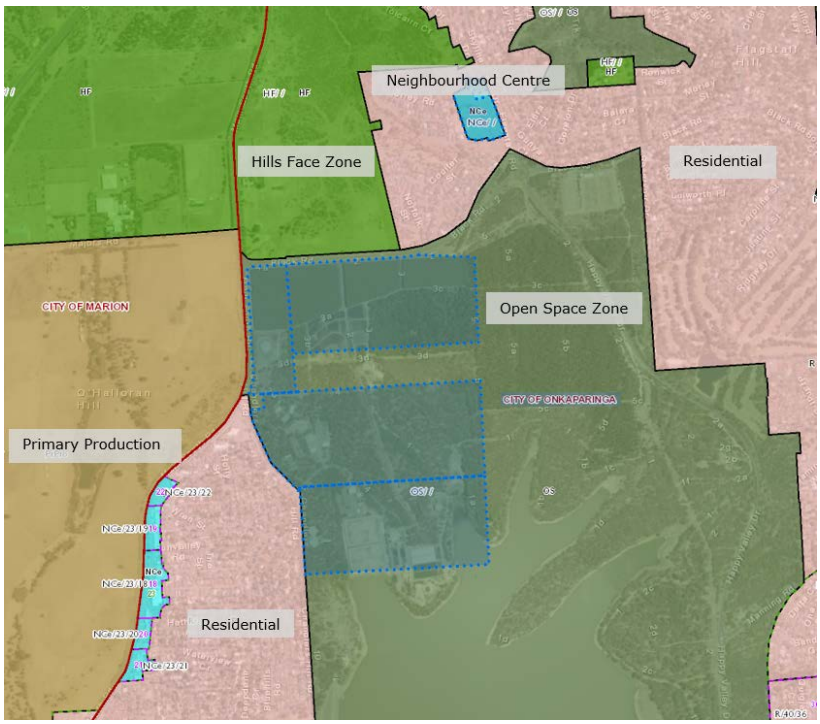


Figure 8*: Subject site zoning context*
Source: PLB Pro, retrieved 30 September 2019

3.2 Locality

The subject site is located within the City of Onkaparinga, however the western site boundary forms the eastern local government boundary of the City of Marion. Immediately west of the Reservoir Reserve and within the City of Marion, is the former Glenthorne Farm, a landholding currently held by the University of Adelaide, forming part of the future Glenthorne National Park (refer Figure 9).

While there are large swathes of open space to the north and south which connect to the Reservoir Reserve, principally the Reserve has a residential interface. Residential dwellings are located immediately to the south-west of the subject site between Main South Road and Chandlers Hill Road. Directly north of the subject site is a large landholding owned by Reservoir Grazing Company within the Hills Face Zone. The locally listed former Tapley Farm buildings are located on this land.

Of particular note is the Flagstaff Pines residential estate, located to the north-east of the site on Black Road. The Applicant has undertaken specific engagement activities with the Flagstaff Pines residents, discussed in detail in section 8.4.

Figure 9: *Site context*
Source: Submitted documentation (Development Application document)

4. COUNCIL COMMENTS

4.1 City of Onkaparinga

The Council did not object to the development, but made the following points:

- Council acknowledges that while the proposal doesn't explicitly involve conservation work or open space maintenance, the solar panels will contribute to ecologically sustainable and demand on non-renewable resources, closely linked to conservation type activities which is considered acceptable.

- Council acknowledges that the proposal will require minimal maintenance and is not expected to impact on the function or operation of the existing reservoir and water supply and storage functions. The solar array will be constructed on a flat part of the site, requiring minimal earthworks.
- General support was provided for the design and appearance of the proposal, including the low-profile array design, landscaped setback and offset planting which will ameliorate potential reflection issues. The location of the solar array in the north-western portion of the site does not necessitate the removal of native vegetation.
- Council does not consider the loss of the pines detrimental to the character nor conservation given the non-native origin.
- Council considers the proposal to increase the energy efficiency of the existing reservoir operation and will work to achieve the stipulated provision to establish renewable energy facilities.
- Council considers that the distance between the proposal development and the heritage listed items will not materially impact on the historical components onsite or their context. Council considers the existing vegetation and proposed landscaping will ensure little, if any, visual impact from the Reservoir and surrounds. State heritage listed items on Glenthorne Farm and locally listed Tapley Farm Complex are considered by Council to be sufficiently distant from the proposal so will not affect the heritage value.

Council recommended their standard conditions and notes be included. Council's intent, to regulate the construction phase of the development, is adequately expressed within the recommended conditions.

5. REFERRAL BODY COMMENTS

Referral responses are contained in the Attachments.

5.1 Transport Assessment and Policy Reform, DPTI (Commissioner of Highways)

The proposal was referred to the Commissioner of Highways (the Commissioner) on account of vehicular access being taken from a Secondary Arterial Road and DPTI maintained road (Black Road). The subject site also abuts a Primary Arterial Road (Main South Road). As the vehicle crossover is existing, the proposal is in keeping with the Department's policy to minimise access points onto arterial roads.

The Commissioner suggested that given the limited time (i.e. construction phase) that increased traffic volumes will be experienced, a Construction Traffic Management Plan should be developed.

With regard to the removal of pines and noticeable change in the viewscape, the Commissioner requested that, in the event that glare affects motorists on Main South Road, Black Road or Majors Road, the applicant is to install additional screening.

5.2 Essential Services Commission

The Essential Services Commission recommended a generic advisory note regarding the Applicant obtaining appropriate licences.

5.3 Department of Environment and Water

The Department for Environment and Water (DEW) provided no objections to the development. A suggestion was made to strategically retain some trees to provide visual amenity for park users of the future Glenthorne National Park. Further discussion on this matter is provided in the Planning Assessment.

Several state and local heritage items are located within the broader Reservoir Reserve context. The closest items, being the dam wall and towers, are respectively located approximately 1.6km south and 1.3km south-east of the proposed development. The former Glenthorne Farm site to the west of Main South Road has several state heritage listed buildings. The locally listed former Tapley Farm Complex is situated immediately to the north of the subject site on Black Road.

Schedule 8 – Item 5 of the Development Regulations 2008, identifies State heritage places as requiring referral to the Minister administering the *Heritage Places Act 1993*, where development directly affects a heritage place, or development which in the opinion of the relevant authority, materially affects the context within which the State heritage place is situated.

The application was not referred to Heritage SA on account that the state heritage listed items and their context, are sufficiently distanced from the proposal so they are not materially affected by the development. The proposal does not affect the context of the listed places. No comments were provided by DEW with regard to heritage matters.

6. PUBLIC NOTIFICATION

The application was subject to public notification pursuant to Section 49(7d) of the *Development Act 1993* as the construction works total more than $4 million.

Public notification was undertaken via public notice in The Advertiser and the Southern Messenger on Wednesday 2 October 2019. The public notification period concluded on Friday 1 November 2019. Two (2) representations were received.

The issues raised, and the response from the applicant are summarised as follows:

Issue	Summary of Applicant's response
Devaluation of surrounding residential land holdings	- This matter is not considered within the Onkaparinga Council Development Plan.
Applicant concealing the extent of the development in terms of total megawatts (MW).	- The reference to a generating capacity of 5MW is made in acknowledgement of the use of this figure within the *Development Act 1993* and Development Regulations 2008 as an important threshold test. - The generating capacity is approximately 9MW, though the detailed design phase may vary this figure, the extent of the development will not be altered.
Industrial scale development nearby a residential estate.	- Adaptive design measures are proposed to mitigate against interface concerns. - Proactive stakeholder engagement has been undertaken.
Proposal lacks an independent impact assessment report regarding health risks.	- This matter is not considered within the Onkaparinga Council Development Plan.

Increase of ambient temperature as a result of the development (+5 degrees). Comparisons to the Hope Valley development are considered inappropriate given the larger scale Happy Valley development.	- The 'SA Water Photovoltaic Heat Island (PVHI) Report', dated 23 May 2019 was prepared and made publically available on the Applicant's website. - The report was prepared in partnership with Aurecon and in consultation with DPTI – Crown and Major development team to determine appropriate setbacks. - The report adopted a multi-method approach which comprised of a theoretical model simulation, physical sampling and statistical analysis. - The report concluded that the maximum consequence on a neighbouring allotment, was an expected increase in air temperature of 1°C. This assumed the worst-case panel temperature, wind speed, highest ambient temperature and no thermal effect from anything other than the PV array.
The ongoing maintenance obligation of the screening landscaping and native vegetation is unknown.	- The Applicant's Specialist Native Vegetation team have been involved in species selection. - The species selected for the buffer areas have been chosen based on the ability to thrive in the site's soil conditions. Plants will be locally sourced to ensure development has occurred in local conditions and the time of year chosen for sowing / planting will be conducive to increased success rates. - The Applicant would be accepting of a condition requiring maintenance to ensure they are established to fulfil the screening function.
Altered rainwater absorption will have a negative impact on vegetation which has a screening purpose. There is a risk of increased flooding as a result of the development.	- The development does not propose the introduction of impervious ground surface treatments. - 300-400mm of top soil will be removed, however this will be replaced with compacted conditioned fill. - The ground surface throughout the solar array will allow for ongoing absorption of rainfall. - Stormwater will be managed through swales to direct water run-off to existing watercourses. - The proposed development does not involve significant changes in grade or levelling. - Existing site hydrology will be largely maintained.
There will be noise emissions from a development of this magnitude. The application inadequately addresses this issue.	- The Applicant has considered the key noise source as being the construction period. - Pursuing a low profile, prefabricated solar design which does not require percussion

	piling will achieve less disturbance to the surrounding area. - Ongoing operations are not anticipated to result in significant noise emissions, limited only to that resulting from inverter equipment which will be installed within weather-proofed shelters. - Located within a central position, the inverters will be separated from the northern perimeter, being the closest point to the adjoining sensitive land uses. - The Applicant will obtain baseline noise levels, once the pine trees are removed, to establish a reference point for potential future noise concerns.
The application does not specify security and lighting. The concern was raised that the development may appear as an industrial site with unsightly high security fencing and bright security lights at night.	- The existing Reservoir Reserve perimeter security fence will be utilised. - No lighting is proposed for the development as existing security arrangements are considered sufficient.
The application inadequately addresses site remediation and the removal and disposal of solar panels.	- The Applicant will dispose of used panels in the most sustainable way practicable, maximising recycling opportunities. - Solar modules are largely recyclable. Component materials such as glass, aluminium and semi-conductors can all be recovered and reused. The Applicant intends to have all components, including panels, mounting structures, cables, batteries and inverters de-assembled and transported off site to appropriate recycling facilities. - Regarding remediation, this will depend on how the Applicant intends to utilise the land once there is no longer a need for the solar array. As the framework is pre-fabricated and requires no piling works, site disturbance at the time of decommissioning is anticipated to be low and limited to the removal of underground cables.

Table 1: Issues and Response

A copy of each representation and the applicant's response is contained in the Attachments. Figure 10 depicts the location of the representors in relation to the subject site.

Figure 10: *Representor's proximity to subject site*
Source: PLB Pro, retrieved 14 November 2019

7. POLICY OVERVIEW

The subject site is within the Open Space Zone as described within Onkaparinga Council Development Plan (Consolidated 20 December 2018). Relevant planning policies are contained in the Attachments and summarised below.

7.1 Open Space Zone

DEVELOPMENT PROVISIONS	PROVISIONS SUMMARY
OPEN SPACE ZONE	
OBJ 1, 2, 6, 8	• A zone in which the open space character is preserved to provide a visual contrast to the surrounding urban area. • Development that contributes to the desired character of the zone.
Desired Character	• While the focus is on their natural state, carefully managed departures from this will occasionally be necessary for the benefit of the community.
PDC 1, 3, 7, 8, 9, 12, 15, 16, 17, 22, 25, 29, 30	• Buildings should be…. sited unobtrusively so as not to detract from the open, natural character of the zone • Materials used in fencing should be sympathetic to the natural character of the landscape and provide as little visual intrusion as possible. • Development should not compromise the integrity of the Happy Valley Reservoir as a water storage and supply facility. • Public access to the Happy Valley Reservoir should be restricted where there is potential to compromise the integrity of the reservoir's management.

The open space zone promotes the preservation of the open space character to provide a visual contrast to the surrounding urban area. The zone is envisaged to accommodate

a range of public and private activities in an open and natural setting including recreation land uses and habitat conservation and restoration. The reservoir is part of the broader Metropolitan Open Space System (MOSS). While the focus is on the natural state, carefully managed departures from this are considered to occasionally be necessary for the benefit of the community. The desired character for the zone specifically identifies the reservoir as being held in government ownership.

The proposed is in keeping with the desired character of the zone in that the natural state of the broader reservoir area will remain, however the proposal will be carefully managed in order to support the primary water storage and supply function. The array structures, inverters and BESS have been designed to be unobtrusive in scale and location. A landscape buffer is proposed to provide an ongoing natural amenity function and visual barrier between the solar array and vehicles travelling on Main South Road.

7.2 Council Wide

DEVELOPMENT PROVISIONS		PROVISIONS SUMMARY
GENERAL SECTION		
Design and Appearance	**PDC** 1, 5, 10, 22, 23	• Buildings should reflect the desired character of the locality while incorporating contemporary designs that have regard to the following…building height, mass and proportion. • Development on land adjacent to a State or local heritage place, as listed in Table Onka/10 - State Heritage Places or in Table Onka/9 - Local Heritage Places, should be sited and designed to reinforce the historic character of the place and maintain its visual prominence. • Setbacks – Table Onka/2 – Building Setbacks from Road Boundaries o Road boundary (Secondary Arterial Road – 8m) o Secondary Road Boundary (Primary Arterial Road – 10m)
Energy efficiency	**OBJ** 1, 2 **PDC** 4	• Development that provides for on-site power generation including photovoltaic cells and wind power • Public infrastructure and lighting, should be designed to generate and use renewable energy
Hazards	**OBJ** 2, 5 **PDC** 1, 8, 9, 10 (a, b, c, e), 13	• Development located away from areas that are vulnerable to, and cannot be adequately and effectively protected from the risk of natural hazards. • Development located to minimise the threat and impact of bushfires on life and property. • Buildings and structures should be located away from areas that pose an unacceptable bushfire risk as a result of one or more of the following…vegetation cover comprising trees and/or shrubs, poor access, rugged terrain, inability to provide an adequate supply of water for firefighting purposes.
Heritage	**OBJ** 1, 3 **PDC** 1, 3 (b, e, f, i), 4	• The conservation of State and local heritage places. • Conservation of the setting of State and local heritage places. • Development of a State or local heritage place should retain those elements contributing to its heritage value, which may include… important vistas and views to and from the place, outbuildings and walls, trees and other landscaping elements and the use of the place. • Development of a State or local heritage place should be compatible with the heritage value of the place.
Infrastructure	**OBJ** 1, 2 **PDC** 1	• Infrastructure provided in an economical and environmentally sensitive manner • The visual impact of infrastructure facilities managed
Interface between land uses	**OBJ** 1, 2, 3 **PDC** 1(a, b, f), 2, 6, 7	• Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through dust…noise…glare • Development should be sited and designed to minimise negative impacts on existing and potential future land uses desired in the locality

DEVELOPMENT PROVISIONS		PROVISIONS SUMMARY
		• Non-residential development on land abutting a residential zone should be designed to minimise noise impacts to achieve adequate levels of compatibility between existing and proposed uses.
Landscaping, fences and walls	**OBJ** 1 **PDC** 2, 4, 5	• Landscaping should… include the planting of locally indigenous species where appropriate… and result in the appropriate clearance from powerlines and other infrastructure being maintained • Landscaping should not… increase the risk of weed invasion
Natural resources	**OBJ** 1, 2, 4, 5, 6, 7, 8, 10, 11, 12, 13 **PDC** 1, 2, 4, 7, 8, 12, 13, 14, 18, 26, 27, 28, 29(d), 33, 37, 38, 39, 40	• Retention, protection and restoration of the natural resources and environment • Native flora, fauna and ecosystems protected, retained, conserved and restored • Minimal disturbance and modification of the natural landform. • Protection of the scenic qualities of natural and rural landscapes. • Development should be undertaken with minimum impact on the natural environment, including air and water quality, land, soil, biodiversity, and scenically attractive areas. • Stormwater management systems should…utilise….the discharge to open space, landscaping or garden areas, including strips adjacent to car parks • Development should be designed and sited to minimise the loss and disturbance of native flora and fauna, including marine animals and plants, and their breeding grounds and habitats.
Orderly and sustainable development	**OBJ** 1, 2, 3, 4, 5 **PDC** 1	• Development occurring in an orderly sequence and in a compact form to enable the efficient provision of public services and facilities. • Development abutting adjoining Council areas having regard to the policies of that Council's Development Plan. • Development should not prejudice the development of a zone for its intended purpose.
Renewable Energy Facilities	**OBJ** 1, 2, 3 **PDC** 1	• Development of renewable energy facilities that benefit the environment, the community and the state. • Location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment and other land uses. • Renewable energy facilities, including wind farms and ancillary development, should be located in areas that maximize efficient generation and supply of electricity and designed and sited so as not to impact on the safety.
Siting and visibility	**OBJ** 1 **PDC** 1, 2, 3, 4, 5, 6, 8, 9(b)	• Protection of scenically attractive areas, particularly natural, rural and coastal landscapes. • Development should be sited and designed to minimise its visual impact on: a) the natural, rural or heritage character of the area b) areas of high visual or scenic value, particularly rural and coastal areas c) views from the coast, near-shore waters, public reserves, tourist routes and walking trails • The nature of external surface materials of buildings should not detract from the visual character and amenity of the landscape. • Development should be screened through the establishment of landscaping using locally indigenous plant species…along allotment boundaries to provide permanent screening of buildings and structures when viewed from adjoining properties and public roads
Transportation and access	**OBJ** 2 **PDC** 2, 8, 14, 22, 23, 25, 27, 29, 37	• Development that provides safe and efficient movement for all transport modes and ensures access for vehicles including emergency services, public infrastructure maintenance and commercial vehicles • Development should be integrated with existing transport networks… and designed to minimise its potential impact on the functional performance of the transport network. • Development should have direct access from an all-weather public road.

DEVELOPMENT PROVISIONS		PROVISIONS SUMMARY
		• The number of vehicle access points onto arterial roads shown on *Overlay Maps - Transport* should be minimised • Vehicle parking areas should be sealed or paved to minimise dust and mud nuisance
Waste	**OBJ** 1 **PDC** 1, 2, 3	• Development that, in order of priority, avoids the production of waste, minimises the production of waste, re-uses waste, recycles waste for re-use, treats waste and disposes of waste in an environmentally sound manner.
OVERLAYS		
Transport and access	Transport overlay	• Primary Arterial Road (Main South Road) • Secondary Arterial Road (Black Road and Chandlers Hill Road)

8. PLANNING ASSESSMENT

The application has been assessed against the relevant provisions of the Onkaparinga Council Development Plan (Consolidated 20 December 2018), which are contained in the Attachments.

8.1 Land Use and Character

The General Section of the Onkaparinga Council Development Plan encourages the development of renewable energy facilities that benefit the environmental, the community and the State (Obj 1 – Renewable Energy Facilities). Facilities should be sited in areas that provide opportunity to harvest the natural resources to maximise efficient generation and supply of electricity. The location, siting, design and operation of facilities are to avoid or minimise adverse impacts on the natural environment.

The Open Space Zone recognises and manages extensive areas of open space in natural and landscaped settings. These spaces are recognised as making a valuable contribution to the maintenance of ecosystems. While the focus is on the natural state, carefully managed departures will occasionally be necessary for the benefit of the community (Open Space Zone – Desired Character).

The Development Plan is silent in respect to large-scale solar developments, with these facilities being relatively new to South Australia, however the principles related to wind farms can be applied. Wind farms are generally considered non-complying in the Open Space Zone, except where the turbine generates power to be used wholly for activities on the property on which the turbine is situated. The solar electricity generation is for the sole purpose of supporting the onsite water infrastructure operations.

Buildings and structures should not be located in a conservation area, unless for reserve or park management purposes (Open Space Zone – PDC 22). Where buildings are proposed within the zone, they should be sited to be unobtrusive so as not to detract from the open, natural character of the zone (PDC 12).

PDCs which are specific to development within the Happy Valley Reservoir identify that development should not compromise the integrity of the Happy Valley Reservoir as a water storage and supply facility (PDC 29). Although there has been a recent decision to make public some of the reservoirs operating by SA Water, access to the Happy Valley reservoir is currently restricted so as not to compromise the integrity of the reservoir's on-going management and importance to the network (PDC 30).

The subject site is a large allotment that, while zoned as open space, is currently being used for commercial forestry purposes, under lease by Forestry SA. The proposal will result in a loss of 18 hectares of commercial forestry land while the solar farm is in

operation. There will be no loss of recreational open space given the historical commercial forestry operations.

One representation raised a concern that the proposal represents an industrial scale development nearby a residential estate. A site responsive landscape design has been proposed to mitigate the potential visual impacts introduced by the proposal. On this basis, the introduction of the solar panels will not unduly change the overall open space function of the Reservoir Reserve and is not anticipated to alter the reserve from continuing to operate to deliver the primary purpose of water storage and supply.

8.2 Design and Appearance

Design and Appearance policies within the General Section of the Development Plan seek appropriate setbacks from allotment boundaries from Primary (10m) and Secondary Arterial Roads (8m) (PDC 22 – Design and Appearance). In support of this provision, the Development Plan requires development to be sited and designed to minimise negative impacts on existing and potential future land uses desired in the locality (PDC 2 – Interface between land uses).

To provide a visual amenity buffer for neighbouring residents in the north-west, a 40m forest zone setback is proposed to be retained along the length of the northern boundary fronting Black Road. The existing Aleppo pines will be retained in this area (refer Figure 11). A further 20m offset planting zone is proposed south of the 40m forest zone, creating a 60m vegetation buffer setback from Black Road (refer Figure 12). A 10m clearance zone is proposed in between the offset planting zone and the solar array to ensure vegetation overshadowing does not occur (refer Figure 13).

On the western boundary, fronting Main South Road, a 10m offset planting zone and 10m clearance zone is proposed to prevent glare and visual impacts. Figure 14 depicts the existing view from Main South Road, while Figure 15 illustrates a view from Main South Road. Figure 16 provides a section through the western portion of the site.

The Development Plan provisions seek to provide landscaping which includes locally indigenous species, reducing the risk of weed invasion and results in appropriate clearance from infrastructure to allow ongoing maintenance (PDC 2 and 4 – Landscaping, fences and walls). Indicative vegetation buffer sections were submitted which illustrate the proposed layout for the offset planting zones. Species selection for the buffer zones was based on providing effective screening, avoidance of shading the solar array and provision of food sources for native birds, in particular the Yellow-tailed Black Cockatoo. To increase biodiversity and prevent weed proliferation, species selection lists were proposed which were based on local plant species and the ability to enhance the site's overall biodiversity.

The proposal incorporates a low profile solar array framework. The MAVERICK™ system will be installed to conform to the terrain profile and be an approximate maximum height of 1m from the finished ground level (refer Figure 4). The system has been utilised to achieve a significantly lower maximum height than the solar array systems utilised across the *Zero Cost Energy Future* project, which typically result in a maximum height up to 3.8m.

The Development Plan stipulates that buildings are to reflect the desired character of the locality (PDC 1 – Design and Appearance). Furthermore, the siting and design of renewable energy facilities is to avoid or minimise adverse impacts on the natural environment and other land uses (OBJ 3 – Renewable Energy facilities). Four inverters, approximately 2.8m high will be installed within the array network and are not anticipated to present a visual impact as viewed from Main South Road. The BESS will

be installed near to the existing substation, however it will be obscured from public view due to existing vegetation.

Fencing is required to be compatible with the associated development and with existing predominant, attractive fences and walls in the locality (PDC 5 – Landscaping, fences and walls). Whilst the Applicant has deferred quantifying the amount of fencing upgrades required until the detailed design phase, it is anticipated that any upgrades will be in keeping with the existing wire security fencing (refer Figure 11).

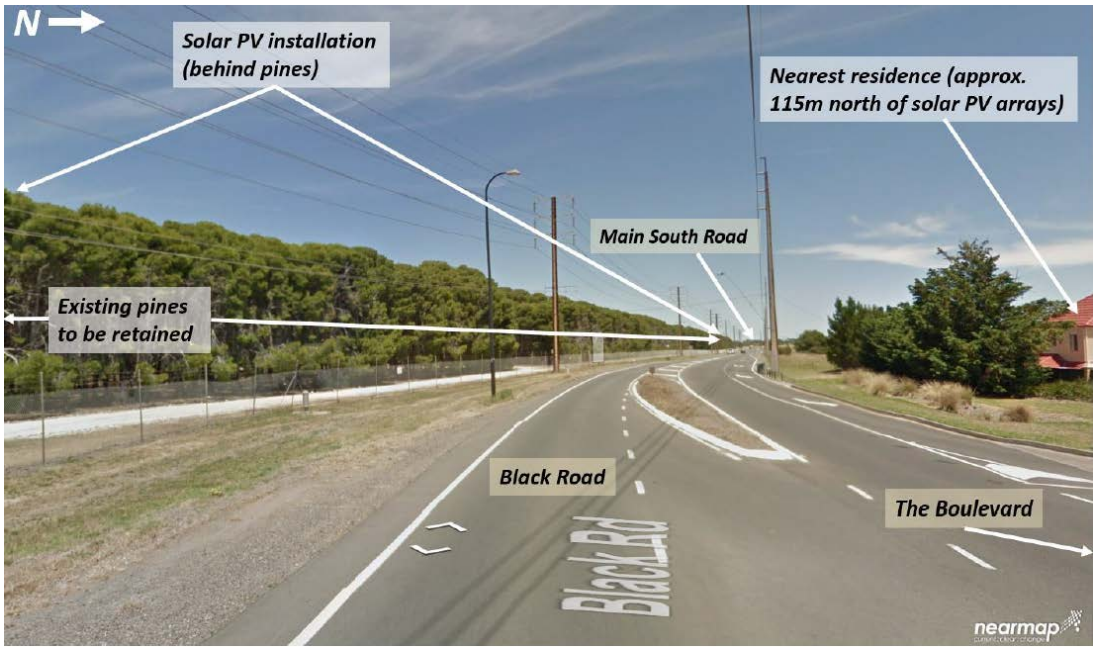


Figure 11: *Existing Black Road site conditions*
Source: Submitted documentation (original basemap, Nearmap)

Figure 12: *View looking south from corner of Main South Road and Black Road (10 years post-planting)*
Source: Submitted documentation (3D render)

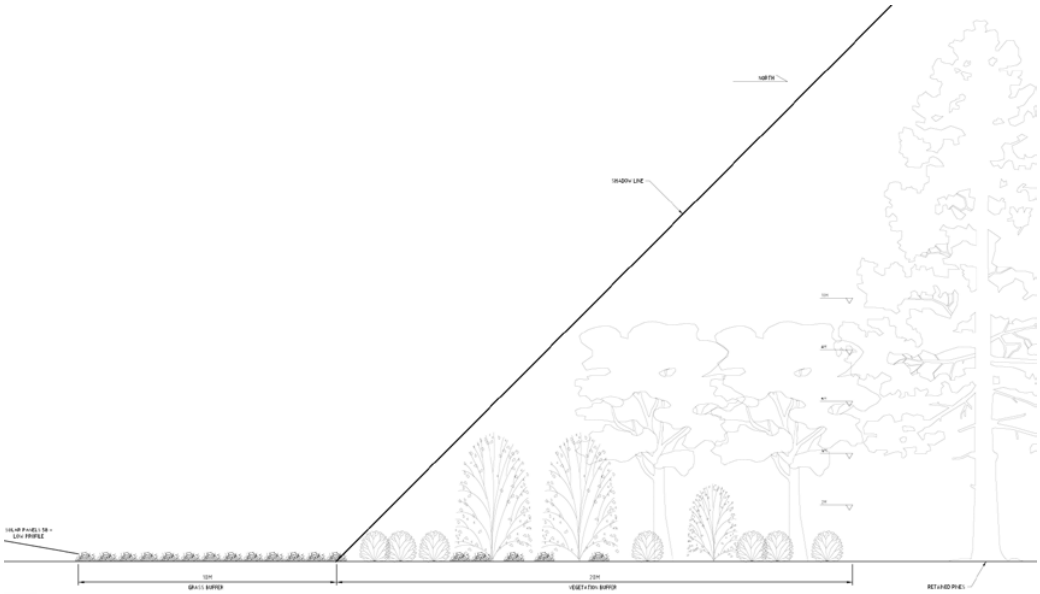


Figure 13: *Northern vegetation buffer*
Source: Submitted documentation (Northern vegetation buffer, 503097-GE-SKT-1003, Revision A, dated 18/11/2019)

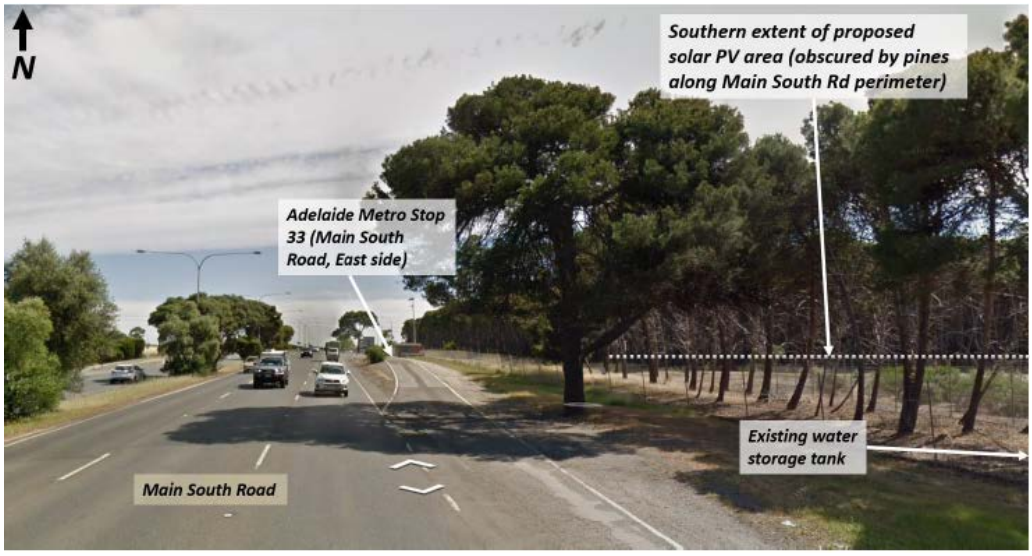


Figure 14: *Existing Main South Road site conditions*
Source: Submitted documentation (original basemap, Nearmap)

Figure 15: *View looking north from Main South Road (10 years post-planting)*
Source: Submitted documentation (3D render)

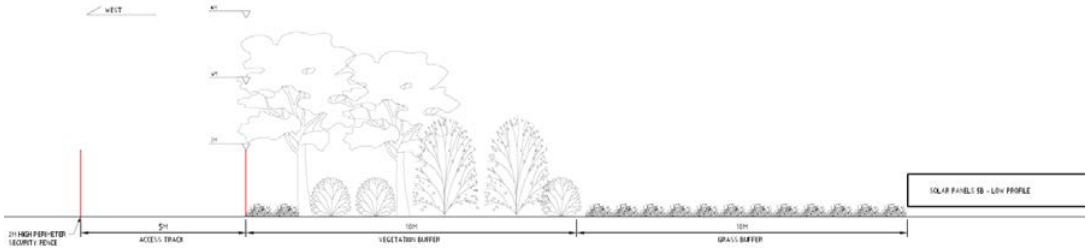


***Figure 16**: Western vegetation buffer*
Source: Submitted documentation (Western vegetation buffer, 503097-GE-SKT-1002, Revision A, dated 18/11/2019)

8.3 Energy efficient infrastructure

The General provisions of the Development Plan seek that development should not occur without the provision of adequate utilities and services. Infrastructure is to be provided in an economical and environmental sensitive manner with the visual impact of facilities managed (Obj 1 and 2 – Infrastructure). Energy efficiency objectives refer to the provision of development which incorporates on-site power generation through PV cells. Specifically, public infrastructure should be designed to generate and use renewable energy (PDC4 – Energy Efficiency).

The proposed development seeks to reduce the operational costs and improve reliability of energy supplies. As a government agency, the Applicant is pursing the outcomes of the Development Plan by maintaining and operating public infrastructure through onsite renewable energy generation.

8.4 Interface between Land Uses

Visual Impact

The General provisions of the Development Plan seek that renewable energy facilities be located, designed and operated in a manner that avoids or minimises adverse impact to, and conflict with, the environment and other land uses (Obj 1 and 2 – Interface Between Land Uses; Obj 3 – Renewable Energy Facilities).

Whilst the solar array will be relatively low scale and adjoin a vegetated Reserve, it does represent a change to the appearance of the subject site. As part of the proposal, the Applicant commenced an independent community consultation process in December 2018, which involved public meetings, corner meetings, site visits, written communication and a web-based information portal and discussion page. A Community Reference Group was established to gain an understanding and account for the concerns of the local community. The Applicant has acknowledged that a range of issues were reported by the community and a strong preference was communicated for the solar panels to be integrated into the current landscape.

Initially, the Applicant presented a visual impression of the proposal which incorporated a 10m wide, 2m high mound, planted with native species along Black Road (refer Figure 17). However, the community feedback received indicated that the proposed landscaping was undesirable.

The proposed development is reflective of the feedback received throughout the engagement process. The development now includes a retained 40m wide Aleppo pine buffer adjacent Black Road, with additional native plantings behind to provide understory screening and wind protection (refer Figures 12 and 13). The updated

landscape design proposal was presented to attendees of a public meeting held on 12 June 2019. While some participants preferred the proposal to not proceed in any form, the consensus was that the revised landscaping proposal, retaining a portion of the existing pine trees, offered a more acceptable visual outcome to the residents.

Both representations made reference to concerns about the devaluation of surrounding residential landholdings as a result of the proposal. Property values are not a relevant consideration within a statutory planning process. Regardless, the applicant has committed to work with the community to further develop landscape designs to minimise the visual amenity impact from the solar array.

The Development Plan seeks to mitigate potential glare impacts caused by development (PDC 1(f) – Interface between land uses). This is envisaged to be achieved through screening and the establishment of landscaping using locally indigenous plant species to provide permanent screening of buildings and structures when viewed from adjoining properties and public roads (PDC 9 – Siting and Visibility).

3D rendered perspectives have been generated by the Applicant to demonstrate the anticipated view shed from Main South Road (refer Figure 15). Design measures to minimise glare and reflection, as viewed from the primary arterial road, include:

- low profile concertina framework which conforms to the terrain of the site;
- 1m maximum height fixed solar array; and
- the establishment of a landscaping buffer on the northern and western boundaries.

To ensure any potential glare impacts are quantified and mitigated, a glare analysis could be prepared, although most modern solar panels are manufactured to minimise such effects. The Commissioner of Highways has recommended that the applicant undertake additional screening in the event that glare affects motorists on Main South Road, Black Road or Majors Road.

Figure 17: *Initial option prepared for community consultation*
Source: Submitted documentation (3D render)

Noise and vibration

Noise and vibration policies require non-residential development to be designed to minimise noise impacts on land adjoining a residential zone (PDC 1 and 6 – Interface between land uses).

One submission raised noise emissions concerns, specifically regarding a development of this magnitude. The submission raised that the application inadequately addressed

this matter. An Environment and Heritage Assessment Report and Project Environmental Management Plan was submitted which addresses noise and vibration (section 1.3.1).

Noise impacts during construction have the potential to generate nuisance for local residents within the Flagstaff Pines residential estate. This may include noise from site establishment works, construction vehicles, and equipment during the installation of the solar array and associated infrastructure. Regarding construction vehicles and idling motor noise, of the existing site access options available, one vehicular site access is proposed to be utilised. This access point is located the longest distance from the Flagstaff Pines residential estate.

Of particular note, the MAVERICK™ framework system does not require percussion piling. The use of this system minimises potential for noise impacts and nuisance throughout the construction process.

The solar array is not anticipated to create noise or vibrations during the operational phase detectable beyond the site boundary.

It is recommended that the applicant prepare a Construction Environmental Management Plan (CEMP). The CEMP should include mitigation measures to manage noise to comply with the requirements of the *Environment Protection (Noise) Policy 2007.*

Air Quality

Impacts during the construction phase are likely to include dust emissions, which have the potential to generate nuisance for local residents.

The operation of a solar array is unlikely to generate any significant air pollution. The maintenance of adequate ground cover under and around the solar array will prevent dust. The existing internal access roads will be utilised by maintenance vehicles only. The development should not comprise any machinery or equipment that generates air emissions.

It is recommended that the applicant prepare a CEMP. The CEMP should include mitigation measures to manage dust impacts.

Lighting and fencing

Concerns were raised through one submission that the application did not specify the proposed security and lighting onsite. Of particular concern was the development may appear as an industrial site with unsightly high security fencing and security lights at night.

Lighting does not form part of the proposed development. Any upgrades to the security fencing, quantified through the detailed design phase, are not anticipated to vary the existing fencing arrangements which currently surround the Reservoir Reserve.

The construction of the solar farm is unlikely to generate any light spill impacts, noting that hours of operation will be limited as part of the CEMP in order to address other impacts such as noise.

Solar Photovoltaic Heat Island

One submission received during the public consultation raised concern over the potential ambient temperature increases that may occur as a result of the proposal

(+5 degrees). In particular, a concern was raised regarding the inappropriate comparison between Hope Valley and the larger scale Happy Valley development.

The Applicant stated that a precautionary principle has been applied. Specifically, greater setback distances have been applied from the site boundary to any installed equipment, to ensure that existing land uses on adjacent properties are not affected.

The Applicant has undertaken research which has included reviews of international heat island effect studies, theoretical modelling, statistical analysis using a weather forecasting and research model (i.e. mesoscale) and physical sampling of temperature along a 30m distance transect over multiple days on the array installed at SA Water's Hope Valley Water Treatment Plant.

It was found that the natural fluctuations in the surrounding air temperature dominated and there was no clear correlation between change in temperature and distance that could be directly attributed to the solar array. The Computational Fluid Dynamics (CFD) simulation measured in the immediate vicinity of the solar array (<10cm), and identified that the air temperature rises by up to 3 degrees. However, as the air moves away from the immediate vicinity (>20cm), the air mixes and has cooled to be within a fraction of a degree Celsius. This modelling concluded that the scale or extent of the Photovoltaic Heat Island (PVHI) impact on neighbouring allotments is of limited temperature variance significance.

Importantly, mesoscale statistical analysis concluded that cumulatively only 11 days of the year (3%) exhibit weather conditions which coincide with the CFD results. For the remaining 97% of the year, the climate conditions (wind and temperature) do not align with those that produce any PVHI effect on neighbouring allotments.

The PVHI effect has recently been the subject of further study with the rapid rise in large-scale solar installations around the world, mostly sited in more open agricultural areas and pasture lands. Studies have shown that the PVHI effect may occur within the perimeter of solar arrays, but remains a localised phenomenon, with the affect dissipating within close proximity of the solar field. Consequently, use of appropriate setbacks from property boundaries should prevent any impacts on non-involved landholders (such as to more sensitive crops, horticultural activities or areas of environmental significance).

The potential extent and impact of PVHI from larger scale solar farms has recently been considered by the Victorian Civil and Administrative Tribunal (VCAT) in the matter of *ESCO Pacific Pty Ltd v Wangaratta RCC [2019] VCAT 219 (14 February 2019)*.

A 30m setback was recommended to ensure that any potential impacts from this affect are fully contained within a solar development site, although a lesser distance could be considered based on existing vegetation, roadways or similar buffer feature to neighbouring land.

The proposed development incorporates a total setback of 70m between the site boundary and the solar array along the northern boundary which interfaces with residential land uses. On the western site boundary, interfacing with Main South Road and the former Glenthorne Farm, a 20m setback is proposed between the site boundary and the solar array.

8.5 Orderly and Sustainable Development

The Development Plan seeks to achieve an orderly sequence of development and enable the efficient provision of public services and facilities. Where development abuts

adjoining Council areas, regard to the policies of that Council's Development Plan is required (Obj 5 – Orderly and sustainable development). Furthermore, development should not prejudice the development of a zone for its intended purpose (PDC 1 – Orderly and sustainable development).

The City of Marion is located on the western side of Main South Road. The land adjacent the subject site to the west is zoned for Primary Production purposes. DEW's referral response provided confirmation of the Glenthorne National Park envisaged for this land and the relationship to the subject site (refer Figure 18).

The future delivery of Glenthorne National Park will contribute to the broader open space network. It is noted that the South Australian Government's intention is to open the Happy Valley reservoir to the public in the future. However, at this stage the Applicant has been provided with limited information regarding the timing and extent of the public accessibility of the reservoir. The proposed development and existing water infrastructure is unlikely to be publicly accessible due to operational requirements and these elements will not provide the recreational amenity benefits sought from opening Reserves.

Therefore the positioning of the solar array in close proximity to these operational facilities minimises the likelihood of disruption to future recreational access throughout the reservoir landholding and will not prejudice the delivery of the Glenthorne National Park. Likewise, the proposed development does not preclude the broader Reservoir Reserve from being made publicly available in the future.

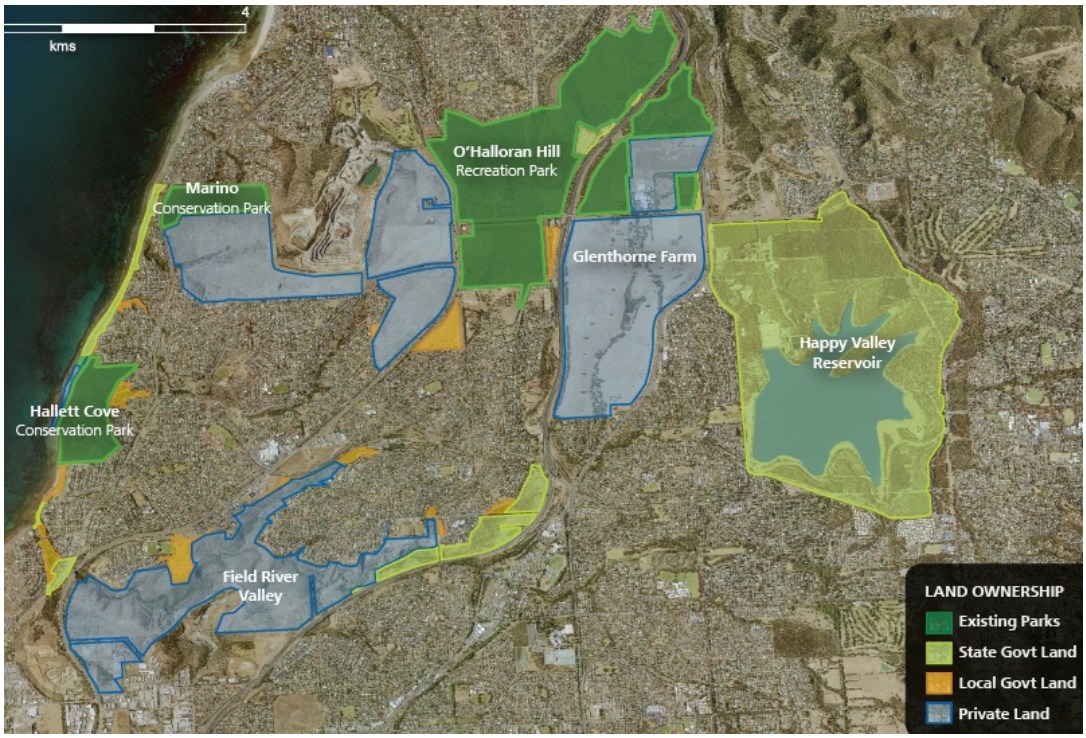


Figure 18: Proposed Glenthorne National Park – existing land ownership
Source: Department for Environment and Water

8.6 Landscaping

The Development Plan encourages the inclusion of landscaping to enhance amenity and the use of locally indigenous species where appropriate (Obj 1 and PDC 2 –

Landscaping, Fences and Walls). Landscaping should not introduce pest plants, increase the risk of bushfire nor increase the risk of weed invasion (PDC 4 – Landscaping, Fences and Walls).

The ongoing landscape maintenance obligation was raised in one representation. An extension of this concern was the altered rainfall absorption which may have a negative impact on screening vegetation. It is anticipated that the maintenance obligation rests with the Applicant as the landowner and operator of the Water Treatment Facility.

A landscape plan was submitted which detailed the proposed buffer and clearance areas, species list and sections. Substantial effort has been undertaken by the Applicant to articulate an appropriately vegetated buffer for nearby residents. In total, a 60m forest and planting zone will be achieved along the northern boundary through the retention of 40m of existing Aleppo pines.

A northern vegetation section was submitted which detailed the proposed offset planting zones. Some 19 species have been selected to provide a multi-layered visual buffer. Species have been selected based on their site-responsive attributes, specifically local native species, soil type and ability to provide a food source of native birds found within the Reservoir Reserve. Taller trees are proposed to be planted in the northern half of this area to avoid casting shade on the solar array.

A 10m clearance zone allows for the planting zone to grow without creating shading of the solar array, resulting in loss of efficiency for the project. The northern clearance zone will incorporate low-growing native grasses which will assist in soil stabilisation and weed suppression. It is anticipated this clearance zone will remain traversable by maintenance vehicles.

The western boundary is proposed to be landscaped to achieve a 10m wide visual buffer from Main South Road. This buffer is anticipated to be consistent with the vegetation proposed on the northern boundary, with the exception of the two tall tree species. These have been omitted to ensure western afternoon shading of the solar array does not occur, accounting for the sun's trajectory. Similarly, the clearance zone will accommodate low-growing native grasses.

8.7 Hazards

Bushfire

Planning policies seek development that minimises the threat of bushfire (Obj 5 – Hazards). Objective 10 stipulates that buildings and structures should be located away from areas that an unacceptable bushfire risk, resulting from vegetation cover comprising trees and/or shrubs, poor access, rugged terrain, inability to provide an adequate supply of water for firefighting purposes.

The Reservoir Reserve is mapped as being a High Bushfire risk area. For all their major landholdings, the Applicant has prepared a Fire Management Plan (FMP) which accompanies their Land Management Plans. The FMP is consistent with AS/NZS 4360 for Risk Management to ensure appropriate mitigation strategies are pursued for the reserve.

Approximately 18 ha of pine plantation has recently been cleared to accommodate the development, thereby lowering the fuel load in the immediate vicinity. Existing access tracks onsite will be retained for ongoing maintenance purposes and will enable emergency service vehicles to traverse the site. The perimeter fencing on the subject site is permeable in nature, lowering the risk of trapping debris and increasing fuel

load. In the event of a bushfire, access to water supply is conveniently located within the Reservoir Reserve.

To prevent weed proliferation and improve soil stabilisation, low-growing native grasses are proposed within the clearance zones on the northern and western boundaries.

The proposed development is consistent with the *Minister's Code: Undertaking development in Bushfire Protection Areas,* which principally applies to dwellings, tourist accommodation and other habitable buildings.

The application was not referred to the South Australian Metropolitan Fire Service (SAMFS) on account that the proposed development is not a dwelling, tourist accommodation of other form of habitable building (Schedule 8 – Item 18, *Development Regulations 2008*).

Flooding

One submission raised concerns regarding the risk of increased flooding as a result of the development. The subject site is not located within an area identified as being susceptible to flooding, reflected in Overlay Maps Onka/8, Onka/9, Onka/13 and Onka/14 Development Constraints. Development constraint mapping for Flagstaff Pines land parcels does not include land which is subject to flooding. It is not anticipated that the development would contribute to an increase in flooding.

Other hazards

With the exception of bushfire risk, the site is not located within an area identified as being susceptible to other natural hazards, such as contamination, acid sulphate soils or landslips.

8.8 Heritage

Heritage policies, relating to both state and locally listed places, prioritise the conservation of the places and the surrounding setting (OBJ 1 and 3 – Heritage Places). Where development is considered, there are requirements to retain those elements which contribute to the heritage value, including vistas, trees, landscaping elements and the use of the place (PDC 3 – Heritage Places).

The reservoir is an early example of a large and complex water storage system, reflecting Adelaide's expansion and public utility improvements. Specifically relevant to the application, the dam wall and towers are respectively located approximately 1.6km south and 1.3km south-east of the solar array. It should be noted that the closest new aspect of development to a heritage place is the BESS, which will be installed near to the existing substation. This element is anticipated to be in keeping with the other water treatment equipment and infrastructure in the vicinity.

In proximity to the subject site are the former Glenthorne Farm (State heritage listing west of Main South Road) and locally listed former Tapley Farm Complex, located north of the subject site on Black Road.

As previously mentioned, the application was not referred to Heritage SA on account that the state heritage listed items are sufficiently distanced from the proposal so they are not materially affected by the development, nor does the proposal affect the context of the listed places (refer Figure 19).

Historically, the subject site within the Reservoir Reserve has been utilised for commercial forestry purposes and as such, the proposed development represents a similar ancillary activity to the primary use of storing and supply of water.

***Figure 19**: Proposed development in relation to heritage listed places*
Source: PLB Pro, retrieved 14 November 2019

8.9 Natural Resources

The Development Plan seeks the retention and protection of natural resources, the environment and water quality (Obj 1 and 2 – Natural Resources); native flora, fauna and ecosystems should be protected, retained, conserved and restored (Obj 8 – Natural resources) with minimal disturbance and modification of the natural landform (Obj 10 – Natural Resources). The planning scheme also seeks development which is designed to minimise loss and disturbance of native flora and fauna, instead prioritising conservation (PDC 28, 29 – Natural Resources). Stormwater should be captured and re-used where practical and safe, and water quality should be protected (PDC 7 – Natural Resources).

A Project Environmental Management Plan (PEMP) and Construction Environmental Management Plan (CEMP) were submitted which document the existing site conditions, potential development proposal impacts and construction methodology.

Flora

The Reservoir Reserve currently supports significant tracts of remnant native vegetation, totalling approximately 120ha. Across the northern and north-eastern portion of the landholding there are multiple areas of pine plantation, managed by Forestry SA, which comprises of *Pinus halepensis* (Aleppo Pines) and *Pinus radiata* sub

species. Figure 20 illustrates the varied vegetation communities present within the Reserve. The presence of native vegetation, both remnant and planted, limits the number of viable areas which could be considered for the installation of a solar array, particularly given the important habitat role which the native vegetation plays for local wildlife. Figure 21 illustrates Forestry SA's pine plantation vegetation and planting dates.

The proposed development does not involve clearing of native vegetation. The facility is situated to avoid disturbing native vegetation and aligns with areas under Forestry SA's lease and operations. The vegetation recently cleared for the solar array was planted in 1949 and 1951 and represents the least biodiverse area within the Reservoir Reserve. It should be acknowledged that the *Pinus halepensis* sub-species is considered a declared weed under the *Natural Resources Management Act 2004*.

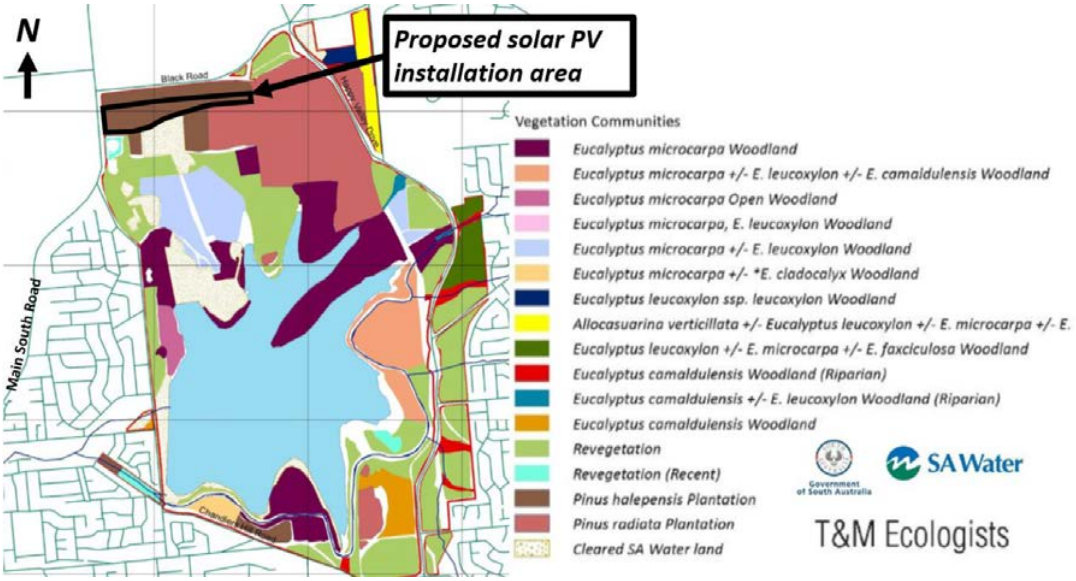


Figure 20: *Reservoir vegetation communities*
Source: Submitted documentation (PEMP, originally prepared by T&M Ecologists)

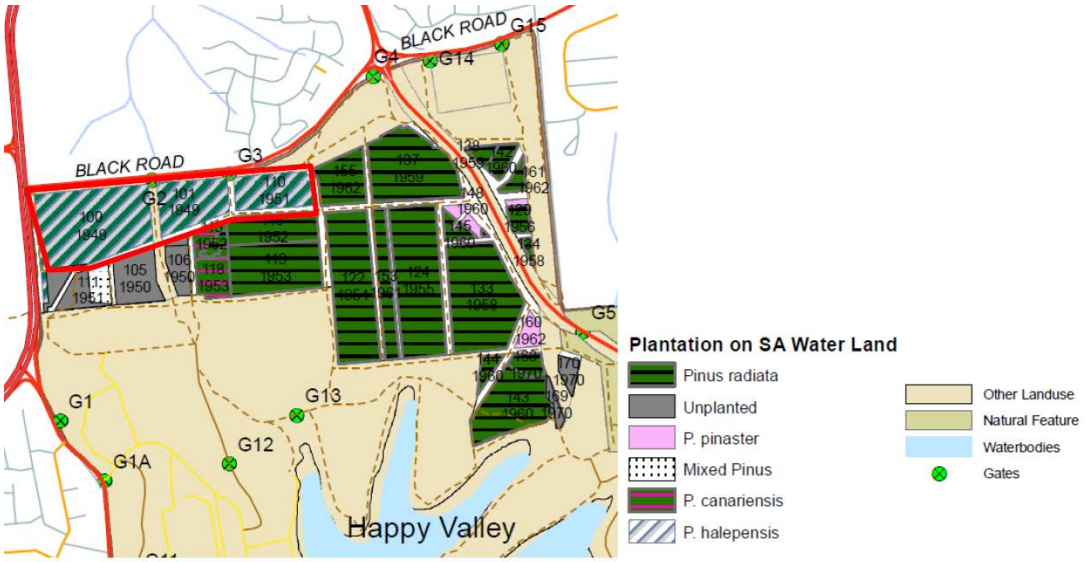


Figure 21: *Forestry SA pine plantation map identifying species and planting dates*
Source: Submitted documentation (PEMP, originally prepared by Forestry SA)

Fauna

The 18ha of pine plantation recently cleared, represents 5% of the total vegetation cover within the broader reservoir area for native fauna habitat. The threatened and endangered species recorded within the Reserve are most commonly observed in the remnant and revegetated areas of native vegetation, providing the most appropriate habitat. Of particular note, the Yellow Tailed Black Cockatoo is found throughout the Reserve. The cockatoo's main source of food is found within native species, located within the native and revegetated areas in the reserve. The Cockatoos are also partial to pine cones from *Pinus radiata* and *Pinus halepensis* species. The cockatoos are not dependent on the pine plantations for food, and the solar panel installation will not remove all pines onsite.

With regard to mammals, the Western Grey Kangaroo, Ringtail Possum and Koalas are found within the broader Reservoir Reserve. Due to shading from the dense canopy, and pine needle leaf litter, the pine plantation areas provide very little grass or other vegetation palatable for Western Grey Kangaroo to graze. They preferentially graze in the adjacent open grassy firebreak and power line easement areas as well as areas of native revegetation and remnant vegetation. The CEMP has identified mitigation and management strategies to ensure fauna protection during the construction phase, this document has been recommended to form a condition.

Stormwater and water quality

Locating the proposal in the north-west corner of the reservoir site where the land is gently sloping, minimises the need to modify the natural landform. Given the topography of the site and primary function of water storage, the Applicant is cognisant of managing water quality impacts. Several watercourses traverse the Reserve, however there are no formalised water courses present on the subject site.

Existing site hydrology will be largely maintained. The Applicant has identified that during the course of detailed design, a detailed stormwater and site hydrology assessment will be undertaken to ensure that any alteration to site hydrology will be appropriately managed. There may be a small increase in runoff from the additional structures and hardstand surfaces within the inverter and BESS areas. The applicant intends to manage these additional flows within the boundaries of the subject site as much as possible.

Earthworks, including drainage works form part of the proposal to manage stormwater runoff. The extent of stormwater works and drainage network upgrades will be quantified through the detailed design phase.

There is approximately 1000m between the solar array and the reservoir itself. There are substantial vegetative buffers between the proposed development and the reservoir body which will limit the erosive material impacting the water quality.

Measures to avoid and/or prevent sediment or pollutants entering natural drainage systems can be covered in a Dust Management and Soil Erosion and Drainage Management Plan, sub-plans of the recommended CEMP.

8.10 Transport and access

The Development Plan requires that development should have access from an all-weather public road and should provide for safe and efficient movement of vehicles that avoids unreasonable interference with the flow of traffic on adjoining roads (PDCs 22, 23 – Transport and Access). Development with access from arterial roads (i.e. Black

Road) should be sited to avoid the need for vehicles to reverse onto or from the road (PDC 27 – Transport and Access).

Access to the subject site is provided by Black Road through an existing unsealed access point (refer Figure 22). A gravel roadway extends southward from this gateway, presently allowing for vehicles to enter and exit in a forward direction.

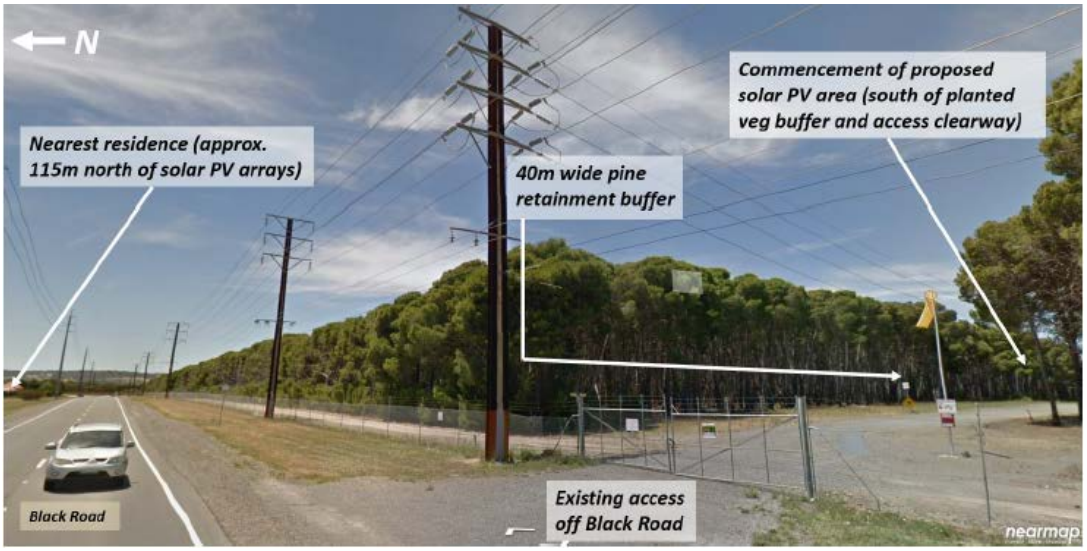


Figure 22: *Existing Black Road site entrance condition*
Source: Submitted documentation (original basemap, Nearmap)

Construction phase

One existing vehicular access point will be utilised from Black Road for construction and ongoing maintenance vehicle access. The project is likely to temporarily increase traffic movements entering and exiting the site during construction. The Applicant proposes to implement temporary traffic management controls to minimise the interruption to local traffic movements during the delivery and installation of the solar array and associated infrastructure.

Council raised no concerns regarding traffic movements. The Commissioner of Highways suggested that given the limited time that increased traffic volumes will be experienced, a Construction Traffic Management Plan should be developed. Traffic impacts can be managed through a condition of approval, as recommended by the Commissioner of Highways.

Operational phase

It is important to note no additional access points are proposed from the secondary arterial road, Black Road. A number of existing gravel service tracks currently enable Forestry SA trucks to manoeuvre on site. The layout of the solar array has been designed to avoid the access tracks and enable construction vehicles and ongoing maintenance vehicles to traverse the site.

During the operational phase, the only access that will be required will be for cleaning of the panels and vegetation management around the array. No employees are anticipated to be onsite for the operational phase of the development.

Traffic movement during the operational phase are therefore expected to be low, and predominantly light vehicles. Ongoing traffic impacts are expected to be negligible.

Parking

The Development Plan does not provide car parking rates for any form of development that is comparable to a solar array. Existing access tracks, within broader powerline easements, provide sufficient space to accommodate off-street parking during the construction phase. The ample size of the subject site also allows for adequate car parking during the construction phase.

8.11 Waste Management

The Development Plan seeks the prevention or minimisation of waste generation through the application of the waste management hierarchy (PDC 1 – Waste).

One submission raised concern regarding the application inadequately addressing site remediation and the removal and disposal of solar panels. An Environment and Heritage Assessment Report and Project Environmental Management Plan was submitted which addresses waste and resource use (section 1.2.5).

The construction of a solar array facility will generate waste streams from the surplus packaging of solar panels and various equipment and cabling products. A Waste Management Plan is recommended to ensure that these materials are appropriately collected, stored, secured and disposed of to minimise any off-site impacts and then recovered or recycled to achieve a high level of sustainable practice.

The Applicant has indicated that the construction contractor has established contact with Reclaim PV Recycling, an Adelaide-based company who recycles end of life and damaged solar panels.

It is recommended that a Waste and Recycling Management Plan be prepared.

9. CONCLUSION

The proposed solar array and associated infrastructure has been sited to minimise its visual impact, as far as reasonably possible, and to take advantage of the opportunity to generate renewable energy onsite.

The existing landscape will be modified as a result of the development, however a forest and landscaped buffer to the main northern road frontage will largely obscure the development when viewed from Black Road. The design of the panels, including the low-profile framework which conforms to the site's terrain, helps minimise the potential impacts associated with reflection and/or glare from Main South Road.

The greatest impacts in terms of noise, traffic generation, dust and general nuisance will be experienced during the construction period. To appropriately manage these, it is recommended that the applicant prepare a Construction Environmental Management Plan (CEMP) which demonstrates how the development will comply with the relevant environmental protection policies.

On balance, whist it is recognised that the development will result in a loss of some of the existing pine plantations in the Reservoir Reserve, and a visual change to the landscape, the negative impacts associated with the ongoing operation of the development can be suitably managed.

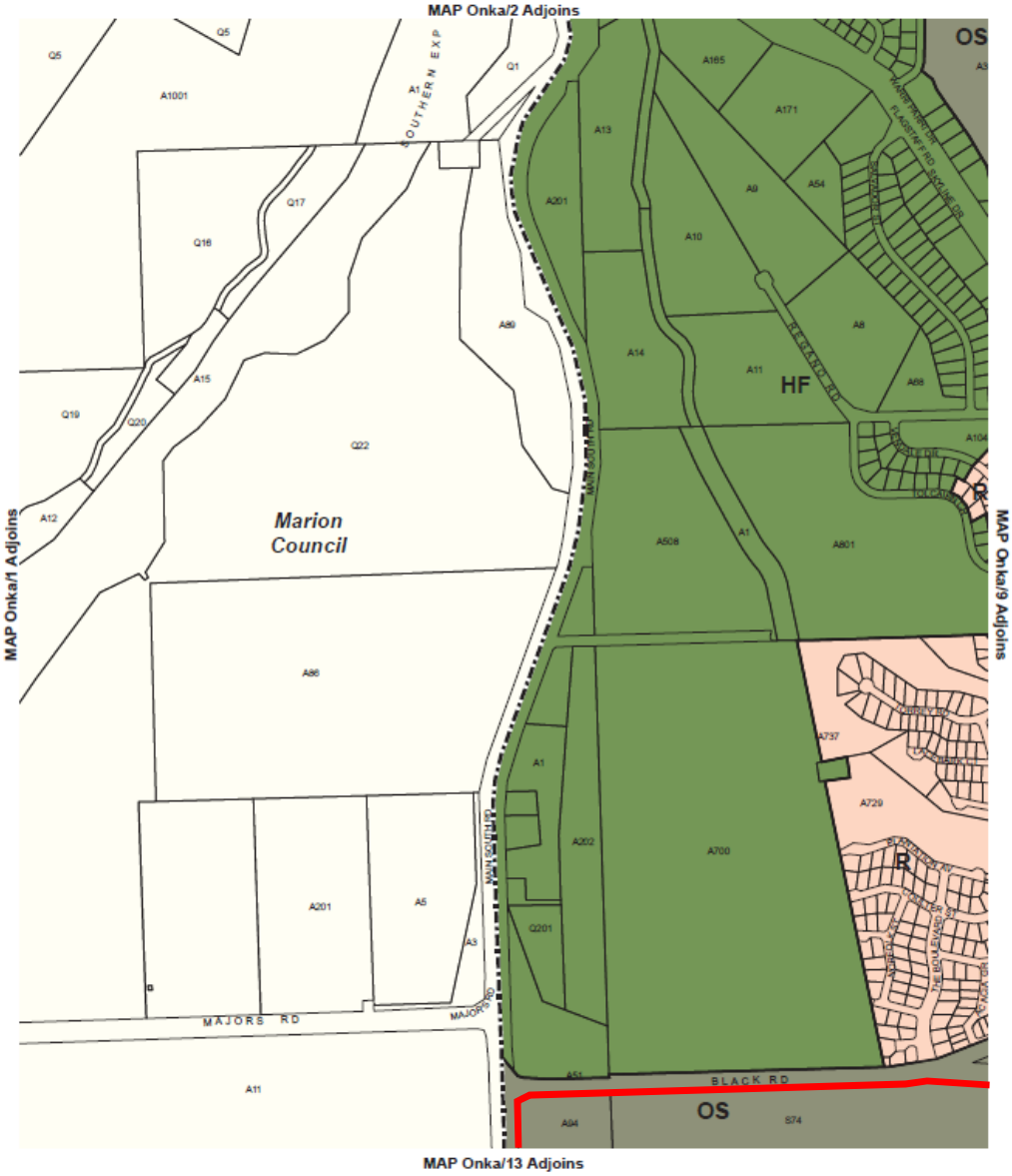
While the focus is on the natural state within the Open Space Zone, carefully managed departures from this are considered to occasionally be necessary for the benefit of the community. The solar electricity generation is for the sole purpose of supporting the onsite water infrastructure operations. The development is consistent with the overall objectives of the Onkaparinga Council Development Plan to provide facilities that benefit the environment, the community and the state.

If no further information is required, and all relevant assessment matters have been considered, this planning report can be endorsed by the State Commission Assessment Panel pursuant to Section 49 (7e) of the *Development Act 1993,* and a formal recommendation with appropriate conditions provided to the Minister for Planning for his further review and decision.

Brianna Fyffe
SENIOR PLANNING OFFICER
PLANNING AND LAND USE SERVICES (DPTI)

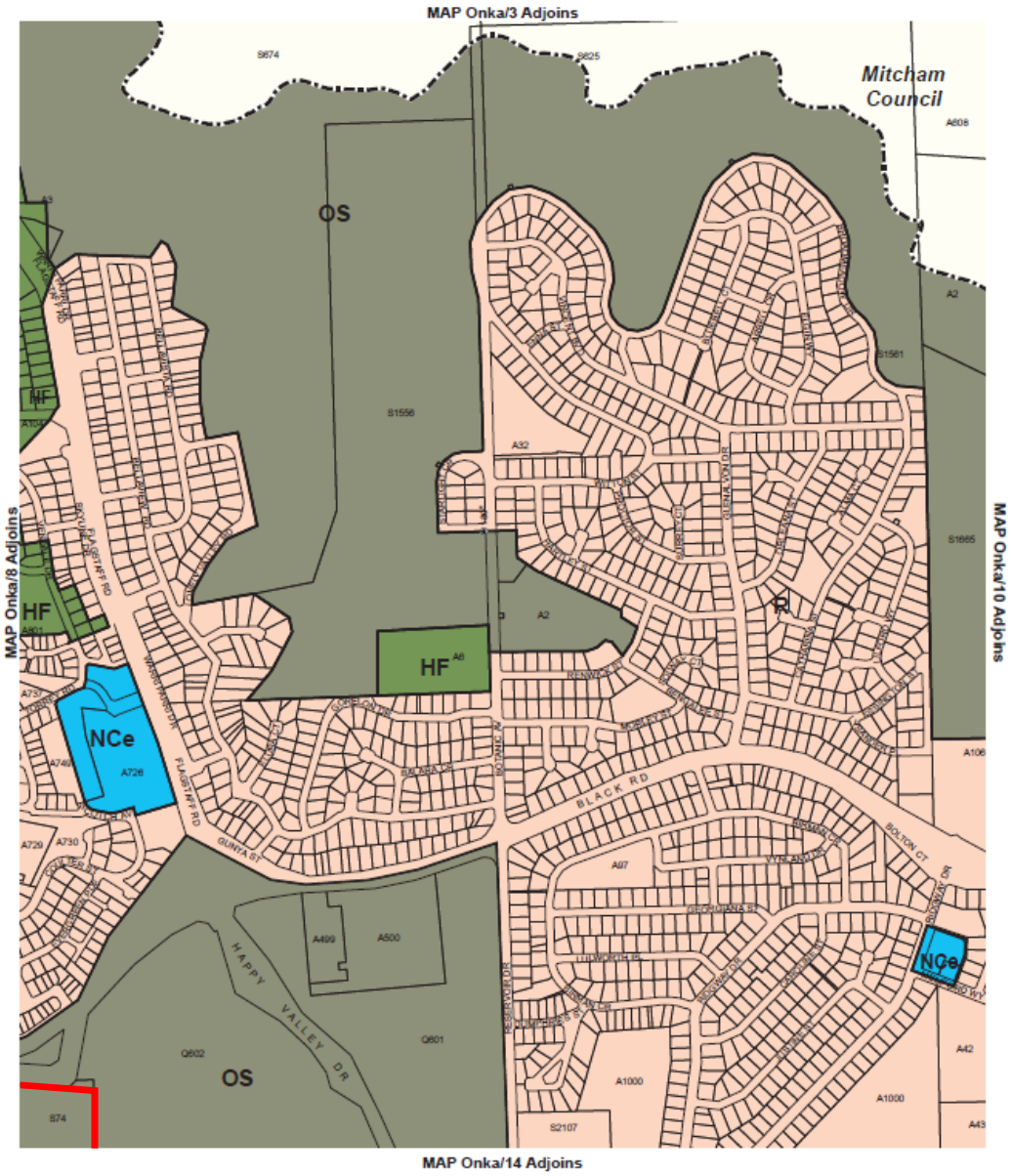
ATTACHMENT 1

PLANS – ONKAPARINGA COUNCIL DEVELOPMENT PLAN



Zone Map Onka/8

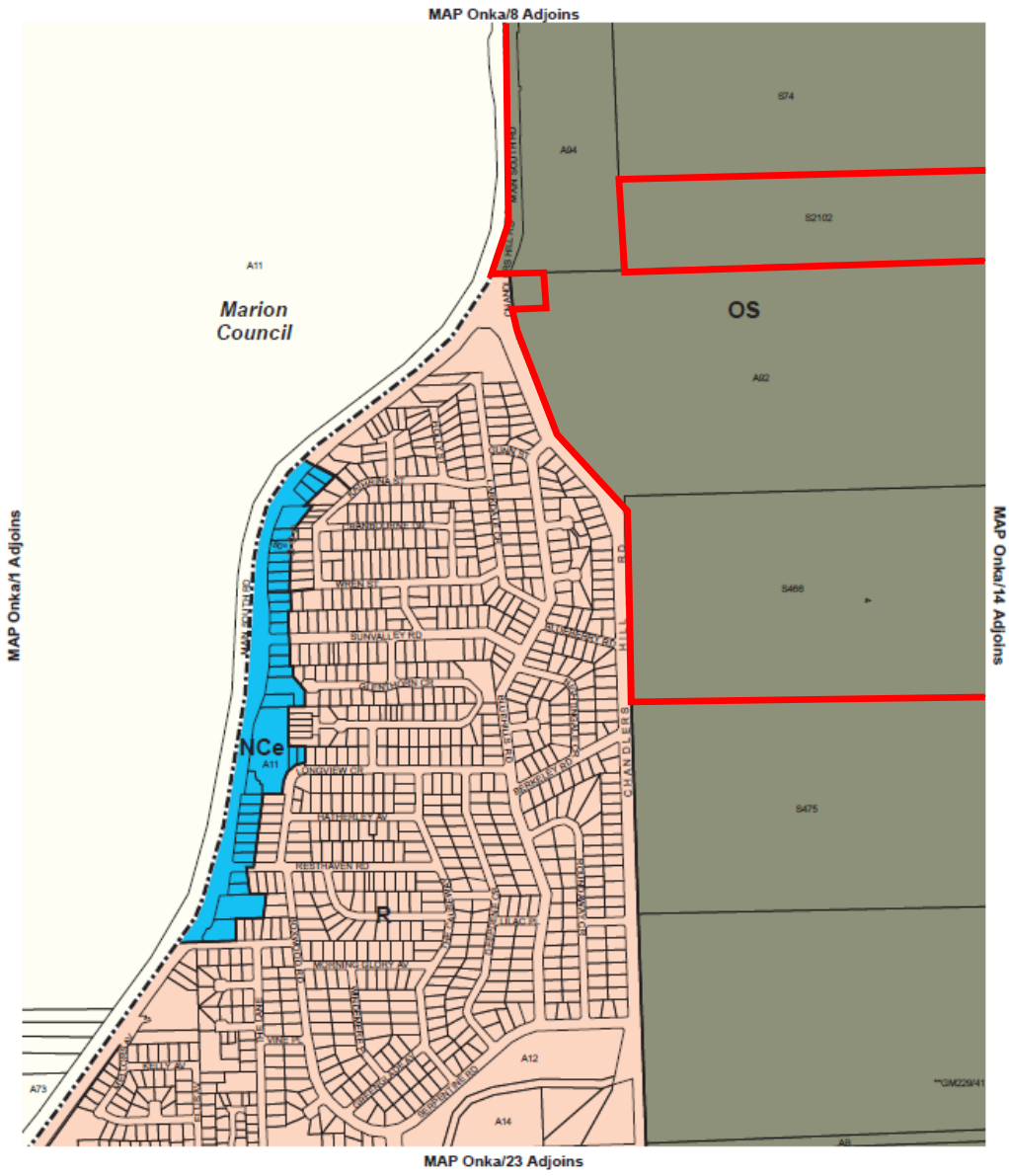
ONKAPARINGA COUNCIL
Consolidated - 20 December 2018



Zones
- HF — Hills Face
- NCe — Neighbourhood Centre
- OS — Open Space
- R — Residential
- Zone Boundary
- Development Plan Boundary

Zone Map Onka/9

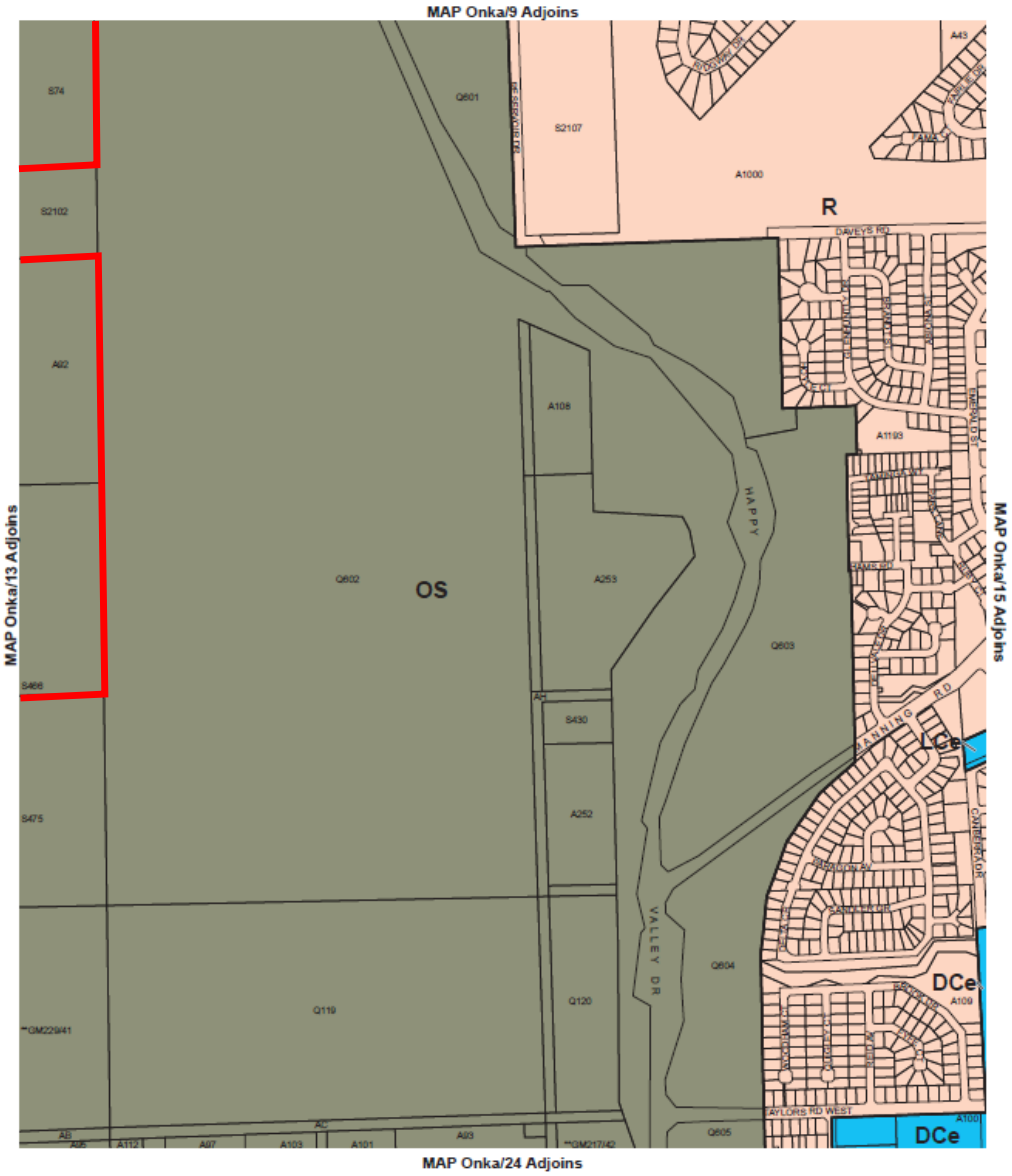
ONKAPARINGA COUNCIL
Consolidated - 20 December 2018



Zones
- NCe Neighbourhood Centre
- OS Open Space
- R Residential
- Zone Boundary
- Development Plan Boundary

Zone Map Onka/13

ONKAPARINGA COUNCIL
Consolidated - 20 December 2018



Zones

DCe	District Centre
LCe	Local Centre
OS	Open Space
R	Residential
	Zone Boundary

Zone Map Onka/14

ONKAPARINGA COUNCIL
Consolidated - 20 December 2018

PHOTOS – SITE VISIT – 12 AUGUST 2019

View along Black Road, facing east

View along Black Road, facing west

6th August 2019

Attention: Simon Neldner, DPTI
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5000

Dear Simon

Development Application – Section 49 (Crown Development) for Solar PV installation at Happy Valley Reservoir Reserve and Water Treatment Plant (WTP)

SA Water is seeking Development Approval for the installation of solar PV arrays and associated battery storage facilities along with ancillary equipment at the Happy Valley Reservoir Reserve and Water Treatment Plant. The proposed works at Happy Valley Reservoir form part of the *Zero Cost Energy Future* project, where Solar Photovoltaic (PV) cells and Battery Energy Storage Systems (BESSs) are planned for installation across SA Water's key sites.

Please find attached copies of the completed development application form and associated supporting documentation.

SA Water's Stakeholder Engagement Team have made a concerted effort to ensure the surrounding residents have been provided reasonable opportunity to be a part of the design process for the proposed development. This has involved street corner meetings, public meetings, written communications, web-based information portal and discussion page (found here: https://watertalks.sawater.com.au/), site visits, notification in local media and signage. Engagement with the local community regarding the Zero Cost Energy Future (ZCEF) project by SA Water and proposed installation of solar PV arrays at Happy Valley Reservoir Reserve commenced in December 2018. The proposed development as it appears within the accompanying report and supporting information is reflective of the feedback received throughout the engagement process. SA Water is committed to maintaining ongoing communication with the surrounding residents, and local community more broadly, so that Final Designs meet community expectations.

The proposed design has utilised a unique low-profile (5B) solar PV type which considerably reduces the overall visual profile of the solar arrays. While the proposed technology type and general arrangement have been confirmed, there remains a number of items within the overall design which require further investigation. This includes finer details for the proposed landscaping (though the placement has been broadly confirmed) and placement/ dimensions of associated ancillary equipment within the project site. SA Water are working closely with the project team and surrounding residents to help inform a way forward on these items. Equally, guidance from the DPTI Planning and Land Use Services team will ensure that the proposal meets statutory requirements whilst minimising any potential interface concerns.

Information regarding the broader *Zero Cost Energy Future* project and details for this specific proposal, including SA Water's stakeholder engagement efforts, is to be provided to the City of Onkaparinga Council in parallel to the lodgement of this application. Continued correspondence between this council and SA Water throughout the Development Assessment process will ensure that any potential concerns can be addressed as efficiently as possible.

SA Water have engaged the services of Aurecon Australia Pty Ltd in order to facilitate the process of obtaining Development Approval for each of the planned Solar PV installations. Should you have any queries in relation to the applications or proposed works please feel free to contact Lauren Nicholson (Aurecon – on behalf of SA Water) on 0478550440 or lauren.nicholson@aurecongroup.com .

Yours Sincerely,

Lauren Nicholson (Aurecon)
Senior Consultant, Environment and Planning

*For billing purposes, please address all tax invoices (fee requests) as follows:

South Australian Water Corporation
Attn: Dr Jackie Griggs (Senior Environmental Impact Assessment Officer- *Zero Cost Energy Future*)
Email: eia@sawater.com.au
250 Victoria Square
GPO Box 1751
ADELAIDE SA 5001

SECTION 49 & 49A – CROWN DEVELOPMENT
DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: __**City of Onkaparinga**_____

APPLICANT: ___**SA Water Corporation**_____

ADDRESS: _250 Victoria Square, Adelaide SA 5000__

CROWN AGENCY: _South Australian Water Corporation_____

FOR OFFICE USE

DEVELOPMENT No: _____

PREVIOUS DEVELOPMENT No:_____

DATE RECEIVED: / /

CONTACT PERSON FOR FURTHER INFORMATION

Name: _Lauren Nicholson (Aurecon - on behalf of SA Water)_

Telephone: 0478550440__

Fax: _____ [work] _____ [Ah]

Email: __lauren.nicholson@aurecongroup.com _____

❒ Complying ❒ Merit ❒ Public Notification ❒ Referrals	Decision: _____ Type: _____ Finalised: / /

NOTE TO APPLICANTS:

(1) All sections of this form must be completed. The site of the development must be accurately identified and the nature of the proposal adequately described. If the expected development cost of this Section 49 or Section 49A application exceeds $100,000 (excl. fit-out) or the development involves the division of land (with the creation of additional allotments) it will be subject to those fees as outlined in Item 1 of Schedule 6 of the *Development Regulations 2008.* Proposals over $4 million (excl. fit-out) will be subject to public notification and advertising fees.
(2) Three copies of the application should also be provided.

	Decision required	Fees	Receipt No	Date
Planning:	_____	_____	_____	_____
Land Division:	_____	_____	_____	_____
Additional:	_____	_____	_____	_____
Minister's Approval				

EXISTING USE: Reservoir and ForestrySA Pine plantation

DESCRIPTION OF PROPOSED DEVELOPMENT:__The installation of solar Photovoltaic arrays and associated infrastructure

___including battery storage equipment within the land described below (comprising SA Water's Happy Valley Reservoir Reserve)

__along with required earthworks for construction._____ _____

LOCATION OF PROPOSED DEVELOPMENT:_Multiple Allotments affected. please see attached Certificates of Title.__

House No: _____ Lot No: 94 Street: Chandlers Hill Rd Town/Suburb: Happy Valley

Section No [full/part] _____ Filed Plan: 205351 Volume : 5412 Folio: 975

Section No [full/part] _____ Hundred: Noarlunga

LAND DIVISION:

Site Area [m^2] _____ Reserve Area [m^2] _____ No of existing allotments _____

Number of additional allotments [excluding road and reserve]: _____ Lease: **YES** ❒ **NO** ❒

DEVELOPMENT COST [do not include any fit-out costs]**:** _$18,650,000_____

POWERLINE SETBACKS: Pursuant to Schedule 5 (2a)(1) of the *Development Regulations 2008,* if this application is for a building it will be forwarded to the Office of the Technical Regulator for comment unless the applicant provides a declaration to confirm that the building meets the required setback distances from existing powerlines. The declaration form and further information on electricity infrastructure and clearance distances can be downloaded from the DPLG website (www.dac.sa.gov.au).

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the *Development Act 1993.*

SIGNATURE: _  _____ Dated: 06/08/2019

DEVELOPMENT REGULATIONS 2008
Form of Declaration (Schedule 5 clause 2A)

Government of South Australia

To: State Commission Assessment Panel (SCAP)

From: South Australian Water Corporation (C/- Aurecon Australasia Pty Ltd)

Date of Application: 06/08/2019

Location of Proposed Development: Land within Happy Valley Reservoir Reserve

House No: _____ Lot No: 94 Street: Chandlers Hill Rd

Town/Suburb: Happy Valley

Section No (full/part): _____ Hundred: Noarlunga

Volume: 5412 Folio: 975

and: Volume 5412 Folio: 953

Nature of Proposed Development:

Installation of Solar PV arrays, Battery Storage facilities and associated equipment within the above allotment. Energy generation and storage capabilities for the direct benefit of ongoing wastewater treatment operations by SA Water.

I Lauren Nicholson (of Aurecon Australasia) **being a person acting on behalf of the applicant (delete the inapplicable statement) for the development described above declare that the proposed development will involve the construction of a building which would, if constructed in accordance with the plans submitted, not be contrary to the regulations prescribed for the purposes of section 86 of the Electricity Act 1996. I make this declaration under clause 2A(1) of Schedule 5 of the Development Regulations 2008.**

Signed: _____ **Date:** 06/08/2019

Government of South Australia

Note 1

This declaration is only relevant to those development applications seeking authorisation for a form of development that involves the construction of a building (there is a definition of 'building' contained in section 4(1) of the Development Act 1993), other than where the development is limited to –

a) an internal alteration of a building; or
b) an alteration to the walls of a building but not so as to alter the shape of the building.

Note 2

The requirements of section 86 of the Electricity Act 1996 do not apply in relation to:

a) an aerial line and a fence, sign or notice that is less than 2.0 m in height and is not designed for a person to stand on; or
b) a service line installed specifically to supply electricity to the building or structure by the operator of the transmission or distribution network from which the electricity is being supplied.

Note 3

Section 86 of the Electricity Act 1996 refers to the erection of buildings in proximity to powerlines. The regulations under this Act prescribe minimum safe clearance distances that must be complied with.

Note 4

The majority of applications will not have any powerline issues, as normal residential setbacks often cause the building to comply with the prescribed powerline clearance distances. Buildings/renovations located far away from powerlines, for example towards the back of properties, will usually also comply.

Particular care needs to be taken where high voltage powerlines exist; or where the development:

- is on a major road;
- commercial/industrial in nature; or
- built to the property boundary.

Note 5

An information brochure: 'Building Safely Near Powerlines' has been prepared by the Technical Regulator to assist applicants and other interested persons.

This brochure is available from council and the Office of the Technical Regulator. The brochure and other relevant information can also be found at **sa.gov.au/energy/powerlinesafety**

Note 6

In cases where applicants have obtained a written approval from the Technical Regulator to build the development specified above in its current form within the prescribed clearance distances, the applicant is able to sign the form.

SA Water

Development Application

Happy Valley Reservoir Reserve

Zero Cost Energy Future

Solar Photovoltaic Project

Version: 2
Date: 06/08//2019
Status: Final

Government of South Australia

Document Controls

Version History

Version	Date	Author	Comments
1.0	22/07/2019	Kate Croucher	Draft
1.1	25/07/2019	Lauren Nicholson	Technical Review
1.2	01/08/2019	Jackie Griggs Doug Shadwell	SA Water Environment, Land and Heritage comments incorporated ZCEF Project Manager
1.3	02/08/2019	John Hart	SA Water Project Lead sign off
Final	06/08/2019	Lauren Nicholson	Submitted to DPTI for Approval

Template: Report Version 4.0 31/07/17

Table of Contents

1 Introduction

1.1 Outline

SA Water Corporation is proposing the installation of a solar photovoltaic (PV) facility and associated works within the Happy Valley Reservoir Reserve and Water Treatment Plant (WTP). The works form part of the broader Zero Cost Energy Future project, which aims to reduce the operating costs of, and improve reliability of energy supplies to, SA Water's critical water infrastructure.

Aurecon Australasia Pty Ltd has been engaged by SA Water to provide planning advice and to assist in obtaining a development approval for the proposed development in accordance with the *Development Act 1993*. SA Water is an agency for the Crown and the works proposed are for the purposes of public infrastructure; as such, the proposal is a Crown Development in accordance with section 49 of the Development Act.

This Planning Report has been prepared to support the Crown Development Application and provides:

- an overview of the Zero Cost Energy Future project;
- a description of the subject land and locality;
- details of the proposed development;
- a summary of stakeholder engagement efforts;
- an outline of procedural matters related to the assessment of the application; and
- our assessment of the development having regard to the provisions of the City of Onkaparinga Development Plan.

1.2 Proponent

The proponent for the project is SA Water, which is a government enterprise, wholly-owned by the Government of South Australia, and established by the proclamation of the *South Australian Water Corporation Act 1994*. SA Water is an agency of the Crown for the purposes of Section 49 of the Development Act.

The primary point of contact for any and all correspondence relating to this development application is listed below:

Ms Lauren Nicholson
Town Planner
Aurecon (on behalf of SA Water)
Ph: 0478550440
Email: Lauren.Nicholson@aurecongroup.com

The primary point of contact for all applicable project finance matters, including the issuing of invoices, is listed below:

Dr Jackie Griggs
Senior Environmental Impact Assessment Officer- *Zero Cost Energy Future*
SA Water
Ph: 0448379303
Email: eia@sawater.com.au

2 Zero Cost Energy Future Project Overview

Electricity costs comprise a significant operating cost across all SA Water assets. Recent increases in the cost of electricity present a risk for SA Water with impacts on SA Water's operating budget and the associated cost of service provision to SA Water customers. Currently SA Water is a wholesale (spot) market participant and as such is exposed to spot market price risk. The electricity price risk is mitigated through SA Water's own power generation, curtailment of consumption and other hedging strategies.

SA Water has recently developed an Energy Management Framework which includes a range of strategies for reducing operational energy costs. A key component of this overarching framework is the installation of solar PV cells and battery energy storage systems (BESSs) across a number of SA Water's sites with greatest energy needs to facilitate their operations.

The proposed installation of solar PV cells and BESSs at key SA Water operating sites, such as the Happy Valley Reservoir and Water Treatment Plant (WTP) site, will immediately reduce the operating energy costs for the site and reduce exposure to increases in electricity costs. Importantly, the generating capacity of the proposed solar PV cells is to be balanced against the provision of a BESS to ensure electrical stability is maintained and to allow greater security and reliability for the continued supply of power to the site.

The works and activities contributing to the proposed installation of solar PV cells and BESSs across key SA Water sites is being completed under the project banner of *Zero Cost Energy Future*.

3 Subject Land and Locality

3.1 Background

Happy Valley Reservoir Reserve and Water Treatment Plant (WTP)

The existing site which is the subject of this development application comprises the Happy Valley Reservoir Reserve and associated Water Treatment Plant. The Happy Valley Reservoir was constructed in the 1890s to assist in the provision of Adelaide's water supply and is one of the major land holdings of SA Water. With a capacity of 11,500 megalitres, today the reservoir supplies more than 40% of the city's water. The reservoir is a short-term balancing water storage facility that receives water from the Mount Bold Reservoir (6km south-east) via a 5km tunnel diverted at the Clarendon weir. The reservoir provides water to the Happy Valley Water Treatment Plant, operated by Allwater.

From 2002 to 2004 extensive upgrade works were undertaken on the reservoir, enabling it to meet national and international standards. The total area of the Reservoir Reserve is approximately 625 hectares, with the water body spread over approximately 178 hectares at full capacity. The Reserve contains approximately 120 hectares of remnant vegetation, 100 hectares of revegetation and approximately 63 hectares of pine plantations (under the management of ForestrySA), as well as supporting associated infrastructure. Native vegetation evident in the area includes Grey Box (*Eucalyptus macrocarpa)*, SA Blue Gum (*E. Leucoxylon* ssp. *Leucoxylon*), Pink Gum (*E. fasciuculosa)* and Red Gum (*E. camaldulensis var. camaldulensis)*. Public access is restricted at the Happy Valley Reservoir Reserve, with high security fencing surrounding the site. The main gate off Chandler's Hill Road is staffed by a security guard with other perimeter gates kept locked at all times. Any parties requiring access must undertake formal induction processes.

A Memorandum of Understanding (MOU) exists between SA Water and ForestrySA, enabling ForestrySA to have ongoing access to specific areas within SA Water's reservoir reserves in the Mt Lofty Ranges for commercial softwood timber production. Happy Valley Reservoir Reserve is one such site where ForestrySA have access to particular areas as well as a responsibility for operating and managing these plantations in a way which minimises negative impact on water quality and yield.

3.2 Subject land

The north-western portion of the SA Water owned land comprising the Happy Valley Reservoir Reserve has been identified as the preferred positioning for the proposed solar PV arrays and associated infrastructure.

The Happy Valley Reservoir Reserve comprises multiple allotments with the proposed development to be situated across two (2) allotments within the north-western corner. Legal descriptions of the two land parcels proposed to accommodate the development are listed below, while Figure 1 (on the following page) shows the position of the proposed development in relation to the total extent of the existing SA Water owned land parcels at Happy Valley Reservoir Reserve.

- Allotment 94, Filed Plan 205351, Chandlers Hill Road, Happy Valley. Within Certificate of Title Volume 5412, Folio 975, Hundred of Noarlunga.
- Section 74, Hundred Plan 105500, Chandlers Hill Road, Happy Valley. Within Certificate of Title Volume 5412, Folio 953, Hundred of Noarlunga.

Copies of the relevant Certificate of Titles have been included within Appendix A of this report.

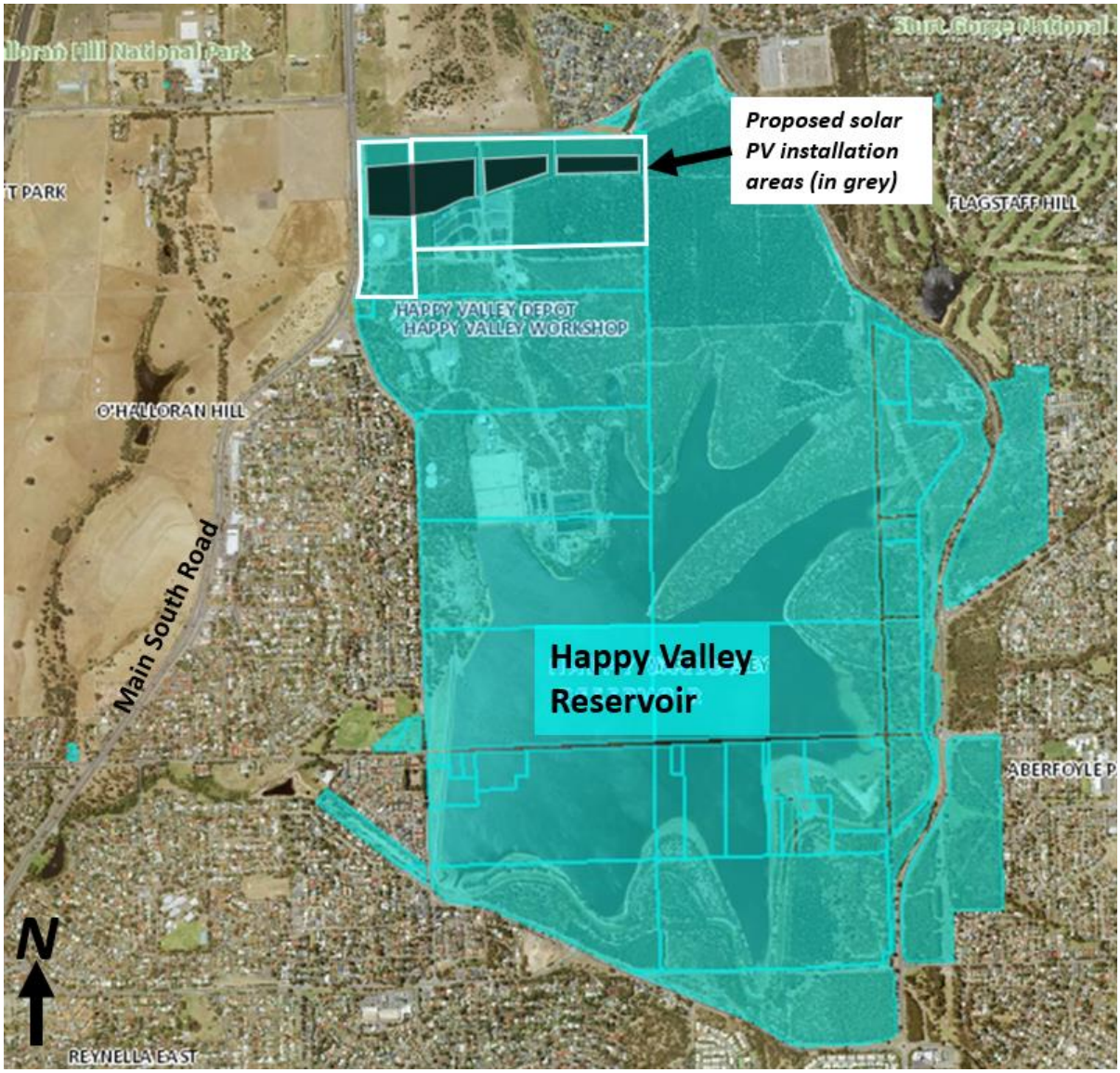


Figure 1. Happy Valley Reservoir landholding. Individual allotment boundaries shown in teal and subject land parcels outlined in white with indicative development footprint in grey. Note: boundaries are approximate and shown for illustrative purposes only. Base image source: AquaMap, SA Water corporate GIS

After it was identified that the Happy Valley Reservoir and associated Water Treatment Plant would be included within the Zero Cost Energy Future project, site investigations were undertaken to determine the location which would best support the installation of solar PV arrays and associated equipment. A number of factors at the Happy Valley Reservoir landholding affected the availability of suitable land, including two key constraints; the presence of sloping terrain and presence of native vegetation. Each of these are discussed in greater detail under the sub-headings below;

Sloping Terrain

By design, the Happy Valley Reservoir landholding is situated within undulating terrain, allowing for the effective capture and storage of water. Ground elevations are highest towards the outer extent of the reservoir landholding and the terrain then falls away from the outer perimeters (particularly the northern perimeter) to form a central depression which contains the reservoir waters. The installation of solar PV arrays requires a relatively flat expanse of terrain, and importantly, must avoid south-facing slopes as this represents the least viable positioning for solar generation. Figure 2, on the page below, illustrates the topography of the Happy Valley Reservoir

landholding with 2 metre contour intervals shown (orange lines) and demonstrates that the north-western portion is most flat, with least variation in terrain compared to all other areas within the Happy Valley Reservoir Reserve.

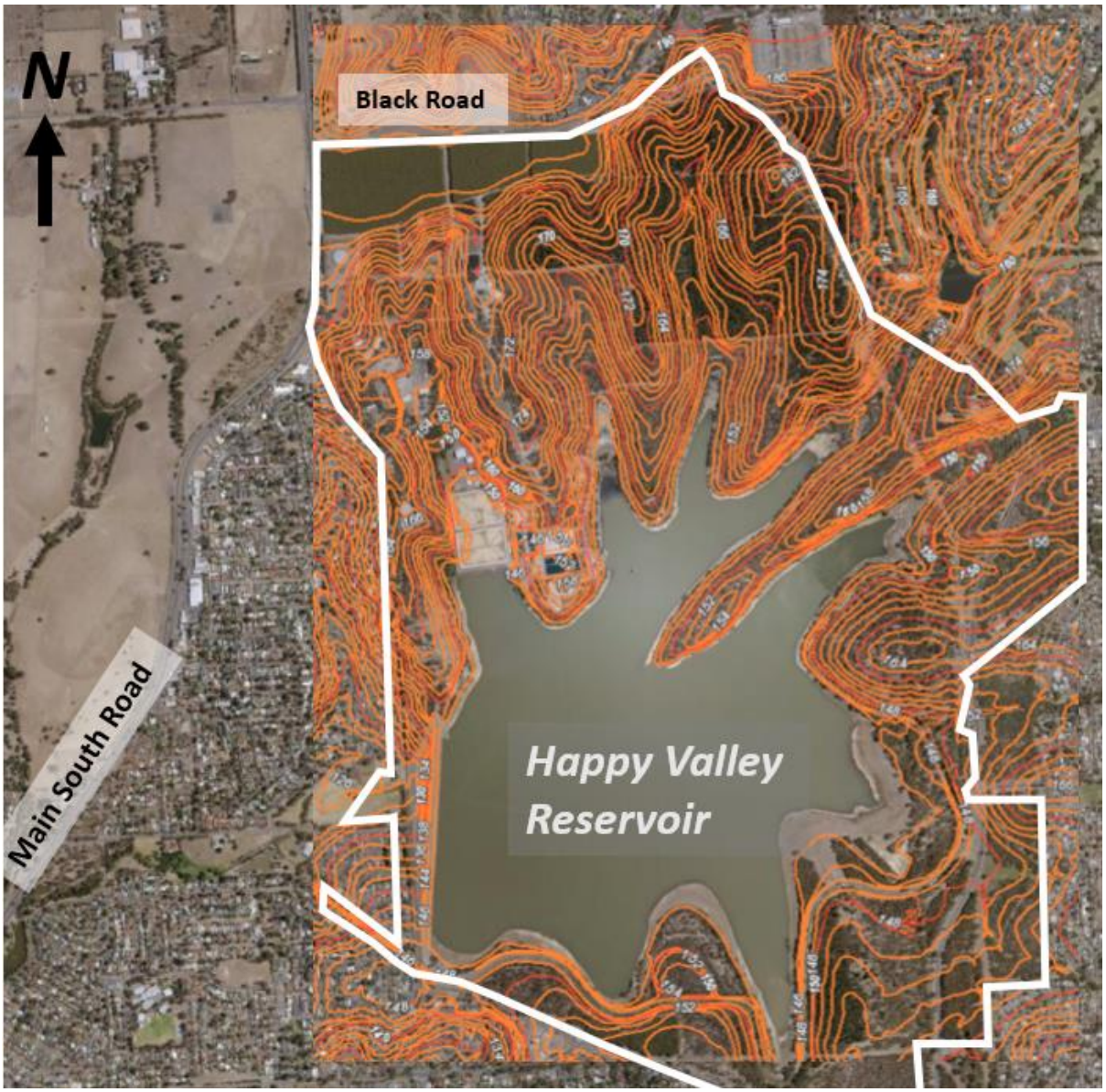


Figure 2. Happy Valley Reservoir and surrounds, with 2m contour intervals shown for SA Water land holding (white outline). Note: boundaries are approximate and shown for illustrative purposes only. Base image source: NatureMaps, Enviro Data SA, https://data.environment.sa.gov.au/NatureMaps/Pages/default.aspx

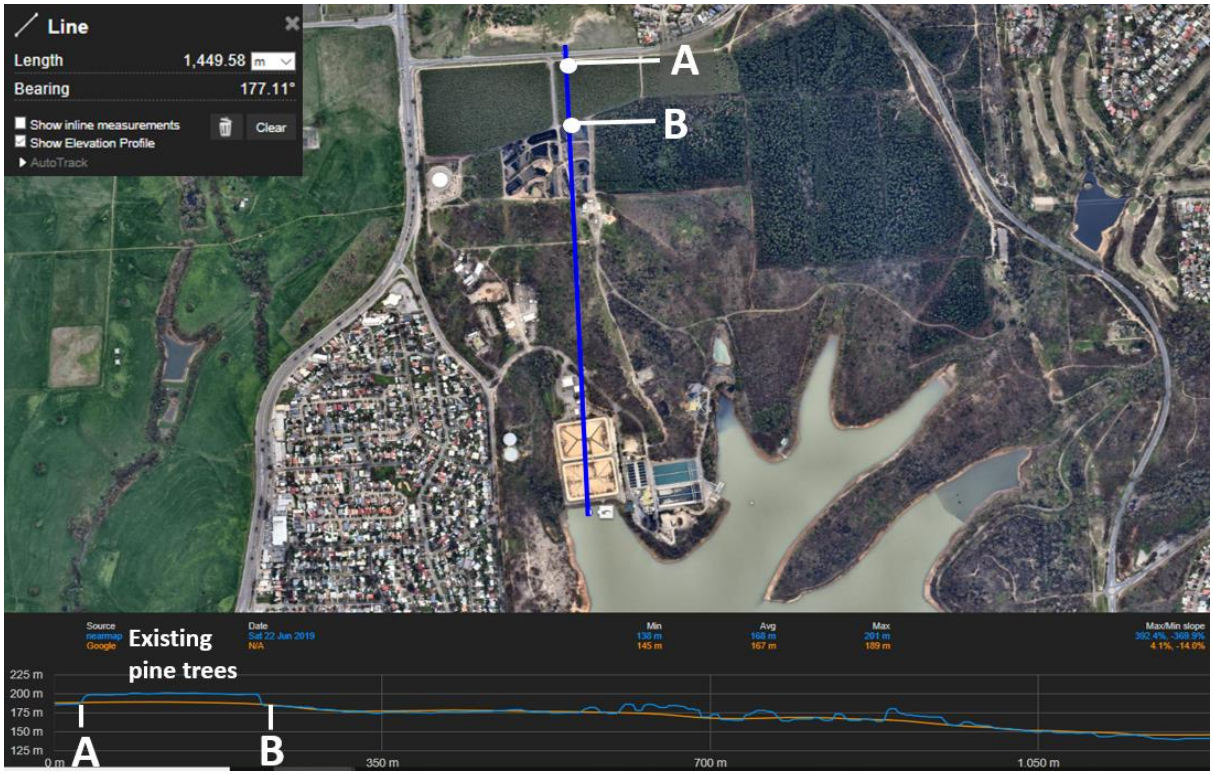


Figure 3. Terrain cross section for north-western portion of the Happy Valley Reservoir Reserve (see Appendix C for larger image). Note: boundaries are approximate and shown for illustrative purposes only. Base Image source: Nearmap, https://www.nearmap.com.au/

Figure 3, above, provides an understanding of where the terrain begins to fall away at the southern extent of the flat land within the north-western corner. At the bottom of Figure 3 a cross section elevation profile is shown for the blue (north-south directional) line within the aerial view. In the cross section above (bottom of Figure 3), an orange line shows the ground level terrain, whereas the blue line shows the above ground profile (i.e. existing pine trees and built structures). Points A and B within the cross section demarcate the northern and southern perimeters of the existing pine plantation, respectively. The land between points A and B is relatively flat and maintains an approximate ground level elevation of 186m-187m above mean sea level (amsl). The land between Point B and the 350m mark (approximately 100m further south) within the area used for sludge drying, exhibits a drop in elevation by more than 10m amsl (approx.) and exhibits an average gradient of 8%.

A copy of Figure 3 and two additional cross section images are included within Appendix C - Terrain Cross-Sections, as these are more easily viewed at full-page size.

Presence of Native Vegetation

The Happy Valley Reservoir Reserve currently supports significant areas of remnant native vegetation (approximately 120 hectares) and areas which have been revegetated with native species (approximately 100 hectares). Across the northern and north-eastern portion of the landholding there are multiple areas of pine plantation, managed by ForestrySA, comprised of *Pinus halepensis* and *Pinus radiata* sub species. The below map, prepared by T&M Ecologists as part of the Happy Valley Reservoir Reserve Land Management Plan (March 2017), provides a breakdown of the different vegetation communities present within the landholding;

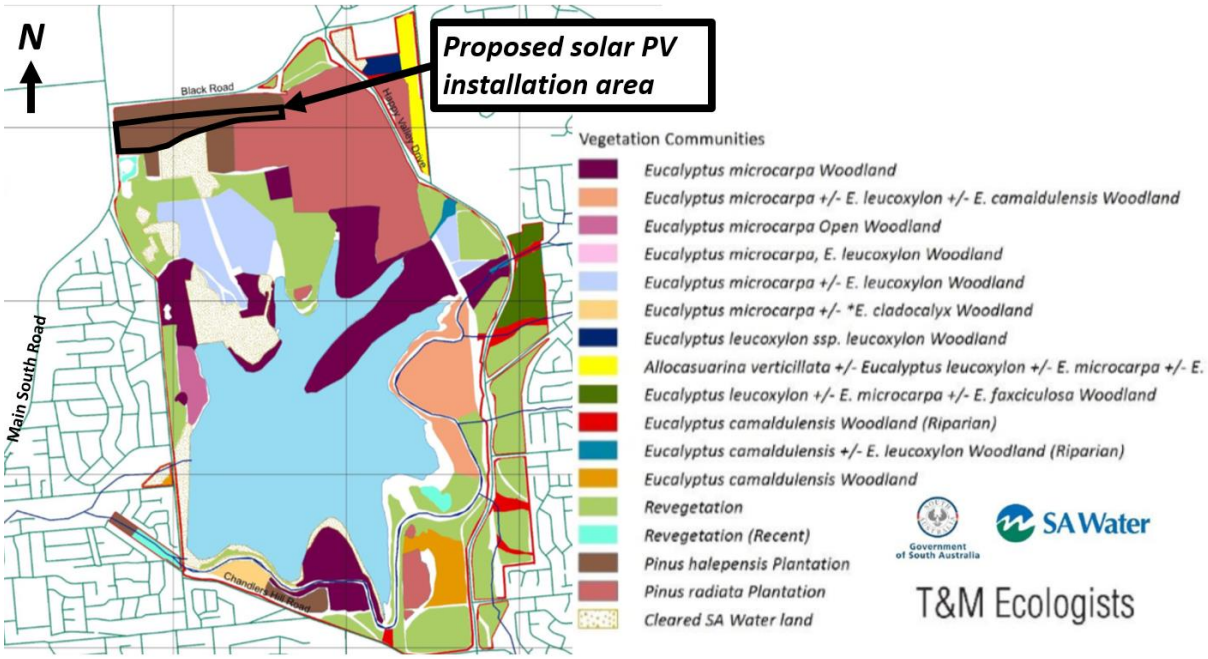


Figure 4. Happy Valley Reservoir Reserve vegetation communities. Approximate proposed solar PV installation area outlined in black. Base image source: T&M Ecologists Pty Ltd., March 2017, Happy Valley Reservoir Reserve Land Management Plan.

The presence of native vegetation, both remnant and planted, limits the number of viable areas which could be considered for the installation of solar PV arrays, particularly given the important habitat role which the native vegetation plays for local wildlife. A full account of this is provided within the Environmental Impact Assessment included as an item within the appendices of this report (Appendix E- Environmental Impact Assessment).

The north-western portion of the landholding, where the land is flattest, currently contains a ForestrySA commercial pine plantation of Aleppo pines (*Pinus halepensis*) that were planted in 1949 and 1951. An ecological assessment of the Happy Valley Reservoir Reserve found that ForestrySA's pine plantation is the least biodiverse area in the reserve. There is little or no understorey vegetation and no hollow-forming trees for wildlife nesting in the pine plantation. Native trees, such as Grey Box, within other areas of the reserve, support declining and threatened bird species, including the Brown Treecreeper, which is endangered in the Mount Lofty Ranges. The Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of south-eastern Australia are a listed threatened ecological community under the *Environment Protection and Biodiversity Conservation (EPBC) Act 1999*. It is also acknowledged that the *Pinus halepensis* sub-species present within the north-western portion of the reservoir land is considered a declared weed under the *Natural Resources Management Act 2004*.

The Project Location

Based upon the investigations undertaken as part of the site selection process, and given the constraints present within the landholding, an area within the north-western portion of the Happy Valley Reservoir Reserve was determined to offer the most viable location. This area is suitably flat and is free from native vegetation. However, as this position would be in relative proximity to the northern perimeter (with frontage to Black Road) and to the western perimeter (with frontage to Main South Road), the need for appropriate measures which would reduce the potential for interface impacts was recognised early on in the project. Significant Stakeholder Engagement works have been undertaken by SA Water with nearby residents and a full account of this is provided within Section 4.5 (pg. 21). The engagement with local residents by SA Water has guided the determination of the proposed location and design for the solar PV installation at Happy Valley Reservoir Reserve, with further details on this outlined in Section 4.1 (Pg.15).

The proposed development comprises approximately 11.29 hectares of relatively flat land which currently supports Aleppo Pine (*Pinus halepensis*). The project area is divided into three separate portions in order to maintain the existing access tracks. The solar PV arrays are proposed to utilise the entirety of the Aleppo Pine plantation area, with the outer edge of the arrays to align with the present plantation envelope. At the northern development perimeter, it is proposed that a 40m wide portion of the existing pines will be retained along the entire northern frontage. A further 30m width is proposed from the southern edge of the remaining pines to the commencement of the solar PV arrays, to allow for a 20m wide vegetation buffer to be established and a 10m wide clearway to the edge of the solar PV arrays for vehicle access. A vegetation buffer is also proposed to be established along the western frontage to Main South Road.

Figure 5, below, illustrates the proposal location and immediate surrounds.

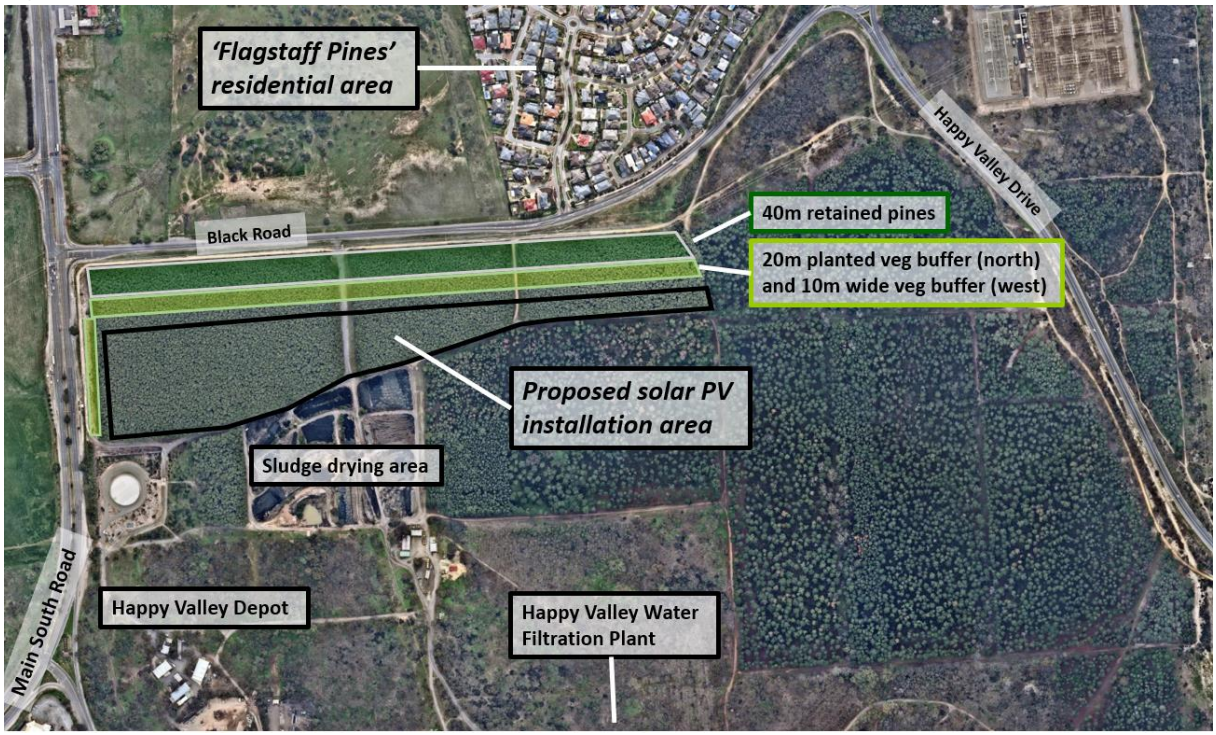


Figure 5. Happy Valley Reservoir Reserve solar PV proposal with retained pines and planted buffer. Note: boundaries are approximate and shown for illustrative purposes only. Base Image source: Nearmap, https://www.nearmap.com.au/

3.3 Surrounding Land Uses

Happy Valley Reservoir Reserve is located approximately 15km south of Adelaide CBD within the foothills of the Mount Lofty Ranges and sits within the north-western portion of the City of Onkaparinga. The City of Marion council area commences along the opposite (western) side of Main South Road. Existing land uses within the surrounding locality predominantly comprise residential properties, along with recreational reserves, sports clubs, schools and retail centres. Adjacent to the Happy Valley Reservoir Reserve are the suburbs of Happy Valley, O'Halloran Hill, Flagstaff Hill and Aberfoyle Park. Land uses of interest are displayed in Figure 6, below, including schools, Flagstaff Hill Golf Club and Sturt Gorge Recreation Park. The major arterial roads of Main South Road and the Southern Expressway are also displayed, as well as the proposed development location.

Figure 6. Happy Valley Reservoir Reserve and surrounding land uses. Note: boundaries are approximate and shown for illustrative purposes only. Base Image source: Nearmap, https://www.nearmap.com.au/

The nearest residential properties to the proposed development are situated along the northern side of Black Road, within the 'Flagstaff Pines' residential development. The nearest dwelling to the solar proposal is approximately 115m to the north, measured from the northern-most point of the solar PV arrays. The proposal is expected to be entirely screened from the view of these residences given the significant screening provided by the retained pines and additional vegetation plantings, paired with the considerable distance which separates these residences from the proposal.

Figures 7-10, on the following page, illustrate existing conditions and views in proximity to the proposed development utilising Nearmap Streetview imagery.

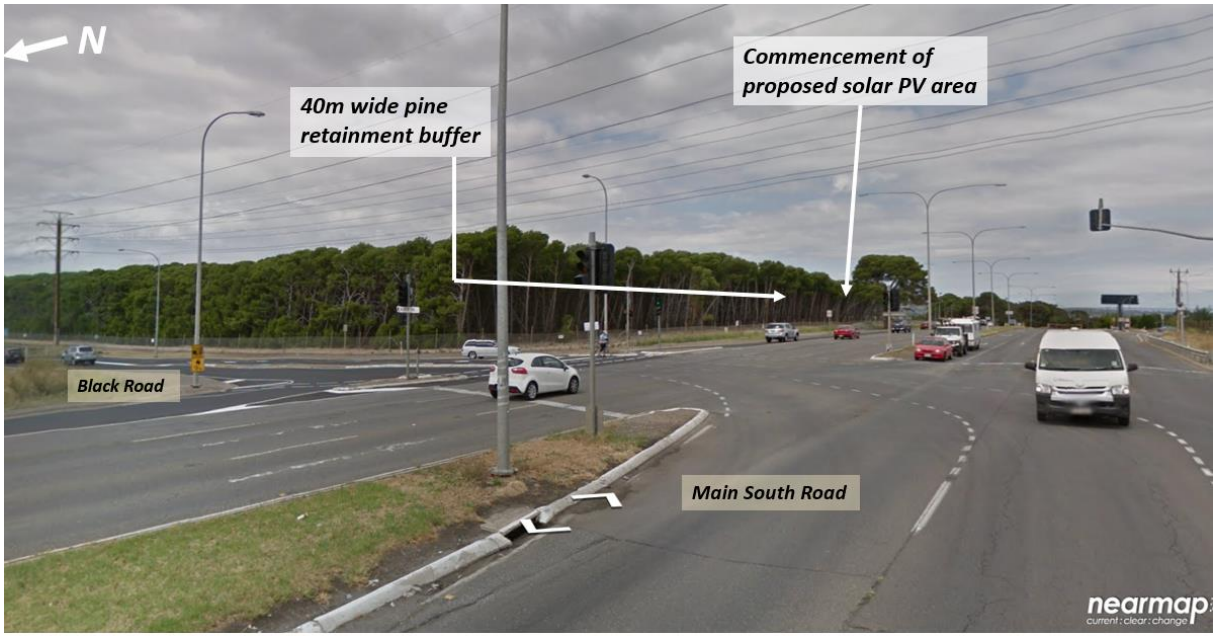


Figure 7. Nearmap Streetview image from Main South Rd, facing southeast towards north-western corner of Happy Valley Reservoir Reserve land. Note: boundaries are approximate and shown for illustrative purposes only. Base image source: Nearmap, http://maps.au.nearmap.com/

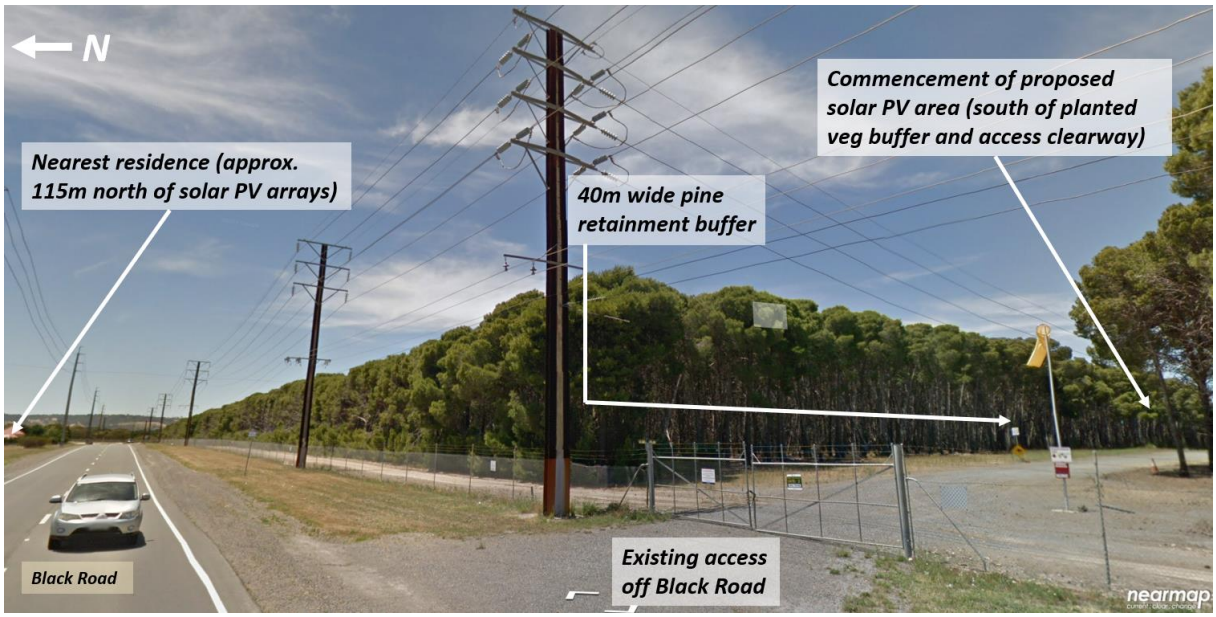


Figure 8. Nearmap Streetview image from Main South Rd, facing southeast towards north-western corner of Happy Valley Reservoir Reserve land. Note: boundaries are approximate and shown for illustrative purposes only. Base image source: Nearmap, http://maps.au.nearmap.com/

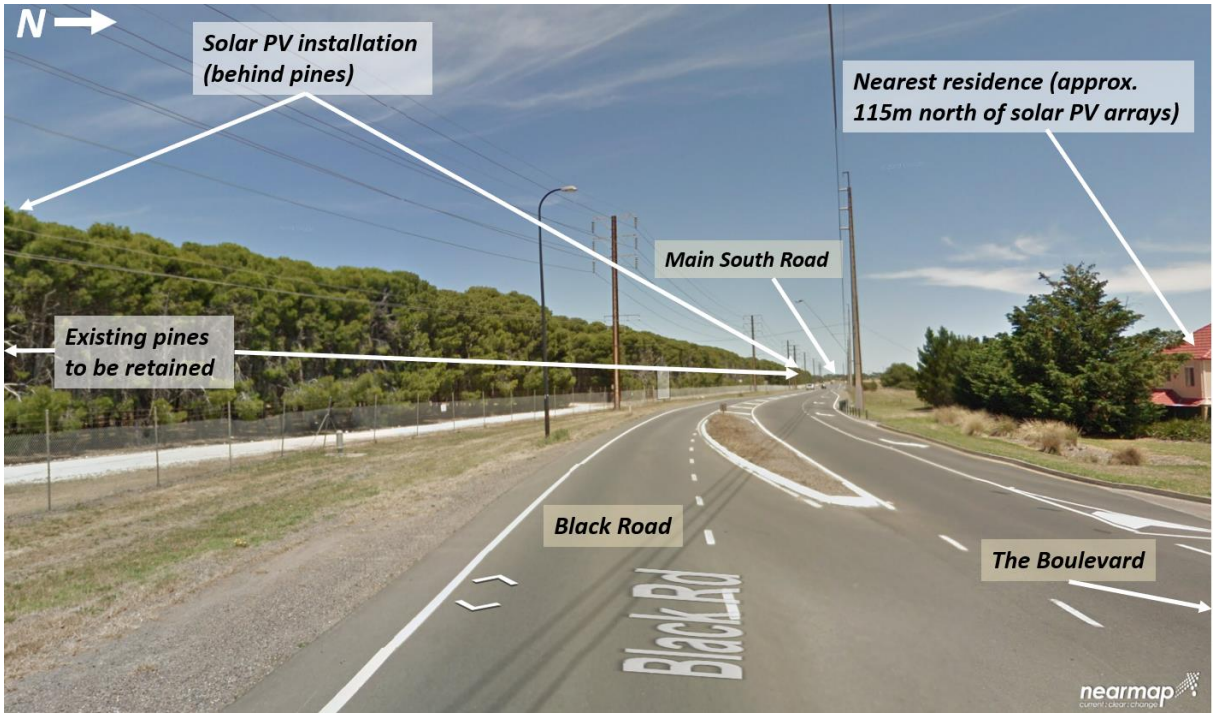


Figure 9. Nearmap Streetview image from Black Rd, facing west-southwest Main South Rd along northern perimeter of Happy Valley Reservoir Reserve land. Note: boundaries are approximate and shown for illustrative purposes only. Base image source: Nearmap, http://maps.au.nearmap.com/

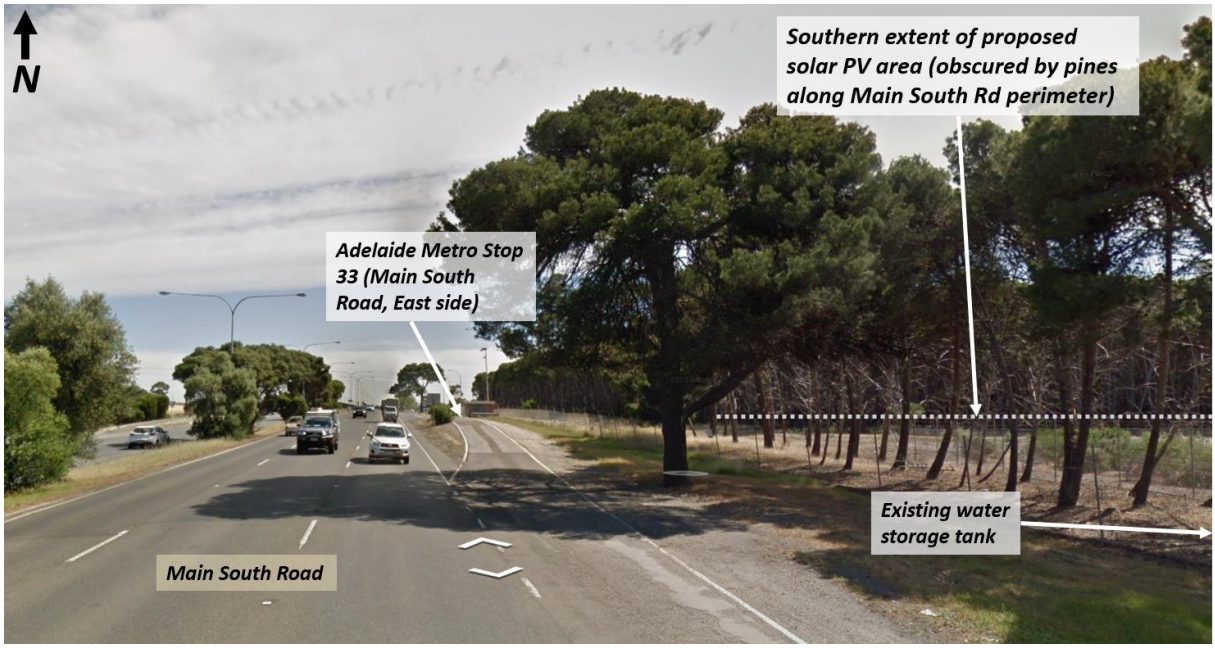


Figure 10. Nearmap Streetview image from Main South Rd, facing north towards the southern perimeter of the proposed solar PV installation area at Happy Valley Reservoir Reserve. Note: boundaries are approximate and shown for illustrative purposes only. Base image source: Nearmap, http://maps.au.nearmap.com/

4 Proposed Development

4.1 Description of Proposal

The proposed development at Happy Valley Reservoir Reserve has adopted a unique low-profile solar design type (5B) that allows for an overall visual profile which is significantly less conspicuous by comparison to more typical solar design types such as Single Access Tracking (SAT), which have been utilised elsewhere as part of the Zero Cost Energy Future project. The selection of a unique solar PV design was made in recognition of the need to maintain existing levels of visual amenity in the locality and was further based upon feedback from the surrounding residents as part of the SA Water led Stakeholder Engagement process (see Section 4.5, Pg. 21).

The installation of a solar power generation and energy storage facility (with associated equipment), utilising the low-profile 5B design system, involves the below components;

- Approximately 37,895 individual solar PV cells, each measuring approximately 1960mm long x 991mm wide and 40mm in base;
- Associated low-profile 5B concertina framework for the solar panels (indicative framework design illustrated in Figure 14).
- Approximately four (4) inverter stations, installed within appropriate weather proofing. Each with approximate dimensions: 2812mm high x 2438mm wide x 5855mm long (see Figure 15 for indicative design);
- Battery Energy Storage Systems (BESS) equipment, to be installed near to the point of connection at the Happy Valley Water Filtration Plant (WFP) (model specifications and location to be confirmed within Detail Designs);
- Removal of existing Aleppo Pines (*Pinus halepensis*) from proposed solar PV area.
- Associated groundworks and levelling, including the provision of a lay-down area for construction;
- Electrical cabling, installed via underground trenching. Note: 5B solar design significantly reduces need for trenching of electrical cables within the solar PV array footprint;
- Surface upgrades to existing access tracks to ensure all-weather accessibility;
- Upgrades to existing security fencing (where required); and
- Establishment of proposed landscaping buffer to the north and west of the proposed solar PV arrays.

In total, the proposal requires approximately 11.29 hectares of land for the installation of solar PV arrays and associated infrastructure on the subject land. The 5B design utilises an arrangement whereby individual solar PV modules are installed within groups of 'panels', where each panel measures 36.7m long x 5.5m wide. The proposed layout allows for the installation of 412 panels.

The proposed development allows for an approximate setback of 77m from the northern property perimeter, bordered by Black Road (a Secondary Arterial Road). An approximate setback of 20m, measured from the edge of the solar PV arrays to the existing perimeter access track along the western security fence will be allowed for. This setback will encompass the establishment of a 10m wide vegetation buffer (utilising native species of local provenance – planting schedule TBC) to run parallel to the western property perimeter bordered by Main South Road (a Primary Arterial Road). A further 10m clearance zone will be allowed for from the eastern edge of the vegetation buffer to the commencement of the solar PV arrays to allow for vehicle access between the vegetation

buffer and the arrays. A relatively wide verge exists between the western property perimeter (demarcated by the existing security fence) and commencement of Main South Road, which allows the solar PV arrays to be reasonably setback from the carriage-way of the Primary Arterial Road.

Figure 11, below, illustrates the proposed solar PV layout within the subject land while Figure 12 provides a cross section diagram facing west and extending south from Blacks Road towards the existing water storage tank. Similarly, Figure 13 (on the following page) provides a cross-section diagram facing north and extending east from Main South Road. Figure 14 (further below) offers an example of the 5B Solar PV design as installed in two locations previously, as well as illustrating the deployment of the pre-assembled system.

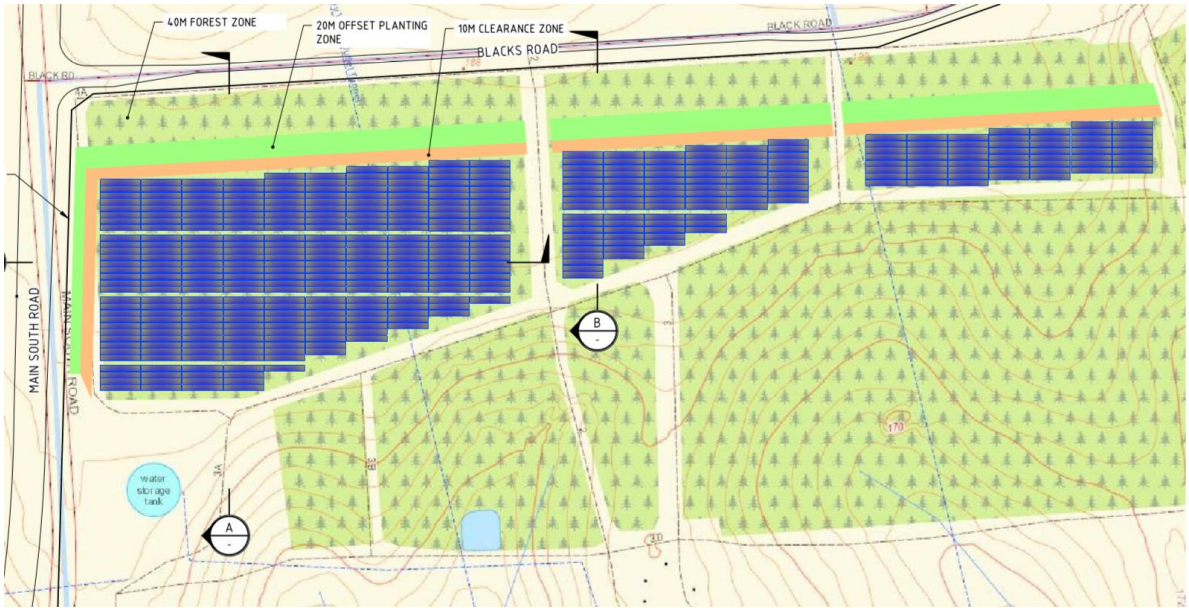


Figure 11. Happy Valley Reservoir Reserve- Proposed area for 5B Solar PV install, including proposed landscaped buffers and retained pines. Excerpt from Appendix B- Design Drawings.

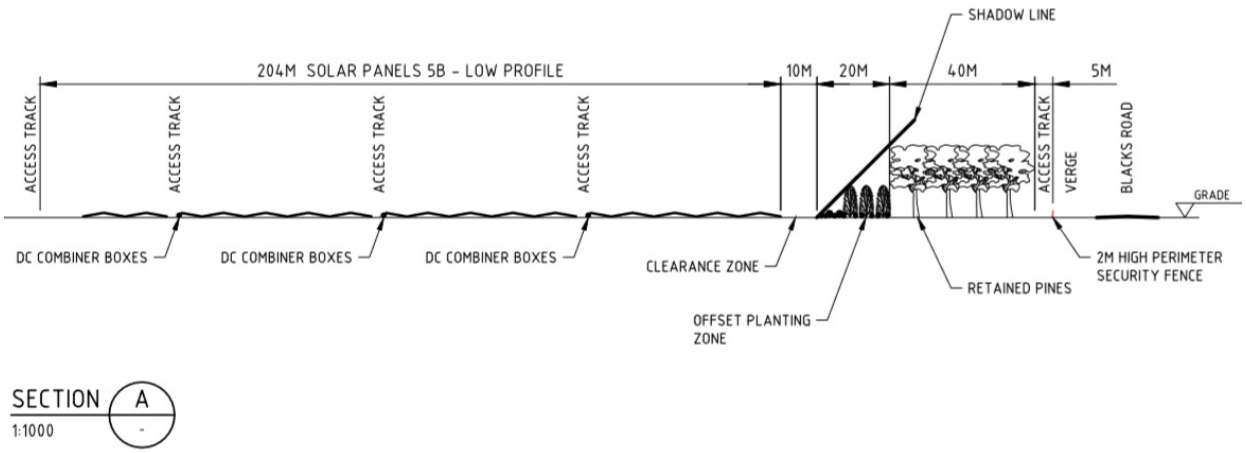


Figure 12. Cross section 'A' (facing west) for Happy Valley Reservoir solar PV layout. Demonstrating 5B profile against proposed landscaping and retained pines, with Blacks Road at Right Hand Side. Excerpt from Appendix B- Design Drawings.

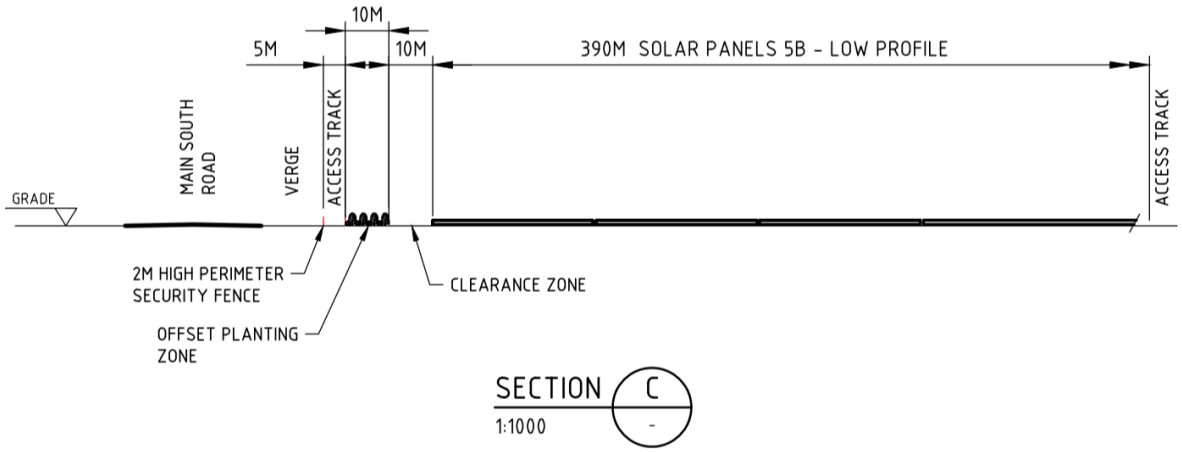


Figure 13. Cross section 'C' (facing north) for Happy Valley Reservoir solar PV layout. Demonstrating 5B profile against proposed landscaping (post pine removal), with Main South Road at Left Hand Side. Excerpt from Appendix B- Design Drawings

Figure 14. The 5B solar PV design. Clockwise from top-left: 5B modules are pre-assembled for rapid deployment and installation; 5B solar PV system recently installed at Port Bonython, SA, and; a previously installed 5B solar PV system in Victoria**. Images obtained from 5B website: https://5b.com.au/**

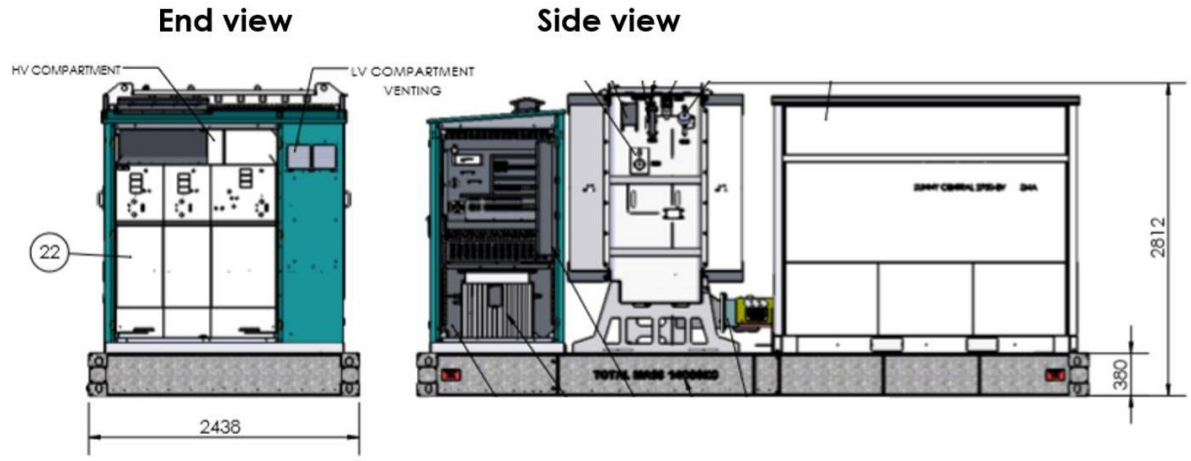


Figure 15. Typical Inverter block elevation. End (width) view to the left and side (length) view to the right, demonstrating dimensions of 2812mm high x 2438mm wide x 5855mm long (final design and dimensions subject to confirmation).

5B are an Australian owned company, founded in 2013 and offering a 'cutting-edge technology' through their flagship 'MAVERICK™' portable and prefabricated solar array. The 5B solar PV design achieves a significantly lower overall height (from ground level to top of arrays) when compared to more conventional solar PV technology such as Single-Access-Tracking (SAT). The maximum height from finished ground level for the 5B arrays is expected to be approximately 1m, but may fluctuate slightly to conform to the terrain profile. Nonetheless, this is significantly lower than typical maximum heights for solar arrays proposed as part of the ZCEF program, which have proposed heights of up to 3.8m elsewhere.

5B utilises a robust ballasted configuration suitable for wind regions A to D and has withstood tropical cyclone conditions in northern Australia. For more information on the 5B solar PV design and recently completed projects across Australia, please visit the website using the following link: https://5b.com.au/ . The 5B system does not require percussion piling and thereby minimises potential for noise impacts and nuisance throughout the construction process. The installation of the proposed solar PV panels at Happy Valley Reservoir Reserve will be fully engineered to ensure that the panel frames can withstand all loading, including wind loading.

4.2 Environmental management

SA Water is committed to ensuring the Happy Valley Reservoir Reserve solar PV project is constructed in a sustainable manner which minimises impacts to the surrounding environment- a commitment which extends to all installations within the Zero Cost Energy Future project. An overview of potential construction activities and associated environmental impacts with the upgrade works are detailed in Table 1 below.

Table 1. Construction Activities and Associated Environmental Impacts

Activity / Aspect	Potential Environmental Issues/Impact to be aware of and manage
Use of vehicles, equipment & plant	Noise creating nuisance
	Property damage from vibration
	Emissions to air from equipment
	Introduction/spread of weed seeds or plant pathogens
	Fire (hot works or use near dry vegetation) Nuisance to neighbours – access, light spill etc
Storage of materials, maintenance and refuelling of machinery and equipment	Spills leading to pollution and contamination of soil, water
	Damage to vegetation and fauna
	Emissions of noxious / toxic gases
Washdown of equipment/plant	Pollution to water (watercourses or stormwater) Introduction/spread of weed seeds or plant pathogens Damage to vegetation and fauna
Excavation and earthworks	Damage to vegetation and fauna
	Disturbance or damage to Aboriginal and non-Aboriginal Heritage
	Discovery/management of soil or groundwater contamination
	Dust
	Erosion of exposed surfaces
	Pollution to water (watercourses or stormwater)
Stockpiling / spoil management	Damage to vegetation and fauna
	Pollution to water bodies from poor location / erosion / runoff
	Water management and flooding
	Dust
	Inappropriate waste disposal / landfill
	Contamination Amenity of the estuarine/beach environment for water/beach users
Waste Management and Disposal	Aesthetics – litter / debris
	Inappropriate waste disposal / landfill
	Resource use
Dredging	Inappropriate waste disposal
	Pollution to water (watercourses)
	Damage to vegetation and fauna Impacts to recreational uses of area / nuisance
Import of fill material	Introduction of weeds and diseases (phytophthora)

Activity / Aspect	Potential Environmental Issues/Impact to be aware of and manage
	Contamination (imported)
Site / compound establishment	Aesthetics – visually intrusive structures
	Inappropriate waste management, litter
	Access impacts and nuisance to neighbours
	Noise creating nuisance
Dewatering or other discharges/ water released from site	Pollution
	Water management and flooding
	Contamination Damage to vegetation
Management of contaminated or hazardous materials	Pollution to soil or water

A detailed environmental impact assessment has been undertaken which has identified potential impacts of the project on the existing environment and community. The assessment has been undertaken for the broader project site, which includes the entire area presently supporting the Aleppo Pines (*Pinus halepensis*), as opposed to only assessing the area which is proposed to accommodate the solar PV arrays. i.e. the bounds of the environmental impact assessment extends to the northern perimeter of the pine trees, and should therefore not be confused with the actual footprint of the proposed solar PV arrays.

A copy of the environmental impact assessment undertaken by SA Water is included within Appendix E- Environmental Impact Assessment.

In addition to this assessment, it is important to note that a program-wide Construction Environmental Management Plan (CEMP) has been prepared by Enerven (as design and construction partner appointed by SA Water) for the Zero Cost Energy Future project. A copy of this CEMP is included as an attachment within Appendix F – ZCEF Construction Environmental Management Plan (CEMP).

4.3 Site works and Construction

The expected site works will include:

- Removal of existing Aleppo Pines from the area proposed for the installation of solar PV arrays. To be undertaken by ForestrySA (as the owner of the plantation), through liaison with SA Water (to manage interface with ZCEF Project). ForestrySA have secured a customer to take the wood produced from the pines identified for removal.
- Earthworks including minor levelling works and remediation post removal of pines as preparation for panel installation.
- Trenching/ installation of new High-voltage and Low-voltage electrical cabling. This may consist of both aboveground (i.e. within cable support systems) and underground cable routes. Note: 5B design requires minimal trenching.
- Site works will include installation of the framework to support the panel arrays, with a layout, height and configuration similar to that shown in Figures 11 and 14 above. The 5B system does not require percussion piling and thereby minimises potential noise impacts.
- The earth works will include drainage works to manage stormwater run-off, with some upgrades to the existing drainage network potentially required.

- Upgrades will be required of SA Water's electrical infrastructure to facilitate connecting the array to a High Voltage (HV) switchboard.
- All construction work and equipment installation at the site will take approximately 20 weeks. This includes commissioning of the solar plant, which involves connection and testing works. The BESS will be installed post procurement and will take approximately 8 weeks to be installed and tested.

An upgrade to SA Water's security systems are being investigated, however it is expected that the existing perimeter fence which surrounds the Happy Valley Reservoir Reserve will provide the appropriate level of security. Where it is identified that security fencing will be required (additional to that presently in situ), this information will be included within the final Detailed Designs.

4.4 Project Timing

The proposed timing for the installation of the photovoltaic panels at the site is currently being finalised, but will follow the following high level plan:

- Tender Review: October 2018
- Tender Award: November 2018
- Detailed Design: October 2019
- Solar PV Installation and Connection: March – August 2020
- Site Acceptance Tests/Panels Operational: August-September 2020
- Battery Energy Storage Systems (BESS) installation, connection & commissioning: August 2020

4.5 Stakeholder Engagement

Engagement with the local community regarding the Zero Cost Energy Future (ZCEF) project by SA Water and proposed installation of solar PV arrays at Happy Valley Reservoir Reserve commenced in December 2018. The community consultation process has adopted a multi-method approach which includes street corner meetings, public meetings, written communications and a web-based information portal and discussion page (found here: https://watertalks.sawater.com.au/).

In December 2018, SA Water invited residents from approximately 300 properties within the Flagstaff Pines residential development (northeast of the proposed Happy Valley Reservoir Reserve solar PV project site) to attend street corner meetings to discuss the solar panel installation.

Attended by approximately 40 residents; the street corner meetings were an initial opportunity to hear from people living closest to the area proposed for the development. Feedback received from attending residents was summarised and further distributed to local residents, along with invitations to participate in online engagement on the proposal through Water Talks on SA Water's website.

SA Water sought nominations from local residents to establish a Community Reference Group to gain an understanding, and account for the concerns of the local community. The first meeting of the Reference Group was held on 13 March 2019. At the request of the group, engagement was opened up to the broader community, which has thus far included 3 public meetings, site visits, mailouts, notification in local media and signage.

The concerns identified during community consultation has been used to inform the project team and our contractors in developing landscaping plans for the Happy Valley Reservoir Reserve solar panel installation.

It is acknowledged that a range of issues of importance have been reported by the community. The community have expressed a strong preference for the solar panels to be integrated into the current landscape to the fullest extent possible. Initially SA Water presented a landscaping option that included a 10-metre-wide, 2 metre high mound, planted with native species, along Black Road and South Road. Visual impressions were developed utilising several viewpoints. This option was presented to the community at a public meeting on 14 May 2019. Examples of some of the artists impressions developed for this initial landscaping option are provided below;

Facing North Along Black Road

Pine planting with mound

Corner of Black Road and South Road, Facing East South East

Newly planted with mound

Corner of Black Road and South Road, Facing East South East

Alternative planting with mound

Feedback from the community indicated that the proposed landscaping options presented (including varied combinations of vegetation types and mounding) were undesirable and an alternative option showing a greater compromise on behalf of SA Water was requested.

Taking into consideration feedback received from the community, SA Water has proposed an updated landscape design for the site whereby a 40 metre width of ForestrySA Aleppo pine plantation adjacent Black Road would be retained, with additional native plantings behind to provide understory screening and wind protection. The updated landscape design proposal was presented to attendees of the public meeting held on 12 June 2019. After much discussion, the consensus was that the revised landscaping proposal, retaining a portion of the existing pine trees, offered a more acceptable visual outcome to the residents, though a number of residents expressed their preference that the proposed installation of solar PV arrays did not proceed in any form. Participants of the public meeting held 12 June 2019 were invited to attend a site visit to the Happy Valley Water Treatment Plant (WTP) and Forestry SA's Aleppo pine plantation on Saturday 13 July 2019.

SA Water will work closely with ForestrySA to ensure there are clear steps moving forward to ensure the 40m wide buffer of Aleppo pines can be suitably retained and maintained. Additional native plantings will be established nearer to the solar installation to provide understory screening. SA Water will continue to work with the community to further develop landscape designs for the proposed development to minimise the impact to visual amenity from the solar installation.

5 Procedural Matters

5.1 Relevant authority

The Minister for Planning is the relevant authority for Crown Development, taking advice from the State Commission Assessment Panel (SCAP).

5.2 Nature of development

The nature of the development is best described as an electricity generating plant in the form of a solar PV installation and battery storage facility with a generating capacity of more than five megawatts.

Electricity generating stations are not listed as either complying or non-complying forms of development within the Open Space Zone.

SA Water has obtained a broad approval for the Zero Cost Energy Future project from the Office of the Technical Regulator (OTR). A copy of the OTR's advice is provided in Appendix D.

5.3 Referral bodies

Pursuant to Section 49(4a) of the *Development Act 1993*, SCAP must provide notice of the Crown Development Application to the City of Onkaparinga.

Having regard to Schedule 8 of the *Development Regulations 2008,* it is acknowledged that while the proposed development is adjacent to both a Primary Arterial Road (Main South Road, to the west) and a Secondary Arterial Road (Black Road, to the north), the proposal is expected to utilise the existing access arrangement and does not propose the alteration to an existing access or creation of a new access. Having regard to the relevant maps and overlays within the City of Onkaparinga Development Plan, the subject land does not appear to be affected by any future road widening plan. Therefore, it is our consideration that Table item 3 of Schedule 8 does not apply to the proposed development and a referral to the Commissioner of Highways is not required.

In addition, the broader Happy Valley Reservoir Reserve landholding contains sites forming part of the State Heritage listing '*Happy Valley Reservoir (Dam Wall and Towers)*' – State Heritage ID 12710. It is acknowledged that the individual structures forming part of this listing are each located within allotments that are separate to those in the north-western portion of the Happy Valley Reservoir Reserve landholding where the proposed development is to be sited. Furthermore, the proposed development is positioned a significant distance from the listed items and would not be visible from the items due to the presence of mature vegetation. Accordingly, it is our view that Table item 5 (1) of Schedule 8 does not apply, and therefore a referral is not required to the relevant Minister administering the *Heritage Places Act 1993*.

In summary, after having regard to all relevant sections of the Table within Schedule 8 of the *Development Regulations 2008* we do not consider that the proposed development requires referral to any State Agencies.

5.4 Public notification

The cost of the proposed development is more than $4 million; as such formal public notification of this Crown Development Application is required.

Additionally, as detailed within Section 4.5, SA Water has undertaken extensive engagement with surrounding residents and the broader community. This has included public meetings, mail outs and web based communications. SA Water will continue to work closely with the local residents to ensure they are made aware of major milestones of the Development Assessment process and so that they can help guide continued efforts in finalising the Detailed Designs.

Details of the proposed solar PV installation, as well as the broader objectives of SA Water's Zero Cost Energy Future will be provided to the City of Onkaparinga council in parallel to the Development Application lodgement. Continued correspondence between Aurecon (on behalf of SA Water) will be maintained throughout the development process to ensure City of Onkaparinga are made aware of any important milestones, and so that we can more readily address any items raised by Council staff.

The proposed construction work for the broader project has potential to cause temporary disturbances to adjacent land uses. The Stakeholder Engagement Team will ensure that consultation is ongoing throughout design and construction to minimise any impacts. Construction will be carefully managed to ensure any potential impacts to the rural residential properties nearby are mitigated.

6 Planning Assessment

The site of the proposed development is located within the City of Onkaparinga council area. Accordingly, Onkaparinga Council Development Plan (consolidated 20 December 2018) is the relevant Development Plan. As delineated within the Development Plan, the proposal is positioned entirely within the Open Space Zone.

Table 2, below, outlines the objectives and principles of development control considered to be relevant to the assessment of the proposed development. These reflect items within the General Section of the Development Plan, as well as those appearing within the relevant Zone and Policy Area provisions.

Table 2. Relevant Development Plan Provisions

Zone Specific		
Open Space Zone	Objectives	1,6, 8
	Principles of Development Control	3, 7, 8, 9, 10, 12, 25, 29, 30

Council Wide		
	Objectives	**Principles of Development Control**
Design and Appearance	1, 2	5, 15, 22
Energy Efficiency	1, 2	1, 3, 4
Hazards	1, 2, 4, 5, 7	1, 3, 4, 7, 8, 9, 10, 13
Infrastructure	1, 2, 3,	1, 3, 5, 9, 10, 11, 12, 17
Interface between Land Uses	1, 2, 3	1, 2, 3, 6
Orderly and Sustainable Development	1, 2, 3, 4, 5	1, 6, 8
Renewable Energy Facilities	1, 2, 3	1
Siting and Visibility	1	1, 5, 8, 9
Transportation and Access	2	2, 8, 14, 22, 23, 24, 27, 29

6.1 Land Use

The Open Space Zone envisages a setting in which open space character is preserved, providing a visual contrast to the surrounding urban area through both natural and landscaped environments. It recognises the importance of maintaining natural ecosystems and their vital roles in the areas of biodiversity, water filtration, aquifer recharge and wildlife protection. While the Zone's desired character is predominantly for the retention of natural areas, it recognises the occasional need for a carefully managed departure from this state. The removal of vegetation to allow for the proposed development is expected to be limited to the plantations of introduced Aleppo Pine (*Pinus halepensis*). The installation of the proposed solar PV infrastructure is not expected to impact the wider locality of the Open Space Zone, including the passive and active recreational land uses surrounding the Happy Valley Reservoir Reserve.

While solar PV installations are not specifically listed as an envisaged use for the zone, the proposed development is directly supportive of the continued use of this land for water storage and treatment for the provision of water supply to Metropolitan Adelaide. The proposal has been carefully sited and designed to ensure that it minimises impact upon existing and future planned operations within the Happy Valley Reservoir Reserve, and has also been designed to ensure maximum energy generating capacity is achieved, thereby solidifying its important functionality to the existing land use. Once operational, the solar PV infrastructure will deliver significant and immediate benefit to the Happy Valley Reservoir by reducing operational costs and allowing for greater security in the provision of ongoing reliable power.

6.2 Design and Appearance

The proposed layout and design of the solar PV installation at Happy Valley Reservoir Reserve has incorporated concerted efforts to ensure the proposed development will preserve existing levels of visual amenity as far as practicable. The particular elements which achieve this include;

- The uptake of a unique solar PV technology type (5B) which achieves a significantly less obtrusive visual profile than conventional solar PV array types. The 5B design allows for a maximum above ground height of approximately 1m, whereas a typical (SAT) array can reach 3.8m in height;
- The consistent orientation and spacing of the 5B arrays in a concertina formation, allowing for a coordinated appearance;
- Retainment of a 40m wide portion of Aleppo Pines (by the direct request of the 'Flagstaff Pines' residents), measured from the northern perimeter of the plantation southward;
- Allowance for appropriate setbacks and the establishment of native vegetation planted buffers for additional visual screening along the northern and western boundaries of the array footprint;
- Careful placement of ancillary infrastructure (including BESS and inverter shelters) away from the development perimeters and towards the interior of the land holding to reduce visual impact; and
- The use of existing security fencing around the Happy Valley Reservoir Reserve perimeter to avoid the need for further security fencing to be installed.

6.3 Hazards

The proposed development is not located within an area identified as susceptible to flooding, as prescribed within the applicable Overlay Maps- Development Constraints of the Onkaparinga Council Development Plan (consolidated 20 December 2018). However, it is positioned within an area identified as a High Bushfire Risk as per the Bushfire Protection Area BPA Map Onka/2 – Bushfire Risk.

For all of its major landholdings, SA Water has detailed Fire Management Plans which accompany their Land Management Plans. The Fire Management Plans use a risk assessment methodology consistent with the Australian and New Zealand Standard AS/NZS 4360 for Risk Management to determine appropriate mitigation strategies within each reserve. Fire Management Plans include a detailed Works Programme and Annual Bushfire Preparedness checklist which is audited annually to ensure SA Water is effectively managing its fire risk. In addition, the proposed development is not a habitable building, will not store hazardous materials and is surrounded by permeable fencing, reducing the risk of trapping debris. The proposed development is considered to be consistent with the Minister's Code: Undertaking development in Bushfire Protection Areas.

A detailed stormwater and site hydrology assessment will be undertaken by SA Waters construction partner as part of the Detailed Design work to ensure that any alteration to existing site hydrology resulting from the proposed development will be appropriately managed.

6.4 Interface between land uses

The proposed development has been situated within land that is currently vacant of built form. The chosen location allows for significant separation from sensitive land uses and residential land uses. The development is designed and located to minimise the potential for adverse impact upon the existing amenity within this locality and to support the continued operation of desired land uses.

The potential for adverse impacts upon the surrounding locality is minimised through the relatively inoffensive nature of the development, which requires little ongoing maintenance and operational activities. The greatest potential for adverse impacts such as noise and dust nuisance are largely limited to that associated with the construction period.

The project will involve a range of construction activities that will generate noise. Such noise sources include construction vehicle movements and activities (i.e. light vehicles, generators, and delivery of materials and general traffic). Impacts to adjacent residents associated with noise during construction will be temporary and unlikely to be significant provided controls are in place, including:

- Construction activities should be in accordance with the EPA Construction Noise Information Sheet (EPA 425/10):
  - 7.00 a.m. to 7.00 p.m. Monday to Saturday inclusive; and
  - 9.00 a.m. to 5.00 p.m. on Sundays and public holidays (only where required).
- All construction traffic movement will be undertaken at speeds typically 25-40 km/h, the use of exhaust breaks will be minimised where safe to do so.
- Further, all plant and equipment required to be maintained in good order to meet the stringent noise pollution requirements including appropriate mufflers, silencers and/or enclosures fitted.

Some localised dust may be generated as a result of the construction works, including within disturbed areas and access tracks. Impacts associated with dust will be short term and managed through the Contractor's Environmental Management Plan.

6.5 Natural Resources

The proposed development has sought a position which avoids disturbance to areas of native vegetation present in the broader landholding. A detailed environmental impact assessment has been undertaken for the proposed development and surrounding project site and is included within Appendix E - Environmental Impact Assessment.

SA Water understands the importance of managing water quality impacts both during construction and on an on-going basis. This understanding is integrated into the Corporate Project Management Methodology as well as within CEMP documents. The proposed development will require a detailed hydrology assessment to ensure that stormwater run-off can be appropriately managed and existing infrastructure can be utilised where possible. Acknowledging the presence of the Happy Valley Reservoir waterbody approximately 1.2km to the southeast of the proposal, and given also the sloped terrain which extends south of the project site, the proposal shall be constructed and managed to retain as much stormwater as possible onsite and minimise impact on the surrounding landscape and natural resources.

SA Water will ensure that the successful contractor will appropriately manage stormwater during the construction phase in accordance with the CEMP. A Soil Erosion and Drainage Management Plan will be developed by the Construction Contractor to ensure spoil is managed appropriately in accordance with the *Stormwater Pollution Prevention Code of Practice for Local, State and Federal Government.*

6.6 Transportation and Access

The existing Happy Valley Reservoir Reserve and Water Treatment Plant is accessible via multiple gateways, with the nearest to the proposed development being located off Black Road at the northern perimeter of the subject land. A gravel roadway extends southward from this gateway, presently allowing for vehicles to enter and exit SA Water land in a forward direction. The proposed development area, which currently supports a ForestrySA pine plantation, is well serviced by an extensive network of gravel sealed access tracks. The proposed layout and placement of the solar arrays and associated infrastructure will seek to avoid existing access ways so that present vehicle movements are maintained and so that the development will be easily accessible throughout the construction phase and for ongoing management. Ongoing access throughout the life of the solar infrastructure will be limited to any required maintenance/ replacement or cleaning of the panels and other equipment and is expected to be of relatively low frequency.

SA Water understand the importance of minimising the interruption to local traffic movements during the delivery and installation of the solar PV panels and associated components. This requirement has been integrated into the Project Management Methodology. Accordingly, SA Water propose to implement temporary traffic management controls in accordance with relevant Australian Standards and commit to appropriate refurbishment of the roadside infrastructure post the construction period where this is required. Greater detail surrounding this approach will be available through consultation with the construction partner, and can be included within Detailed Designs and associated Traffic Management Plans.

7 Conclusion

The proposed installation of solar PV arrays at key SA Water operating sites, such as the Happy Valley Reservoir Reserve and Water Treatment Plant, will immediately reduce the operating energy costs for the site and reduce SA Water's exposure to increases in electricity costs. It supports the continued operations of this important site of public infrastructure, which further supports the City of Onkaparinga Region and the Greater Metropolitan Adelaide region.

The proposed development is well separated from sensitive land uses, and will not conflict with the ongoing operations at Happy Valley Reservoir Reserve, but will instead directly contribute to increased energy efficiency for such operations. The proposal is also considered to have appropriately mitigated against potential impacts to adjoining land uses. This has been ensured through the adoption of a unique solar PV technology type, retainment of existing pines to function as a buffer and the provision of additional landscaping utilising appropriate native vegetation species.

The development has been designed to minimise longer term impacts, although it is recognised that short term impacts will occur during the construction period. These impacts will be appropriately managed throughout the construction period in accordance with the CEMP developed by Enerven (as SA Water's construction and design partner) for the Zero Cost Energy Future project.

The proposed development **is not** seriously at variance with the City of Onkaparinga Development Plan, being generally consistent with the intent of the Open Space Zone and relevant Council Wide provisions, and merits the approval of the Minister for Planning.

Appendix A Certificate of Title

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 5412 Folio 953

Parent Title(s) CT 4397/469

Creating Dealing(s) CONVERTED TITLE

Title Issued 16/04/1997 **Edition** 2 **Edition Issued** 05/11/1997

Estate Type

FEE SIMPLE

Registered Proprietor

SOUTH AUSTRALIAN WATER CORPORATION
OF ADELAIDE SA 5000

Description of Land

SECTION 74
HUNDRED OF NOARLUNGA
IN THE AREA NAMED HAPPY VALLEY

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED B AND A TO THE ETSA CORPORATION (V 3983811 AND TG 6651919 RESPECTIVELY)

Schedule of Dealings

NIL

Notations

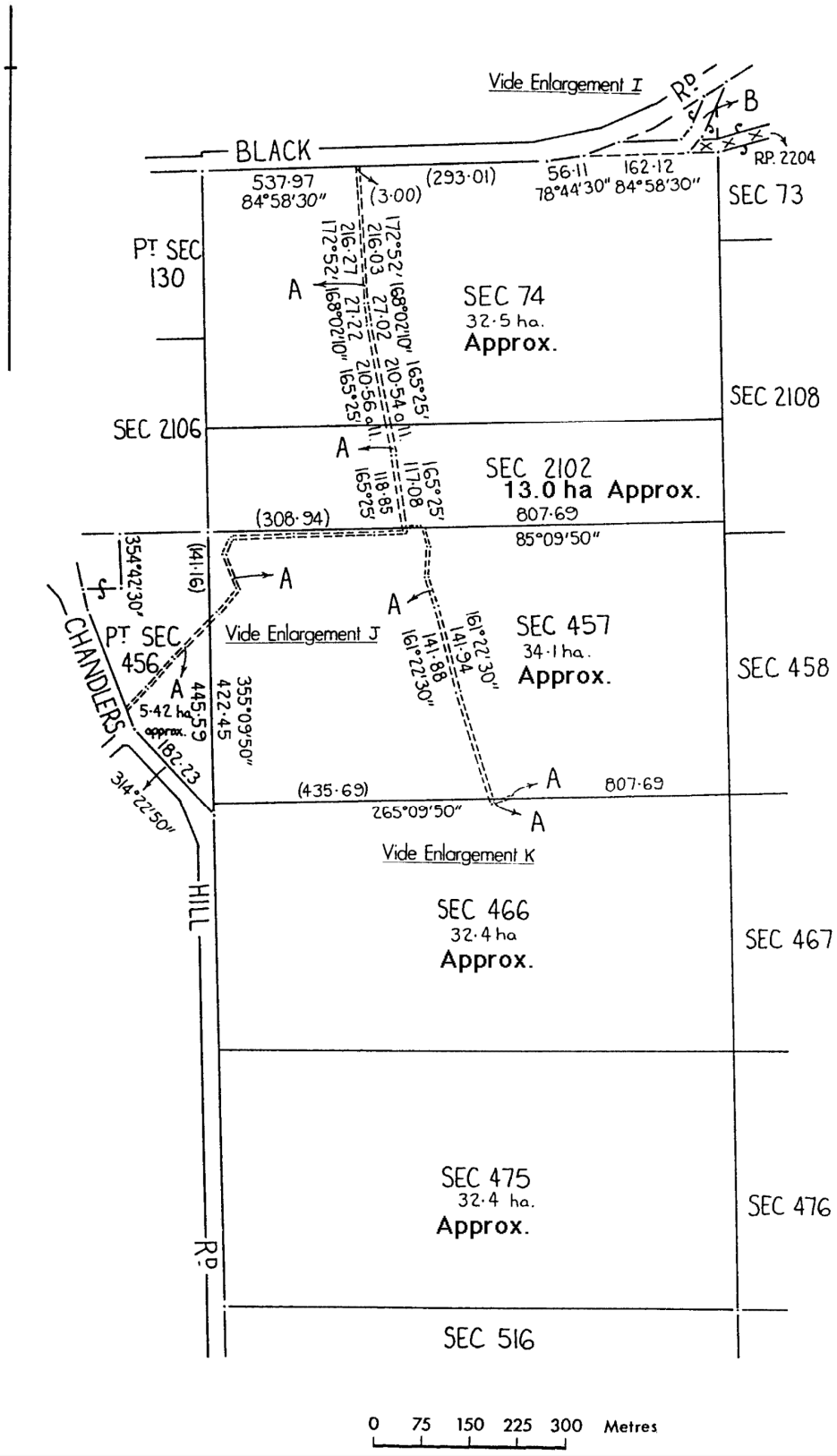
Dealings Affecting Title NIL

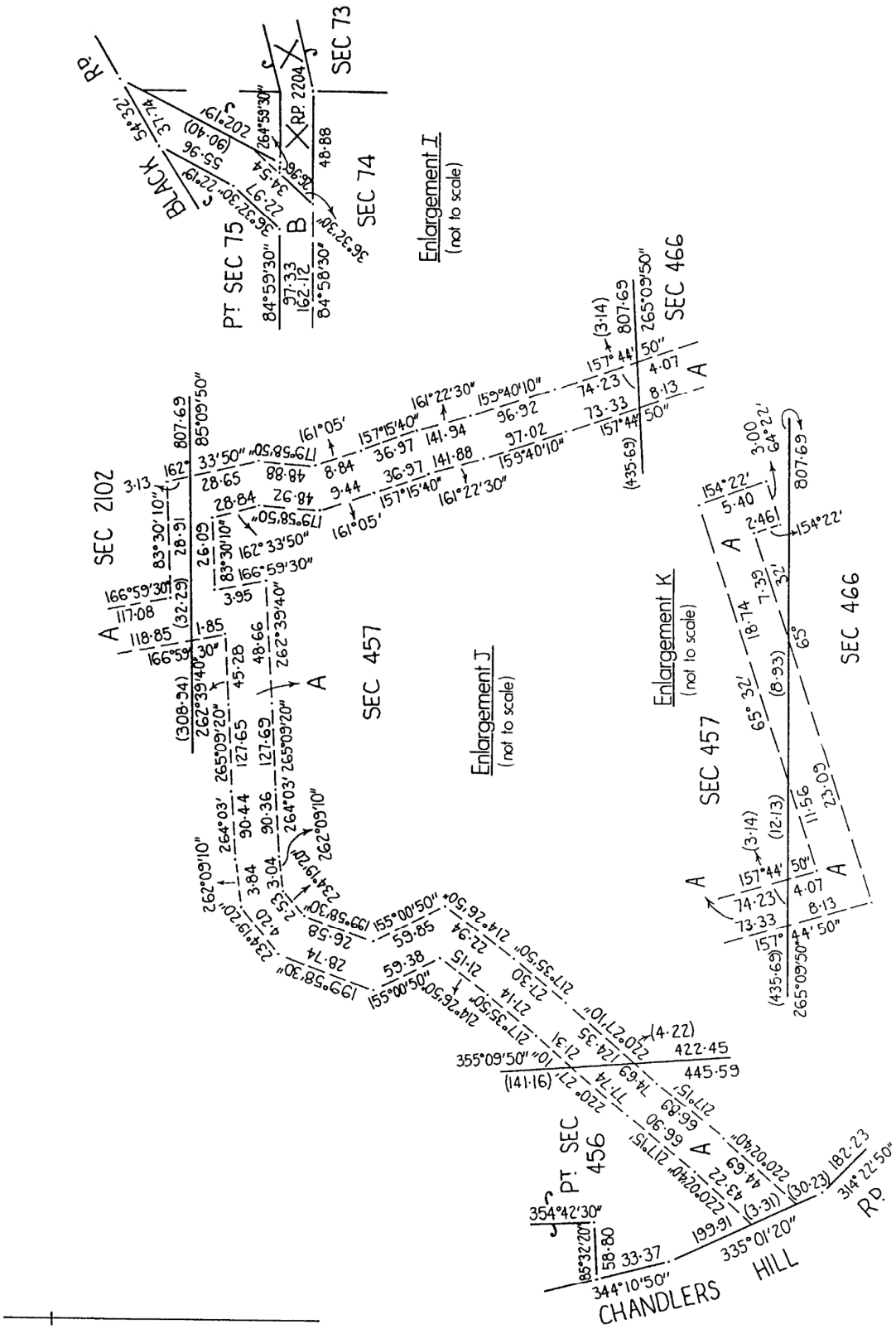
Priority Notices NIL

Notations on Plan NIL

Registrar-General's Notes NIL

Administrative Interests NIL





LAND SERVICES SA

Product	Register Search (CT 5412/975)
Date/Time	05/08/2019 05:32PM

REAL PROPERTY ACT, 1886 South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 5412 Folio 975

Parent Title(s)	CT 3885/44				
Creating Dealing(s)	CONVERTED TITLE				
Title Issued	16/04/1997	**Edition**	2	**Edition Issued**	05/11/1997

Estate Type

FEE SIMPLE

Registered Proprietor

SOUTH AUSTRALIAN WATER CORPORATION
OF ADELAIDE SA 5000

Description of Land

ALLOTMENT 94 FILED PLAN 205351
IN THE AREA NAMED HAPPY VALLEY
HUNDRED OF NOARLUNGA

Easements

NIL

Schedule of Dealings

NIL

Notations

Dealings Affecting Title NIL

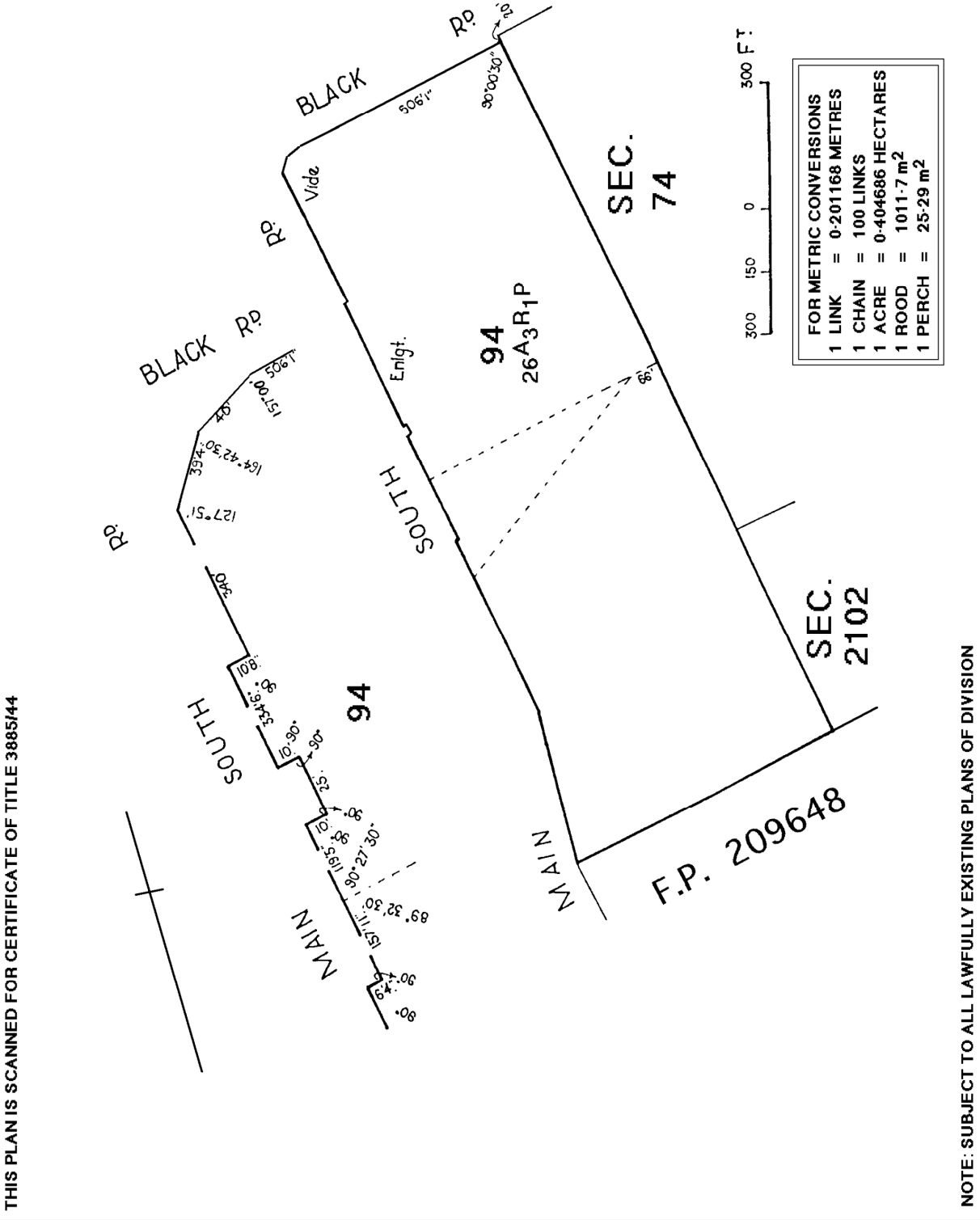
Priority Notices NIL

Notations on Plan NIL

Registrar-General's Notes

CONTROLLED ACCESS ROAD VIDE PLAN 16

Administrative Interests NIL



THIS PLAN IS SCANNED FOR CERTIFICATE OF TITLE 3885/44

NOTE: SUBJECT TO ALL LAWFULLY EXISTING PLANS OF DIVISION

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 5516 Folio 144

Parent Title(s) CT 5468/26

Creating Dealing(s) RT 8448961

Title Issued 19/03/1998 **Edition** 1 **Edition Issued** 19/03/1998

Estate Type

FEE SIMPLE

Registered Proprietor

SOUTH AUSTRALIAN WATER CORPORATION
OF ADELAIDE SA 5000

Description of Land

ALLOTMENT 92 FILED PLAN 209648
IN THE AREA NAMED HAPPY VALLEY
HUNDRED OF NOARLUNGA

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO THE ETSA CORPORATION (TG 6651919)

Schedule of Dealings

NIL

Notations

Dealings Affecting Title NIL

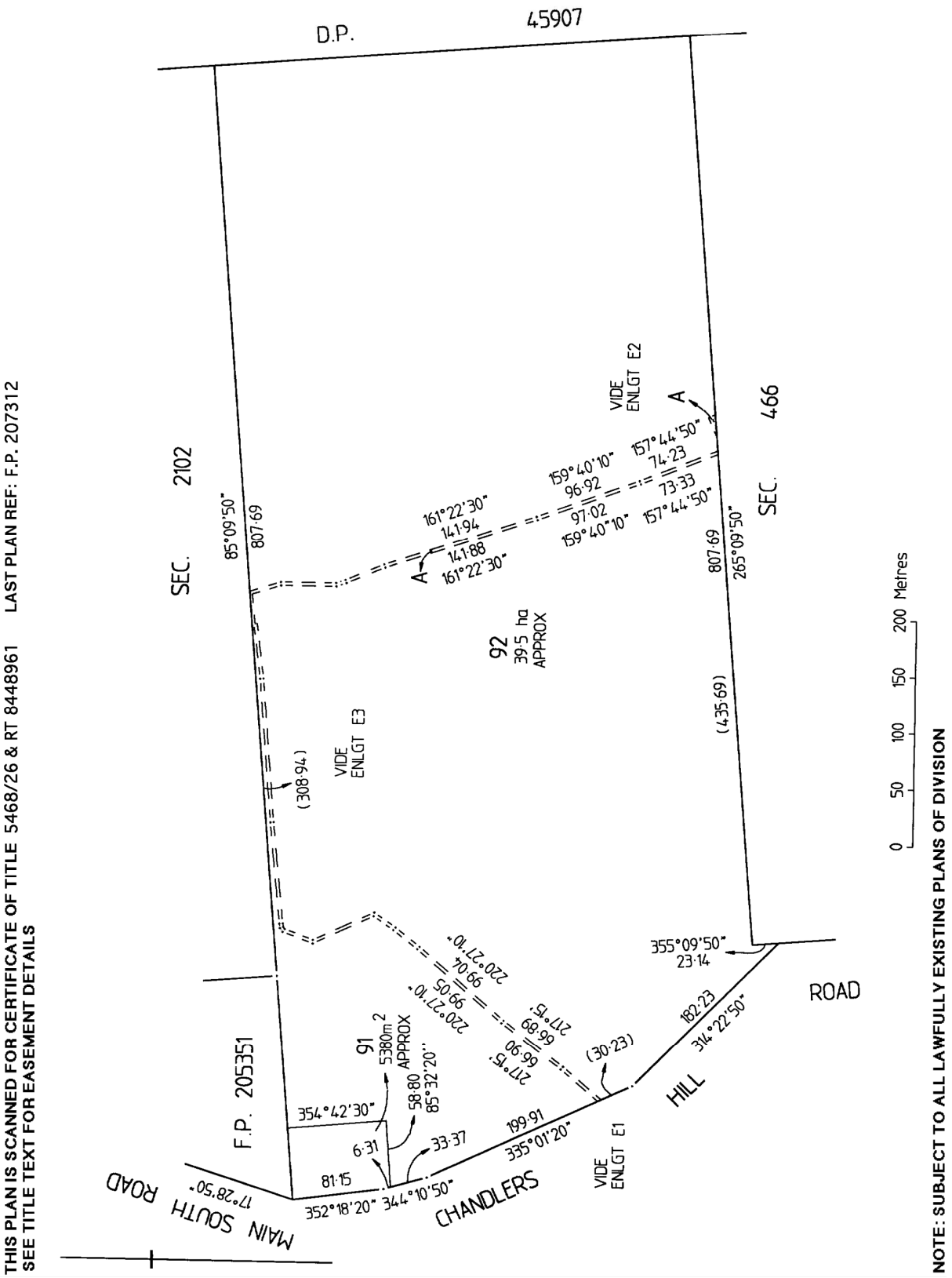
Priority Notices NIL

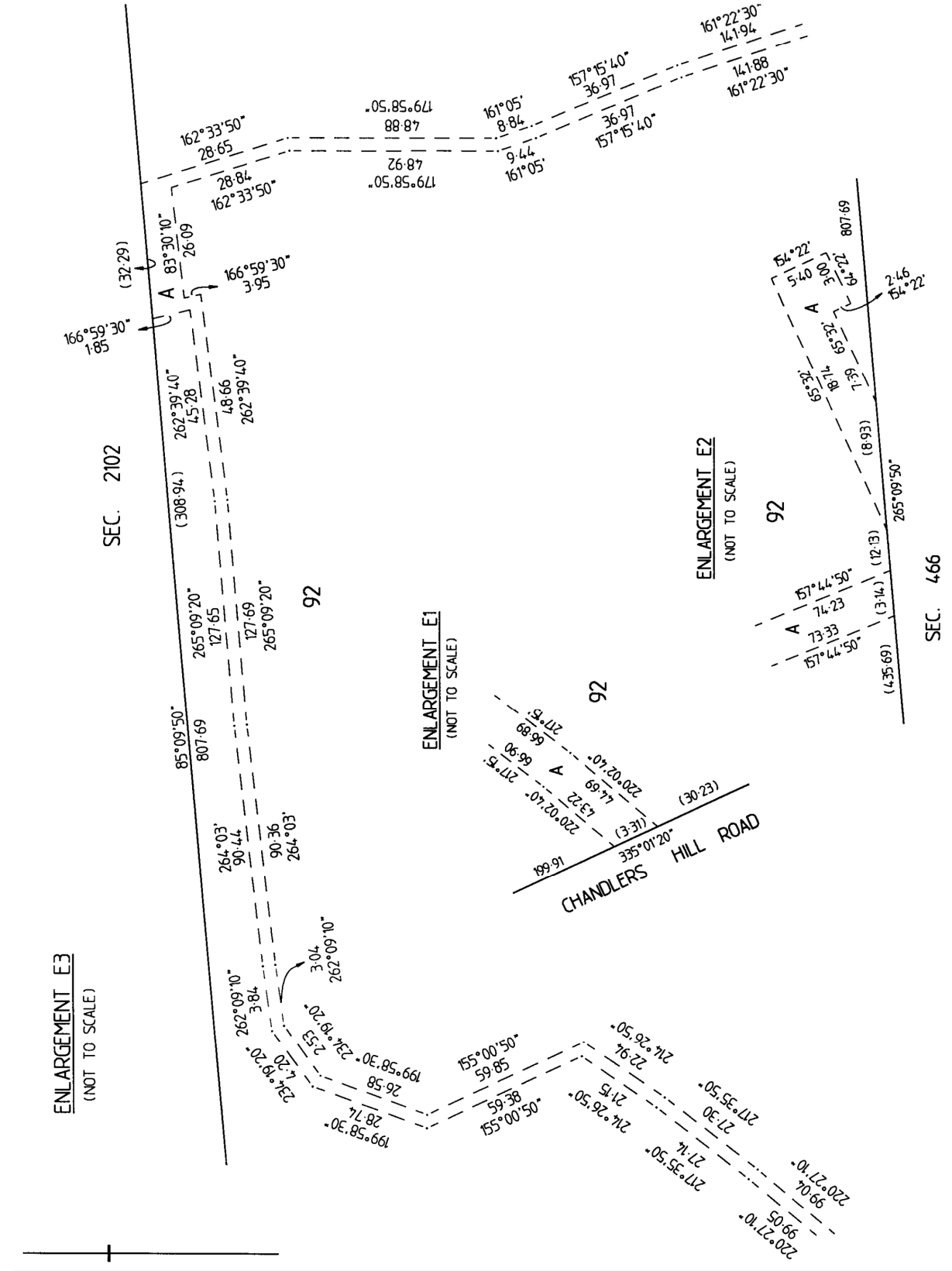
Notations on Plan NIL

Registrar-General's Notes

CONTROLLED ACCESS ROAD VIDE PLAN 34
APPROVED FX26559

Administrative Interests NIL





REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 6089 Folio 962

Parent Title(s) CT 5402/991

Creating Dealing(s) TG 11671264

Title Issued 25/01/2012 **Edition** 1 **Edition Issued** 25/01/2012

Estate Type

FEE SIMPLE

Registered Proprietor

SOUTH AUSTRALIAN WATER CORPORATION
OF ADELAIDE SA 5000

Description of Land

SECTIONS 466 AND 475
HUNDRED OF NOARLUNGA
IN THE AREA NAMED HAPPY VALLEY

Easements

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED A TO DISTRIBUTION LESSOR CORPORATION (SUBJECT TO LEASE 8890000) (TG 6651919)

SUBJECT TO EASEMENT(S) OVER THE LAND MARKED B (TG 11671264)

Schedule of Dealings

NIL

Notations

Dealings Affecting Title NIL

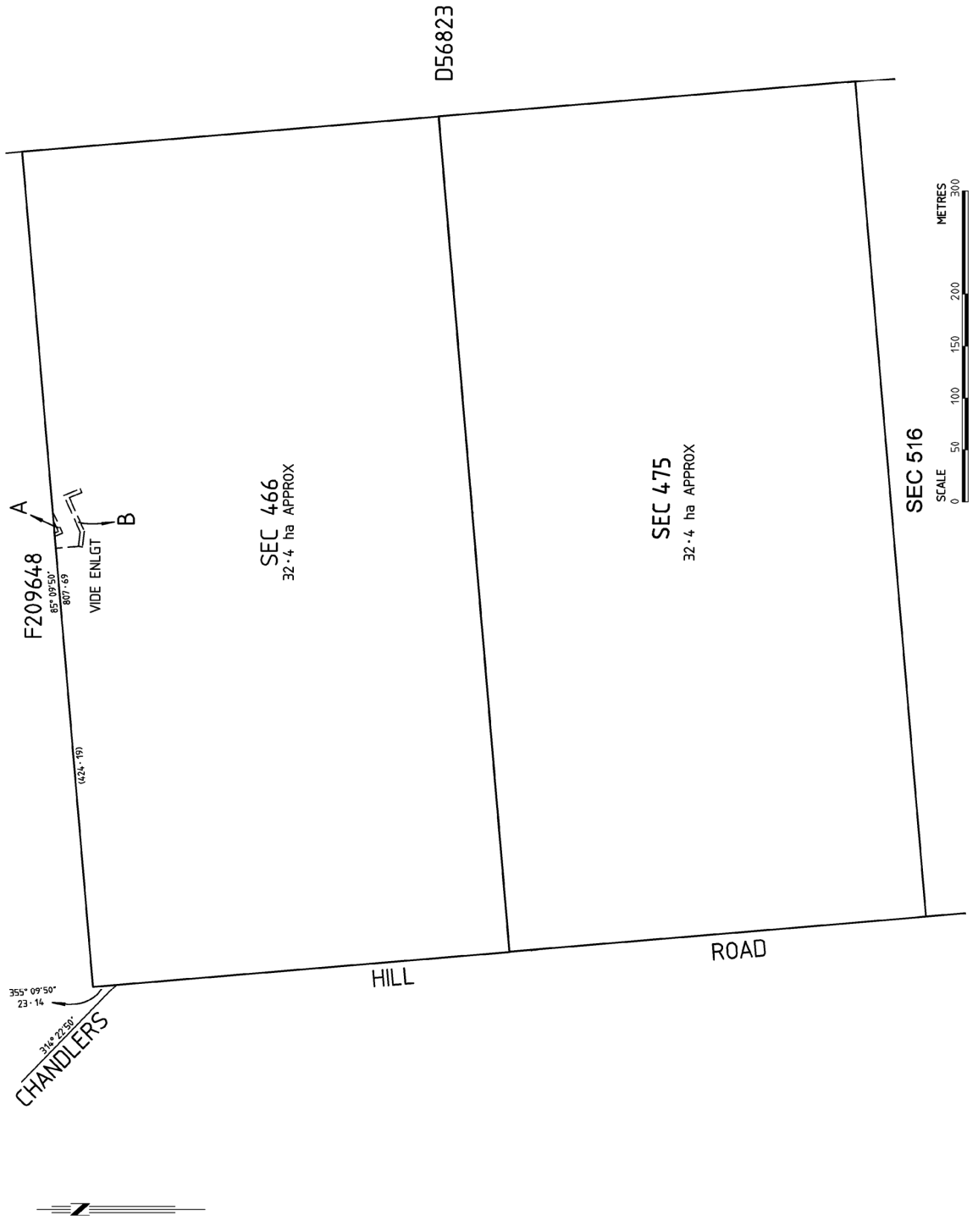
Priority Notices NIL

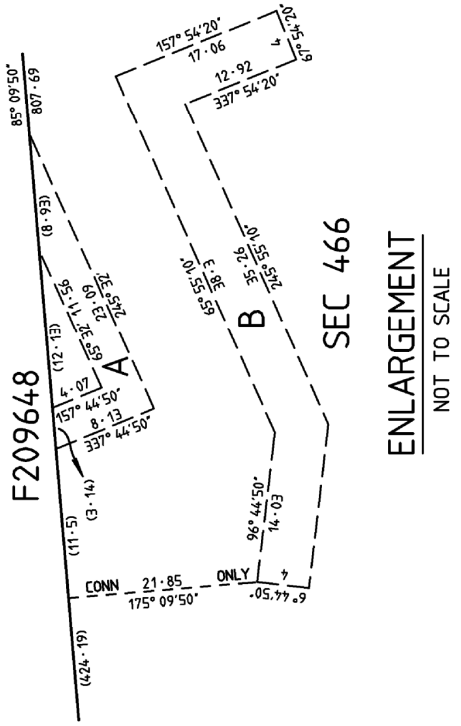
Notations on Plan NIL

Registrar-General's Notes NIL

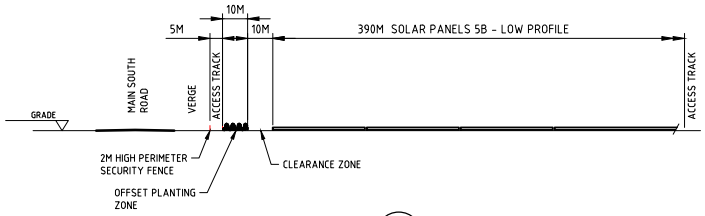
Administrative Interests

CONFIRMED IN SA HERITAGE REGISTER 08/11/1984

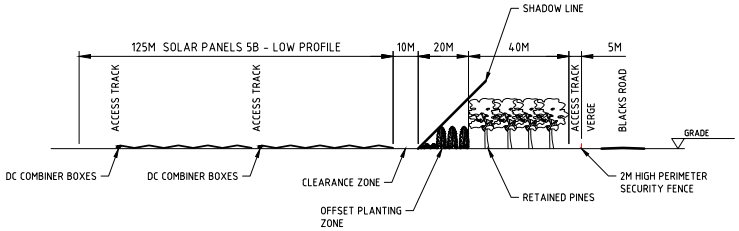




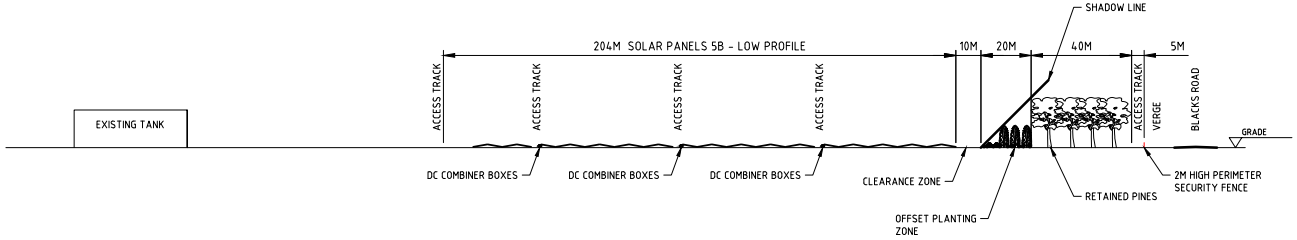
Appendix B Design Drawings



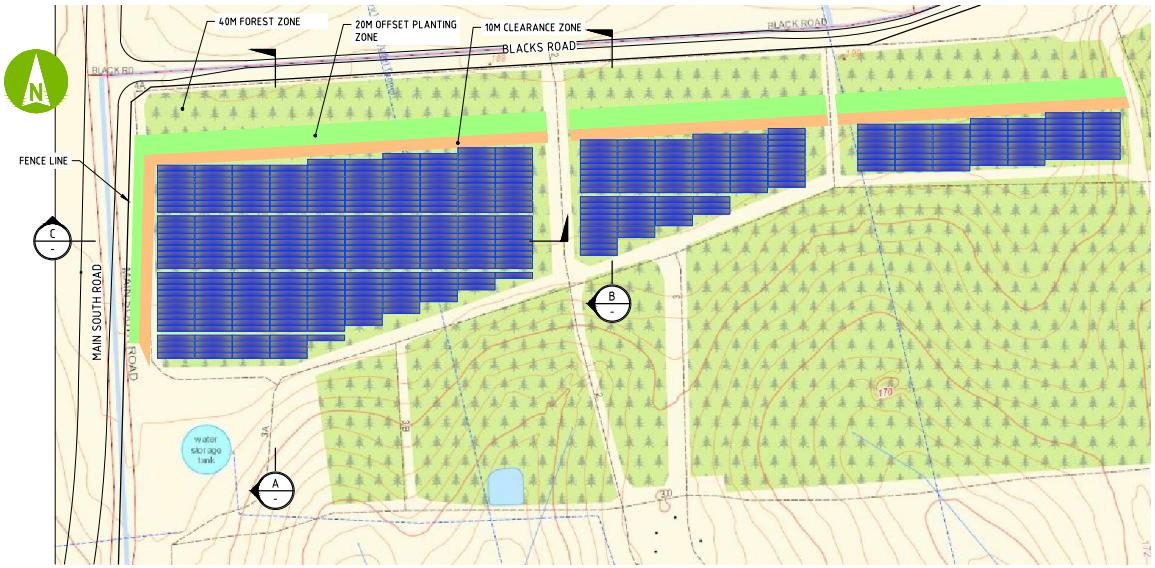
SECTION C
1:1000



SECTION B
1:1000



SECTION A
1:1000



PLAN VIEW
SCALE N.T.S

NOTES:
1. THIS DRAWING TO BE READ IN CONJUCTION WITH 5BD00777 - LAYOUT- MAX CAPACITY
2. ALL DIMENSIONS SHOWN ARE APPROXIMATE.

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

REVISION PANEL

REV	DATE	DRN	DETAILS	APR'D
D	18/07/19	CT	ISSUED FOR INTERNAL REVIEW	
C	12/07/19	CT	ISSUED FOR INTERNAL REVIEW	
B	09/07/19	CT	ISSUED FOR INTERNAL REVIEW	
A	04/07/19	CT	ISSUED FOR INTERNAL REVIEW	

CURRENT REV CONTRACTOR: CURRENT REV PROJECT:

CURRENT REV AUTHORISED
SIGNATURE

DESIGN PANEL

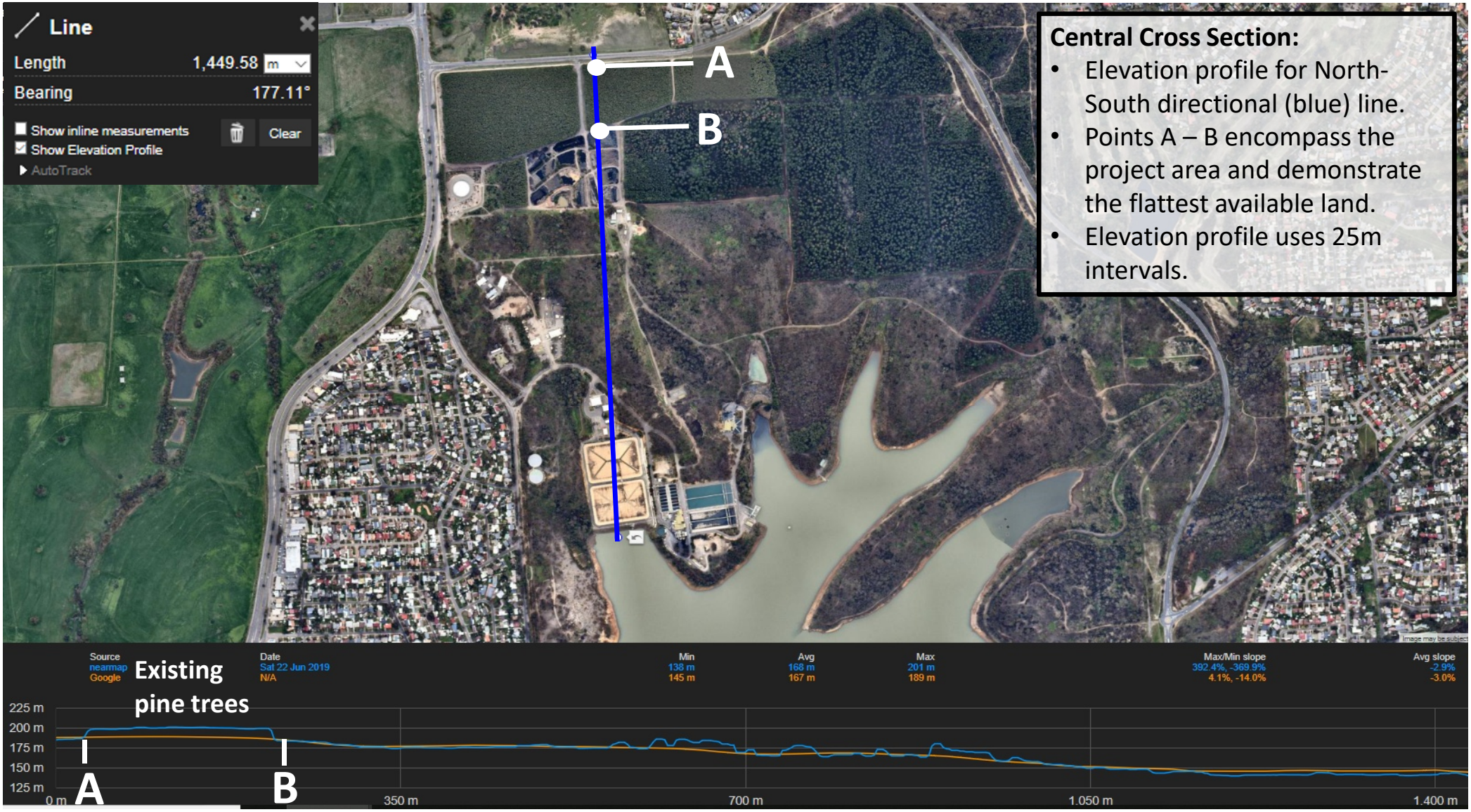
DESIGNED	AUTHORISED
DRAWN	SIGNATURE
REVIEWED	
CONTRACTOR:	

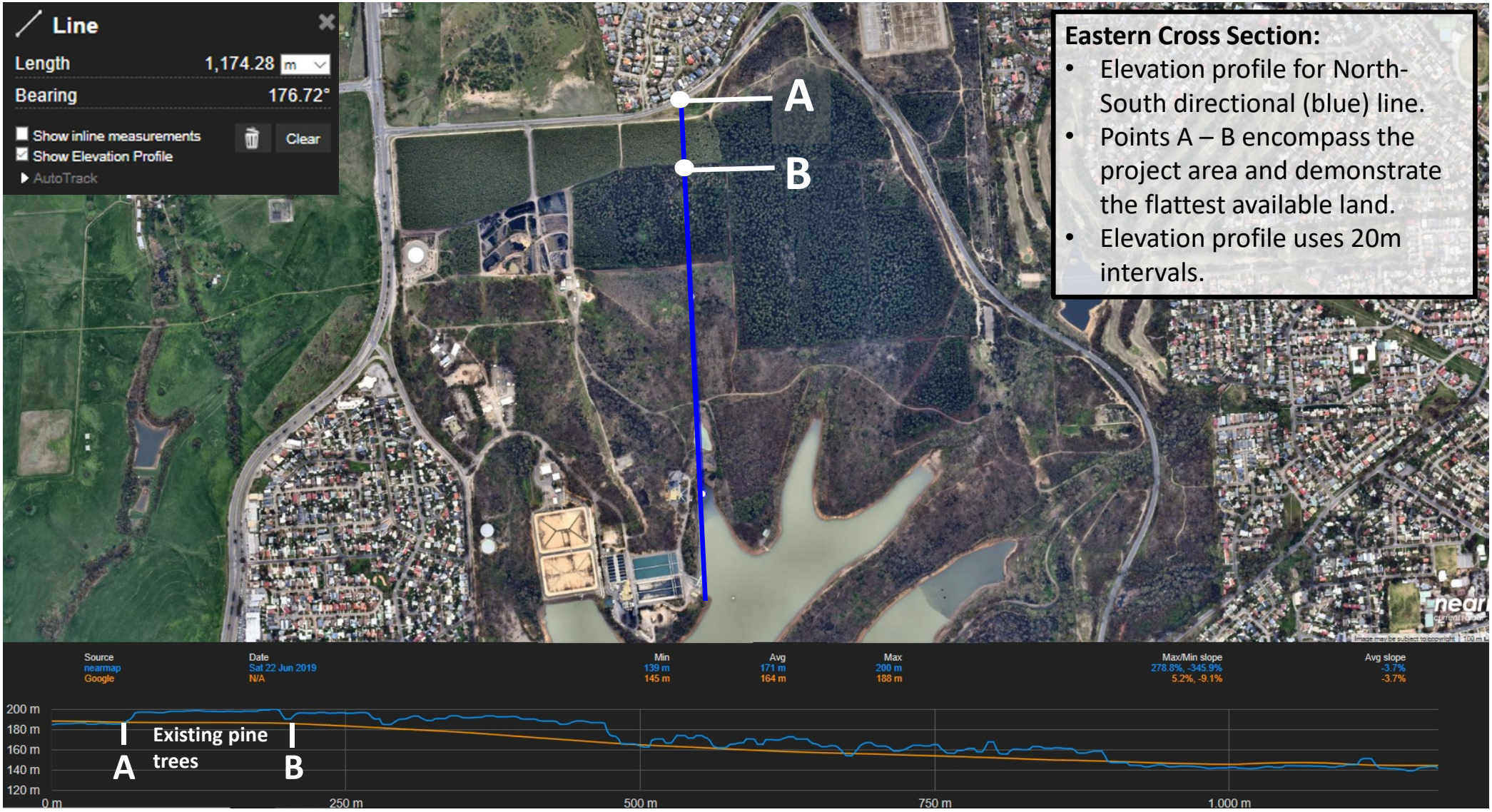
HAPPY VALLEY WATER TREATMENT PLANT

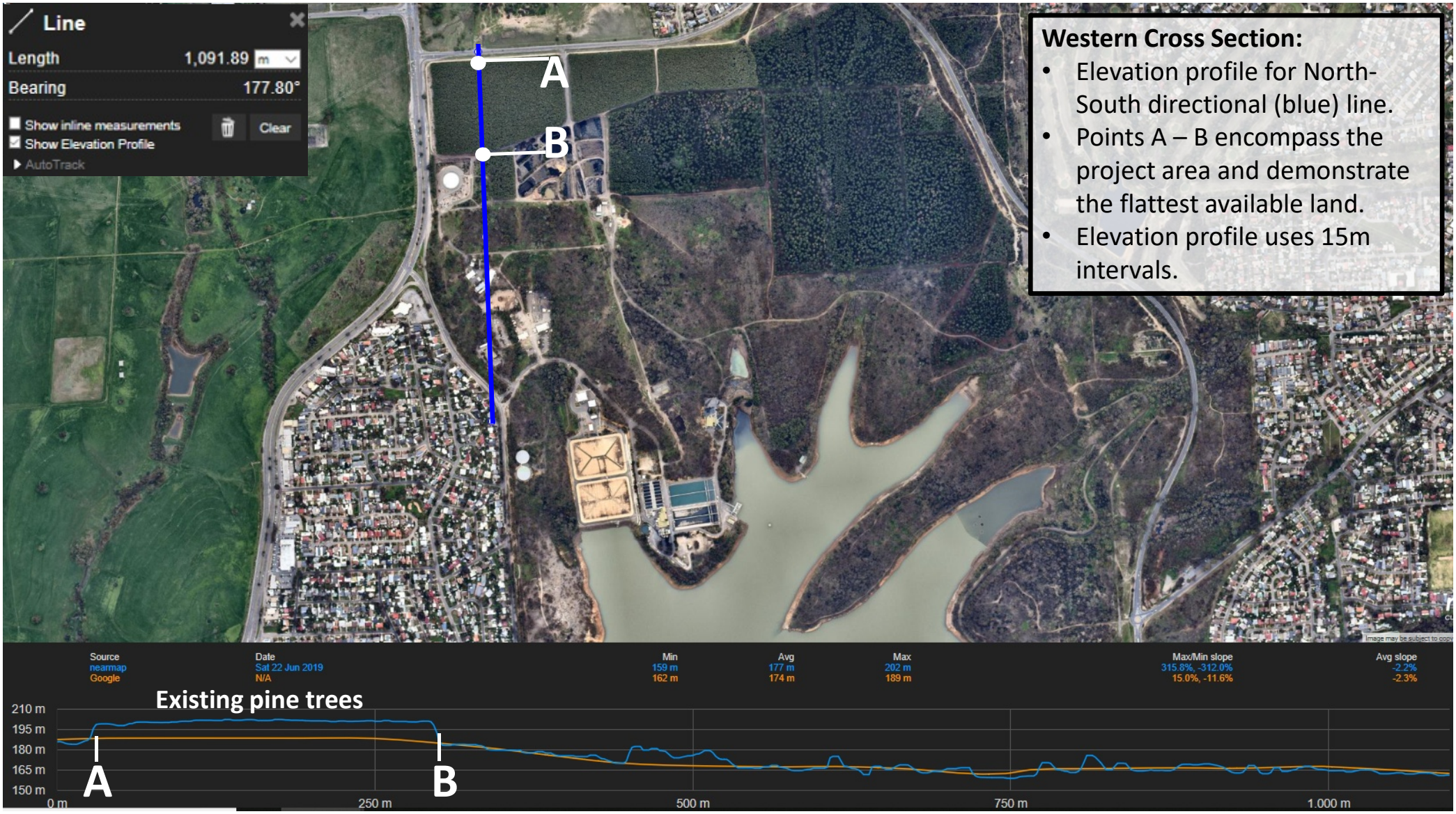
5B - LOW PROFILE SOLAR PANELS
SECTIONS

A1 SHT SIZE	TOTAL SHEETS:
	PROJECT No:
D REVISION	
MAXIMO ID: HAVWTP	
SUPERSEDES:	
DRAWING NUMBER	503097-GE-SKT-1000

Appendix C – Terrain Cross Sections


Line
Length 1,449.58 m
Bearing 177.11°
Show inline measurements
Show Elevation Profile
AutoTrack
Clear
A
B
Central Cross Section:
• Elevation profile for North-South directional (blue) line.
• Points A – B encompass the project area and demonstrate the flattest available land.
• Elevation profile uses 25m intervals.
Source
nearmap
Google
Date
Sat 22 Jun 2019
N/A
Min
138 m
145 m
Avg
168 m
167 m
Max
201 m
189 m
Max/Min slope
392.4%, -369.9%
4.1%, -14.0%
Avg slope
-2.9%
-3.0%
Existing pine trees
225 m
200 m
175 m
150 m
125 m
A
B
0 m
350 m
700 m
1.050 m
1.400 m


Line
Length 1,174.28 m
Bearing 176.72°
Show inline measurements
Show Elevation Profile
AutoTrack
Clear
A
B
Eastern Cross Section:
• Elevation profile for North-South directional (blue) line.
• Points A – B encompass the project area and demonstrate the flattest available land.
• Elevation profile uses 20m intervals.
Source nearmap Google
Date Sat 22 Jun 2019 N/A
Min 139 m 145 m
Avg 171 m 164 m
Max 200 m 188 m
Max/Min slope 278.8%, -345.9% 5.2%, -9.1%
Avg slope -3.7% -3.7%
200 m
180 m
160 m
140 m
120 m
Existing pine trees
A
B
0 m
250 m
500 m
750 m
1,000 m


Line
Length 1,091.89 m
Bearing 177.80°
Show inline measurements
Show Elevation Profile
AutoTrack
Clear
A
B
Western Cross Section:
• Elevation profile for North-South directional (blue) line.
• Points A – B encompass the project area and demonstrate the flattest available land.
• Elevation profile uses 15m intervals.
Source
nearmap
Google
Date
Sat 22 Jun 2019
N/A
Min
159 m
162 m
Avg
177 m
174 m
Max
202 m
189 m
Max/Min slope
315.8%, -312.0%
15.0%, -11.6%
Avg slope
-2.2%
-2.3%
Existing pine trees
210 m
195 m
180 m
165 m
150 m
A
B
0 m
250 m
500 m
750 m
1.000 m

Appendix D Office of the Technical Regulator (OTR) Certificate

Government of South Australia
Department for Energy and Mining

Ref: 2017/01873.01 D18133459

Energy and Technical Regulation

Office of the Technical Regulator

Level 8, 11 Waymouth Street
Adelaide SA 5000

GPO Box 320
Adelaide SA 5001

Telephone: 08 8226 5500
Facsimile: 08 8226 5866

www.sa.gov.au/otr

15 October 2018

Paul Cooledge
SA Water
250 Victoria Square
Adelaide SA 5000
By email: paul.cooledge@sawater.com.au

Dear Michael,

RE: CERTIFICATE FOR DEVELOPMENT OF THE SA WATER ZERO COST ENERGY FUTURE PROJECT

The development of the SA Water Zero Cost Energy Future Project has been assessed by the Office of the Technical Regulator (OTR) under Section 37 of the Development Act 1993.

Regulation 70 of the *Development Regulations 2008* prescribes if the proposed development is for the purposes of the provision of electricity generating plant with a generating capacity of more than 5 MW that is to be connected to the State's power system – a certificate from the Technical Regulator is required, certifying that the proposed development complies with the requirements of the Technical Regulator in relation to the security and stability of the State's power system.

In making a decision on your application, our office has taken the following information into account:

- An initial meeting regarding the project between SA Water, Aurecon and the OTR on 14 August 2018;
- A follow up meeting between SA Water, Aurecon and the OTR on 20 September 2018;
- Your application emailed to the OTR on 5 October 2018.
- Further information regarding the project emailed by Aurecon to the OTR on 15 October 2018.

After assessing the information provided, I advise that approval is granted for the proposed project.

I note SA Water's request to commission the Photo Voltaic (PV) Generation prior to commissioning the Battery Energy Storage System (BESS). I approve this request on the basis that the required Fast Frequency Response, as per the OTR's Generator Development Approval Procedure Version 1.1, is made available in full no later than six months after the commissioning of the PV Generation has occurred.

Should you have any questions regarding this matter, please do not hesitate to call David Bosnakis on (08) 8429 3323.

Yours sincerely

Rob Faunt
TECHNICAL REGULATOR

cc: John Hart – SA Water
Ashley Nicholls – SA Water
Paul Godden - Aurecon

Appendix E - Environmental Impact Assessment

Document Category

Environmental Management System

Environment and Heritage Assessment Report and Project Environmental Management Plan (PEMP) – Happy Valley Solar Arrays

Version: 0.1
Date: 20/05/19
Status: For Release

Document ID: SAWF-ENV-0007

Government of South Australia

PART A: Project Environment and Heritage Assessment

1 Description of existing site

The Happy Valley Reservoir Reserve covers an area of approximately 625 hectares, of which the water body itself (at capacity) covers approximately 178 hectares. The reservoir reserve supports approximately 120 hectares of remnant native vegetation, 100 hectares of revegetation and 103 hectares of pine plantations (leased and managed by ForestrySA), as well as the reservoir itself and associated water treatment infrastructure. The solar panel installation will require the harvesting of 18 hectares of ForestrySA pine plantation.

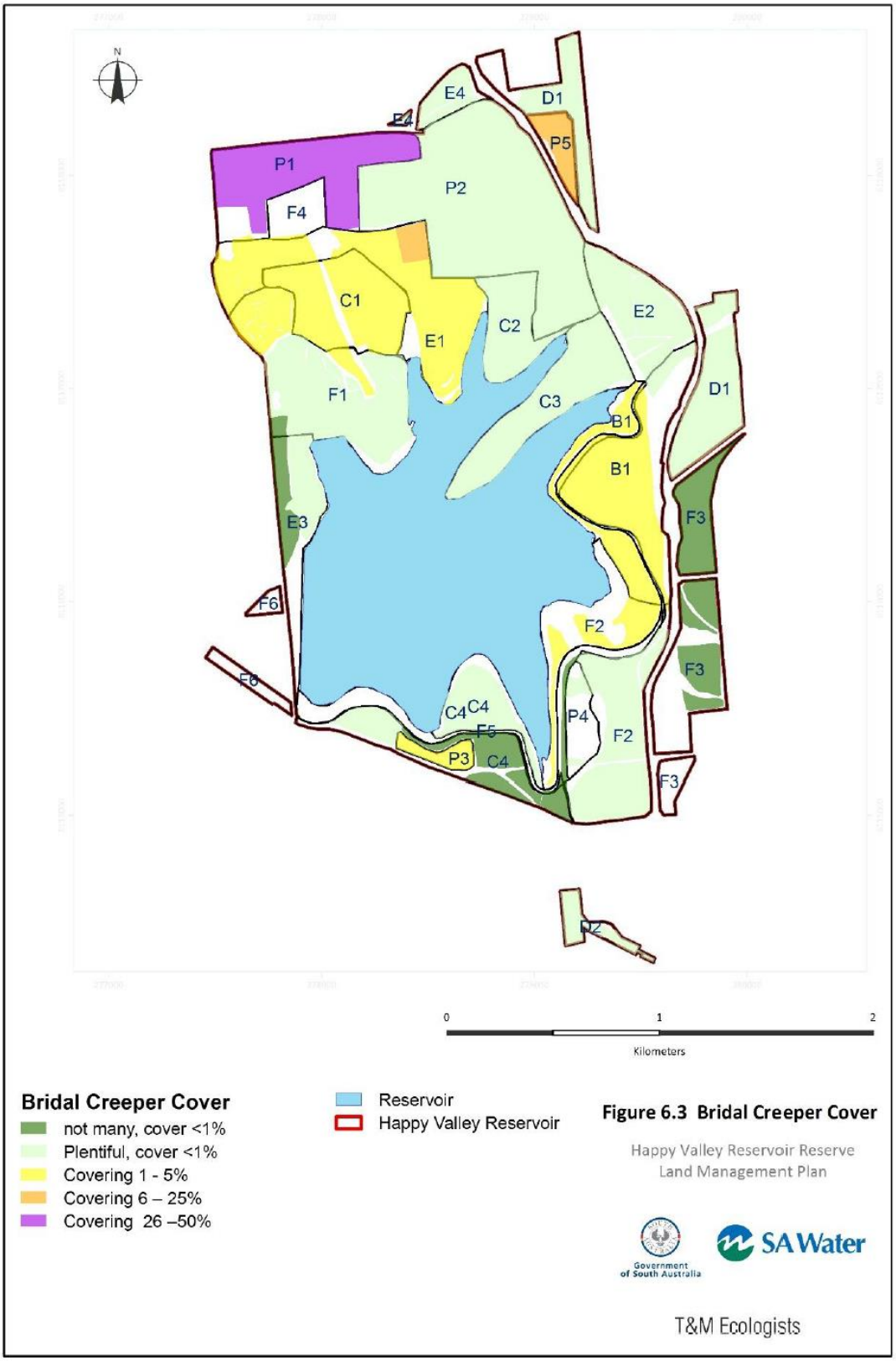
Key biological assets identified in the reservoir reserve include:

- nine high priority remnant native vegetation sites which are largely comprised of the nationally threatened Grey Box (*Eucalyptus microcarpa*) Woodland community – ongoing minimal disturbance weed control is undertaken by Bush For Life and Nature Conservation Society SA volunteers at these sites;
- a high diversity of native plant species; and
- the provision of habitat for a range of native bird, reptile and mammal species.

Happy Valley Reservoir Reserve is located on Lots 4, 7, 91, 92, and 93 Chandlers Hill Road, , Happy Valley. The location identified for solar panel installation is the flat area of land at the north eastern corner of the Happy Valley Reservoir Reserve bounded by Main South Road, O'Halloran Hill to the west and Black Road, O'Halloran Hill to the north, identified as SA Water Land Management Unit P1 (and potentially parts of unit P2), located on certificate of title references CT5412/975 plan / parcel F205351A94 and CT5412/953 plan/parcel H105500 S74.

The area proposed for the installation of solar panels currently contains a ForestrySA commercial pine plantation of Aleppo pines (*Pinus halepensis*) that were planted in 1949 and 1951 (land management unit P1). To the west is the newly designated Glenthorne National Park. To the north on the other side of the road are paddocks and a residential development to the north-east known as "Flagstaff Pines". To the south is a water supply tank, water treatment sludge drying lagoons, and Radiata pine (*P. radiata*) plantation, with contours and drainage lines sloping to the reservoir to the south. To the east is another area of Radiata pine plantation (land management unit P2).

This assessment covers the aspects and impacts of the installation of a solar array and associated infrastructure following the harvest of the pine trees. ForestrySA will be responsible for managing the environmental impacts associated with commercial harvesting of timber, so this aspect is not covered in the assessment below.

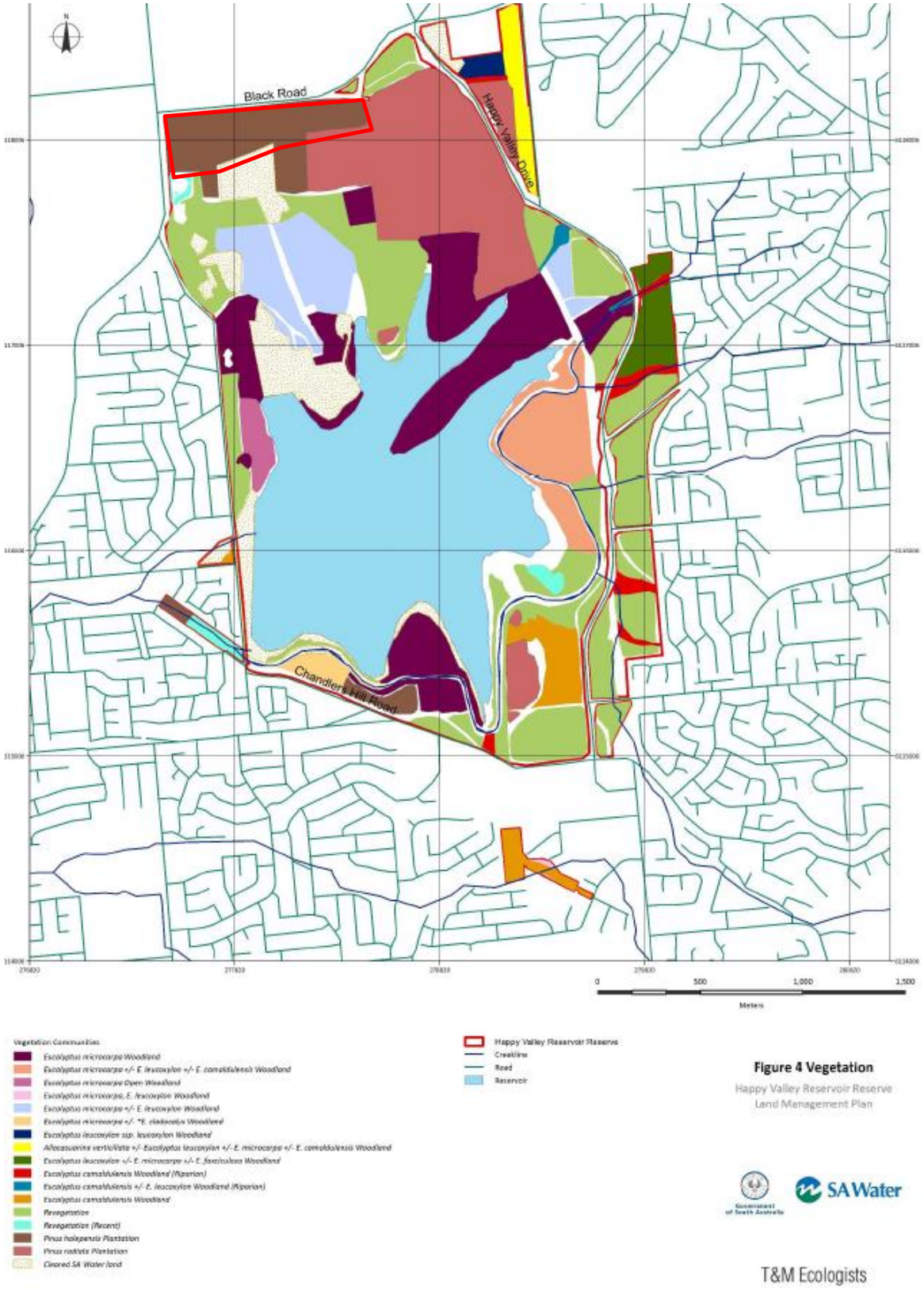


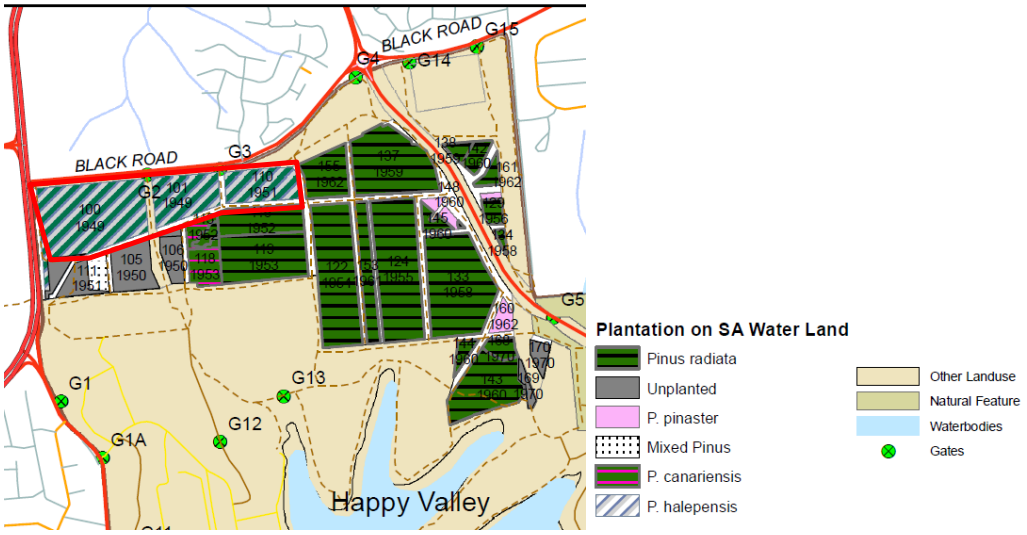
Above figure from SA Water Land Management Plan shows the land management units which are referred to in the text below, namely P1 which is where the pines are planned to be harvested and the solar arrays installed.

1.1 Biological Environment

1.1.1 Vegetation

The figure below produced by T&M Ecologists shows the different vegetation communities present at Happy Valley Reservoir Reserve. The area proposed for the installation of solar panels currently contains ForestrySA commercial pine plantations (dark brown area – circled in red), which were planted by ForestrySA during 1949 and 1951.


Black Road
Happy Valley Drive
Chandlers Hill Road
0
500
1,000
1,500
Meters
Vegetation Communities
Eucalyptus microcarpa Woodland
Eucalyptus microcarpa +/- E. leucoxylon +/- E. camaldulensis Woodland
Eucalyptus microcarpa Open Woodland
Eucalyptus microcarpa, E. leucoxylon Woodland
Eucalyptus microcarpa +/- E. leucoxylon Woodland
Eucalyptus microcarpa +/- *E. cladocalyx Woodland
Eucalyptus leucoxylon ssp. leucoxylon Woodland
Allocasuarina verticillata +/- Eucalyptus leucoxylon +/- E. microcarpa +/- E. camaldulensis Woodland
Eucalyptus leucoxylon +/- E. microcarpa +/- E. foecunda Woodland
Eucalyptus camaldulensis Woodland (Riparian)
Eucalyptus camaldulensis +/- E. leucoxylon Woodland (Riparian)
Eucalyptus camaldulensis Woodland
Revegetation
Revegetation (Recent)
Pinus halepensis Plantation
Pinus radiata Plantation
Cleared SA Water land
Happy Valley Reservoir Reserve
Creeklines
Road
Reservoir
Figure 4 Vegetation
Happy Valley Reservoir Reserve
Land Management Plan
SA Water
T&M Ecologists



This portion (above) from a ForestrySA pine plantation map shows the species and dates of pines planted in the northern area of Happy Valley Reservoir Reserve. This project plans to utilise the areas currently covered by *P. halepensis (green and grey striped area on map circled in red)*.

Potential aspect/impact			**Tick if relevant**
No identified impacts and/or no risk of impacts to vegetation as part of project			☐
Potential impacts to vegetation. (If ticked, complete section below) – Ensure total construction footprint considered – including access requirements, laydown/stockpile areas, turnaround, re-connections etc (may not all be within main project site)			☒
Native Vegetation			
New works (approval required):	Level 1 (minor) ☐	Level 2 (medium) ☐	Level 3 (major) ☐
Impacts covered by operational / maintenance regulations			☐
Vegetation with conservation value and/or rare/threatened/protected species/communities present within or adjacent to works area (consider regional, state and national ratings)			☐
Vegetation with high habitat value, wetlands / riparian zones within works area			☐
Other (specify e.g. vegetation covered by heritage agreement)			☐
Other vegetation (inc Significant / Regulated trees)			
Works will impact significant / regulated trees			☐
Works will impact non protected vegetation e.g. amenity plantings, commercial plantations			☒
Vegetation description (include area/number of trees to be removed, pruned, condition of vegetation etc)			
Happy Valley Reservoir Reserve has 120 hectares of remnant native vegetation present predominantly comprised of Grey Box (*Eucalyptus microcarpa*) Woodland, with discrete patches of South Australian Blue Gum (*Eucalyptus leucoxylon*). Drooping Sheoak (*Allocasuarina verticillata*) occurs sporadically in the Grey Box Woodland and there is a small patch of Southern Cypress Pine (*Callitris gracilis*) present on the north-western side of the reservoir reserve. River Red Gums (*Eucalyptus camaldulensis ssp. camaldulensis*) line the reservoir edges and predominate along the creeklines and drains. The native vegetation at Happy Valley is best described as "islands" surrounded by revegetation, built infrastructure or pine plantation. Over 150 species of native plants and over 100 introduced species have been recorded at Happy Valley Reservoir Reserve. The Grey Box (*Eucalyptus microcarpa*) Grassy Woodlands and Derived Native Grasslands of South-eastern Australia are a listed threatened ecological community under the Environment Protection and Biodiversity Conservation (EPBC) Act. The area selected for installation of the solar arrays consists of part of ForestrySA commercial pine plantations at Happy Valley Reservoir Reserve – consisting of Aleppo pine (*Pinus halepensis*) and/or Radiata Pine (*Pinus*			

Potential aspect/impact	Tick if relevant
radiata), depending on exact final location of arrays. These were planted in the 1950's and are overdue for harvesting. ForestrySA are ready to harvest the pines, and have secured a customer to take the wood produced. Locating the arrays in the pine plantation area following harvesting rather than replanting another commercial tree crop avoids the project impacting on nearby high value native Eucalyptus forest and woodland and is the preferred approach. The pine plantation areas are bounded by cleared SA Water operational land or areas of revegetation with the nearest *E. microcarpa* woodland being approximately 300m away with pine plantation or revegetated woodland in between, which provides sufficient buffer to the proposed activities. Clearance will not require any approval under the Native Vegetation Act and will not impact on any regulated trees under the Development Act, as it comprises a commercial plantation. Note that *Pinus halepensis* is considered a declared weed under the Natural Resource Management Act.	

Summary of impacts		
Area of native vegetation to be removed	0	ha
Condition of vegetation (describe & as ratio)		
Number of trees to be removed	Sign/Reg: 0	Other: Up to 18ha of commercial pine plantation to be harvested
Number of trees to be pruned	Sign/Reg:0	Other:

Alternatives & Mitigation Measures to be employed to avoid or minimise impacts
Ensure that the boundaries of the proposed solar array site are clearly identified and that the adjacent vegetation, whether it be retained pine plantation or areas of revegetation buffer are identified as "out of bounds" to any construction traffic and activities. Also consider planting of native grasses and groundcovers to increase biodiversity and prevent weed proliferation (see section 1.1.3 below).

1.1.2 Fauna

Aspects	Tick where relevant
Low risk of impacts to fauna or fauna habitat identified for the works	☒
Impacts to fauna or fauna habitat (breeding areas, nests or hollows, barriers and corridors) *consider terrestrial and/or aquatic (inc consider fish barriers or impacts to flows) and consider timing of works	☐
Rare and endangered species or migratory species potentially in/adjacent to works area (*EPBC Act* and NPWS)	☒
Other (specify)	☐

Summary of assessment and potential impacts
The amount of pines proposed to be harvested to accommodate solar arrays (around 18 ha) comprises approximately 5% of the total area of vegetation cover available at the reservoir reserve for habitat for native animal species. Native trees, such as Grey Box, Blue Gum, Drooping Sheoak, River Red Gums and Southern Cypress Pine within the Happy Valley Reservoir Reserve support declining and threatened bird species. The Nature Conservation Society of SA has observed and recorded bird species present in the native vegetation areas of the reservoir reserve for the last 15 years, and records 96 native bird species which includes eleven species rated as Rare, three rated as Vulnerable and one rated as Endangered at a State level. At a regional level, nine species are rated as Rare, fourteen rated as Vulnerable, three rated as Endangered and a further three species are rated as Critically Endangered. This makes a total of 29 conservation rated bird species. These species are most common in the remnant and revegetated areas of native vegetation which provide good habitat, being found only occasionally and in passing in the pine plantations as they provide poor habitat value for these species. The revegetated areas (planted in the 1980's) buffer the remnant vegetation and help to prevent

Aspects	Tick where relevant
external negative impacts (such as weed invasion or plantation harvesting activites) and also provides habitat values and resources for native fauna, particularly bird species. The Yellow Tailed Black Cockatoo (*Calyptorhynchus funereus ssp xanthanotus*) is found throughout the reservoir reserve, and the remnant vegetation and revegetation areas provide the most suitable habitat for this species. It has a varied diet which is obtained from a range of habitats, many of which are present in the reservoir reserve. A large portion of its diet is comprised of wood boring grubs and seeds of especially native species of tree such as Allocasurina (SheOaks), Casurina, Eucalypts such as Grey Box and River Red Gums (also flowers), Acacias (also the gum from these species), Banksia, Xanthorrhea and Haekeas. They are also partial to pine cones from Pinus radiata and Pinus halepensis species. The cockatoos are not dependent on the pine plantations for food, and the solar panel installation will not remove all the pines onsite. The areas of revegetation have included the planting of the above native species of trees to further enhance the available food supply for this and other species. A number of mammal species are present in the reserve including the Western Grey Kangaroo (Macropus fuliginosus,), Common Ringtail Possum (Pseudocheirus peregrinus) and the Koala (Phascolarctos cinerus). Recent field inspections have identified that the preferred habitat for these species is the native vegetation areas, particularly for the latter two species which prefer hollow bearing Eucalyptus trees – hollows are very unlikely to be found in commercial pine plantations. Water-rats (Hydromys chrysogaster) may also be present in and adjacent to the reservoir, which is well away from the project site. The Western Grey Kangaroo (Macropus fuliginosus) population is a very mobile and active mammal and is abundant across the whole reservoir reserve. Due to shading from the dense canopy, and pine needle leaf litter, the pine plantation areas provide very little grass or other vegetation palatable for them to graze. They preferentially graze in the adjacent open grassy firebreak and power line easement areas as well as areas of native revegetation and remnant vegetation, where the canopy cover is less complete. They primarily use the pine plantations for shade and shelter, and are likely to avoid the area during construction activities due to noise and the presence of workers on site, however may opportunistically visit the area during the construction phase, particularly after hours and in the early morning. A number of different reptiles have been recorded in the reserve, including lizards, skinks, and snakes, however no specific surveys have been carried out to determine their number or distribution within the pine plantations. Amphibians are dependent on and more closely associated with water sources such as drainage lines or the reservoir itself and are unlikely to be found in the pine plantations.	
Alternatives & Mitigation Measures	
During construction activites any trenches that need to be left open during the night must be fenced and/or covered to prevent fauna visiting the site after hours from falling in. Sticks or planks of wood can also be propped into trenches to allow fauna to exit themselves. Should fauna, particularly snakes, become trapped in the trenches, a fauna rescue service should be contacted to assist in their safe removal.	

1.1.3 Pest Plants and animals

Aspects	Tick where relevant
Declared/environmental weed species within project area or surrounds	☒
Pest animal species that may require management	☐
Phytophthora, phylloxera risk? Identify whether a 'High/Medium/Low Potential Threat Area' under the Phytophthora	☒
Other (specify)	☐
Summary of assessment and potential impacts	
Weeds are one of the most significant overall land management issues for Happy Valley Reservoir Reserve, with a number of the weed species present being highly invasive and/or declared under the Natural Resources Management Act 2004. SA Water's land management program for the Happy Valley Reservoir Reserve has identified significant (25-50% cover) infestations of bridal creeper in pine plantation area P1 (see figure 6.3 provided in Introduction above), with adjacent P2 land management unit having significant	

Aspects	Tick where relevant
infestations of both this and the declared boneseed weed (50-75% cover). Monadenia, artichoke thistle and Olives are also present. Under their Memorandum of Understanding (MOU) with SA Water, ForestrySA is responsible for controlling weeds in their pine plantations. Priority weeds for control in and adjacent to plantations at Happy Valley are Boneseed, Olive and regenerating Pines. The MOU also includes a commitment to timely overplanting and/or attention to weed control in thinned or clear-felled plantations. Unfortunately, thinned out sections of the adjacent north eastern (P2) pine blocks have developed significant stands of Olive and Boneseed (declared weeds) in their open understorey. Happy Valley Reservoir Reserve is designated a high potential threat area for Phytopthora, so vehicles and equipment that may leave the already made tracks need to have good hygiene and not be carrying dirt or vegetative material from offsite or from one management area to another.	
Alternatives & Mitigation Measures	
It is uncertain what level of weed infestation will be present following ForestrySA harvesting activities prior to the installation of solar arrays. As such an assessment will need to be made. There is likely to be weed seed present in the soil, and with increased light availability following canopy removal significant weed populations may establish, it may also depend on the time of year that activities occur. A control strategy to manage and prevent the spread of boneseed weed and bridal creeper, and prevent the introduction of any new weed species needs to be included in the contractor's EMP. Good vehicle hygiene and keeping to the designated project area will assist in preventing both weed invasion and the introduction and/or spread of Phytopthora into nearby native vegetation. *Initially following array installation a weed spraying program will be required that targets the above weeds as they will proliferate unchecked and could grow large enough to shade the panels.Ongoing it is recommended that a permanent perennial cover of low growing native grasses and groundcover be established in and around the panel array to outcompete the weeds that will proliferate if not checked, this will reduce further the need for vehicle access during ongoing operation.*	

1.2 Physical Environment

1.2.1 Water and water quality

The following image shows the contours in relation to the pine plantation areas. The area in which *P. halepensis* is planted is the flattest area in the reserve, and is not associated with any major drainage lines that lead to the reservoir.

Aspects	Tick where relevant
Waterbodies (watercourse, wetlands, coastal/marine) within or close to works area	☒
Stormwater infrastructure (drains/culverts) within or close to works area	☐
Water management and/or flooding risk (consider catchment above work site and below)	☐
Works within watercourse (incl on banks) or involve alteration/modification of drainage lines or flow patterns (either during construction or operation)	☐
Discharges to land or water (or change to existing discharges) required during construction, commissioning/testing and/or during operation)	☐
Groundwater impacts e.g. potential for dewatering or interaction with groundwater during works	☐
Construction of bore / well or other operation requiring drilling	☐
Soil, Erosion & Drainage Management site specific controls required during works eg erosion control required, sedimentation risk, bank/batter stabilisation required	☒
Change in non-permeable surface area - change to flow/drainage requirements at site	☐
Risk of pollution to water from construction/operation, risk of spills, etc	☐
Acid sulphate soil risk	☐
Large volumes of water required during construction (dust suppression, construction water). consider source and volume	☐
Other (specify)	☐
Summary of assessment and potential impacts	
The area identified for the array installation (land management unit P1) is relatively flat, has negligible flooding susceptibility and is a substantial distance (approximately 1000m) from the Happy Valley Reservoir, which supplies water to the Happy Valley Water Treatment Plant for treatment and distribution to about 40% of metropolitan Adelaide water supply system. There is substantial vegetation buffers present from adjacent pine plantation and revegetation areas between this area and the reservoir and it is unlikely that any substantial erosive material will make its way from the site to the reservoir. However, eroded sediment could affect the adjacent vegetated areas, potentially smothering vegetation particularly if there is substantial grading activities required following pine harvesting activities. Once installed, the solar arrays will provide a series of impermeable surfaces around which localised rainfall will concentrate, with increased rain running off the panels edges and concentrating on the ground below.	

Aspects	Tick where relevant
However there will be no change to the ground surface underneath, which will be able to absorb this rainfall. It is likely that these areas will be where increased vegetation growth (including weed species) is likely to be found. This vegetation will assist soil stabilisation and further detain any runoff. Stormwater management will need to be considered as part of detailed design.	
Alternatives & Mitigation Measures	
Suitable civil works and stormwater and drainage management will be required to minimise dust, erosion and runoff during site preparation, construction and operation activites, and should be managed by installing temporary or potentially permanent erosion control devices such as sediment fences, haybales, swales, detention basins and riprap, depending on the location and extent of the final design. *It is recommended that a perennial low growing grass and groundcover mix be seeded following array installation to stabilise disturbed soil and provide a grassy cover in which rainfall and runoff will be absorbed.*	

1.2.2 Air Quality

Aspects	Tick where relevant
Potential for construction emissions and associated impacts (dust, odours, other emissions or particulates (vehicles, noxious/toxic gases)) - *Consider proximity to sensitive receptors, working or connecting to 'live' wastewater infrastructure?)*	☒
Operational emissions (e.g. odour, other (e.g. chlorine, heat) - *consider proximity to sensitive receptors*)	☐
Monitoring required (pre/during/post)	☐
Other (specify)	☐
Summary of assessment and potential impacts	
Depending on the time of year that construction occurs, it is possible that site activities such as vehicle and machinery movement may generate dust. There have been recent concerns raised regarding the potential for heat island effects, particularly in relation to large-scale solar farm installations. This has resulted in the precautionary principle being applied, with a setback distance of 10- 25m from the site boundary to any installed equipment, to ensure that existing land use on adjacent properties is not affected. Research has been undertaken by the project which has included reviews of international heat island effect studies, theoretical modelling, statistical analysis using a weather forecasting and research model and physical sampling of temperature along a 30m distance transect over multiple days on the arrays already installed at Hope Valley WTP. For the latter, it was found that the natural fluctuations in the surrounding air temperature dominated and there was no clear correlation between change in tempature and distance that could be directly attributed to the solar array.	
Alternatives & Mitigation Measures	
The contractor will need to monitor dust levels, and should dust be at risk of leaving the site, wet down areas where dust is being generated. *A setback of at least 10m will be included in the array layout design – this already exists due to the boundary road and existing high voltage powerline easement on the northern boundary. Additional setback may be required for amenity purposes (see 1.3.4 Amenity below)*	

1.2.3 Greenhouse/energy use

Aspects	Tick where relevant
Greenhouse gas reporting is required on a quarterly basis:	
• *Contracts above $4 million require reporting of Scope 1,2 and 3 emissions*	☒
• *Contracts less than $4 million require reporting of Scope 1 and 2 emissions only.*	☐

Aspects	Tick where relevant
Energy use from lighting, generators, vehicles fuel use	☒
Renewable and non-renewable energy consumption	☐
Significant use of energy intensive construction materials e.g. steel, concrete, copper, PVC	☐
Waste to landfill	
Other (specify)	☐
Summary of assessment and potential impacts	
The project will have plant and vehicle emissions, with the potential for air pollution and greenhouse gas emissions. Steel or aluminium framing, metal cabling (copper, aluminium) and concrete for footings (fence, potentially array frames) will be required, which all have embodied greenhouse gas emissions. In addition, the following information was provided by SA Water's Climate Change Advisor: The array installation will follow the harvesting and removal of 18ha of mature pine plantation forest, which currently absorb carbon dioxide and store it as carbon in their tissues. There are community concerns that this change in land use will cause a loss of carbon benefit from the pine trees. According to the Chief Scientist, a high-level independent advisor to the Prime Minister of Australia; forests absorb 0.5 – 2.0 tonnes of CO2 per hectare per year. In order to calculate the tonnes of CO2 absorbed by the Aleppo pines at Happy Valley, conservatively it can be assumed that the absorption flux is 2 tonne per hectare per year. Over the solar panel's estimated lifetime of 25 years, this equates to 1000 tonnes of CO2 (for 20 ha of pines) which would have been absorbed by the trees. Although a commercial pine plantation cannot be relied upon to provide a 'carbon sink', installing the solar array will reduce the CO2 released into the atmosphere by approximately 57,600 tonnes. The proposed solar panels will generate an expected 390,000,000 kWh (390GWh) of electricity during their 25-year lifetime. This energy production equates to the release of 40,000 tonnes of Carbon Dioxide (CO2). In comparison, for the equivalent amount of electricity (390GWh), a gas fired power station will release 170,000+ tonnes of CO2. This demonstrates that there is approximately 19.59 times greater net carbon benefit of solar panels in lieu of pine trees.	
Alternatives & Mitigation Measures	
Machinery must be maintained in good working order, and vehicles and machinery should be shut off when not in use. Recycling and reuse of waste materials will be maximised (see section 1.2.5). The contractor will be required to report on the greenhouse gas emissions associated with this program of works for this and other sites where installation of solar panels is occurring, on a quarterly basis. *The project will result in a significant installation of renewable energy generating equipment, which will directly reduce SA Water's greenhouse gas emissions associated with electricity use.*	

1.2.4 Site Contamination

Aspects	Tick where relevant
Current / past land use (or surrounding land use) includes potentially contaminating activities or area known to be contaminated site – soil or groundwater (specify below)	☐
Project involves land acquisition or disposal?	☐
Site history or environmental site assessment required / being undertaken (specify below)	☐
Existing onsite contaminated or hazardous materials to be managed (asbestos, contaminated stockpiles)	☐
Disposal of waste and chemical substances required as part of project	☐
Risk of migration of contaminants from or to neighbouring land especially during works – or risk that works could result in migration of contaminants (e.g. by altering groundwater movements)	☐
Acid sulphate soil risk	☐
Other (specify)	☐

Aspects	Tick where relevant
Summary of assessment and potential impacts	
There is little to no risk of contaminants being present in the pine plantation area, with the only chemicals used in this area having been herbicides to manage weeds, and this has been done sparingly.	
Alternatives & Mitigation Measures	
None required.	

1.2.5 Waste and Resource Use

Aspects	Tick where relevant
Project will generate waste requiring management, transport and disposal (construction demolition waste, rock/spoil etc.).	☒
Increase or change to waste management (during construction and/or operation) e.g. generation of new waste	☐
Significant use of materials or resource use (including new resource – groundwater extraction)	☐
Use or opportunity to use recycled materials or recycling of generated materials (cut & fill balances, pavement recycling, concrete recycling)	☒
Other (specify)	☐
Summary of assessment and potential impacts	
The waste generated during the construction phase of this project will likely include office waste (including food scraps), packaging materials from solar panels and equipment such as wooden pallets, cardboard boxes, plastic over wrap and plastic strapping, various metal and plastic wastes from construction e.g. empty cable drums, liquid sewage wastes generated from portable toilets (if required) and possibly also concrete waste (from foundations for buildings such as for a control building, battery and fencing activities). It is also possible that some solar panels may be broken during delivery / construction (due to cracking from excessive pressure on installation and or physical damage).	
Alternatives & Mitigation Measures	
The contractor will aim to segregate waste to reduce the amount of materials going to landfill (recyclables, green waste, bottles), in addition it will seek organisations that can reuse or recycle materials for the benefit of the community and environment (for instance, contacting Men's Shed to see if they would like to have any recyclable materials, or Born Again Pallets who accept certain types of pallets). Several companies in Adelaide offer EPA-approved concrete disposal and concrete recycling services, including the nearby Lonsdale Concrete Waste and Recycling Depot. Repurposed construction waste is a cheaper alternative to quarry-based materials particularly for access roads. By recycling construction demolition waste, recycled material makes its way back to the market as a useable product ensuring a closed loop in the manufacturing process. The contractor will be looking for opportunities to use such recycled materials as part of the project. The contractor has also established contact with Reclaim PV Recycling, a company based in Adelaide who recycles damaged and end of life solar panels. *Approximately 90% of most PV modules are made up of glass, with some impurities in this glass that could include plastics, lead, cadmium and antimony. PV modules are largely recyclable – component materials such as glass, aluminium and semiconductors can all be recovered and reused. Disposal of old solar panels in landfill is not recommended , instead they should be diverted to companies such as Reclaim PV Recycling. This company has two methods for reclaiming PV modules. One method is cell extraction, which is a unique process of reclaiming efficient cells from damaged solar modules. By removing the good cells, they can reduce the amount of energy needed to effectively recycle solar cells.. The other method is resource recovery and involves a fully functioning technique for dismantling modules and separating the raw elements. This then produces glass, silicon cells and metals to various manufacturing sectors. This not only creates a resource recovery stream for localised industries, but also provides a positive environmental offset by avoiding landfill and reducing CO2 emissions.*	

1.3 Social Environment

1.3.1 Noise and Vibration

Aspects	Tick where relevant
Noise sensitive land uses/receptors potentially affected or close by	☒
Potential change in ongoing or operational noise levels (new or altered noise source e.g. new PRV, pumps, change to traffic movements around a SA Water facility) (if tick *undertake noise assessment including pre monitoring and model anticipated changes)*	☐
Construction noise impacts – from works themselves and/or from access to site (consider traffic routes and traffic management relating to noise).	☒
Vibration – potential for impacts to heritage sites/objects/sensitive properties (dilapidation surveys)	☐
Other (specify)	☐
Summary of assessment and potential impacts	
Delivery trucks, construction vehicles and equipment accessing the site will generate noise during solar array installation. This may be audible by the nearest residential neighbours in the "Flagstaff Pines" housing development. There may be some vibration impacts from the installation of piles for mounting the racking systems, the degree and extent of this will depend on the type of racking system chosen to mount the arrays (e.g. driving in with a piling rig vs coring holes and concreting in vs ballast system). Once installed the arrays and associated equipment should not create any new noise or vibration emissions detectable beyond the site boundary. .	
Alternatives & Mitigation Measures	
Should the racking system chosen involve the driving of piles which could create off-site vibrations, dilapidation surveys of adjacent residences is recommended. *Restrict noisy activities to EPA recommended hours 7am – 7pm (Mon-Sat), 9am-5pm (Sun/Public Holidays).*	

1.3.2 Community and Land use

Aspects	Tick where relevant
Change in land use following project (permanent)	☒
Temporary change in access or use of area during works *(eg reduced access to recreational areas, parklands, closure of park; consider timing of works – impact on community events?)*	☐
Land acquisition required	☐
Opportunity for new / improved community spaces/facilities as part of project / post project	☐
Sensitive land use or use with critical needs potentially impacted (schools, child care centres, age care, hospitals etc)	☐
Traffic disruption/delays	☐
Security/privacy – (eg security projects or upgrades - camera angles, new fences etc)	☒
Other community concerns (specify)	☐
Summary of assessment and potential impacts	
There will be a change in land use from commercial pine plantation to solar array, which may also require an upgrade to existing fences within the reservoir reserve – although the current boundary fence is adequate,	

Aspects	Tick where relevant
future recreational access to the reservoir reserve may require the installation of internal fences, this is still to be determined. A cross-government taskforce has been convened to lead the investigation into all South Australian reservoirs and appropriate recreational use. Happy Valley Water Treatment Plant is an operational facility and access to the public is currently restricted, however there is a program looking at the provision of recreational access to the Reservoir Reserve and the possibility of linkages with Glenthorne National Park.	
Alternatives & Mitigation Measures	
SA Water is leading the communications and engagement element of therecreational access to reservoirs project and will make contact with residents living in close proximity to reservoir reserves in the coming months to help inform the development of opening plans.	

1.3.3 Access

Aspects	Tick where relevant
Access to project area already established – no change required	☒
New access required (track/road/access point etc)	☐
Severance of access (permanent or temporary during works) to properties (including residential, community, business/commercial)	☐
Traffic interruption /delays (permanent or temporary)	☐
Travel patterns altered, road closure/detours (pedestrian and vehicles)	☐
Parking impacts	☐
Other (specify)	☐
Summary of assessment and potential impacts	
There is existing access from Black Road, O'Halloran Hill to the land parcels with two double leaf gates through the chainlink fence in at least two places with existing access tracks that bisect the land parcels that should be sufficient to provide access for both tree harvesting and solar panel construction activities. No new access points are required. The project is likely to temporarily increase traffic movements entering and exiting the site during construction. During operation the only access that will be required will be for cleaning of the panels and vegetation management around the arrays.	
Alternatives & Mitigation Measures	
The contractor will need to have a traffic management plan included in their EMP for the works, particularly to manage movements into and out of the site. *Ongoing it is recommended that a permanent perennial cover of low growing native grasses and groundcover be established in and around the panel array to outcompete the weeds that will proliferate if not checked, this will reduce further the need for vehicle access during ongoing operation.*	

1.3.4 Amenity

Aspects	Tick where relevant
Impacts on view or view scapes	☒
Structures/built form visually intrusive or change to current	☒
Urban design considerations for new structures – including risk of graffiti/crime prevention etc	☐

Aspects	Tick where relevant
Impacts on open space, reserves, parks, marine park (specific below)	☐
Improved amenity opportunities (landscaping, improved water quality, improved open space etc).	☐
Light spill (construction or operation)	☐
Other (specify)	☐
Summary of assessment and potential impacts	
Removal of the pines and replacement with a solar array will create a marked and noticeable change in the view scape, particularly for adjacent residents and traffic travelling along Black Road / Majors Road and Main South Road. The closest residences at the north eastern corner of the Aleppo pine plantation are approximately 50m from the edge of the nominated land parcels for solar installation, with a partial screen of roadside vegetation, a power line, Black Road, a 2m high chainlink fence, firebreak and a high voltage transmission line easement between. The blocks of land on the northern side of Black Road between the housing development and South Road consist of open paddocks with a few scattered trees. It is understood that the proposal will change the current landscape and SA Water are looking at ways that the project can minimise this impact and maximise the visual amenity of the area. The residents to the south west of the plantation area are unlikely to notice a change in viewscape from their homes as there is a substantial amount of other vegetation, and some water treatment infrastructure such as a tank and a few scattered SA Water buildings in between. However it is noted that this is a commercial pine plantation and is likely to be subject to harvesting at some point in time.	
Alternatives & Mitigation Measures	
Impact on viewscape could be ameliorated by the following options: *a) Retaining a buffer of pine trees – this would need to be at least a few rows thick to be an effective screen, and would require the arrays to be set back a further distance to avoid shading impacts from the trees. This would reduce significantly the area available for solar arrays.* *b) Planting a buffer of thick, screening native vegetation – this may take a number of years to be established, and the solar arrays will be clearly visible in the meantime. It will also need to take into account the easement required by the high voltage power line.* *c) Installing a mound of about 2m high along the edge of the solar arrays and initially vegetating with native grasses to provide a quick cover, with subsequent planting of low growing, bushy, screening native vegetation in the front and on top of the mound. This will require the sourcing and trucking to site of substantial volumes of suitable waste derived fill as there is unlikely to be sufficient material present on-site, which will increase heavy traffic movements to the site for a short period of time, and will incur a substantial cost.* *SA Water is currently engaging with the local community on these options, and the final outcome may contain elements of more than one option.*	

1.3.5 Heritage (European)

Aspect	Tick where relevant
National or State Heritage site(s) potential impacted by works	☐
Local heritage sites (on Local Government Development Plan) potential impacted by works	☐
Indirect/non-structural aspects of heritage items impacted (e.g. colour scheme, aesthetic impacts)	☐
Potential vibration impacts (risk of cracking or impacts to structural integrity) from works (esp rock breaking etc)	☐
Geological Heritage	☐
Other (specify – marine heritage etc)	☐

Aspect	Tick where relevant
Summary of assessment and potential impacts	
The Happy Valley Reservoir (Dam wall and towers) are State Heritage Listed and arepresent on an adjacent land parcel within the Reservoir Reserve, approximately 1.2km away. There are state heritage listed buildings at Glenthorne Farm, approximately 600m from the western edge of the proposed location. There is also the locally listed Former Tapley Farm Complex at 1533-1541 Main South Road O'Halloran Hill approximately 400m to the north east of the proposed location for solar arrays, with a service station and hotel located between. The proposed project and activities are not likely to have any impact on these items, given that there is sufficient buffer of land between them.	
Alternatives & Mitigation Measures	
Nothing further required	

1.3.6 Aboriginal Heritage

Aspects	Tick where relevant
Works on or within existing structure/building (or no excavation) – low risk of encountering heritage	☐
Aboriginal heritage (AAR- DSD) Register search completed	☒
Aboriginal Heritage risk assessment completed	☒
Other (specify)	☐
Summary of assessment and potential impacts	
The land comprising of the Happy Valley Water Treatment Plant and Reservoir Reserve is on the 'Country' of the Kaurna People. The significance of land and waters of this area is central to their lives: at birth, death, ceremonies and socially, whilst hunting, gathering camping, and travelling. An enquiry was made in 2017 and there are no Aboriginal Heritage Sites or Objects recorded on the Aboriginal Affair Register for the SA Water owned land parcels at Happy Valley. However, the Register is not a comprehensive record of all Aboriginal sites and objects, and other sites and objects of Aboriginal significance may exist even though the Register does not identify them. All Aboriginal sites and objects are protected under the Aboriginal Heritage Act 1988, whether they are listed in the Register or not. While proximity to a watercourse usually increases the risk of heritage being found, the reservoir is not a natural waterbody, and the work planned is not located adjacent to any substantial drainage lines which might increase the risk of heritage being present. Being located in pine plantation area which has been subject to commercial plantation activities (planting, thinning etc.) means that there has been higher levels of ground disturbance compared to the adjacent remnant vegetation areas. The construction contractor will be required to comply with SA Water's Standard Operating Procedure for the Discovery of Aboriginal Sites during the construction work in the unlikely event heritage is encountered and construction employees will be inducted into the requirements of this procedure.	
Alternatives & Mitigation Measures	
SA Water's Standard Operating Procedure for Discovery of Aboriginal Heritage is to be followed in event of heritage discovery.	

1.3.7 Native Title

Aspects	Tick where relevant
Native Title to be considered - advice from the Crown Solicitors Office (through Corporate Council) to determine whether Native Title exists over land within the project area	☐

Aspects	Tick where relevant
ILUA process applicable in works area?	☐
Notification Process undertaken if native title not extinguished or ILUA triggered?	
Other (specify)	☐
Summary of assessment and potential impacts	
There is no Native Title in any parcel checked by reference to the Kaurna NT determination – for CT5382/810 (now CT5412/975 plan / parcel F205351A94 and CT5412/953 plan/parcel H105500 S74).	
Alternatives & Mitigation Measures	
None required	

1.3.8 EPA Licenced site

Aspects	Tick where relevant
Project on a site covered by EPA licenced (wastewater treatment plants, desalination plant etc	☐
Project involves changes to emissions to water or air (eg odour) – changes could include an increase in volume, change in quality, change in timing, different discharge point. Consider if temporary or permanent. (EPA notification required.)	☐
Other (specify)	☐
Summary of assessment and potential impacts	
Project is not on an EPA licenced site	
Alternatives & Mitigation Measures	
Nothing required	

Part B: Project Environment Management Plan

1 Objectives of the Environmental Management Plan

The general objectives of this Environmental Management Plan are to:

- Ensure that potential environmental or heritage risks associated with common construction activities are being considered as part of the planning and delivery of SA Water's works
- Ensure that control measures are in place to minimise potential risks and impacts
- Achieve the project objectives in relation environment and heritage management
- Ensure the works are undertaken in accordance with our customer's expectations
- Continually improve project/site practices for the mitigation and management of impacts
- Establish clear responsibilities for environmental and heritage management as part of the works
- Ensure compliance with all statutory and regulatory requirements.

2 Legal and other requirements

A key governing legal requirement for all projects is set out in the SA *Environment Protection Act 1993*, Section 25:

A person must not undertake an activity that pollutes, or might pollute, the environment unless the person takes all reasonable and practicable measures to prevent or minimise any resulting environmental harm.

A summary of the environment and heritage approval / permits associated with the project is provided below, with the status and where relevant, conditions, for each.

Act	Description	Tick if relevant to project	Status/Assessment outcome/ comments	Summary of approval/ assessment conditions (if relevant)
Environment Protection and Biodiversity Conservation Act 2000 (Cth)	Approval from the Commonwealth Environment Minister is required for actions that have or are likely to have a significant impact on matters of national environmental significance (MNES). If project triggers above, referral under EPBC Act required.	☒	EBPC self-assessment is required.	Self-assessment has been undertaken and the project is not considered likely to have a significant impact on any MNES.
Development Act 1993	Works that constitute Development require approval. Development includes (not limited to): • Change of land use • Building works • Prescribed earthworks • Impacts to Significant/Regulated Trees	☒	Development approval is required.	A development application will be prepared and lodged with DPTI for approval. Local councils and other referral agencies will be consulted with to ensure their issues are covered in the development application.
Heritage Act/Development Act	Works that impact on State heritage require development authorisation	☒	Search of heritage databases undertaken	No heritage listed structures will be impacted by the works
Environmental Protection Act 1993 (Section 36 – Requirement for licence)	Prescribed activities of Environmental Significance require an EPA licence. (E.g. dredging/earthworks drainage/abrasive blasting, transport of contaminated soil, sewage treatment, desal, etc.)	☐	Some sites have EPA licences (e.g. Adelaide Desalination Plant, WWTP's)	There is no EPA licence for this site.
Environmental Protection Act 1993 (Section 10 & 25) General Environmental Duty and Standard for the Production	Excavation of borrow pits, diversion channels and construction of temporary roads, blocking banks etc. where materials are planned for re-use off site, or materials are imported from off-site	☒	No approval required	If material is required for a mound, need to ensure spoil management is undertaken in accordance with the EPA's Waste Derived Filled requirements.

Act	Description	Tick if relevant to project	Status/Assessment outcome/ comments	Summary of approval/ assessment conditions (if relevant)
and Use of Waste Derived Fill (WDF)				
Native Vegetation Act 1991	Approval for clearance of native vegetation is required under the Act. Native vegetation includes trees, shrubs, groundcovers and grasses.	☐	The Native Vegetation Act 1991 may apply depending on project location, many sites have been selected based on avoiding native vegetation.	The area selected for array installation has been selected as there is no native vegetation present that will be impacted.
National Parks and Wildlife Act 1972 (SA)	Scientific Permit.	☐	No impacts to National Parks land	N/A
Aboriginal Heritage Act 1988	Authorisation from the Minister for Aboriginal Affairs is required to interfere, damage or disturb Aboriginal heritage sites, objects or remains.	☒	The Register for Aboriginal sites and objects has been checked for each land parcel, and a risk assessment done, no further work required.	All Aboriginal sites and objects protected under the Aboriginal Heritage Act 1988. In event of discovery, stop work follow the SA Water SOP for Discovery of Aboriginal heritage Sites
Natural Resources Management Act 2004 (Section 175—transporting declared plants)	Consultation with NRM Board is required if transporting plants declared under Part 175 of NRM Act	☒	Declared boneseed and olives may be present and require control/removal	The Contractor will be responsible for obtaining authorisation from the Natural Resources Management Board to transport declared plants on a public road, in accordance with Section 175 and 188 of the Natural Resources Management Act 2004 (SA).
Native Title Act 1993	Notice to be issued if works Native Title. Note: ILUA notification process may be applicable in some areas.	☒	Native title has been checked against the certificates of title, and is not present.	No further work required
Local Government Act 1999 (SA)	Section 221: Alteration of road a Person must not make an alteration to a public road unless authorised to do so by the council. Section 31 permit (not required, no roads to be temporarily closed during Early Works).	☐	N/A	
Road Traffic Act 1961 (SA)	Section 33 Council approval is required for temporary	☐	Approval required if temporary closure if a Council Road	N/A

Act	Description	Tick if relevant to project	Status/Assessment outcome/ comments	Summary of approval/ assessment conditions (if relevant)
	closure of a public road to facilitate an event			
Parliamentary Committees Act 1991 (SA)	16A: Certain public works referred to Public Works Committee (PWC) Subject to subsection (3), a public work is referred to the PWC by force of this section if the total amount to be applied for the construction of the work will, when all stages of construction are complete, exceed $4M	☒	Infrastructure construction works in excess $4M require Public Works Committee (PWC) referral and associated Cabinet Submission	SA Water has referred the program of works which includes this project site to the Public Works Committee (PWC) and an associated Cabinet Submission.

3 Environmental Management System and Structure

3.1 Environmental system requirements

As a minimum, the contractor should have in place systems and methods for ensuring that the environmental requirements identified in this document are implemented. Normally this would be through the development a site specific or project specific Environmental Management Plan for the works.

3.2 Inductions and Training

All project staff, including subcontractors, must be inducted to the requirements of the project Environment Management Plan and associated procedures. The induction should ensure that any site specific environmental controls and/or requirements associated with Aboriginal Heritage are communicated to staff prior to the commencement of on-site works.

A record of inductions must be maintained.

3.3 Records and record keeping

Relevant schedules and records should be retained on site during the construction phase of the project. As a minimum this should include:

- Environmental Management Plan
- Prestart inspection checklists
- Induction / Training registers
- Monitoring/inspection reports and audit reports
- Non-conformance reports
- Environmental incident reports/register
- Waste tracking and disposal records
- Listed/controlled waste transport certificates and volumes
- Complaints registers

3.4 Roles and Responsibilities

3.4.1 Project Manager

The nominated SA Water Project Manager is responsible for:

- Ensuring that Contractors/SA Water works crew are provided with and made aware of the contents and requirements of this EMP
- Monitoring the effectiveness of implementation of this plan
- Being a point of communication with SA Water's Environment and Heritage Services Team

3.4.2 Site Supervisor/ Site Manager

The Contractor's/SA Water site manager (or nominated onsite environmental representate) is responsible for:

- Implementing the control measures in this document such as establishing site controls
- Inducting site personnel into the requirements of the EMP

- Undertake regular site inspections and monitoring the effectiveness of onsite controls, instigating improvements where necessary
- Maintaining site records such as site inspections/monitoring reports, induction records, NCRs or incident reports
- Liaising with the Project Manager where environmental issues or concerns are raised that require further attention
- Enforcing work practices that minimise adverse environmental impacts through due diligence
- Ensuring all employees report any environmental risks or hazards
- Implementing additional mitigation measures in the event of non-conformances or emergencies

3.4.3 Employees, sub-contractors and Labour hire personnel

All employees (including subcontractors) have an obligation to protect the environment when carrying out their work this includes:

- Being aware of the contents of the EMP including general environmental statutory requirements to carry out their work with due diligence.
- Complying with instructions/directions given by the Site Supervisor
- Report any incident that may result in environmental harm that arises in the course of or in connection to their work.

3.5 Inspections and Monitoring of Environmental Performance

Inspections of the work area should be carried out by the Site Supervisor to ensure the environmental management controls are effective. Monitoring of the environmental controls should consider the performance indicators each of the environmental issues provided in Section 4.

Issues arising from site inspections should be addressed as soon as possible, in some cases non-conformance reports may be raised. Issues identified should also be discussed at toolbox or site meetings together with any improvement measures that have been implemented.

Monitoring records should be retained by the Site Supervisor. A suggested typical monitoring schedule is outlined below:

Frequency	Issues
Prior to works	• Compound/worksite controls are in place, locations for materials/stockpiles and access identified • Location of sensitive neighbours • Location of stormwater entry points, drainage lines, water courses identified • Location of spill control measures and spill kits available
Daily	• Site is neat and tidy • Waste contained appropriately • Chemicals and materials stored appropriately • No evidence of dust nuisance • No evidence of water contamination/runoff form site • Adjacent roads clean (not covered in sediment etc).
Before/during rainfall events	• Runoff controls in place and maintained • Protection of stormwater entry points • Adjacent roads clean (not covered in sediment etc). • Drainage lines clear of debris

Frequency	Issues
Weekly/monthly	• Overall environmental management measures as per EMP in place.

3.5.1 Audits and Inspections

During the construction phase of the project Environmental Services (in conjunction with the Project Manager) may undertake inspections/audits of the contractor to ensure compliance with the requirements of the project environmental controls.

3.5.2 Non -conformance and corrective actions

A process for handling non-conformances should be in place. As a minimum requirement this should include procedures for the identification and reporting of any non-conformances with the project documentation, including the EMP.

If inspections/monitoring/auditing activities identify an environmental non-conformance the following actions should be undertaken:

- Inspect/Review the non-conformance, where necessary stop/control the activity until the environmental non-conformance is addressed
- Reporting of the non-conformance by the contractor to SA Water's project manager
- Investigate the reasons for the non-conformance and
- Implement appropriate action to address the non-conformance, amend project EMP/Project plans as necessary
- Record details of the non-conformances

4 Emergency Response and Environmental Incidents

4.1 Emergency Planning, Preparedness and Response

Emergency response and incident procedures should be in place for the project, these procedures should provide an effective response whilst minimising environmental harm or disruption (refer SAWP-ENV-0024 Environmental Emergency Response Plans).

The Emergency Response Procedure should be available and on display at the worksite/site office and all personnel must be inducted into its requirements. The procedure should include key contact details

Also included on the contact list should be the details of: (1) a person(s) for emergencies that will be available 24 hours a day, seven days a week, and has the authority to stop or direct works (2) emergency response personnel (3) the SA Water Project Manager (4) local councils and the local hospital(s) and (5) if necessary, nearby residents

In the event of an emergency the emergency response procedure should be enacted. Post the event a review should be undertaken to evaluate the effectiveness of the response against the procedure and determine if any amendments are considered appropriate.

Contact	Contact details
SA Water Project Manager	John Hart
SA Water Environment Impact Assessment Officer	Jackie Griggs
Police, Fire and Ambulance	000
Country Fire Service (CFS)	1300 362 361
Metropolitan Fire Service (MFS)	(08) 8204 3600
SafeWork SA	1300 365 255 / 1800 777 209 (for serious incidents/ injuries)
Environment Protection Authority (EPA)	(08) 8204 2004 / 1800 623 445
RSPCA (Head Office, Adelaide)	(08) 8231 6931
National Parks and Wildlife South Australia (NPWSA)	(08) 8204 1910

4.2 Environmental Incident Management

In the event of an incident action should be taken to stop/modify the work to effectively minimise impacts to the environment. Where an environmental incident occurs that causes or threatens to cause serious or material environmental harm (breach of legislative requirements, widespread impact etc) then as per Section 82 of the *Environment Protection Act* the EPA should be notified.

Incidents may include: main burst/flooding events, sewer spills, chemical or fuel spills, discharge if contaminated water, unauthorised/unintended impacts to vegetation etc.

Any environmental incidents should be investigated and reported to the SA Water's Project Manager as soon as practicable or no later than 24 hours after the incident is identified. Reports should include details of the incident and any corrective actions taken.

A record of all incidents should be maintained (refer SAWP-ENV-0027 Environmental Incident Reporting).

In the case of an environmental emergency the Emergency Response Procedure/Plan should be followed.

5 Environmental Management Controls

The following pages include suggested control measures to be used during the works to mitigate environmental impacts. The effectiveness of the controls should be monitored as per Section 4.

Environmental Impact	**Water Quality Impacts / Pollution of Water**
Objective	Prevent or minimise adverse effects on surface water and groundwater quality, flows and drainage
Performance indicators	• No deterioration on receiving waterway quality including for pH, turbidity, dissolved oxygen, chlorine residual and visual oils and greases. • Construction materials and sediment laden runoff prevented from entering waterbodies/stormwater
Controls	**Pre Construction** • Review construction area to minimise potential for surface runoff to enter the site and to identify controls for runoff leaving the site • Identify water bodies/drainage lines (including stormwater side entry pits) and identify sediment /erosion control requirements eg silt fences around stockpiles, silt sock locations at stormwater entry pits etc. • Review project activities that will require protection and installation of controls • Identify designated stockpile/laydown areas away from drainage lines. • Schedule works that will occur in watercourses /drainage lines for periods of favourable weather (eg dry periods) or implement construct techniques that reduce construction footprint (eg directional drilling) **Construction** • No discharge to a watercourse (including stormwater system) without approval from Environmental Services • Install erosion and sediment control devices prior to works commencing (silt fences, silt socks, hay bales diversion drains, geotextile fabric) and ensure maintained (eg remove debris from sediment control items regularly) • Ensure stockpiles have erosion control devices installed, particularly on downslope of stockpiles • Monitor weather forecasts to identify rain events and ensure control measures in place • Inspect and maintain/clean sediment control items regularly • Clearly define access tracks and routes and use these • Use a street sweeper or similar to clean sediment/debris form public roads • Compact, backfill and resurface disturbed or unsealed areas as soon as possible • No onsite refuelling, service or maintenance or cleaning in areas where runoff/wastewater may enter stormwater system or waterbodies. • All equipment washdown to be undertaken within an identified washdown area, no discharge of washdown water to stormwater or watercourse. • Turbid water from concrete cutting etc not to be directed to stormwater or watercourses.

Environmental Impact	Damage to Vegetation
Objective	Protect and minimise impacts to vegetation as part of the works
Performance indicators	• No unauthorised clearance • Protection in place (bunting, marking off) for vegetation on site where appropriate
Controls	**Pre construction** • Identify vegetation in/adjacent to the works area that may be impacted and plan access routes, plant/vehicle parking, stockpiles and material storage locations away from vegetation • Plan works to avoid in first instance or minimise impacts to vegetation (Significant/Regulated trees or Native Vegetation) • Seek approval for any impacts to Sig/Reg trees or native vegetation clearance prior to works **Construction** • No clearing of native vegetation (unless approved or covered by maintenance/operational exemption as per SA Water's Native Veg SOP) • Utilise existing access tracks/roads where available or ensure access via previously disturbed cleared areas. • Park vehicles and store equipment or stockpiles (including soil) in areas that are designated/pre-marked as laydown areas or already cleared (e.g. tracks) to avoid smothering or damaging native vegetation. • Avoid impacts to roots (10m from drip line optimal) wherever possible. If roots (≥ 50mm) are discovered during the works these are to be bridged where possible. Roots discovered <50mm which are broken are to be clean cut with a saw. • Where working in roadside areas care shall be taken not to impact in areas where Department of Planning, Transport and Infrastructure or district council based 'Roadside Significant Markers' are present. These identify that a section of roadside reserve contains a significant feature such as rare flora, matters of cultural heritage or significant native vegetation. Contact Environmental Services for details if working in these areas.

Environmental Impact	Introduction of weeds and pathogens
Objectives	• Pest plants / pathogens not introduced into worksite or spread as result of works • No movement of declared plants in a uncontrolled manner.
Performance indicator	• No new incursions of declared plants or plant pathogens post construction • Weed and hygiene measures in place
Controls	**Preconstruction** • Ensure any declared plants within work area are identified • Ensure plant and machinery washed down prior to entry to work zone. **Construction**

	• Ensure imported material is 'weed free' by applying a risk based approach, material is considered weed/pest free if:
	  ○ Quarry material is sourced at depth and is not stockpiled/surface material.
	  ○ classified as standard TS-4.
	  ○ Sourced from a licenced quarry (and/or quarry site inspected by the local NRM Board with records to confirm appropriate weed management strategy is in place that minimises the risk of weed contamination of material taken from that site).
	  ○ If quarry material is considered top soil, inspection by suitably qualified person is required to ensure fill is weed/pest free.
	• Locate stockpiles away from weed infested areas where possible
	• Appropriate wash-down of machinery if sourced from weed or disease risk areas or have carried imported material.
	• All equipment wash-down to be undertaken within an identified wash-down area and water contained within that area (no discharge of wash-down water to stormwater or watercourse).

Environmental Impact	**Fauna**
Objective	Prevent or minimise disturbance to native fauna and their habitat.
Performance Indicator	• Fauna within works area not adversely impacted
Controls	**Pre-construction** • Ensure contact list for local/regional fauna rescue organisation available **Construction** • Any injury or death of native wildlife caused by the construction activity will be reported to the SA Water Environment Officer • If tree hollows are present and trees require pruning/ clearing, these must be checked for fauna before removal • If any fauna is found, the SA Water Site Representative will report the details of discovered fauna to the SA Water Environment and Heritage Services Team for relocation if required. • Where native fauna is likely to be present within works area minimise risk of entrapment (eg close trenches overnight)

Environmental Impact	**Stockpile, Erosion and Stormwater Management**
Objective	Minimise the potential for environmental impacts associated with poor stockpile management.
Performance indicator	• No sediment laden runoff leaving works area • No dust from stockpiles leaving site and impacting sensitive land uses (residents/schools, sensitive habitats) • Management of contaminated spoil in accordance with EPA requirements

Controls	**Preconstruction**
	• Identify designated stockpile/laydown areas away from drainage lines, drip lines of trees/vegetated areas
	• Identify potential soil contamination that may require management and ensure appropriate areas for stockpiling established
	Construction
	• Follow requirements of the SA EPA Guideline for stockpile management including:
	  ○ Materials with a potential to produce leachate and contaminated runoff should be stored in a sealed and bunded area.
	  ○ Limit stockpile height
	  ○ Materials must be stored away from surface watercourses, flood zones and groundwater recharge areas to prevent environmental harm to water.
	• Locate designates fill stockpiles away from vegetation and drainage lines.
	• No stockpiling within the drip lines of trees to minimise compaction of the root zones.
	• Maintain separate stockpiles for different materials
	• Remove excess spoil from the site and dispose of in accordance with EPA requirements including at EPA licenced landfill or other appropriate location as approved by SA Water's Environment Officer.
	• Install erosion control measures such as silt fences, hay bales, sedimentation sumps, sand bags, geotextile fabric, diversion drains or other appropriate measures on the down slope side of stockpiles.

Environmental Impact	**Air Quality (Dust, emissions, odours)**
Objective:	Ensure that particulate and gaseous emissions do not cause environmental nuisance or harm to surrounding community and environment.
Performance indicator	• No community complaints during construction regarding air quality (dust, odours) • No impact to adjacent sensitive land uses (eg houses, schools) • Results from visual inspections show no visible dust leaving boundaries of construction site
Controls	**Preconstruction** • Identify site access, laydown areas and stockpile locations • Identify sensitive receivers and dust monitoring requirements. **Construction** • Restrict high risk activities during extreme weather events (strong winds, hot dry weather) to dry/calm conditions if required to limit dust generation. • Water cart available to control dust if required. • Minimising the extent of exposed and stripped surface areas within the project area • Ensure construction facilities are designed and operated to prevent the emission of smoke, dust, cement dust and other potentially deleterious matter into the atmosphere.

	• Maintenance of vehicles and equipment. • Reduce idling time of vehicles and plant. • Reduce vehicle speeds on dirt roads to reduce dust emissions. • Cover loads if dust is an issue. • Stockpiles to be managed to reduce dust (manage height, covering wetting as required) • Undertake inspections of dust/ emissions controls and activities and respond accordingly

Environmental Impact	**Noise and Vibration impacts**
Objective:	To ensure noise and/or vibration from construction does not cause an environmental nuisance or adversely impact amenity/ people or result in damage to property.
Performance Indicator	• No complaints related to noise or vibration • No property damage resulting from vibration

Controls	**Preconstruction**
	• Plan timing of noisy activities to avoid impacts on nearby residents
	• Select good plant and equipment that generates low noise and vibration
	• Consult with stakeholders (though SA Water) in advance of works
	• Ensure machinery has appropriate mufflers, silencers and/or enclosures fitted
	• Investigate alternative processes/methods that will reduce noise and vibration
	Construction
	• Construction activities should be in accordance with the EPA Construction Noise Information Sheet (EPA 425/10).
	  ○ Normal hours of work should be between 7am and 7pm, Monday to Saturday
	  ○ Work outside these times may be permitted to avoid impacts such as unreasonable interruption of vehicle or pedestrian traffic movement, Environmental Services should be advised in such cases.
	• Notify nearby residents/landowners if any project activities proposed outside of normal construction times (though SA Water)
	• Use appropriate equipment for the task
	• Regularly maintain plant and equipment used during construction (eg rotating parts to be balanced)
	• Enclose, where practical, stationary constant noise sources such as air compressors, generators etc to reduce noise levels
	• Maximise the distance between vibration sources and receivers if possible
	• Maintain complaints register and respond to complaints received

Environmental Impact	Storage and Handling of Hazardous Substances
Objective	Manage the storage of hazardous substances to avoid contamination of surrounding soils and water.
Performance Indicators	• Hazardous substances stored appropriately and spill kits on site. • No impact to soil/groundwater associated with storage use of hazardous substances.
Controls	**Preconstruction** • Plan for sufficient plant and equipment to ensure minimal maintenance and refuelling required on site • Identify areas for storage, refuelling and spill kits. • Establish bunded area and/or where appropriate lockable bunded container in compound for storage **Construction** • Hydrocarbon spill kit available and personnel trained in the efficient use spill kits readily available. • Minimise quantities of hazardous substances, fuels and lubricants stored on site. Store and handle chemicals/hydrocarbons as per the product MSDS. MSDS to be available at all times for hazardous substances that are used or stored. • Storage and management requirements for hazardous substances in accordance with legislative guidelines including bunding, impervious floor and in a location not subject to flooding and within a pre-marked laydown area. • All waste oil to be collected and disposed of at an EPA Licensed Recycling Depot. • Ensure no discharge of hazardous substances or fuels/lubricants into water courses or storm water. • The decanting, mixing, applying, storing of chemicals including paint, or the refuelling of vehicles or equipment shall not be conducted within 50 m of a watercourse or drainage channel. • In the event of a minor spill (e.g. diesel), affected soil to be excavated and disposed of at an appropriately licenced landfill. • In the event of a major fuel or chemical spill, immediately notify SA Water Site Representative of the spill and if known, any associated details (e.g. Type of spill, source, time of incident).

Environmental Impact	Contamination
Objective	• Identify potential contamination issues on site. • Manage such issues to protect employees, the public and the environment.
Performance Indicator	• No impact to soil/groundwater associated with contaminated material. • No risk to employees from encountering and managing contaminated material.
Controls	**Preconstruction** • Undertake assessment of risk of encountering contamination based on historical or surrounding land uses **Construction**

	• In the case of unusual odours or visual observation being made during excavation that indicates soil/groundwater contamination work is to cease and the SA Water Environmental officer contacted. • The discovery of contaminated soil and/or groundwater is to be immediately reported to the SA Water Site Representative so as the appropriate authorities can be notified. • Contaminated material must be transported and disposed of in accordance with EPA requirements (licenced waste transporter and to EPA licenced facility). • Waste transfer certificates retained for contaminated material and available on request. • If contaminated discovered: ***Isolate*** the suspected contaminated area. ○ Separate any suspected soil/fill, store on impervious material (tarp/fortecon) and cover to prevent rain or wind mobilising material. Any contaminated fill requires NATA Certified Laboratory Test Results and must be disposed to an EPA licensed landfill (contact Environmental Heritage Services to arrange this) ○ Groundwater contamination is required by law to be reported to the EPA. ○ No disposal of contaminated groundwater to a stormwater or watercourse.

Heritage Impact	**Aboriginal Heritage Management**
Objectives	• Prevent or minimise Disturbance to cultural heritage sites • Ensure all statutory requirements are complied with and controls listed below are implemented to minimise potential disturbance to unknown sites.
Performance indicators	• Management of any Aboriginal discoveries in accordance with SA Waters SOP for the discovery of Aboriginal Heritage (refer Appendix A)
Controls	**Pre Construction** • For all works not limited to within building or on existing infrastructure, undertake an AAR register search to determine if known heritage sites within the works area and complete heritage risk assessment **Construction** • SA Water's procedure for the discovery Aboriginal Heritage must be available on site and all construction personnel inducted into this procedure. • In the event of potential a potential heritage site or object being discovered during construction, works in the area must stop and the procedure for the Discovery of Aboriginal Heritage followed (refer Appendix A)

Environment Impact	**Fire Management**
Objective	• Ensure compliance with South Australian Country Fire Act 1989 • To ensure that construction activities do not cause and emergency incident such as starting a fire.

Performance indicator	• No emergency incidents as a result of construction activities.
Controls	**Pre Construction** • Review fire danger season and schedule works to minimise risks associated with fire, where possible • Conduct a risk assessment on days notified as total fire ban days before undertaking any works on site • Have in place an emergency response plan for the works **Construction** • Fire extinguishers/on site fire fighting equipment to be available on site and in work vehicles, major plant and equipment and ensure workers trained in their use • Hot work permits required for 'hot works' on total fire ban days, no works on catastrophic fire rating days unless approved. • Maintain all machinery and vehicles in good condition to minimise risk of fires • Fit plant with spark arrestors • No burning off or burning of wastes

Impact	**Waste Management**
Objective	• To ensure all statutory requirements are complied with relating to management of waste (including Waste to Resources Policy) • Maximise reuse and recycling of materials
Performance indicators	• Compliance with waste management requirements

Controls	**Pre Construction** • Adopt the principles of the waste management hierarchy and plan/procure materials that : ○ Avoid the production of waste ○ Minimise the production of waste ○ Maximise reuse and/or recycling of waste ○ Recovery of energy or other resources from waste ○ Treatment of waste ○ Disposal of waste in environmentally sound manner • Confirm the relevant statutory requirements for disposal of wastes from site Construction • Carry out works to minimise waste production • Segregate wastes to maximise reuse/recycling - • Provide and use sealed waste and recycling bins • Dispose of waste materials, waste oils etc at EPA licence facilities • Waste to be removed from site using appropriately licenced waste transporters • No burning of wastes

Impact	**Visual Amenity**
Objective	• Prevent or minimise negative impacts from construction activities on the visual amenity of the local area.
Performance indicators	• No community complaints regarding visual amenity during the construction period or post project associated with site condition (eg demobilisation)
Controls	**Pre Construction** • Assessment of potential visual impacts and opportunities to mitigate or improve visual amenity (eg landscaping/screening). • The establishment of site facilities or undertaking other activities which are likely to adversely affect the visual amenity of the surrounding area are not permitted **Construction** • Implement waste and dust management controls • Stockpiles, equipment and large plant to be located in areas of the project least likely to affect visual amenity (away from houses etc). • Ensure good housekeeping and waste management on site.

Impact	Traffic Management
Objective	• To minimise the impact to the public associated with the construction of this project
Performance indicators	• Minimise complaints from the public regarding traffic management
Controls	**Pre Construction** • Assess impacts on traffic flow, direction and timing as part of project. • Assess traffic management requirements to ensure safety to site workers and community • Develop traffic management plan for works **Construction** • Traffic management controls implemented as per traffic management plan

Appendix A Aboriginal Heritage Discovery Procedure

Have you found a site, object or skeletal remains that may be Aboriginal Heritage?

- See example pictures on next page.

STOP

Do not disturb/remove/touch or displace the site, object or skeletal remains.

- It is an offence to disturb or interfere with Aboriginal heritage or skeletal remains.

PROTECT

Restrict access. Site supervisor to take note of:

- Location in relation to site works (pref GPS).
- Any immediate threats to heritage e.g. construction activities, vandalism, water level.
- Name and contact details of the person who made the discovery.

NOTIFY

Site Supervisor to immediately notify:

- SA Water representative : *ADD CONTACT*
- Local Police or 131 444. If suspected human remains have been discovered.

MANAGE

The SA Water EHS Team will appropriately manage the incident with appropriate guidance from:

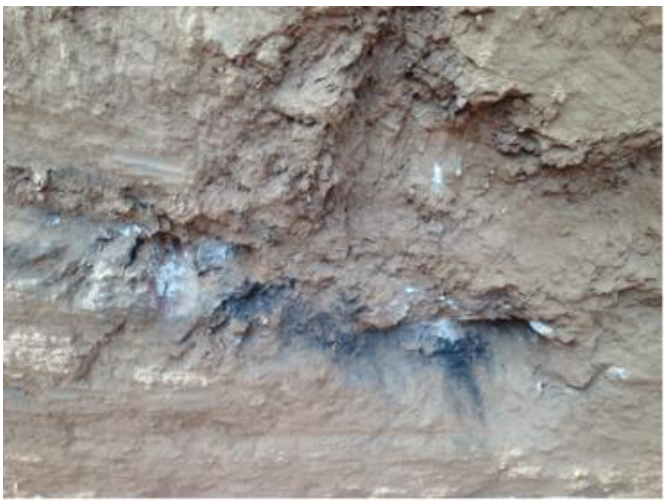
- Local Police (where skeletal remains have been discovered).
- Aboriginal Affairs and Reconciliation .
- The local Aboriginal community.
- An Archaeologist may also be consulted.

RESUME

The SA Water Project Manager will notify the contractor when works can resume.

- This decision will be made in partnership between the PM and EHS team.

Example Pictures



Appendix F – Construction Environmental Management Plan

SA Water: Project ZCEF

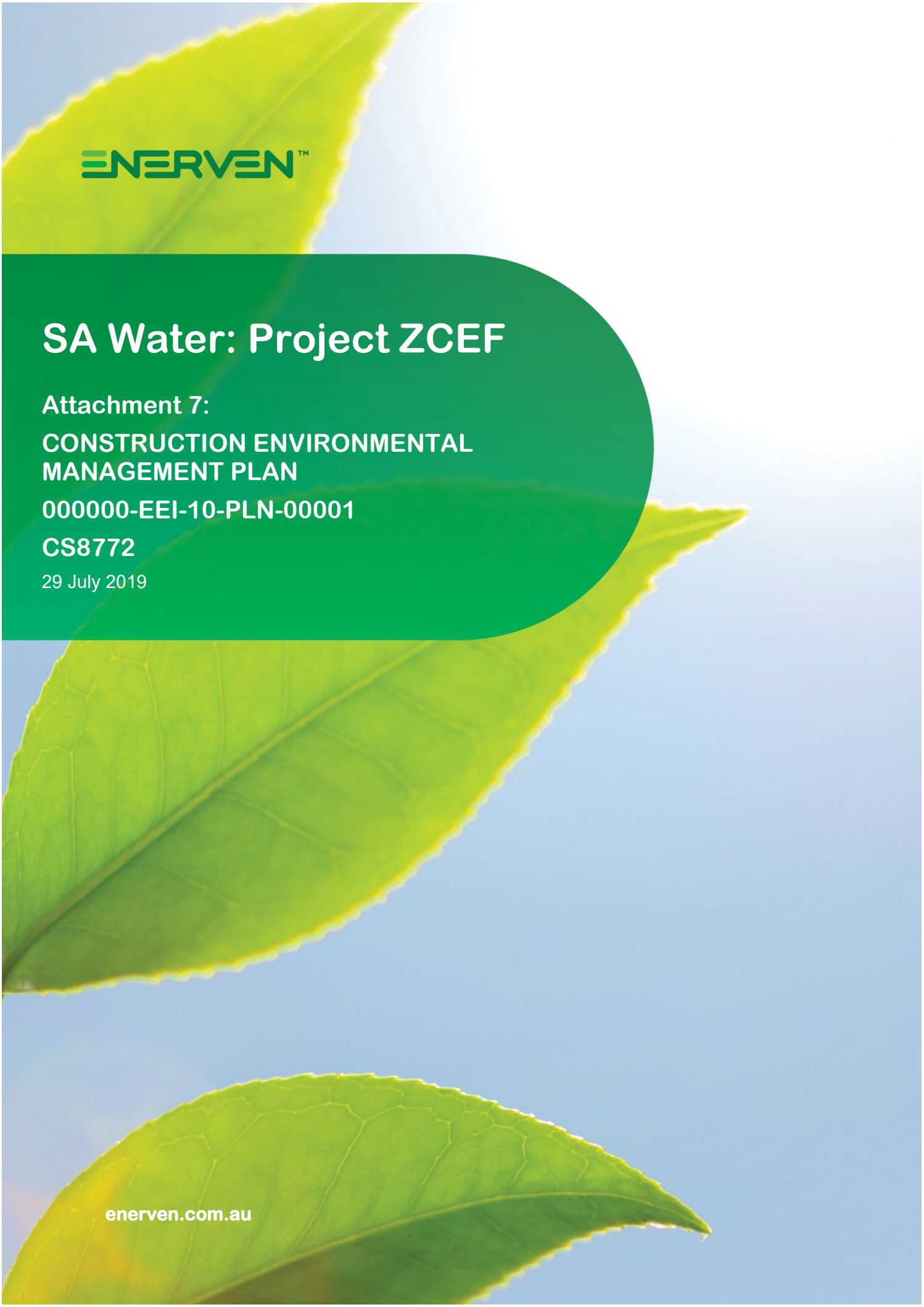
Attachment 7:

CONSTRUCTION ENVIRONMENTAL MANAGEMENT PLAN

000000-EEI-10-PLN-00001

CS8772

29 July 2019



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DOCUMENT CONTROL

For the duration of the project, all personnel shall implement the requirements of this plan. Revisions to the Construction Environmental Management Plan shall be made when:

- The plan no longer reflects the actual work practices of Enerven or its contractors
- The plan does not adequately reflect the requirements of the contract
- A non-conformance is detected in the plan
- To incorporate agreed improvement to the plan

DOCUMENT HISTORY AND STATUS

Rev	Reviewed	Date	Authorised by
1	Draft issued for internal review	24 August 2018	J Balogh
2	Issued to SA Water	7 September 2018	J Balogh
3	Final issue	6 December 2018	J Balogh
4	Draft issued to SA Water	5 March 2019	V Nair
5	Update Fre Management to incorporate CFS requirements	21 March 2019	J Balogh
6	Project Director update	29 July 2019	J Balogh

Signatories

This Construction Environmental Management Plan is reviewed by:

Enerven Environment Consultant
Name: Julianna Balogh

Signature: ..... Date: 29 / 07 / 2019
Authorised by:

Enerven Project Director
Name: Leon Cocchiaro

Signature: ..... Date: 29 / 07 / 2019

Contents

1. Introduction

The CEMP describes the environmental management processes and controls that Enerven will apply for the duration of SA Water's Zero Cost Energy Future (ZCEF).

The purpose of the CEMP is to provide a structured approach for the management of environmental risks during each phase of the project. Implementing this CEMP will ensure that Enerven meets the clients' minimum environmental requirements in addition to relevant legislative and policy obligations in a systematic manner.

The CEMP has been developed in line with SA Power Networks* Environmental Management System (EMS) and is consistent with AS/NZS ISO14001.

* Enerven is a group of SA Power Networks and therefore EMS documentation, including the Environment Policy, is referenced as SA Power Networks.

2. Abbreviations

Abbreviation	Description
ACM	Asbestos Containing Material
AS	Australian Standard
CEMP	Construction Environmental Management Plan
Cwlth	Commonwealth
EMS	Environmental Management System
Environmental Incident	An incident that causes harm and/or damage, or the potential to, the environment eg oil and chemical spills, vegetation clearance without approval, damage to Aboriginal heritage sites, air, water or noise pollution
EPA	Environment Protection Authority
Hazard (environmental)	An object or situation that has the potential to cause harm and/or damage to the environment
KPI	Key Performance Indicator
Near miss (environmental)	An incident that could have resulted in damage to the environment
PM	Project Manager
Regs	Regulations
SDS	Safety Data Sheet
SF6	Sulfur hexafluoride
SQE	Safety, Quality and Environment
WI	Work Instruction

3. Project Description

1.1 Locations

Various SA Water sites across South Australia.

1.2 Construction / Operation Activities

Construction activities involve the following tasks:

- Earth works
- Site preparation
- Vegetation management
- Piling
- Trenching
- Concreting
- Foundation works
- Piling
- Fencing
- Drainage management
- Hauling

4. Roles and Responsibilities

The Environment Consultant is responsible for:

Responsibilities	Timing
Providing management advice to Enerven with respect to technical content of this CEMP and associated environmental procedures or work instructions	Ongoing
Reviewing for currency and updating this CEMP when changes occur to work practices, when it does not reflect the requirements of the contract or to incorporate improvements	As required
Review and participate as required in environmental incident investigation and corrective measures that arise from incidents in relation to the project	On occurrence as required
Ensuring periodic audits are undertaken to determine compliance with the implementation of this CEMP	As per environmental audit schedule

The Environmental Representative is responsible for:

Responsibilities	Timing
Undertake a risk assessment and ensure all environmental controls identified in the planning process are understood and communicated to field employees and contractors and implemented on site	Commencement of the project and ongoing
Ensuring all employees, contractors and visitors are provided with a site induction inclusive of any environmental controls prior to commencing any work activities	Prior to commencing work for the first time and ongoing
Communicating any site controls with respect to this CEMP to field staff and contractors during weekly toolbox meetings	Weekly
Ensuring any environmental incidents or near misses with respect to the project are reported in a timely manner and recorded in the SA Power Networks online reporting system	On incident or near miss
Ensuring regular environment inspections/observations are undertaken to monitor compliance with this CEMP	Fortnightly
Maintaining relevant environmental records on site	Ongoing

The Environmental Representative will be the SQE Advisor allocated to this project. If the Environmental Representative cannot be on site at any given time, the delegate will be the Construction Supervisor at the relevant project site.

5. Training and Site Induction

Relevant Enerven personnel, including contractors and subcontractors, will be required to attend a kick-off meeting prior to site works which will include an environmental component. This will cover key environmental issues, mitigation measures for their control, specific environmental management requirements and roles and responsibilities.

A site induction will be delivered to contractors and subcontractors by the Site Supervisor, or delegate, to inform personnel and contractors of critical environmental protection measures (eg vegetation management, weed hygiene procedures, oil containment, waste soil management) and general environmental obligations. A record of this will form the training register which will include name, contact number, date of induction, and any other relevant information.

In addition, pre-start meetings and toolbox talks will be used throughout the duration of the project to raise awareness and educate personnel on site specific environmental issues.

6. Inspections and Auditing

The Site Supervisor, or delegate, will undertake inspections of the work site on a regular basis to evaluate the effectiveness of environmental controls. These will occur fortnightly or on an as needs basis, depending on the complexity of the work and anticipated environmental risks. Findings will be recorded on a Site Environmental Checklist (see Appendix 4 for a copy of the template), including any actions required.

In addition to inspections, environmental audits will be undertaken by Enerven's Environment Consultant, or the Environmental Representative, to verify compliance with the following:

- The CEMP
- Any client environmental requirements
- Any relevant legal and other requirements (eg approvals, agreements, licenses, permits)

The frequency of audits will be bimonthly (ie every 2 months) and an audit schedule will be prepared and maintained to reflect this.

If any non-conformances are identified during site inspections or audits, they will be investigated to determine the cause and to ascertain the necessary corrective actions. Non-conformances will be verbally reported to the client within 4 hours of occurrence.

7. Incidents and Emergencies

In the event of an environmental incident, near miss or hazard, these will be managed in accordance with SA Power Networks EMS 4.2 Environment Incident Response Procedure, a copy of which will be held at each site. The procedure provides information on emergency incident response including:

- Classification of environmental incidents
- Process for responding to and managing environmental incidents
- Roles and responsibilities
- Regulatory requirements

Specific response actions will depend on the type and location of the environmental incident, near miss or hazard. General response measures may include:

- Control/contain
- Stabilise and neutralise
- Clean up
- Remediate
- Notification
- Investigation
- Reporting

With regards to notification, the relevant authorities will be contacted if necessary, depending on the type of incident, near miss or hazard. A list of emergency contact numbers is provided below. In addition, and in consultation with the client, the EPA may be notified in accordance with the *Environment Protection Act 1993*.

As part of Enerven's reporting obligations, the client will be verbally notified within 4 hours of occurrence.

1.3 Emergency Contacts

Contact	Role(s)	Name (if applicable)	Phone
Emergency Response Personnel	Available 24/7, also has authority to stop or direct works		
Environment Protection Authority (EPA)	Pollution, licensing, site contamination		08 8204 2004
Police, Fire, Ambulance	Life threatening emergencies		000
Metropolitan Fire Service	General enquiries during business hours		8204 3600
RSPCA	24/7 hotline for the rescue/advice for sick or injured animals		1300 4 777 22
Fauna Rescue	24/7 hotline for the rescue/advice for sick or injured native wildlife		08 8289 0896
Koala Hotline	24/7 hotline for the rescue/advice for sick or injured koalas		1300 562 527
Bats Hotline	24/7 hotline for the rescue/advice for sick or injured bats		0475 132 093
National Parks SA	Information on native plants, weeds, water affecting activities		8204 1910
SA Ambulance Service	General enquiries and ambulance service information		1300 136 272
SA Water Program Manager	Project related enquiries	John Hart	0436 682 042
Enerven Program Director	Project related enquiries	Paul Farnworth	0447 057 829

Contact	Role(s)	Name (if applicable)	Phone
SA Water Senior Environmental Impact Assessment Officer	Environment related enquiries	Jackie Griggs	0448 379 303
Enerven Environment Consultant	Environment related enquiries	Julianna Balogh	0419 877 627

8. Environment Control Measures

For each environmental aspect below, the following controls will be undertaken if applicable:

Water Quality	
Objective(s)	• Prevent or minimise adverse effects on surface water and groundwater quality, flows and drainage
Management Strategy	• Works in, around or on waterways must be managed to eliminate or minimise impacts on water quality • If any works are proposed within 10m of the top of a bank or in the bed of a watercourse, a Water Affecting Activity permit is required from the Natural Resources Management Board • Generally, works in or alongside drains, directional drilling under a watercourse or works that extend 10m beyond the top of a bank do not require a permit
Controls	• Review construction area to minimise potential for surface runoff to enter the site and to identify controls for runoff leaving the site. • Review project activities that will require protection and installation of controls. • Identify designated stockpile/laydown areas away from drainage lines. • Schedule works that will occur in watercourses /drainage lines for periods of favourable weather (eg dry periods) or implement construct techniques that reduce construction footprint (eg directional drilling). • No discharge to a watercourse (including stormwater system) without approval from the site superintendent. • Install erosion and sediment control devices prior to works commencing (eg silt fences, silt socks, hay bales diversion drains, geotextile fabric) and ensure they are maintained (eg remove debris from sediment control items regularly) • Ensure stockpiles have erosion control devices installed, particularly downslope of stockpile • Monitor weather forecasts to identify rain events and ensure control measures in place • Inspect and maintain/clean sediment control items regularly • Clearly define access tracks and routes • Compact, backfill and resurface disturbed or unsealed areas as soon as possible

	• No onsite refuelling, service, maintenance or cleaning in areas where runoff/wastewater may enter stormwater system or waterbodies. • All equipment wash-down to be undertaken within an identified wash-down area, and no discharge of wash-down water to stormwater or watercourse. • Turbid water from concrete cutting etc. not to be directed to stormwater or watercourses.
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • No uncontrolled release of contaminated stormwater to drains or waterways
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • Erosion and sediment controls will be inspected to ensure they are effective and maintained
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• EMS 5.10 Water Quality Management Procedure • EPA Handbook for Pollution Avoidance on Commercial and Residential Building Sites • EPA Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry
Legislation	• *Environment Protection Act 1993*

	• *Environment Protection (Water Quality) Policy 2015*

Flora and Fauna	
Objective(s)	• Minimise impacts on flora and fauna • Retain and enhance existing flora and fauna habitat wherever possible
Management Strategy	• Effective management and protection of ecological habitats is essential for the survival of native flora and fauna within and surrounding project sites • Management of these habitats extends beyond minimising direct impacts on flora and fauna and includes protection of vegetation, management of weed species, locating hazardous material storage away from environmentally sensitive areas and managing bushfire risk by minimising potential sources of fuel

Controls	• Areas to be retained and adjacent habitats will be cordoned off, or in the case of vegetation, clearly marked with pink tape, prior to works to prevent damage or accidental clearing
	• This information will be relayed to each contractor and/or subcontractor undertaking the work, so they are clear about what to retain
	• If vegetation clearance is required during the course of works, the relevant approvals will be sought in consultation with the client
	• Prior to any vegetation clearance, a pre-clearing inspection will be undertaken which will include
	  ○ A check for the presence of fauna and if located, engage a suitably qualified person to remove and relocate
	  ○ Salvage potential fauna habitat (eg hollow logs) from clearing where possible and reinstate in appropriate locations
	  ○ Completion of any pre-clearing requirements by the client or as outlined in relevant approvals, agreements, licenses or permits
	• Vehicle movements will be kept to marked areas and defined access tracks
	• No stockpiling of materials or parking of machinery/vehicles, in the drip line of trees
	• Minimise trap hazards for fauna by covering trenches, open pits and excavations, which will be regularly inspected in the event fauna are located

	• If required, barriers will be installed to prevent the movement of livestock and other animals onto the work site • Any injury or death of native wildlife caused by construction activity will be reported to the site superintendent. • Ensure all disturbed areas caused by construction and maintenance activities are restored as close as practicable to their original or agreed condition
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • No damage or injury to protected flora and fauna
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • The site will be regularly checked for the presence of fauna
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• EMS 5.5 Flora and Fauna Management Procedure
Legislation	• *Environment Protection and Biodiversity Conservation Act 1999* • *National Parks and Wildlife Act 1972* • *Native Vegetation Act 1991*

Pest Plants and Diseases	
Objective(s)	• Prevent the introduction and establishment of new pest plants and diseases • Minimise the spread of pest plants and diseases
Management Strategy	• Project sites must be kept free of pest plants for the duration of works, including the reinstatement and/or revegetation period • Controls will be put in place to prevent the establishment of new pest plant and diseases, restrict their spread around the project site and surrounds, and to effectively manage them in accordance with legislation
Controls	• Vehicles, machinery and equipment will be risk assessed to determine the necessary level of inspection and wash down • Where deemed necessary to reduce the spread of weeds or through property owner specified requirements, either a temporary wash down bay will be established, or a mobile wash trailer or pressure spray utilised to ensure vehicles, machinery and equipment are thoroughly washed prior to leaving the area or moving to adjacent properties • Undertake periodic cleaning of excess soil and organic matter from vehicles, machinery and equipment as required in designated area • Where possible, site entry and exit point will be established away from pest plant or disease infected areas • Vehicles will be kept to public roads, designated access tracks or within work areas where practicable • Locate stockpiles away from pest plant infected areas where possible • Any imported soil materials will be sourced from licensed facilities to ensure there is no introduction of weeds or diseases to the site • For ongoing maintenance, weed control measures will be undertaken utilising products which are appropriate for areas with sensitive receptors (ie waterways, native vegetation, ecological habitats, etc.)
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • No evidence of new pest plants on site

Pest Plants and Diseases	
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • The site will be monitored for the presence of pest plants
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• *EMS 5.2 Biosecurity - Pest Plant Animal Disease Management* • *EMS 5.2.1 WI-Weed Spread Prevention* • *EMS 5.2.2 WI-Phytophthora Spread Prevention*
Legislation	• *Natural Resources Management Act 2004*

Soil Erosion and Drainage Management	
Objective(s)	• Prevent pollution of surface water through appropriate erosion and sediment control
Management Strategy	• Ground cover provides the most effective means of preventing erosion • Sediment run-off and dust controls depend on retaining existing vegetation or revegetating and mulching disturbed areas as soon as possible
Controls	• Assess the site and proposed works for risks of erosion and sedimentation, considering slope, soil type, exposed surfaces, proximity to environmentally sensitive areas (eg waterway, fauna habitat, cultural heritage site)

Soil Erosion and Drainage Management	

	• Control erosion of stockpiles, batters and disturbed areas by control devices (eg straw bales, geotextile sediment fences, silt socks) and keep stockpiles away from drainage lines
	• Always check the worksite prior to and during rain or when leaving the site for several days to ensure erosion control measures are effective
	• Maintain erosion and sediment control structures and clean out and replace as needed
	• Prevent sediment loads and wastewaters (generated by activities such as concreting) from entering drainage lines and surrounding waterways
	• Construct wash down bays in appropriate sites (eg not near drains)
	  • Line with durable plastic liner
	  • Use bay specifically for concrete waste only
	  • Decommission bay when works complete at site

Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • No uncontrolled release of contaminated stormwater to drains or waterways
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • Erosion and sediment controls will be inspected to ensure they are effective and maintained
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff

Soil Erosion and Drainage Management	
	• Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• EMS 5.10 Water Quality Management Procedure • EPA Handbook for Pollution Avoidance on Commercial and Residential Building Sites • EPA Stormwater Pollution Prevention Code of Practice for the Building and Construction Industry
Legislation	• *Environment Protection Act 1993* • *Environment Protection (Water Quality) Policy 2015*

Air Quality	
Objective(s)	• Minimise pollutant emissions from construction and maintenance activities as far as feasible and reasonable • Identify and control potential dust and air pollutant sources
Management Strategy	• Management of the ambient air near construction works, noting the protection of workers on site • Use of improved equipment where economically feasible to replace those less efficient
Controls	• Weather conditions will be monitored, and appropriate responses will be organised and undertaken periodically (eg excavations will be minimised or ceased on extremely windy days) • Regular visual monitoring of dust generation from work zones • Plant and equipment will be serviced and maintained in good working order to reduce unnecessary emissions from exhaust fumes • Dust suppression measures (eg water carts, covers, dust barriers) will be used if required for excavation works, stockpiles, unsurfaced haul roads and loads of soil being transported to reduce windblown dust emissions • Sediment will be swept or removed regularly from paved or sealed areas

Air Quality	
	• Traffic movement and vehicle speeds will be restricted over undisturbed areas and unsealed roads • Minimise the extent of exposed and stripped surface areas within the project area • Stockpiles to be managed to reduce dust (manage height, cover, water down as required)
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • Number of complaints from residents or businesses related to dust
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • Dust control measures will be inspected to ensure they are in place and implemented
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Legislation	• *Environment Protection Act 1993* • *Environment Protection (Air Quality) Policy 2016* • *Local Nuisance and Litter Control Act 2016* • *National Environment Protection (Ambient Air Quality) Measure 2003* • *National Environment Protection (Diesel Vehicle Emissions) Measure 2001* • *Ozone Protection and Synthetic Greenhouse Gas Management Act 1989*

Noise, Vibration and Visual Amenity	
Objective(s)	• To ensure any works causing noise or vibration do not affect nearby structures, heritage items or sensitive receptors • Maintain amenity in adjoining areas
Management Strategy	• Plan activities and engage affected stakeholders to minimise noise and vibration impacts • Implement noise and vibration mitigation measures • Conduct monitoring and ensure compliance with SA EPA legislation • Reduce visual impact of construction to surrounding community

Controls	• Turn off or throttle down machinery when not in operation
	• Restrict construction noise to applicable hours as per EPA guidelines
	  • Between the hours of 7am and 7pm Monday to Saturday
	  • Any other time to avoid impacts such as unreasonable interruption to vehicle or pedestrian traffic movement – this must be authorised by the Site Superintendent (SA Water's Program Manager)
	• If works must occur outside of EPA guideline hours, notify SA Water and nearby residents/landholders before commencement, at least 3 days prior
	• Where possible, schedule noisy activities from mid-morning to early afternoon
	• Use equipment with noise control features where available and ensure it is properly maintained
	• Arrange the work site to take advantage of natural barriers (eg hills, trees) and structures (eg fences, stockpiles) to reduce their line of sight with sensitive receptors
	• Site lighting must be designed and used so as to minimise impacts on surrounding land uses, and must not illuminate/project onto areas of conservation including wetlands, waterways and ecological habitats
	• The work site will be regularly maintained and be kept tidy and free of rubbish

Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents

	• No non-conformances • Number of complaints from residents or businesses related to noise, vibration or visual amenity
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • Noise or vibration monitoring if required by SA Water, local council or in response to complaints
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• EMS 5.13 Noise Guideline • SA EPA Guideline: Construction noise • SA EPA Guideline: General environmental noise
Legislation	• *Environment Protection Act 1993* • *Environment Protection (Noise) Policy 2007* • *Local Nuisance and Litter Control Act 2016*

Hazardous Materials	
Objective(s)	• Ensure awareness of risks of hazardous materials and their correct storage, transport, use and disposal • Prevent pollution arising from leakage or spillage of hazardous materials

Management Strategy	• The purchase, handling, storage and disposal of chemicals used on the project site will be managed appropriately to have negligible impact on the environment and do not pose a threat to the health or safety of workers
Controls	• Safety Data Sheets (SDS) for substances and materials will be readily available on site (eg hard copy, tablet) for personnel when required • Refuel plant and equipment off site where possible • If required, store and dispense fuels, oils and chemicals within sealed and bunded areas where spills can be contained and safely cleaned up and removed • Ensure bunds are regularly cleared of stormwater, and oily water mixtures are disposed of by a licensed waste contractor • Secure equipment, containers and drums during transport • Spill containment equipment (eg spill kit) will be made available around the construction site • In the event of a minor spill (eg diesel), the affected soil will be excavated and disposed of at an appropriately licensed landfill • In the event of a major fuel or chemical spill, immediately notify the SA Water Site Superintendent of the spill and if known, any associated details (eg type of spill, source, time of incident) • Any hazardous materials will be stored, handled and transported in accordance with the Dangerous Substances Act 1979
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • No uncontrolled spills of hazardous materials
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • Bunds to be checked that they are the appropriate size and functioning

Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• AS 1940-2004: The storage and handling of flammable and combustible liquids • SA EPA Guideline: Bunding and spill management • SA EPA Guideline: Waste transport certificate
Legislation	• *Dangerous Substances Act 1979* • *Environment Protection Act 1993*

Soil Contamination	
Objective(s)	• To ensure compliance with regulatory requirements associated with the management of waste soil, including stockpiling, sampling, transport and disposal
Management Strategy	• Ensure that sites with soil contamination do not pose a risk to the health and wellbeing of workers or residents and businesses in the vicinity • Provide a clear and transparent process that enables a coordinated approach to the assessment and management of contaminated soil
Controls	• If any contaminated soil is encountered which has not previously been identified, manage accordingly in consultation with SA Water • Ensure controls are in place to prevent the spread of any contaminated soil • Contaminated material must be handled and managed in accordance with EPA requirements (licenced waste transporter and to an EPA licenced facility) • Retain copies of Waste Transport Certificates (WTC) on site and ensure this is recorded on the WTC Register • Where possible, utilise suitable waste soil for beneficial reuse

Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • No environmental notices from SA EPA
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • Contaminated material is managed in accordance with legislation
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• *EMS 5.3 Waste Soil Management Procedure* • *EPA Standard for the Production and Use of Waste Derived Fill*
Legislation	• Environment Protection Act 1993

Heritage	
Objective(s)	• Minimise impacts on items or places of heritage significance • Avoid accidental impacts on heritage items
Management Strategy	• Ensure places with identified heritage values are conserved and managed as required by legislation • Maintain and exceed compliance with all statutory requirements

Heritage	
Controls	• Check with the client to determine if any heritage sites exist in or near the work area prior to commencement • If any heritage sites are identified these will be cordoned off, or clearly marked, as no go zones • No go zones will be checked throughout the duration of the project to ensure disturbance does not occur • If any sites or items believed to be of Aboriginal or non-Aboriginal origin are discovered or unearthed, work will stop immediately, and SA Water's Aboriginal Heritage Discovery Procedure will be followed (see Appendix 5)
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • Immediate reporting of archaeological remains if discovered
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor • Engagement of Aboriginal monitors during earthworks as required
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• EMS 5.7 Cultural and European Heritage Procedure • EMS 5.7.1-WI-Aboriginal Heritage Management
Legislation	• *Aboriginal and Torres Strait Islander Heritage Protection Act 1984*

Heritage	
	• *Aboriginal Heritage Act 1988* • *Environment Protection and Biodiversity Conservation Act 1999* • *Heritage Places Act 1993*

Fire Management	
Objective(s)	• Minimise the risk of adverse impact from fire on life, property and the environment
Management Strategy	• Ensure measures are in place to appropriately respond quickly and effectively in the event of a fire • Ensure measures are in place to allow the Country Fire Service (CFS) to access and safely circulate through the site in the event of an emergency
Controls	• Ensure spark-arrestors are fitted on vehicles and plant powered by internal combustion engines • Where possible, utilise diesel powered vehicles and plant • Hot work permits required for 'hot works' on total fire ban days, no works on catastrophic fire rating days unless approved by SA Water's Site Superintendent • Any welding activities to be undertaken in a controlled manner that minimises fire risk • The work site will be regularly inspected to ensure no build-up of flammable materials, particularly in high fire risk seasons • There will be access to firefighting equipment (eg fire extinguisher, portable water spray) at each work site • No burning off or burning of waste • Cigarette butts will be disposed of in designated containers • Locked gates to work areas must be secured with a CFS standard issue lock that can be opened by CFS personnel in the event of an emergency incident when the site is unoccupied • Access ways around and through the site shall always be kept clear of vegetation, machinery, plant, equipment and materials to enable movement by CFS and other emergency services vehicles in a continuous forward motion

Fire Management	
	• A minimum of 6.0 metres around the perimeter of the solar panels shall be maintained clear of vegetation and be generally trafficable by CFS and other emergency services vehicles
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• Bushfire Risk Management Manual No. 8
Legislation	• *Fire and Emergency Services Act 2005*

Waste Management	
Objective(s)	• Minimise the production of wastes • Maximise the reuse and recycling of materials used on site • Dispose of wastes in an environmentally responsible manner, and in accordance with legislation
Management Strategy	• Adopt the principles of the waste management hierarchy by maximising the reuse, recycling and recovery of materials

Waste Management	
	• Organise regular waste collections to avoid excessive on-site storage
Controls	• Separate recyclable waste and materials from general waste for recycling or reuse and clearly mark bins to avoid cross contamination • Cover and store wastes in a designated area to prevent it being blown or washed away • Dispose of hazardous materials (eg asbestos waste, contaminated materials) to an EPA licensed facility, using EPA's Waste Tracker system for the Waste Transport Certificate (WTC) when required • Copies of all WTCs will be kept on site, and recorded on the WTC Register (see Appendix 6 for a template of the register)
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • No complaints from residents or businesses related to waste • Presence of onsite waste containers for segregation of waste
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• EMS 5.4 Waste Disposal and Recycling Procedure

Waste Management	
Legislation	• *Environment Protection Act 1993* • *Environment Protection (Waste to Resources) Policy 2010* • *Local Nuisance and Litter Control Act 2016*

Asbestos Management	
Objective(s)	• Minimise any potential hazards posed by asbestos containing material (ACM)
Management Strategy	• Eliminate exposure to asbestos through the identification and removal of asbestos where safe to do so • Where elimination is not possible, exposure is to be minimised as far as reasonably practicable
Controls	• Reasonable steps will be taken to identify all possible locations of ACM • In consultation with the client, if ACM is identified or presumed, the material will be tested and treated accordingly • Dispose of any ACM at an EPA licensed facility, accompanied by a Waste Transport Certificate (a copy to be supplied to the client)
Performance Indicators	• No environmental prosecutions brought against the project • No reportable environmental incidents • No non-conformances • Number of safety audits performed
Monitoring	• Regular monitoring for environmental non-conformances will be undertaken by the SQE Advisor on site • The Environment Consultant will be advised of any non-conformances identified through monitoring by the SQE Advisor
Reporting	• Any reports on environmental incidents, environmental non-conformances or complaints will be maintained by the Enerven Consultant and made available to the client

Asbestos Management	
Corrective Actions	• For each non-conformance identified, the corrective action(s) will be implemented in consultation with the relevant construction staff • Improvement opportunities may also result in the implementation of corrective actions
Reference(s)	• Asbestos.sa.gov.au • Safe Working with Asbestos
Legislation	• *Environment Protection Act 1993* • *Work Health and Safety Act 2012* • *Work Health and Safety Regulations 2012*

9. Environment Control Maps

An Environment Control Map will be developed for each project site, identifying the location of environmental features and hazards (eg vegetation, heritage sites, water bodies, protected areas, etc) to assist in the planning and delivery of works. The maps will be prepared prior to commencement of construction and updated regularly if the work site or activity changes. They will be placed in locations for reference by all site staff and contractors.

An example of an Environment Control Map is provided in Appendix 3.

10. Appendix 1 – Environment Policy

Environmental Policy

Purpose

SA Power Networks is committed to conducting its electricity distribution operations and business activities in a manner that prevents or minimises pollution and other adverse impacts on the environment.

Principles

To fulfil this commitment, SA Power Networks will:

- comply with all environmental legislation, formal agreements, and relevant industry standards;
- measure and continually improve our environmental performance and environmental management system;
- ensure environmental impacts are considered in the planning, design, construction, decommissioning and operation of our work;
- recognise the biodiversity of areas under its operational control, and avoid unnecessary disturbance to cultural and natural sites of significance;
- respond openly and constructively to the reasonable expectations of the community on environmental matters;
- promote an attitude of care and responsibility and a sense of stewardship for the environment by employees through environmental education and training;
- use resources efficiently, minimise waste and where practicable reuse or recycle materials generated by our operations; and
- inform agents, advisers, contractors and consultants of the Environmental Policy.

Policy Area	Customers & Community
Policy Number	5.1
Approved by Board	21/07/2006

Definitions

In this policy statement:

- **environment** means the surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans and their interrelation;
- **Environmental Management System** means an organisation's structure of responsibilities policies, practices, procedures, processes and resources for protecting the environment and managing environmental issues; and
- **biodiversity** means the variety of ecosystems and plant and animal life that can be found in the environment.

Explanations

Responsible management of our resources and our environment will contribute to the well being of the SA community.

Ensuring that environmental considerations are incorporated into all SA Power Networks' business activities as a fundamental part of sound management practice.

The identification of environmental risk and implementation of environmental improvement plans to address the risk will ensure continual improvement in our environmental management.

Robust environmental incident response procedures will reduce pollution and environmental impacts, regulatory risk and business costs.

The integration of the Environmental Management System, based on sustainable development principles, into the existing business system will ensure that SA Power Networks is acting in a diligent manner.

This will:
- protect the environment;
- enhance relationships with shareholders and the community; and
- reduce the risk of litigation, related to environmental incidents, for SA Power Networks Board and personnel.

Responsibilities

The SA Power Networks Board is responsible for this Policy and monitoring compliance with the Policy.

The Chief Executive Officer is responsible for ensuring that all reasonable and practical steps are taken to:
- monitor the effectiveness of the environmental performance of SA Power Networks; and
- hold management responsible for the effective implementation of, and compliance with, the Environmental Management Policy.

General Managers are responsible for:
- ensuring that the operations under their control comply with this Policy;
- establishing and monitoring achievement of agreed environmental performance objectives; and
- actively promulgating the Policy.

Managers and Leaders are responsible for:
- ensuring that legal and environmental standards are met;
- ensuring that the environmental management systems and procedures are developed and applied in the workplace to prevent or minimise environmental risks;
- providing and documenting environmental training;
- ensuring environmental improvement plans and programs are developed, implemented, monitored and reviewed;
- ensuring environmental incident response procedures are implemented, maintained and incidents reported and investigated; and
- ensuring environmental performance is monitored and reported to their General Managers.

All SA Power Networks personnel are responsible for:
- being involved in, and committed to, sound environmental management practices in the workplace;
- complying with all environmental legislation, systems and procedures in their workplace;
- conducting their duties in a manner that prevents or minimises environmental damage or nuisance; and
- reporting any incident or threatened incident to their manager or leader.

General Manager People & Culture is the custodian of the Environmental Policy.

The Manager Environment & Property Services is responsible for:

- coordinating the review process every year for relevance to business requirements and consistency with legislation and government directives;
- reviewing and recommending updates to the Policy;
- monitoring the implementation of the Policy;
- developing, coordinating implementation, monitoring and reporting performance of SA Power Networks environmental management system; and
- providing advice on legislation and other environmental issues.

Controlled Document ID	A-42
Policy Area	Customers & Community
Policy Number	5.1
Approved by Board	21/07/2006
Custodians	General Manager People & Culture
Major Version	5
Commencement Date	21/07/2006
Review Date	29/08/2017
Next Review	29/08/2018

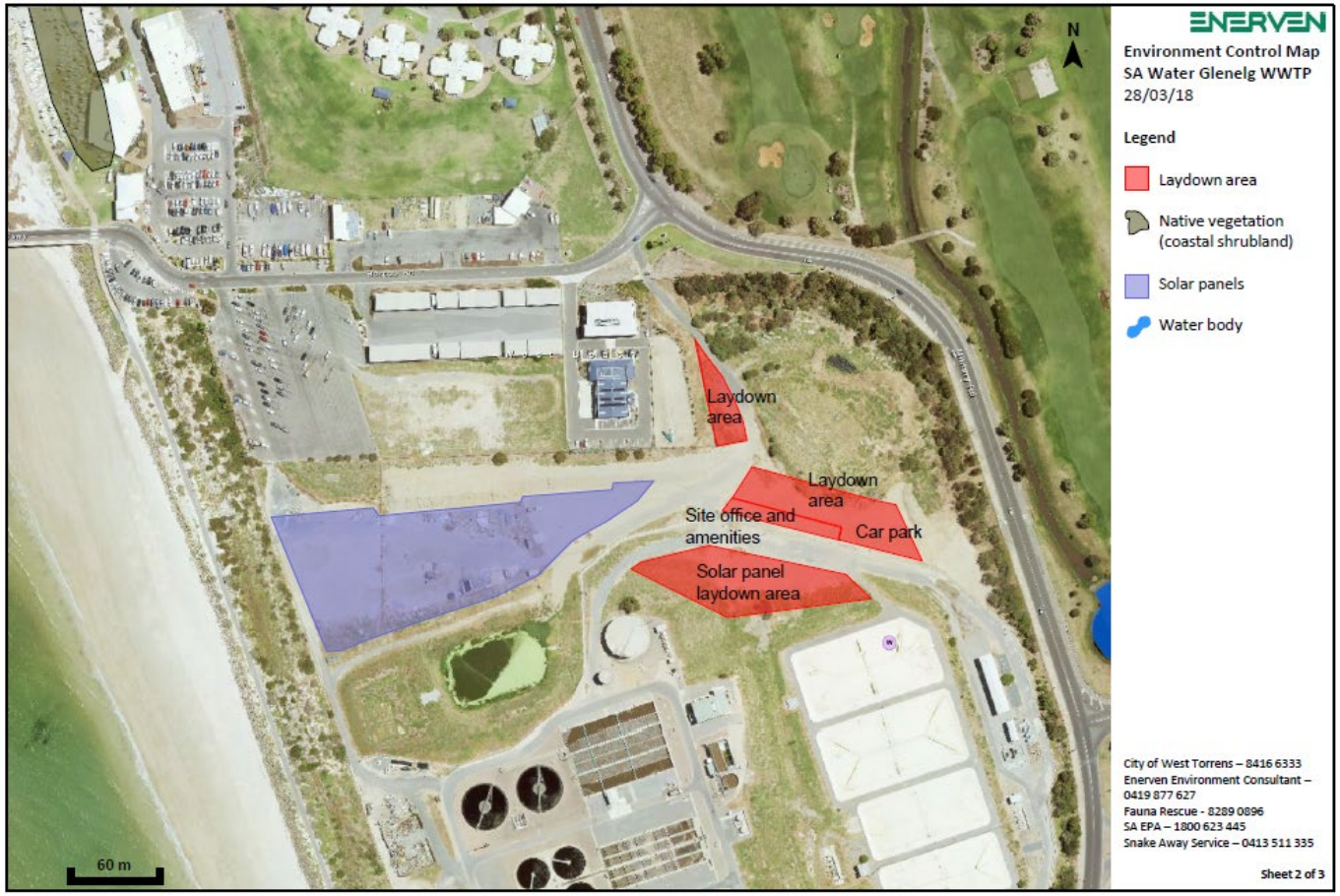
11. Appendix 2 – Legislation Register

SA and Commonwealth (Cwlth) Environmental Legislation (refer to **ENVIROLAW** for detailed legislative obligations and updates)	Air quality - Dust/Odour/ Pollutants	Native Fauna (animals)	Native Vegetation (eg approval for vegetation removal)	Toxic and Hazardous Materials (PCBs, SF6, CFC, Fuels,)	Heritage (Natural, European)	Aboriginal Heritage and Native Title	Noise and Vibration	Water Quality -Erosion and Sediment Control and Pollution	Soil Management (eg waste transport certificates)	Waste Management (liquid and solid)	Water Resource Use/ Restrictions etc)	Pest and Disease Management (plants and animals)
Aboriginal Heritage Act, 1988(SA) /Aboriginal and Torres Strait Islander Heritage Protection Act, 1984 **(Cwlth)**			✓			✓						
Dangerous Substances Act, 1979 (Regs 2008)				✓					✓	✓		
Development Act, 1993 (Regs 2008)			✓									
Electricity Act 1996 (Regs 2010)			✓									
Environment Protection Act, 1993 (various Regs etc)	✓			✓			✓	✓	✓	✓	✓	
Environment Protection and Biodiversity Conservation Act (1999) **(Cwlth)**		✓	✓		✓							
Fire and Emergency Services Act 2005	✓		✓									
Fruit and Plant Act 1992												✓

SA and Commonwealth (Cwlth) Environmental Legislation (refer to **ENVIROLAW** for detailed legislative obligations and updates)	Air quality - Dust/Odour/ Pollutants	Native Fauna (animals)	Native Vegetation (eg approval for vegetation removal)	Toxic and Hazardous Materials (PCBs, SF6, CFC, Fuels,)	Heritage (Natural, European)	Aboriginal Heritage and Native Title	Noise and Vibration	Water Quality -Erosion and Sediment Control and Pollution	Soil Management (eg waste transport certificates)	Waste Management (liquid and solid)	Water Resource Use/ Restrictions etc)	Pest and Disease Management (plants and animals)
Heritage Places Act, 1993(SA) / Australian Heritage Council Act 2003 **(Cwlth)**					✓							
Local Government Act, 1999							✓	✓	✓	✓	✓	
Local Nuisance and Litter Control Act 2016	✓						✓			✓		
National Environment Protection Act 1994 and **(Cwlth)**	✓			✓			✓	✓	✓	✓	✓	
National Parks and Wildlife Act, 1972 (Regs 2001)		✓	✓									
National Trust of South Australia Act, 1955		✓	✓		✓							
Native Vegetation Act, 1991 (Regs 2017)			✓									
Natural Resources Management Act, 2004		✓	✓					✓	✓			✓
Work Health and Safety Act 2012										✓		

SA and Commonwealth (Cwlth) Environmental Legislation (refer to **ENVIROLAW** for detailed legislative obligations and updates)	Air quality - Dust/Odour/ Pollutants	Native Fauna (animals)	Native Vegetation (eg approval for vegetation removal)	Toxic and Hazardous Materials (PCBs, SF6, CFC, Fuels,)	Heritage (Natural, European)	Aboriginal Heritage and Native Title	Noise and Vibration	Water Quality -Erosion and Sediment Control and Pollution	Soil Management (eg waste transport certificates)	Waste Management (liquid and solid)	Water Resource Use/ Restrictions etc)	Pest and Disease Management (plants and animals)
Ozone Protection and Synthetic Greenhouse Gas Management Act 1989	✓											
Zero Waste SA Act 2004										✓		

12. Appendix 3 – Environment Control Map Example



13. Appendix 4 – Site Environmental Checklist

Site Environmental Checklist
ENV-F-001

Area: Environmental
Contact Person (s):

Inspections will be conducted by Enerven's Safety, Quality and Environment (SQE) Advisor or delegate to ensure implementation of Enerven's Safety and Environmental Management Plan by Enerven personnel and contractors. All inspection reports and checklists will be kept by Enerven's SQE Advisors and copies sent to Enerven's Construction Manager and Environment Consultant.

1. PROJECT DETAILS

Project Name:	
Project Number:	
Date:	

2. SITE ACTIVITIES AND CONTRACTORS

List all contractors present at time of inspection and activities being undertaken.

Enerven / Contractor	Work Activities

3. CHECKLIST

	Environmental Item	YES	NO	N/A	Comment
1	**General**				
1.1	A copy of the relevant Environment Control Map or Construction Environment Management Plan (CEMP) is kept on site?	☐	☐	☐	
2	**Flora and Fauna Management**				
2.1	Have any native animals been trapped on site?	☐	☐	☐	
2.2	Has vegetation clearance been undertaken?	☐	☐	☐	
2.3	If yes, has vegetation clearance approvals been obtained?	☐	☐	☐	
3	**Pest and Weed Management**				
3.1	Any pest plants on site?	☐	☐	☐	
3.2	Are vehicles, plant and machinery entering site clean of loose mud and weed matter e.g. burrs etc?	☐	☐	☐	
3.3	Has this been recorded in the SMP, under 'Mobile Plant and Equipment Site Inspection Register?	☐	☐	☐	

ENV-F-001 – Site Environmental Work Checklist Uncontrolled when printed Internal Use Only
Rev 1 Page 1 of 3

	Environmental Item	YES	NO	N/A	Comment
4	**Soil Erosion and Drainage Management**				
4.1	Are required erosion control devices (eg silt traps/fences) in place and working?	☐	☐	☐	
4.2	Are soil stockpiles bunded and stabilised to prevent sediment wash off and dust?	☐	☐	☐	
4.3	Is the site stable to prevent stormwater runoff erosion or dust?	☐	☐	☐	
5	**Hazardous Materials**				
5.1	Are all oil/chemicals stored in portable or temporary bunds or sealed shipping containers and maintained in line with the EPA guidelines?	☐	☐	☐	
5.2	Are fully maintained chemical spill kits on site?	☐	☐	☐	
5.3	Were there any oil or chemical spills during preceding week?	☐	☐	☐	
5.4	If yes, was it cleaned up and reported in line with SA Power Networks environmental incident response procedure?	☐	☐	☐	
5.5	Are relevant SDS's for chemicals located on site?	☐	☐	☐	
5.6	Have chemical waste been disposed of in line with SDS's?	☐	☐	☐	
6	**Noise**				
6.1	Have construction activities been limited to between 7am and 7pm?	☐	☐	☐	
6.2	If no, was out of hours work approved.	☐	☐	☐	
6.3	Has the daily site activity log been completed for any noise compliant and an investigation completed?	☐	☐	☐	
7	**Aboriginal Heritage**				
7.1	Any items of cultural heritage located during work activities?	☐	☐	☐	
7.2	If yes, were the controls in the CEMP under 'Heritage' applied?	☐	☐	☐	
8	**Waste Management**				
8.1	Is the construction site clean?	☐	☐	☐	
8.2	Have waste materials been separated into appropriately labelled bins or returned to a works depot for segregation?	☐	☐	☐	
8.3	Has concrete agitator/equipment waste been washed off site or in an on site sealed pit?	☐	☐	☐	
8.4	Has sewerage waste been collected by a licensed waste contractor?	☐	☐	☐	
8.5	For any waste oil removed from site, have Waste Transport Certificates (WTC) been received from the contractor?	☐	☐	☐	
9	**Waste Soil**				
9.1	Has any excess soil or contaminated soil been removed to an EPA licensed landfill for disposal?	☐	☐	☐	
9.2	If yes: ▪ Has the soil been tested prior to removal or tested at the landfill? ▪ WTCs have been retained in project files/folders on site and recorded on the WTC Register?	☐ ☐	☐ ☐	☐ ☐	
9.3	Has any imported soil been verified as "Waste Fill" and documents retained in the project file?	☐	☐	☐	

	Environmental Item	YES	NO	N/A	Comment
9.4	Have the requirements of Enerven's Waste Soil Management Procedure been met?	☐	☐	☐	
10	**Air Quality**				
10.1	Are vehicle loads covered when leaving or entering site to prevent loss of materials during transport?	☐	☐	☐	
10.2	Are vehicle and equipment turned off when not needed?	☐	☐	☐	
11	**Ground Water Management**				
11.1	Has any excess contaminated groundwater from dewatering cable trenches or earth stakes been removed by an EPA licensed contractor?	☐	☐	☐	
11.2	If yes, has waste disposal documentation been received and retained on site?	☐	☐	☐	
12	**Traffic management**				
12.1	Are all vehicles following designated access route and parking in designated parking areas?	☐	☐	☐	
13	**Bushfire Management**				
13.1	Are bushfire control mitigation measures installed and implemented?	☐	☐	☐	
14	**Complaint Management**				
14.1	Were any complaints received in the preceding week regarding construction activities?	☐	☐	☐	
14.2	If yes, was this recorded and the client informed?	☐	☐	☐	

OUTSTANDING ACTIONS REQUIRING COMPLETION

The Responsible Person must notify the Enerven person (above) that the agreed actions have been completed

Item	Agreed actions to be completed	Responsible person	Due Date	Completed Date

Environmental inspection conducted by:

Name:		**Title:**		**Signature:**	
Date:		**Time:**			

14. Appendix 5 – SA Water's Aboriginal Heritage Discovery Procedure and Example Pictures

Have you found a site, object or skeletal remains that may be Aboriginal Heritage?

See example pictures on next page.

STOP

Do not disturb/remove/touch or displace the site, object or skeletal remains.

It is an offence to disturb or interfere with Aboriginal heritage or skeletal remains.

PROTECT

Restrict access. Site supervisor to take note of:

Location in relation to site works (pref. GPS).
Any immediate threats to heritage eg construction activities, vandalism, water level.
Name and contact details of the person who made the discovery.

NOTIFY

Site Supervisor to immediately notify:

SA Water representative: Charmaine Noack 08 7424 3619 or 0404 836 567
Local Police or 131 444. If suspected human remains have been discovered.

MANAGE

The SA Water EHS Team will appropriately manage the incident with appropriate guidance from:

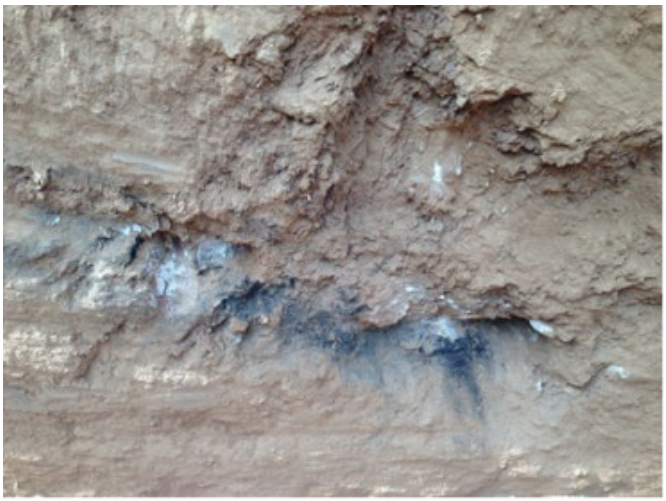
Local Police (where skeletal remains have been discovered).
Aboriginal Affairs and Reconciliation.
The local Aboriginal community.
An Archaeologist may also be consulted.

RESUME

The SA Water Project Manager will notify the contractor when works can resume.

This decision will be made in partnership between the PM and EHS team.
There may be conditions that need to be followed to allow work to resume.

Examples Pictures



15. Appendix 6 – Waste Transport Certificate Register

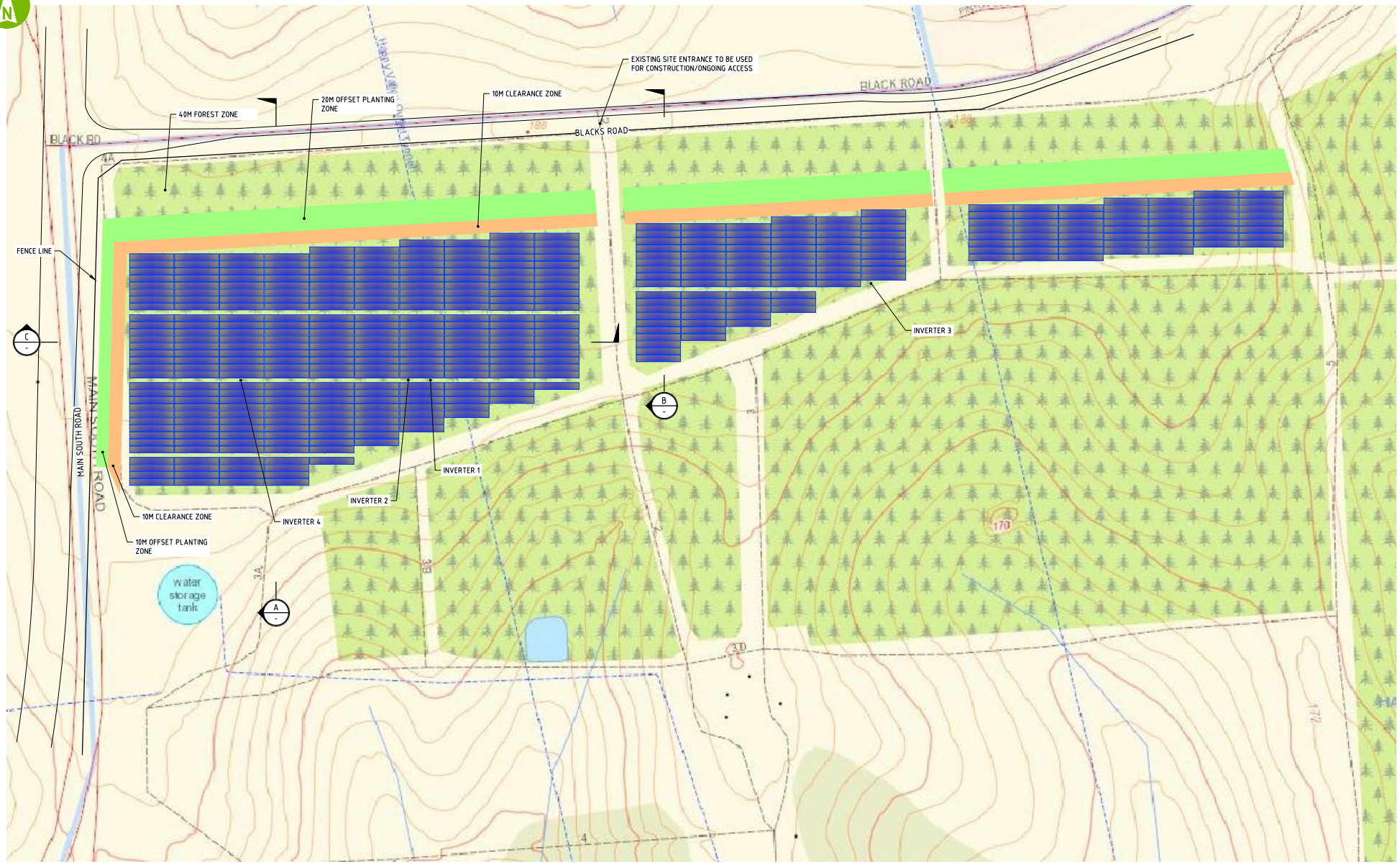
WASTE TRANSPORT CERTIFICATE REGISTER

Point of Generation	Date	Waste Type	WTC Number	Contractor
e.g. MAPS 1	*12/12/2017*	*Oil*	*5T00112411*	*McMahon Services*

1 Station Place,
Hindmarsh SA 5007

Julianna.Balogh@enerven.com.au
0419 877 627

enerven.com.au



PLAN VIEW

SCALE: 1:150

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

REVISION PANEL

REV	DATE	DRN	DETAILS	APR'D
A	19/09/19	CT	ISSUED FOR INTERNAL REVIEW	

CURRENT REV CONTRACTOR: CURRENT REV PROJECT:

CURRENT REV AUTHORISED

SIGNATURE

DESIGN PANEL

DESIGNED	AUTHORISED
DRAWN	SIGNATURE
REVIEWED	

CONTRACTOR:

HAPPY VALLEY WATER TREATMENT PLANT

5B - LOW PROFILE SOLAR PANELS LAYOUT

A1 SHT SIZE	TOTAL SHEETS:	A REVISION	
	PROJECT No:		
MAXIMO ID: HAVWTP			
SUPERSEDES:			
DRAWING NUMBER 503097-GE-SKT-1001			

5B MAVERICK

What would a solar farm look like, if we reinvented it today? 5B started with a clean slate and developed the simplest, fastest way to deploy PV modules into the field. Our answer is the Maverick: a modular PV system built up from our 12 kW MAV array blocks.

Maverick is the solar farm of the future: A pre-fabricated, low-cost solar array that shifts construction, labour and risk from the project site into the factory.

100% Prefabricated

The MAV DC solar unit arrives on site entirely electrically and mechanically prefabricated, simplifying design, slashing site time and labour.

Streamlined Logistics

MAV streamlines solar array procurement to a single source and simplifies on-site logistics: four MAVs ship in a standard 20 ft container.

Rapid Deployment

A MAV unit is deployed with a standard site vehicle in six minutes, with a crew of two, with minimal site preparation. Our continuous array means no trenching for DC cables.

Portable Solar

5B's MAV is the only cost-effective, portable solar array that unlocks the possibility of a solar fleet, giving customers control of how they use their site and solar in the future.

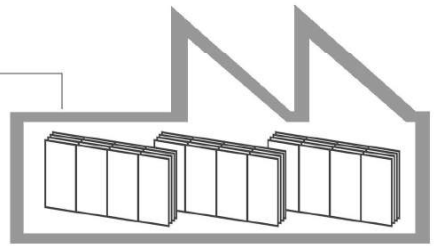
5B MAVERICK

Prefabricated in our factory

Maverick is the solar farm of the future: a modular PV system built up from our 12 kW MAV array blocks. We've slashed costs and project risks, by moving the bulk of work from the field into a safe, controlled, low-cost factory environment. 5B's two-person teams assemble one MAV every five hours.

5B's Sydney factory produces 120 kW of MAVs per day, or 30 MW per year. Because Maverick is a modular solution, you get full flexibility in the design of the DC array, cabling runs and inverter locations.

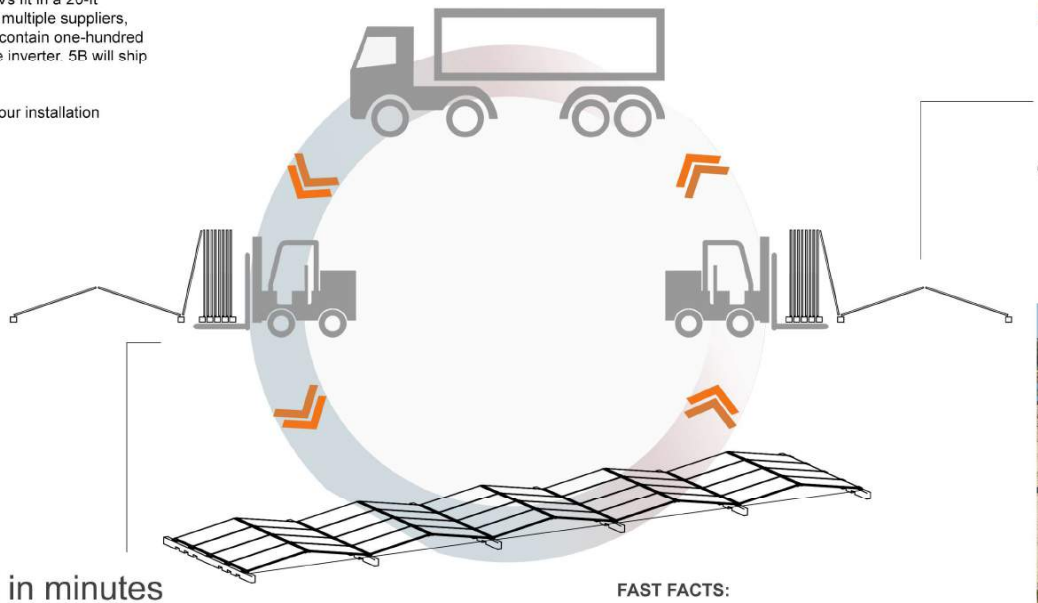
Each MAV leaves the factory pre-commissioned, fault-tested and electrically complete up to the MC4 connectors for each string. A plug-and-play DC cabling solution and pre-fabricated inverter stands also reduce cabling costs and on-site electrical work.



Optimised Logistics

1 The MAV ships in standard shipping containers: Four 32-module MAVs fit in a 20-ft container. Instead of managing complex shipping arrangements with multiple suppliers, the MAV drastically simplifies on-site logistics: your 5B shipment will contain one-hundred per cent of your solar farm components, up to the AC terminals of the inverter. 5B will ship your MAVs on flatbed trucks for smaller applications.

2 MAVs can be stored on site before deployment, adding flexibility to your installation schedule.



Deployed in minutes

3 Before we deploy a MAV, we survey the site with a drone. We then mark out the locations for the recycled rubber pads, which act to level the concrete beams.

Like everyone in solar, we like flat sites the best! We can also handle sites with more challenging terrain, contact us for more information.

4 5B deploys each MAV on site with a five-tonne telehandler or forklift, in less than 10 minutes. A three-person deployment crew deploys 100 kW per day or one megawatt in 10 days.

5 When deploying, the leading MAV is secured with 2 ground anchors, and the following units are daisy-chained. Our concrete beams provide full wind-rated ballast so these are our only ground penetrations.

FAST FACTS:

Due to the continuous array design, a plant built using the Maverick system can generate more MWh per hectare than conventional fixed tilt and single axis tracking designs- between 180-200% more.

Each MAV is ballasted, with minimal ground penetrations, so it can go places that are off-limits for most solar farms. 5B is deploying our Maverick solution on landfill sites and tailings dams for mines.

5B has even made the factory mobile: for your next project we can ship you MAVs or a MAV factory, using our containerised assembly pods.

About 5B

5 billion years of sun. How will you use it? 5B are re-inventing solar energy from the ground up. We are a team of renewable energy experts who care about making energy projects cheaper, faster and smarter.

For pricing and ordering:

Visit our website: **5b.com.au**

Email us: **info@5b.com.au**

Call us: (02) 9550 9239

Relocated to your next site

6 We remove the MAVs from site with the reverse of our deployment process, in the same timeframe. Each MAV is reloaded into shipping containers and ready to be relocated.

The Maverick solution is certified for installation in wind regions A,B and C, with minor additional ballast in wind regions B and C. 5B has a heavy duty Maverick design on its way for wind region D, contact us for more information.

MAVERICK™

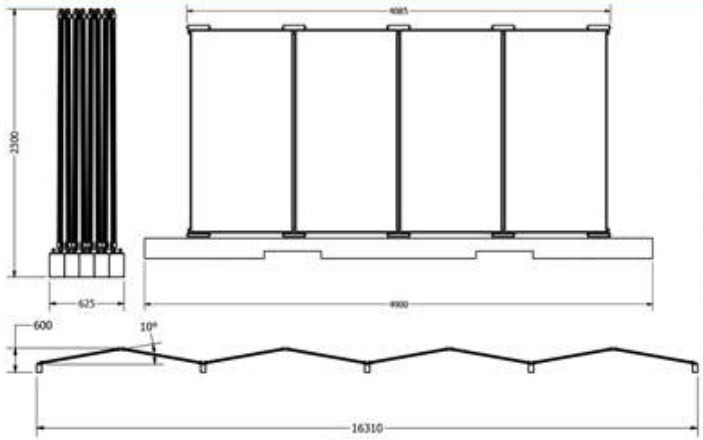
Solar re-invented

Efficient pre-assembly cuts on-site labour by more than 50%

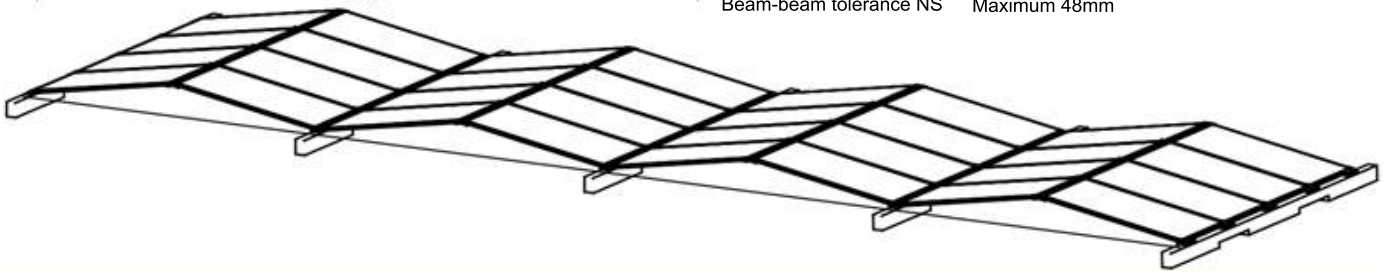
Arrives on site mechanically and electrically prefabricated

Rapidly deployed on site in under 10 minutes

MECHANICAL SPECIFICATIONS



Module Dimensions	1956 x 992 x 40 (mm)
Module Configuration	32 modules per FEWA, 4 wide x 8 long
Packing Configuration	32 modules per unit, 3 units per 20' HQ container
Dimensions	4900 (W) x 600 (H) x 16,310 (L) mm deployed
Installation type	Telehandler or forklift, with 2 installers
Tilt Angle	10 degrees, excluding ground variation
Weight	2400 kg per FEWA
Module connections	Annodised aluminium alloy hinges, module clamps
Tethers	Stainless steel cable
Ballast	Precast 40MPa reinforced concrete beam
Peak wind velocity	Wind region A (60 m/s). Certified for installation up to wind region C, with minor additional ballast
Beam-beam tolerance EW	Maximum 690mm
Beam-beam tolerance NS	Maximum 48mm



ELECTRICAL SPECIFICATIONS

MODULE

PV Module Type	Jinko JKM350M-72	
	STC	NOCT
Maximum Power (Pmax)	350Wp	262Wp
Maximum Power Voltage (Vmp)	39.1V	37.2V
Maximum Power Current (Imp)	8.94A	7.05A
Open-circuit Voltage (Voc)	47.5V	46.0V
Short-circuit Current (Isc)	9.38A	7.46A
Module Efficiency STC (%)	18.01%	
Operating Temperature(ºC)	-40~ +85	

ARRAY

Power at MPP	11.2 kW
Short circuit current	9.4 A per string, 18.8 A array output
Open circuit voltage	760 V
Current at MPP	8.9 A per string,17.9 A array output
Voltage at MPP	626 V
Power Density	1.1 ha/MW [2]
String Configuration	16 modules, 2 strings (1 east, 1 west)
Terminations	2 x MC4 connectors
String return cable	6mm x 20m

[2] Fixed tilt 3.0 ha/MW (NREL)

CERTIFICATIONS

Australian Patent #2015327772, Intl. Patents Pending.

Compliant with Australian Standards and CEC Solar installation guidelines [AS/NZS 5033, AS 1170.0, AS 1170.1, AS 1170.2, AS 1664.1, AS 3600, AS/NZS 3000, AS/NZS 4777:2005, AS/NZS 1768:2007, AS/NZS 4509:2009].

Structurally certified for transport and operation in wind regions A, B and C to the aforementioned standards.

NOTE: Please read the Installation Guide before using the product.

ABOUT 5B

5B is an Australian engineering team dedicated to developing cutting-edge technologies that reduce the cost of renewable energy. 5B's Maverick is the only re-deployable solar array that is cheaper and faster to install than conventional solar.

Contact: info@5b.com.au **Website:** www.5B.com.au

1 Overview

The following Landscape Plan is provided in response to a Request for Further Information (RFI) received from the assigned Senior Planning Officer (Crown and Major Developments, DPTI) Application no. 145/V020/19, where landscaping details were requested as a later provision to the key elements of the RFI received on 23rd August 2019.

This Landscape Plan has been constructed following community consultation with nearby residents and informed by the Pre-European vegetation mapping data (Department for Environment and Water), the SA Water Happy Valley Land Management Plan, and inhouse knowledge of restoration and revegetation activities that have been undertaken in the Happy Valley Reservoir Reserve.

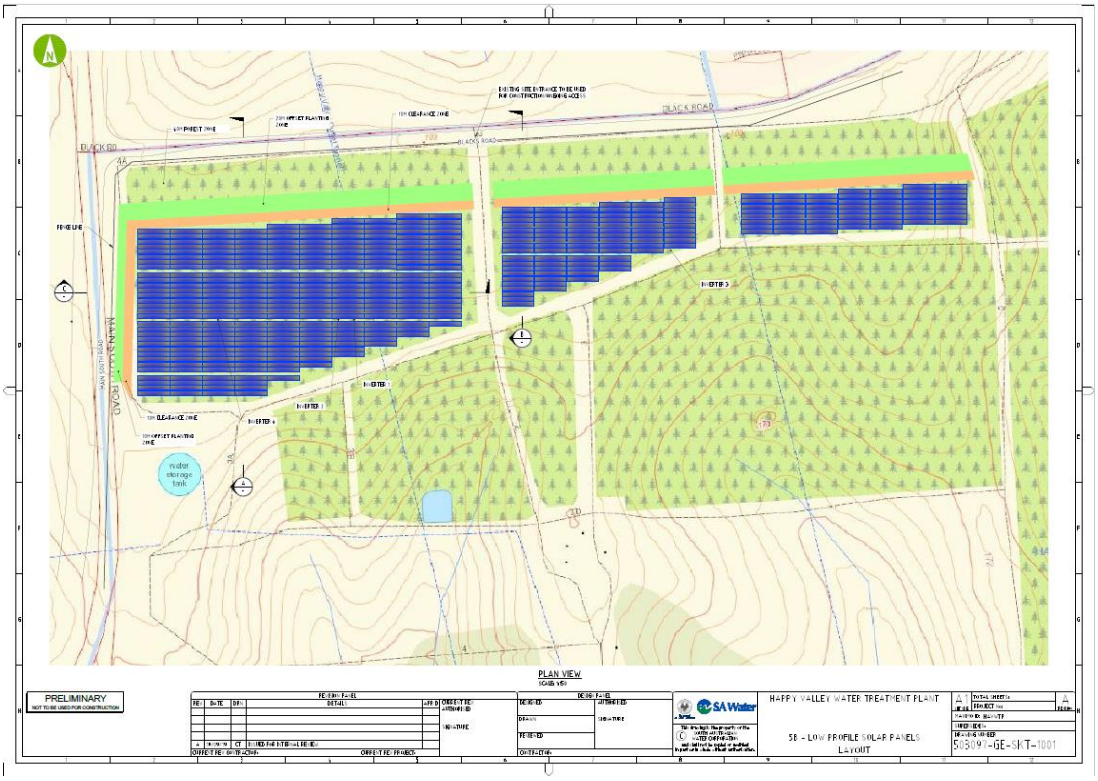
The proposed development at Happy Valley Reservoir Reserve has adopted a unique low-profile solar racking system (known as 5B Maverick) which provides for an overall visual profile which is significantly less conspicuous by comparison to more typical solar design types, being only 60 cm high at the highest point. The decision to adopt this system was made in recognition of the need to maintain existing levels of visual amenity in the locality and was further based upon feedback from the surrounding residents as part of the SA Water led Stakeholder Engagement process. This type of racking system is prefabricated offsite and needs to be deployed on a relatively flat, even surface, where it is folded out in an east-west orientation. 3D visual renders have been prepared by a graphic design firm (Convergen) which illustrate the proposed development as viewed from the corner of Black Rd and South Rd, and further south looking at the Western boundary (see Section 5 Site Renders). It is expected that the planted vegetation buffers (as well as retained pine tree buffer) will almost entirely screen the arrays from the view of passing motorists, though the attached renders have taken a more conservative approach so that the arrays are visible from both vantage points.

The proposed development allows for an approximate setback of 77 m from the northern property perimeter, bordered by Black Road (a Secondary Arterial Road). The overall setback distance from the northern perimeter incorporates a 40 m wide buffer of the existing ForestrySA pines to be retained, a 20 m wide planted vegetation buffer (utilising native species of local provenance) and a further 10 m wide clearway to allow vehicle access around the solar array perimeter.

An approximate setback of 20 m, measured from the edge of the solar PV arrays to the existing perimeter access track along the western security fence will be allowed for. This setback will encompass the establishment of a 10 m wide vegetation buffer (utilising native species of local provenance) to run parallel to the western property perimeter bordered by Main South Road (a Primary Arterial Road). A further 10 m clearance zone will be allowed for from the eastern edge of the vegetation buffer to the commencement of the solar PV arrays to allow for vehicle access between the vegetation buffer and the arrays, and a swale for drainage of stormwater. A relatively wide verge exists between the western property perimeter (demarcated by the existing security fence) and commencement of Main South Road, which allows the solar PV arrays to be reasonably setback from the carriage-way of the Primary Arterial Road.

2 Site preparation

Following harvest of the commercial pine forest by Forestry SA, the area where the array will be installed will have 300 – 400 mm of topsoil removed. Where the panels will be laid will be back filled with conditioned fill which will be compacted to a Maximum Dry Density (MDD) of 95%. This will provide a stable base for the solar racking system and will eliminate the regrowth of pines from seeds dropped, or any weeds. Site drainage will be managed by a system of swales which will dissipate the water into adjacent vegetated areas within the reserve.



Concept Landscape Plan around solar arrays showing vegetation zone (green) and buffer zone (orange). Greater detail and Cross Section diagrams available within Appendix A.

3 Vegetation Selection

Department for Environment and Water mapping information for the northern part of the reservoir reserve indicates that the Pre-European Vegetation communities comprised Grey Box (*Eucalyptus macrocarpa*) +/- SA Blue Gum (E. leucoxylon ssp. leucoxylon), Silver Banksia (*Banksia marginata*), Southern Cypress Pine (*Callitris gracilis*) and Drooping Sheoak (*Allocasuarina verticillata*) Woodland on black clay soils transitioning to SA Blue Gum (E. leucoxylon ssp. Leucoxylon), Southern Cypress Pine (*Callitris gracilis*) and Drooping Sheoak (*Allocasuarina verticillata*) Woodland in the east where the soil profile gets sandier. The species list in Table 2.1 on the following page, and in the attached spreadsheet, is drawn from knowledge of the local native plant species that belong to these two vegetation communities.

Species selection has been made on the basis of several deciding factors, including;

- Provision of an effective screening buffer from the adjacent roads;
- Avoidance of potential shading effects to the adjacent solar array;
- Enhancement to the overall biodiversity of the site; and
- The specific selection of several species of plants which will also provide food sources (flowers, seeds, nuts etc.) for native birds, in particular the Yellow-tailed Black Cockatoos. Concern for the Yellow-tailed Black Cockatoos was raised by the local community throughout the Stakeholder Engagement process.

Table 2.1 – Happy Valley Reservoir solar array buffer species list (excerpt from Attachment B – Detail Breakdown)

Lifeform	Species	Common name	Height after 10 years	Mature height (m)
Trees	*Callitris gracilis*	Slender Cyperus Pine	8	15
Trees	*Allocasuarina verticillata*	Drooping Sheoak	9	9
Shrub	*Acacia acinacea*	Round-leaf wattle	2	2
Shrub	*Acacia paradoxa*	Kangaroo Thorn	4	4
Shrub	*Acacia pycnantha*	Golden Wattle	6	6
Shrub	*Dodonaea viscosa*	Sticky Hop-Bush	4	4
Shrub	*Hakea carinata*	Erect Hakea	3	3
Shrub	*Olearia ramulosa*	Twiggy Daisy-Bush	2	2
Shrub	*Eutaxia diffusa*	Spreading Eutaxia	2	2
Shrub	*Goodenia amplexans*	Clasping Goodenia	1.5	1.5
Shrub/vine	*Billardiera cymosa*	Sweet Apple-berry	0.5	0.5
Shrub/vine	*Hardenbergia violacea*	Purple Coral-pea	0.5	0.5
Mat	*Atriplex semibaccata*	Creeping Saltbush	0.1	0.1
Mat	*Kennedia prostrata*	Scarlet Runner	0.1	0.1
Bulb	*Calostemma purpureum (Mt Bold Gate 4)*	Pink Garland Lily	0.3	0.3
Sedge	*Dianella revoluta*	Flax-lily	0.4	0.4
Grass	*Themeda triandra*	Kangaroo Grass (SA Water SPA stock)	0.5	0.5
Grass	*Rytidosperma sp.*	Wallaby grass (SA Water SPA stock)	0.3	0.3
Grass	*Dichanthium sericeum*	Silky Blue-grass (SA Water SPA)	0.3	0.3

3.1 Northern Boundary (Black Road Interface Buffer)

The separation of the solar PV arrays from the northern property boundary will incorporate the below elements:

(described by north-south directional)

- Existing firebreak and perimeter access track (approx. 7 m measured from existing fence to commencement of pines)
- 40 m width (north-south) of retained pine trees
- 20 m wide planted native vegetation buffer
- 10 m wide clearance (separating the solar PV arrays from the 20 m wide vegetation buffer)

A 20 m wide landscape buffer is proposed on the north edge of the array comprising a native woodland vegetation community type. A further 10 m wide clearance zone exists from the southern edge of the planted native woodland buffer to the commencement of the solar PV arrays. This clearway is provided to ensure appropriate access is available to vehicles for ongoing maintenance and operational purposes. However, it is intended that low-growing native grasses be established within this zone to further contribute to soil stabilisation and weed suppression. Importantly, the selection of native grass species will be made such that the safe passage of vehicles will not be precluded through presenting unreasonable obstruction.

The woodland vegetation buffer will comprise 19 species spanning a range of plant lifeforms designed to provide both a multi-layered visual screen and comprehensive cover to exclude weed invasion. Tree, shrubs, grasses and groundcover species belonging to the local flora typology have been selected based on their affinity for the local soil type (black-cracking clay) with an emphasis on species that have performed well in revegetation projects undertaken by SA Water elsewhere. Notably, included in the proposed species list are natural food plants of the Yellow-tailed Black Cockatoo (*Calyptorhynchus funereus* VSA) known to frequent the reservoir, namely; *Allocasuarina verticillata*, *Hakea carinata* and *Acacia pycnantha*.

Seedlings within the woodland component will be spaced as per the information within Attachment B – Detail Breakdown. As detailed in the attached Detail Breakdown, the

arrangement of plants will give due consideration to the mature spread of key species and the positioning of taller tree species in the northern half of the buffer zone so as avoid shadow casting shade across the solar panel array.

Some species included in the design have a proven ability to establish readily via direct seeding (highlighted in green). These species will be sown direct prior to planting of tubestock at a rate of 1.9 kg/ ha.

The 10 m wide grass buffer strip will be direct seeded using specialist native grass seeding equipment to seed a range of winter and summer growing native grasses (30 kg/ha) with an emphasis on low-growing species, aiming to achieve a minimum of 30 plants per square metre average density.

3.2 Western boundary (Main South Road Interface Buffer)

The separation of the solar PV arrays from the western property boundary will incorporate the below elements:

- 10 m wide planted native vegetation buffer, with westernmost edge of the buffer to commence at the existing perimeter fence line.
- 10 m clearance (separating the solar PV arrays from the vegetation buffer)

A 10 m wide landscape buffer is proposed on the western edge of the array comprising a selection of native shrubs. Consistent with the northern vegetation buffer details, the 10 m wide clearance zone which separates the denser vegetation buffer from the solar PV arrays is intended to accommodate a selection of low-growing native grass species which will still ensure that safe vehicle access is possible.

The vegetation selection within the buffer along the western perimeter and the establishment methods will be consistent to the Black Rd buffer except that the two taller tree species have been excluded to prevent shading of the solar array. This is of much greater criticality along the western perimeter noting the suns movements and the importance of capturing afternoon sunlight from the west.

4 Site establishment and Planting Schedule

Due consideration has been paid to the careful selection of appropriate species, based upon local soil conditions and utilising specimens grown from local provenance so that the genetic profile has adapted to the specific local conditions. Notwithstanding this, it is general practice for SA Water to incorporate target survival rates and replacement planting requirements within contracts awarded for landscaping and revegetation projects. This will ensure that the screening function intended to be achieved by the vegetation buffers is safeguarded against any issues arising during the establishment phase.

A suggested schedule for the landscaping plan is as follows, with planting to occur in the cooler months with the onset of winter rains. This will ensure a far greater survival rate of planted vegetation and will also result in far less delay to root establishment and foliage growth, thereby enabling the screening function to be fulfilled within a reasonable timeframe.

Note: the below timeframes are indicative only, pending confirmation that the project receives all relevant approvals;

- Pine tree harvesting from project location by ForestrySA – November 2019
- Site preparation works (pine tree stump removal and soil levelling) – December 2019-January 2020
- Seed collection and tubestock propagation — January 2020
- Native grass and shrub direct seeding – May 2020
- Tubestock planting – July 2020

5 Site Renders

Below are the two 3D Renders provided to SA Water by graphic design firm, Convergen, to illustrate the anticipated visual profile of the development once the solar arrays have been installed and the vegetation buffer has been established (estimate timeframe; 10 years post planting).

Happy Valley Reservoir Reserve from northern viewpoint looking south – Black Rd and South Road intersection

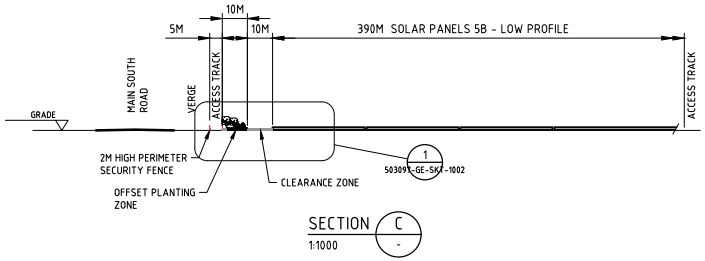
Happy Valley Reservoir Reserve from southern viewpoint looking north –South Road

Version History

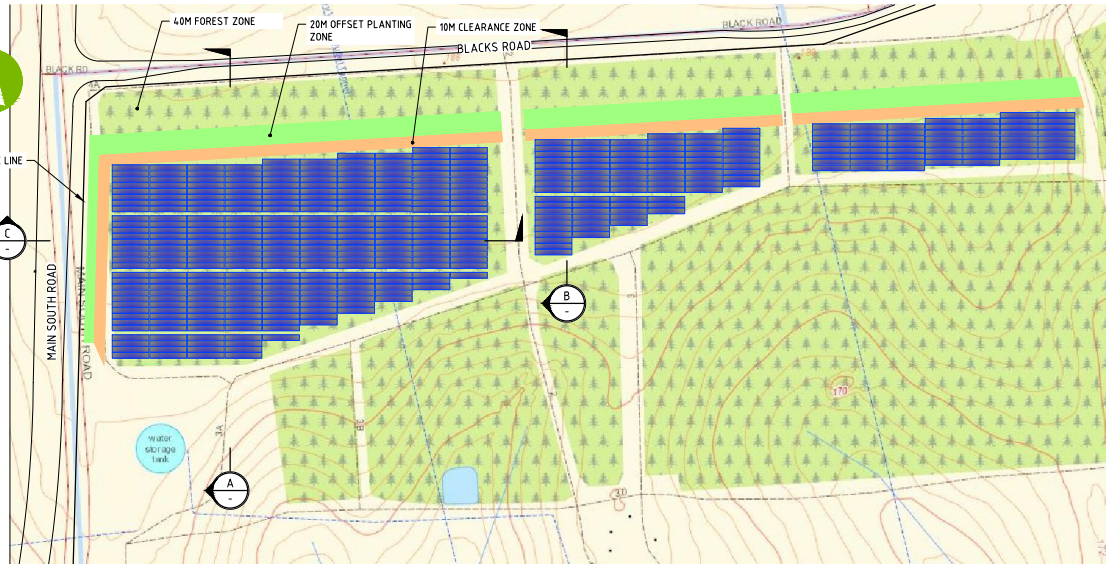
Version	Date	Author	Comments
0.1	11/11/2019	Griggs, J and Kennedy, S.	First draft.
0.2	13/11/2019	Griggs, J and Kennedy, S.	Reviewed by L. Nicholson, J. Hart, E. Senneck.
0.3	18/11/2019	Griggs, J and Kennedy, S.	Final

Template: Document - Short Portrait Version 4.2 08/07/19

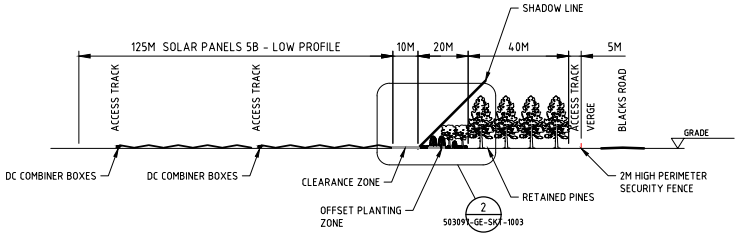
Appendix A -
Aerial Plan and Cross Section Diagrams (Western and Northern planted buffers)



SECTION C
1:1000



PLAN VIEW
SCALE N.T.S



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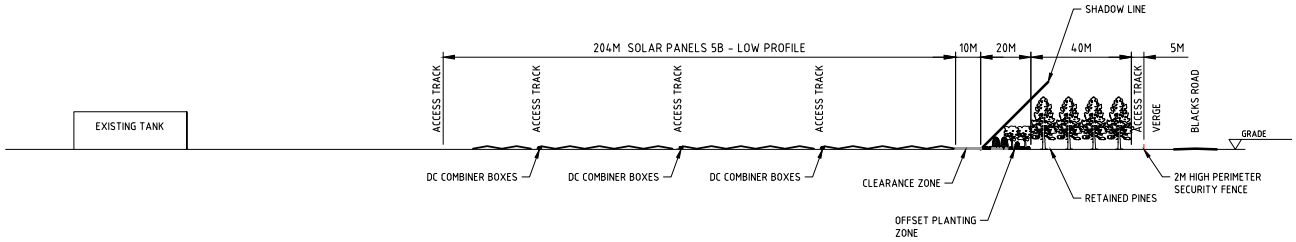


SECTION A
1:1000

NOTES:
1. THIS DRAWING TO BE READ IN CONJUCTION WITH 5BD00777 - LAYOUT- MAX CAPACITY
2. ALL DIMENSIONS SHOWN ARE APPROXIMATE.

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

REVISION PANEL

REV	DATE	DRN	DETAILS	APR'D
E	18/11/19	SLK	ISSUED FOR INTERNAL REVIEW	
D	18/07/19	CT	ISSUED FOR INTERNAL REVIEW	
C	12/07/19	CT	ISSUED FOR INTERNAL REVIEW	
B	09/07/19	CT	ISSUED FOR INTERNAL REVIEW	
A	04/07/19	CT	ISSUED FOR INTERNAL REVIEW	

CURRENT REV CONTRACTOR:
CURRENT REV PROJECT:
CURRENT REV AUTHORISED
SIGNATURE

DESIGN PANEL

DESIGNED	AUTHORISED
DRAWN	SIGNATURE
REVIEWED	
CONTRACTOR:	

HAPPY VALLEY WATER TREATMENT PLANT

5B - LOW PROFILE SOLAR PANELS
SECTIONS

A1 SHT SIZE	TOTAL SHEETS:
	PROJECT No:
E REVISION	
MAXIMO ID: HAVWTP	
SUPERSEDES:	
DRAWING NUMBER	503097-GE-SKT-1000

DETAIL 1
1:50 503097-GE-SKT-1000
WESTERN VEGETATION BUFFER

NOTES:
1. THIS DRAWING TO BE READ IN CONJUCTION WITH 5BD00777 - LAYOUT- MAX CAPACITY
2. ALL DIMENSIONS SHOWN ARE APPROXIMATE.

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

REVISION PANEL

REV	DATE	DRN	DETAILS	APR'D
A	18/11/19	SLK	ISSUED FOR INTERNAL REVIEW	

CURRENT REV CONTRACTOR: CURRENT REV PROJECT:

CURRENT REV AUTHORISED

SIGNATURE

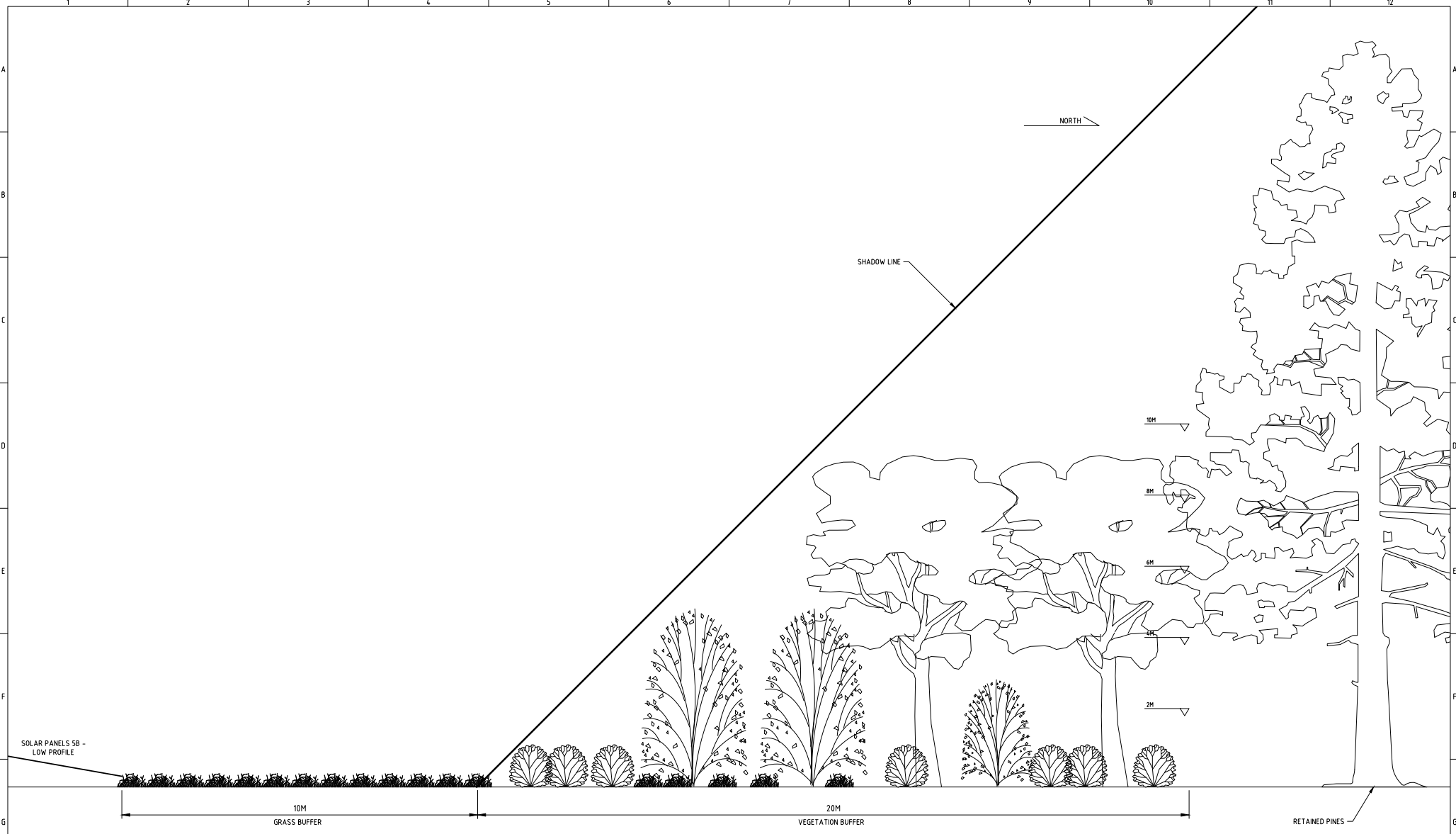
DESIGN PANEL

DESIGNED	AUTHORISED
DRAWN	SIGNATURE
REVIEWED	
CONTRACTOR:	

HAPPY VALLEY WATER TREATMENT PLANT

5B - LOW PROFILE SOLAR PANELS
DETAILS - WESTERN VEGETATION BUFFER

A1 SHT SIZE	TOTAL SHEETS:
	PROJECT No:
A REVISION	
MAXIMO ID: HAVWTP	
SUPERSEDES:	
DRAWING NUMBER	503097-GE-SKT-1002



DETAIL 2
1:50 503097-GE-SKT-1000
NORTHERN VEGETATION BUFFER

NOTES:
1. THIS DRAWING TO BE READ IN CONJUCTION WITH 5BD00777 - LAYOUT- MAX CAPACITY
2. ALL DIMENSIONS SHOWN ARE APPROXIMATE.

PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION

REVISION PANEL

REV	DATE	DRN	DETAILS	APR'D
A	18/11/19	SLK	ISSUED FOR INTERNAL REVIEW	

CURRENT REV CONTRACTOR: CURRENT REV PROJECT:

CURRENT REV AUTHORISED

SIGNATURE

DESIGN PANEL

DESIGNED	AUTHORISED
DRAWN	SIGNATURE
REVIEWED	
CONTRACTOR:	

HAPPY VALLEY WATER TREATMENT PLANT

5B - LOW PROFILE SOLAR PANELS
DETAILS - NORTHERN VEGETATION BUFFER

A1 SHT SIZE	TOTAL SHEETS:
	PROJECT No:
A REVISION	
MAXIMO ID: HAVWTP	
SUPERSEDES:	
DRAWING NUMBER	503097-GE-SKT-1003

Appendix B -
Detail Breakdown of species selection

Black Rd Happy Valley - concept design for screening vegetation using local native species

Selection rastionale:

Dept. for Environment mapping information for the northern part of the reservoir reserve indicates that the Pre-European Vegetation communities comprised *Eucalyptus microcarpa (Grey Box) +/- E. leucoxylon ssp. leucoxylon (SA Blue Gum)* Woodland on black clay soils transitioning to *E. leucoxylon ssp. leucoxylon (SA Blue Gum)* Woodland in the east where the soil profile gets sandier. The species list below is drawn from knowledge of the local native plant species that belong to these two vegetation communities.

									Black Road Buffer					South Road Buffer					
									ha	ha						ha			
									0.92	0.92						0.18			
Lifeform	**Species**	**Common name**	**Height after 10 years**	**Mature height (m)**	**stem/ha by stratum**	**ave. spacing (m)**	**%**	**stem/ha by species**	**A (North Half)**	**B (South Half)**	**Density targets**	**Tube-stock required**	**stem/ha by stratum**	**ave. spacing (m)**	**%**	**stem/ha by species**	**Density targets**	**Tube-stock required**	**Total tubestock required**	**KLN Order underway**
Trees	*Callitris gracilis*	Slender Cyperus Pine	8	15	400	5.0	50%	200	184	-	184	184	0	0.0			-	-	184	600
Trees	*Allocasuarina verticillata*	Drooping Sheoak	9	9			50%	200	184	-	184	184					-	-	184	
							100%			-	-	-			0%		-	-	-	
Shrub	*Acacia acinacea*	Round-leaf wattle	2	2			4%	100	92	92	184				10%	250	45	45	45	
Shrub	*Acacia paradoxa*	Kangaroo Thorn	4	4			5%	125	115	115	230	230			5%	125	23	23	253	
Shrub	*Acacia pycnantha*	Golden Wattle	6	6			40%	1000	920	920	1,840				5%	125	23	23	23	
Shrub	*Dodonaea viscosa*	Sticky Hop-Bush	4	4			20%	500	460	460	920				20%	500	90	90	90	
Shrub	*Hakea carinata*	Erect Hakea	3	3			5%	125	115	115	230	230			10%	250	45	45	275	600
Shrub	*Olearia ramulosa*	Twiggy Daisy-Bush	2	2	2500	2.0	10%	250	230	230	460	460	2500	2.0	10%	250	45	45	505	600
Shrub	*Eutaxia diffusa*	Spreading Eutaxia	2	2			1.0%	25	23	23	46	46			10%	250	45	45	91	
Shrub	*Goodenia amplexans*	Clasping Goodenia	1.5	1.5			5.0%	125	115	115	230	230			10%	250	45	45	275	
Shrub/vine	*Billardiera cymosa*	Sweet Apple-berry	0.5	0.5			5.0%	125	115	115	230	230			10%	250	45	45	275	
Shrub/vine	*Hardenbergia violacea*	Purple Coral-pea	0.5	0.5			5.0%	125	115	115	230	230			10%	250	45	45	275	
							100.0%								100.0%				-	
Mat	*Atriplex semibaccata*	Creeping Saltbush	0.1	0.1			5%	125	115	115	230				5%	125	23	23	23	
Mat	*Kennedia prostrata*	Scarlet Runner	0.1	0.1			5%	125	115	115	230				5%	125	23	23	23	
Bulb	*Calostemma purpureum (Mt Bold Gate 4)*	Pink Garland Lily	0.3	0.3			5%	125	115	115	230	230			5%	125	23	23	253	
Sedge	*Dianella revoluta*	Flax-lily	0.4	0.4	2500	2.0	15%	375	345	345	690	690	2500	2.0	10%	250	45	45	735	
Grass	*Themeda triandra*	Kangaroo Grass (SA Water SPA stock)	0.5	0.5			10%	250	230	230	460	460			10%	250	45	45	505	
Grass	*Rytidosperma sp.*	Wallaby grass (SA Water SPA stock)	0.3	0.3			50%	1250	1,150	1,150	2,300				50%	1250	225	225	225	
Grass	*Dichanthium sericeum*	Silky Blue-grass (SA Water SPA)	0.3	0.3			15%	375	345	345	690				15%	375	68	68	68	
							105%								100%		***900***		**4,304**	
												Direct Seeding							**Direct Seeding**	

Note eucalyptus species have been excluded here due to spreading form, height and powerline restrictions

Black Rd Buffer	**units**	
Width	m	20
length	m	920
Area	m2	18,400
Area	ha	1.84
South Rd Buffer		
Width	m	10
Length	m	180
Area	m2	1,800
Area	ha	0.18
Grass Buffer Black Rd	ha	0.92
Grass Buffer South Rd	ha	0.18
		1.10
Native grass seed rate	g/m2	3
Native grass seed rate	kg/ha	30
Native grass seed weight	**kg**	**33**

MACHINE SEEDING		**DESIGN**	
Black Rd Buffer	ha	1.84	
average km/ha	km/ha	5.5	
row spacing	m	1.8	
Km	km	10.12	
HARD SEED rate	g/km	250	
HARD SEED required	g	**2,530**	
WING/MYR SEED rate	g/km	100	
WING/MYR SEED required	g	**1,012**	
HARD SEED	**g**	***2,530***	%prop
Acacia acinacea	g	506	20%
Acacia pycnantha	g	1,265	50%
Dodonaea viscosa	g	506	20%
Kennedia prostrata	g	253	10%
			100%
WING-FINE		***1,012***	%prop
Olearia ramulosa	g	405	40%
Atriplex semibaccata	g	405	40%

Vittadinia blackii	g	202	20%
			100%

South Rd Buffer	ha	0.18	
average km/ha	km/ha	5.5	
row spacing	m	1.8	
Km	km	0.99	
HARD SEED rate	g/km	250	
HARD SEED required	g	**248**	
WING/MYR SEED rate	g/km	100	
WING/MYR SEED required	g	**99**	
HARD SEED	**g**	***248***	%prop
Acacia acinacea	g	149	60%
Dodonaea viscosa	g	74	30%
Kennedia prostrata	g	25	10%
WING-FINE SEED	**g**	***99***	%prop
Olearia ramulosa	g	40	40%
Atriplex semibaccata	g	40	40%
Vittadinia blackii	g	20	20%
			100%

Combined Seed Requirements		
HARD SEED	**g**	
Acacia acinacea	g	655
Acacia pycnantha	g	1,265
Dodonaea viscosa	g	580
Kennedia prostrata	g	278
		2,778
WING-FINE SEED	**g**	
Olearia ramulosa	g	444
Atriplex semibaccata	g	444
Vittadinia blackii	g	222
		1,111

Government of South Australia
Department of Planning, Transport and Infrastructure

POLICY, STRATEGY AND PROGRAM DEVELOPMENT

Transport Assessment and Policy Reform

GPO Box 1533
ADELAIDE SA 5001

ABN 92 366 288 135

In reply please quote 2019/00339, Process ID: 590838
Enquiries to Mr Daniel Sladic
Telephone 7109 7872
E-mail dpti.luc@sa.gov.au

23 September 2019

Ms Brianna Fyffe
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5000

Dear Ms Fyffe

SECTION 49 DEVELOPMENT ACT (CROWN DEVELOPMENT BY STATE AGENCIES) - REFERRAL RESPONSE

Development No.	145/V020/19
Applicant	SA Water
Location	Chandlers Hill Road, Happy Valley
Proposal	Installation of solar photovoltaic arrays and ancillary infrastructure

I refer to the above development application forwarded to the Commissioner of Highways (CoH) in accordance with Section 37 of the *Development Act 1993*. The proposed development involves development adjacent a main road as described above.

The following response is provided in accordance with Section 37(4)(b) of the *Development Act 1993* and Schedule 8 of the *Development Regulations 2008*.

CONSIDERATION

The subject site abuts both Main South Road and Black Road, arterial roads under the care, control and management of the CoH. At this location, Main South Road and Black Road carry approximately 27,500 and 10,200 vehicles per day respectively and have a posted speed limit of 80 km/h.

Access to the facility is proposed via Black Road only via the two existing access points which is in keeping with the Department of Planning, Transport and Infrastructure's (DPTI) policy to minimise access points onto arterial roads in the interest of road safety and is thereby supported. Whilst sight distance is adequate in both directions along Black Road it is noted that the existing access points are currently unsealed.

Construction Traffic

Given the limited time that increased traffic volumes (particularly heavy vehicles) will be experienced (i.e. during the construction phase) a Construction Traffic Management Plan should be developed to DPTI's satisfaction.

As stated in the 'Environment and Heritage Assessment Report and Project Environmental Management Plan (PEMP) – Happy Valley Solar Arrays' *"removal of the pines and replacement with a solar array will create a marked and noticeable change in the view scape, particularly for adjacent residents and traffic travelling along Black Road / Majors Road and Main South Road".* Whilst offset planting is proposed, in the event that glare affects motorists on Main South Road, Black Road or Majors Road, the applicant shall install additional screening to the satisfaction of the Commissioner of Highways.

ADVICE

DPTI supports the proposed development and advises the planning authority to attach the following conditions to any approval:

1. A Construction Traffic Management Plan shall be developed as part of the Project Environmental Management Plan prior to the commencement of construction. This plan shall detail the types, volumes and distributions of traffic associated with the development as well as how traffic associated with the development, particularly the traffic entering and exiting the site, will be safely managed whilst minimising the interference to the free flow of traffic on the adjacent roads. The potential impacts to infrastructure within the road reserve shall also be addressed.

2. Any required road works shall be funded by the developer and be completed to the satisfaction of the Commissioner of Highways and/or the City of Onkaparinga.

3. All vehicles shall enter and exit the site in a forward direction.

4. Any gates shall be set back a sufficient distance to allow the largest vehicle expected on-site to be able to store off-road while they are being opened or closed.

5. In the event that glare affects motorists on Main South Road, Black Road or Majors Road, the applicant shall install additional screening to the satisfaction of the Commissioner of Highways.

6. Stormwater run-off shall be collected on-site and discharged without jeopardising the integrity and safety of Main South Road or Black Road. Any alterations to the road drainage infrastructure required to facilitate this shall be at the applicant's cost.

The following notes provides important information for the benefit of the applicant and is required to be included in any approval:

- The Metropolitan Adelaide Road Widening Plan shows a possible requirement for a strip of land up to 4.5 metres in width from a portion of the Main South Road and Black Road frontages of this site for future upgrading of the Main South Road/Black Road intersection. The consent of the CoH under the *Metropolitan Adelaide Road Widening Plan Act 1972* is required to all building works on or within 6 metres of the possible requirement. As no building work is proposed within this area, consent is not required in this instance.

- This site abuts a section of Main South Road that was proclaimed as controlled access road on 9 March 1967 pursuant to Part 2A of the *Highways Act 1926*. Departmental records show that there is no proclaimed or permitted means of access by which persons and vehicles may directly enter or leave the controlled access road from/to this site.

Yours sincerely

A/MANAGER, TRANSPORT ASSESSMENT AND POLICY REFORM
for **COMMISSIONER OF HIGHWAYS**

A copy of the decision notification form should be forwarded to dpti.developmentapplications@sa.gov.au

RESPONSE DETAILS - ESSENTIAL SERVICES COMMISSION

Chosen Standard Planning Conditions

None Selected

Other Authored Planning Conditions

Chosen Standard Advisory Notes

None Selected

Other Authored Advisory Notes

As you have received development approval for your energy development project, you might be required to hold a licence under the Electricity Act 1996. Failure to hold the appropriate licences while generating, distributing or retailing electricity could result in a penalty. Please contact the Essential Services Commission to discuss all licensing requirements that might apply to your energy project on: Phone: 08 8463 4444 or email: licensing@escosa.sa.gov.au.

Additional Comments

RESPONSE DETAILS - DEW (PLANNING APPLICATIONS)

Chosen Standard Planning Conditions

None Selected

Other Authored Planning Conditions

Chosen Standard Advisory Notes

None Selected

Other Authored Advisory Notes

DEW has no objections to the development.

We suggest that given the position of the site in relation to Glenthorne National Park, SA Water may wish to consider strategically retaining some trees so the visual amenity of the area is preserved for park users. If SA Water wishes to discuss this option further with DEW it can contact Jennifer Pitman, Ranger in Charge, from the Central Hills District Office on 0438 865 897 or at Jennifer.Pitman@sa.gov.au

Additional Comments

22 October 2019

Brianna Fyfe
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Dear Brianna

Development Application No.	**:**	145/7014/2019
Proposed Development	**:**	Installation of solar photovoltaic arrays and associated infrastructure
Location of Proposed Development	**:**	Pt Pce 601 Chandlers Hill road, Happy Valley SA 5159
Property Identification	**:**	Pt Pce 601 DP 56823, Pt Pce 602 DP 56823, Pt Pce 603 DP 56823, Pt Pce 604 DP 56823, Pt Pce 605 DP 56823, Pt Pce 606 DP 56823, Pt Allot 94 FP 216185, Pt Allot 101 FP 216192, Pt Allot 117 FP 216301, Sec 74 HP 105500, Pt Allot 94 Sec 130 FP 205351, Pt Al...

Thank you for forwarding the above development application for our review and comments to the State Commission Assessment Panel (SCAP) as the relevant authority. The following report has been considered and endorsed by the Council at its meeting held 15 October 2019.

Whilst we are pleased to see a significant development and level of investment proposed for this site, there are a number of issues to be carefully considered and assessed. Our comments on the proposed development and these issues are provided below.

Land Use

The subject land is located on the periphery of the Open Space Zone which encompasses the Happy Valley Reservoir. The Open Space Zone desires for land uses that are associated with recreation activities, public facilities, conservation work, buildings associated with open space maintenance and subordinate uses to these that support their viability, as well as support management of the land within the Zone. Although not explicitly listed as conservation work, nor a building associated with open space maintenance, the solar panels will contribute to ecological sustainability and demand on non-renewable resources, which is closely linked to a conservation type activity and therefore, the proposed land use is considered acceptable.

The land use will also require minimal maintenance and is not expected to impact on the function or operation of the existing reservoir and water supply and storage to metropolitan Adelaide the site provides. The invert shelters associated with the use will only need to be accessed in an ad hoc basis and via an existing access from Blacks Road. The provision of a reliable power source will also reduce the operational costs of the site.

Design and Appearance

Council is generally supportive of the proposed solar PV array design. The low profile 5B solar PV type is to be utilised, which is to be setback 60 plus metres from Blacks Road and will be positioned behind 40 metres of retained pine trees and a designated 20m offset planting zone, which will return around Main South Road to improve the visual outlook when viewed from the west and north.

The retention of the existing pines and 20m offset planting zone will also prevent any potential reflection issues that may be created by the panels when viewed from public vantage points within the vicinity of the subject site.

The siting of the panels in the north-western corner of the site will also prevent the need for any retaining and necessity for removal of native vegetation, which occupies much of the site. The minimal soil disturbance is in keeping with the Zone provisions, which seek to retain the natural land form.

The loss of pines is not considered detrimental to the character nor conservation, as the species are of a non-native origin. Retaining the native vegetation, which would otherwise require clearance if an alternative location was considered, is a better outcome.

Energy Efficiency

The Development Plan seeks for the establishment of renewable energy facilities. The proposed installation of the solar PV array will work achieve this with the provision of a facility to harvest natural resources for the efficient generation of electricity. The proposal details include approximately 37,895 individual solar panels, approximately four inverter stations and battery energy storage systems. The proposal is considered to increase the energy efficiency of the existing reservoir operation and substantially reduce their operational costs.

Heritage

Happy Valley Reservoir was constructed in 1896 and was the third significant water catchment structure to be completed to service the Adelaide metropolitan area. It was prompted, in part, by the increase in water consumption created by the establishment of the water-borne sewage system in the 1880s.

The Happy Valley Reservoir is of heritage value as a relatively early example of a large and complex water storage system and reflects the expansion of Adelaide's population and improvements in the provision of public utilities. The Reservoir comprises a number of components and is associated with the Clarendon Weir, (a State heritage place), which provides additional water to the Reservoir via a 5km long tunnel.

The Happy Valley Reservoir (Dam Wall and Towers) is listed as a State heritage place in the State Heritage Register. The Reservoir "Embankment Tunnel", "Inlet" & "Outlet valve tower and scour tower" are together listed as a local heritage place in the Development Plan.

The proposed solar array is some distance north of the Reservoir and its components, (the inlet and outlet tunnels and the valve tower and scour tower are located within or on the edge of the reservoir itself).

The proposed solar array does not therefore have any physical impact on the reservoir nor its historic components. The Reservoir site comprises a number of allotments. Although on different allotments to the Reservoir, the proposed solar array is on what is interpretable as the same site as the Reservoir, (the Happy Valley Reservoir Reserve). The proposed solar array is however sufficiently distant from the Reservoir and its components that it does not materially impact on the context and setting of the place. Furthermore, existing and proposed landscaping and vegetation is such that the proposed solar array has little, if any, visual impact from the Reservoir and its immediate surrounds.

We anticipate that documentation concerning the proposed development has also been forwarded to Heritage SA for comment regarding impact on the State heritage place.

We agree with the planning report prepared by Aurecon dated 6 August 2019 accompanying the application that the proposed development is sufficiently distant from the former Glenthorne Farm site (State heritage place) and Tapley Farm Complex (local heritage place) not to affect their heritage value.

Social, Economic and Environmental Benefits

The social, economic and environmental benefits are summarised as follows.

- Provision of 37,895 individual solar PV cells, approximately four inverter stations and Battery Energy Storage Systems equipment will provide a renewable energy facility, which will reduce the operational costs of the reservoir.
- No native vegetation is required to be removed as part of the application, only introduced Aleppo Pines.

Conclusion

In summary, the proposed installation of solar photovoltaic arrays and associated infrastructure exhibits the following positive attributes to warrant support, subject to supportive advice from Heritage SA.

- The land use is considered appropriate and likened to a conservation type activity, which is discreetly located to not impede on the function or operation of the water storage and supply facility.
- The panels will be constructed/ established on a flat part of the site and require minimal earthworks.
- The landscaping will complement the development and improve the visual outlook of the solar array from public vantage points, including Black Road, Main South Road and the Flagstaff Pines land development.
- The landscaping species to be utilised in the vegetation buffer are native species.
- The development contributes to ecological sustainability with the delivery of an environmentally sustainable energy facility.

Should the SCAP be of the view the application is of sufficient merit to approve, we request to be consulted on any proposed reserved matters and conditions, however, we recommend the following conditions and notes be imposed on any approval:

1. All development shall be completed and maintained generally in accordance with Drawings XXXX (to be added/confirmed after meeting).

2. That effective measures be implemented during the construction of the development and on-going use of the land in accordance with this consent to:
   - Prevent silt run-off from the land to adjoining properties, roads and drains.
   - Control dust arising from the construction and other activities, so as not to, in the opinion of council, be a nuisance to residents or occupiers on adjacent or nearby land.
   - Ensure that soil or mud is not transferred onto the adjacent roadways by vehicles leaving the site.
   - Ensure that all litter and building waste is contained on the subject site in a suitable covered bin or enclosure.
   - Ensure that no sound is emitted from any device, plant or equipment or from any source or activity to become an unreasonable nuisance, in the opinion of council, to the occupiers of adjacent land.

3. A construction management plan which addresses the mitigation or minimisation of impacts (especially from noise, dust and sediment) must be prepared and submitted to the satisfaction of the City of Onkaparinga and must be implemented during the construction phase. Dust generated by machinery and vehicular movement during site works, and any open stockpiling of soil or building materials at the site, must be suppressed by regular application of water or other suppression methods to ensure that dust generation does not become a nuisance off site. Potential impacts of soil sediment and pollutants leaving the site or entering watercourses during the development of the site shall be mitigated/minimised.

4. During construction and at all times thereafter, stormwater generated from the development shall be diverted away from all buildings, shall not pond against or near the footings and shall not be discharged or flow onto adjoining land. Where drainage is directed to the street water table, this shall be by way of a council approved stormwater drainage system.

5. A Soil Erosion and Drainage Management Plan (SEDMP) prepared in accordance with the "Stormwater Pollution Prevention Code of Practice for Local, State and Federal Government", issued by the EPA, and to the reasonable satisfaction of the council, shall be put in place prior to the commencement of any site works and shall include, but not be restricted to, a temporary construction exit and silt fences. The measures are to prevent material from being washed or otherwise transported from the site. These silt control measures shall be maintained in good working order during construction and be maintained for a period of 12 months. At practical completion a decision will be made by council with regard to the sections of the silt control measures which need to be retained and maintained by the developer during the 12 month maintenance period applying to the SEDMP.

NOTES

1. The proponent is reminded of Clause 23 under Part 6 of the Environment Protection (Noise) Policy 2007. The clause states that construction activity must not occur on a Sunday or other public holiday; and on any other day except between 7am and 7pm. Exceptions to this requirement are prescribed in Clause 23(1) b of the Environment Protection (Noise) Policy 2007.

2. The applicant is reminded of its general environmental duty, as required by Section 25 of the Environment Protection Act, to take all reasonable and practical measures to ensure the activities on the whole site, including during construction, do not pollute the environment in a way which causes or may cause environmental harm.

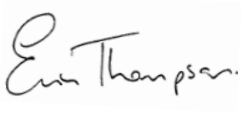
3. Any information sheets, guideline documents, codes of practice, technical bulletins etc that are referenced in this response can be accessed on the following web site: http://www.epa.sa.gov.au

4. Construction activities must be undertaken in accordance with Division 1 of Part 6 of the Environment Protection (Noise) Policy 2007 at all times. Further information can be found at: http://www.epa.sa.gov.au/environmental_info/noise

We wish to reiterate that council is willing to work with the developers and the SCAP to ensure that a quality outcome is delivered for the community.

Please contact John Mason (Senior Development Officer – Planning) on 8384 0549 or john.mason@onkaparinga.sa.gov.au if further information is required.

Yours sincerely



Erin Thompson
Mayor

DEVELOPMENT ACT, 1993
S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	SA Water
Development Number:	145/V020/19
Nature of Development:	Installation of an electricity generating plant in the form of a solar photovoltaic array (exceeding 5MW), battery storage and associated infrastructure and earthworks
Zone / Policy Area:	Open Space Zone
Subject Land:	Corner of Main South Road and Black Road, O'Halloran Hill
Contact Officer:	Brianna Fyffe
Phone Number:	7109 7866
Close Date:	Friday 1 November 2019

My Name: Sasha Slevec My phone number: 0413025938

Primary method(s) of contact: Email: sslevec15@gmail.com

Postal Address: 15 Coulter Street Flagstaff Hill SA Postcode: 5159

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are: *(please tick one)*

- [x] owner of local property
- [ ] occupier of local property
- [ ] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is: 15 Coulter Street Flagstaff Hill SA 5159

My interests are: *(please tick one)*

- [ ] I support the development
- [ ] I support the development with some concerns
- [x] I oppose the development

The specific aspects of the application to which I make comment on are:

- Negative impact on residential property values.
- No assessment on benefit to SA Water customers on prices.
- No assessment on impact on electricity prices to SA residents by virtue of SA Power Networks losing their biggest customer.
- No assessment on impact to local residents property values.

I: *(please tick one)*

- [x] wish to be heard in support of my submission
- [ ] do not wish to be heard in support of my submission *(Please tick one)*

By: *(please tick one)*

- [x] appearing personally
- [ ] being represented by the following person *(Please tick one)*

Signature:

Date: 1/11/2019

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 /or
Email: scapadmin@sa.gov.au

DEVELOPMENT ACT, 1993
S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	SA Water
Development Number:	145/V020/19
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Zone / Policy Area:	Open Space Zone
Subject Land:	Corner of Main South Road and Black Road, O'Halloran Hill
Contact Officer:	Brianna Fyffe
Phone Number:	7109 7866
Close Date:	Friday 1 November 2019

My Name: MICHAEL BUTT My phone number: 0427747789

Primary method(s) of contact: Email: hydrochemical@bigpond.com

Postal Address: PO BOX 604
KENSINGTON PARK Postcode: 5068

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are: *(please tick one)*

- [x] owner of local property
- [ ] occupier of local property
- [ ] a representative of a company/other organisation affected by the proposal
- [ ] a private citizen

The address of the property affected is:
1 EVERGREEN PARADE, FLAGSTAFF HILL

My interests are: *(please tick one)*

- [ ] I support the development
- [ ] I support the development with some concerns
- [x] I oppose the development

The specific aspects of the application to which I make comment on are: SEE ATTACHED SUBMISSIONS

I: *(please tick one)*

- [x] wish to be heard in support of my submission
- [ ] do not wish to be heard in support of my submission *(Please tick one)*

By: *(please tick one)*

- [x] appearing personally
- [ ] being represented by the following person *(Please tick one)*

Signature:

Date: 1 NOVEMBER 2019

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 /or
Email: scapadmin@sa.gov.au

Crown Development Act, 1993

S49/S49ACrown Development

Applicant: SA Water

Development Number: 145/V020/19

Nature of Development: Installation of an electricity generating plant in the form of a solar photovoltaic array (exceeding 5MW), battery storage and associated infrastructure and earthworks

Submissions of Michael Butt

1. **I am opposed to the proposed development for the reasons which are set out below.**

2. **In its application, SA Water appears to have deliberately sought to conceal the extent of the development by referring to the development as "exceeding 5MW" when in fact, SA Water has at all other times, indicated a figure of 9MW (almost double the capacity of the figure presented in the application).**

3. **The proposed scheme involves a massive industrial scale development which will be located only metres away from a residential housing estate. The proximity of such a massive industrial scale development on the doorstep of a residential housing estate is unprecedented in Australia. SA Water has admitted as much. The other solar panel sites namely at Hope Valley and at Glenelg, which SA Water initially sought to suggest were comparable, are both only a fraction of the size.**

4. **Throughout the consultation process, residents raised concerns about the impact of the development on the property values of homes located with the Flagstaff Pines Estate. SA Water has failed to address this issue at all in its submissions.**

5. **SA Water and the SA Government owe residents a duty of care. SA Water has not provided any independent impact assessment reports in relation *inter alia* to health risks associated with a development of this magnitude located on the doorstep of a residential housing estate. The precautionary principle requires that SA Water should do so.**

6. **Residents have grave concerns about the potential for a significant increase in the ambient temperature in and around the solar panel development. Opinions have been expressed that the ambient temperature could increase by as much as 5 degrees. It unacceptable for SA Water to say that it is satisfied from tests conducted at a totally different site, namely the Hope Valley Water Reservoir that there would be no discernible increase in temperature at the Happy Valley Water Reservoir. SA Water's methodology and conclusions appear to have no scientific basis.**

7. **Moreover, the solar panel development at Hope Valley Water Reservoir is not comparable to the proposed development at the Happy Valley Water Reservoir as it is only a fraction of the size of the proposed development at the Happy Valley Water Reservoir site.**

8. **Although SA Water has undertaken to provide screening to improve visual amenities (if the development were to be approved), SA Water has never undertaken to provide ongoing care and maintenance for the trees and native vegetation. This is of considerable concern. It is not acceptable for SA Water to say that it will retain 40 metres of pine trees and plant some native vegetation but not to assume an ongoing maintenance obligation. Such an obligation should be imposed as a condition if the development were to be approved.**

9. **This is particularly important in an era of global warming.**

10. **Furthermore, if approved, the development is likely to negatively impact on the absorption of rainwater which is in turn likely to have a detrimental impact on the vegetation (i.e. the pine trees and native vegetation) which is intended to screen the solar panels and related infrastructure from view.**

11. **There are concerns that the development, if approved, will escalate the risk of flooding in the area despite SA Water's protestations to the contrary. A resident within the Flagstaff Pines Estate has already experienced hydrology issues even with the pine trees in situ.**

12. **There will be noise emissions from a development of this magnitude. SA Water's application does not adequately address this issue.**

13. **SA Water's application lacks specificity in relation to security and lighting. If the development were to be approved, conditions ought to be imposed to ensure that the site does not look like a massive industrial site with unsightly high security fencing and bright security lights at night.**

14. **Solar panels contain highly toxic chemicals which are known carcinogens. SA Water does not adequately address the issue of the removal and disposal of the solar panels and the remediation of the site.**

18th November 2019

Attention: Brianna Fyffe, DPTI
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5000

Dear Brianna

Response to Representations – Section 49 (Crown Development) for Solar PV installation at Happy Valley Reservoir Reserve, DA No. 145/V020/2019

SA Water would like to thank you for this opportunity to provide a response to concerns which have been raised within the two submissions received during the Public Notification of DA No. 145/V020/2019, involving the installation of solar PV arrays and associated equipment in support of the broader Zero Cost Energy Future program. Before addressing the individual concerns within the submissions received from two representors, we would like to take this opportunity to highlight the comprehensive Stakeholder Engagement work which SA Water have undertaken, in partnership with the local community surrounding the Happy Valley Reservoir landholding.

SA Water first invited approximately 300 residents from within the Flagstaff Pines residential development (as the nearest residential community to the proposed project location) to attend 'street corner meetings' held in December 2018 to discuss the proposed solar PV installation. Attended by approximately 40 residents; the street corner meetings were an initial opportunity to hear from people living closest to the area proposed for the development.

SA Water sought nominations from local residents to establish a Community Reference Group to gain an understanding, and account for the concerns of the local community. The first meeting of the Reference Group was held on 13 March 2019. At the request of the group, engagement was opened up to the broader community, which has thus far included 3 public meetings, site visits, mailouts, notification in local media and signage. Information discussed throughout the various engagement formats has also been made available through the SA Water WaterTalks website dedicated to the Happy Valley Reservoir ZCEF project, found here: https://watertalks.sawater.com.au/zcef-happy-valley/documents .

The feedback received throughout the engagement with local community members has actively shaped the proposed design of the development, particularly the selection of a unique low-profile solar PV array type (5B), the retainment of a 40m wide buffer of the existing pine trees and the inclusion of planted vegetation buffers utilising locally indigenous plant species. The meaningful incorporation of the feedback from nearest residences ensures that the proposed development has taken all appropriate steps to minimise potential interface concerns. The retainment of a 40m wide buffer of existing pine trees along the northern boundary will obscure views towards the development from the nearest residences, while the establishment of planted buffers (utilising native vegetation of local provenance) will further safeguard visual amenity throughout the lifespan of the solar PV arrays.

SA Water would like to acknowledge that a number of concerns raised within the submissions from the two representors are not matters considered within the Onkaparinga Council Development Plan and should not therefore be taken into account for the assessment of this Development Application. These include the concerns raised in regard to property values, electricity prices and potential health impacts. Notwithstanding that these items should not be included within an assessment of this proposed development against the relevant provision of the Onkaparinga Council Development Plan, responses to these concerns have previously been offered by SA Water as part of separate stakeholder engagement correspondence, as documented on SA Water's Water Talks page.

Responses have been provided to the remaining concerns raised within the submissions under the individual sub-headings below;

Proposed electricity generation capacity

We acknowledge the concern of one representor that the information submitted within our Development Application referenced a generating capacity "*exceeding 5MW*" and wish to assure this representor that this reference was not made in an effort to "*conceal the extent of the development*". Our reference to a generating capacity of 5MW is made in acknowledgement of the use of this figure within the *Development Act 1993* and *Development Regulations 2008* as an important threshold test when considering the nature of a development and prescribed particulars related to an assessment.

The intended generating capacity of the proposed solar PV installation at Happy Valley Reservoir has been included within prior communications between SA Water and the resident stakeholder group, of which this representor was also involved. Within these communications it has been stated that the generating capacity would be approximately 9MW; a figure which has been calculated based upon the available land area and concept level designs factoring in the selected solar technology type (5B).

Through the more detailed design work which is to progress over the coming months there may be the potential for greater optimisation in the use of the available land area, resulting in a higher MW capacity. Though the final generating capacity figure may vary slightly, the proposed land area which is to accommodate the solar installation within the Happy Valley Reservoir will not change. The information included within our application provides details for all physical components of the installation and the intended layout/ positioning of these within the subject land. Particular effort has been made so that the expected visual profile of the development can also be assessed. In this way, we consider that the overall "*extent of the development*" has been appropriately presented within our application.

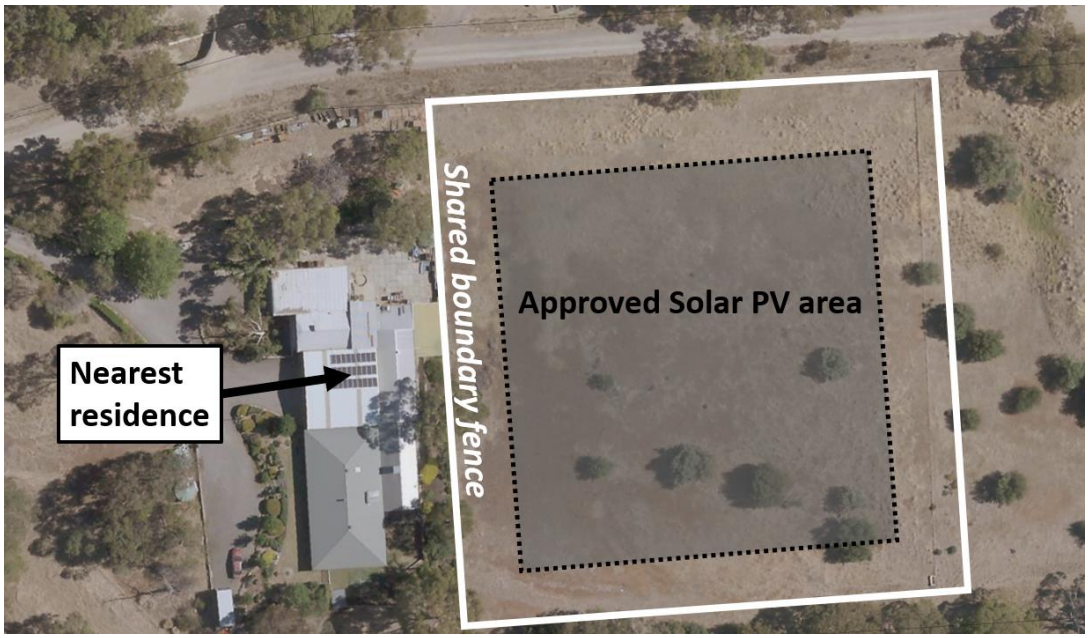
Scale of development and proximity to residential housing estate

While we have previously addressed the overall appropriateness of the development within the selected location, we acknowledge the particular concern raised by one representor for the scale of the development and the proximity to residential land uses.

We understand the representors concern that the proposal involves "massive industrial scale development", and further that the proximity of this development to residences "is unprecedented in Australia". Each of the solar PV installations proposed by SA Water as part of the Zero Cost Energy Future program are situated within a range of locations and exhibit a range of size and scale; therefore necessitating consideration of a diverse and unique range of factors in determining appropriate

designs that respond to the particular locality. Nonetheless, it may still be of some benefit to understand the Happy Valley Reservoir proposal in the context of the broader ZCEF program, in particular;

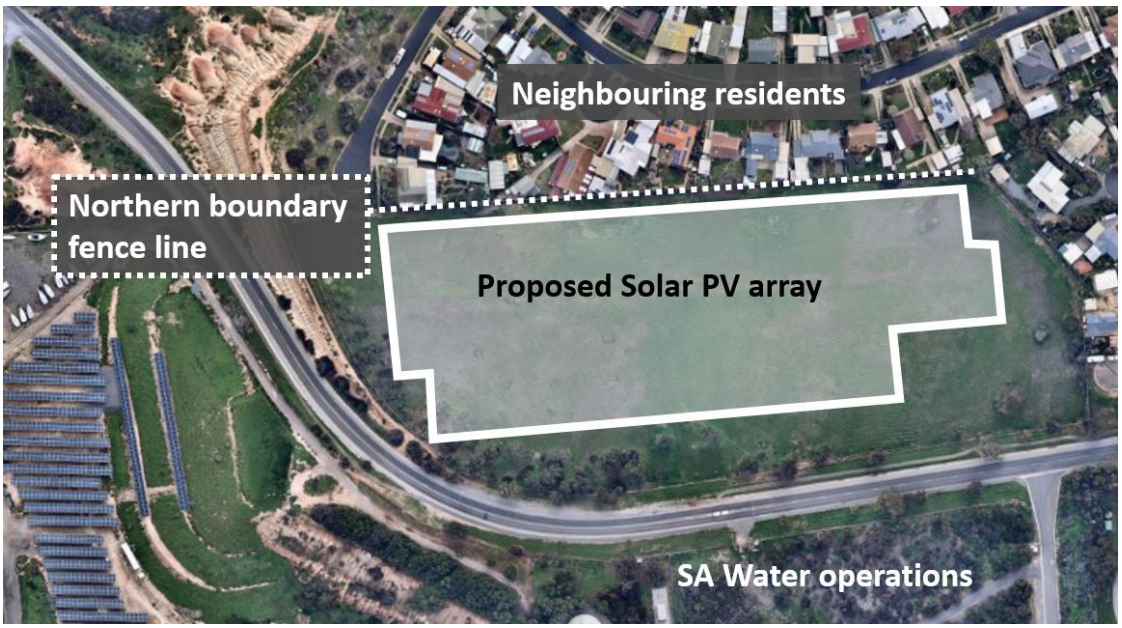
- Happy Valley Reservoir proposes to utilise approximately 11 hectares; placing it as the 11th largest site in the ZCEF program by land area. The largest proposed site is located near the township of Palmer (within the Mid Murray Council region), at Mannum to Adelaide Pipeline Pump Station No.2 (Mannum PPS.2) and requires approximately 37 hectares in total.
- Two additional ZCEF sites which exhibit smaller installation sizes to that proposed at Happy Valley Reservoir are located within allotments that are immediately adjoining to residential properties. These two sites are also located within the City of Onkaparinga council area, and further detailed below;
    - **Onkaparinga Hills PS and Tank site**. Located at Panalatinga Road, Onkaparinga Hills. Requires approximately 0.4 hectares. Approved as DA No. 145/V010/19 on 05/09/2019. aerial image:



Base image source: SA Property and Planning Atlas (SAPPA), https://maps.sa.gov.au/SAPPA/ NOTE: boundaries are approximate and shown for illustrative purposes only.

Agreement was reached through direct correspondence between the SA Water Stakeholder Engagement team and the nearest resident whereby the shared boundary fence line would utilise a combination of Stratco 'Good Neighbour' solid fencing (northern section) and chainmesh security fencing (southern section). This would allow the development to be screened from view adjacent to the dwelling, whilst still permitting morning sunshine to reach the southern garden.

- **Christies Beach Waste Water Treatment Plant (WWTP)**. Located at Hunter Road, Christies Beach. Requires approximately 3 hectares. Under assessment as DA No. 145/V019/2019. Aerial image:



Base image source: Nearmap, https://www.nearmap.com/au/en NOTE: boundaries are approximate and shown for illustrative purposes only.

Similar as with the Happy Valley Reservoir ZCEF site, considerable Stakeholder Engagement work has contributed to the development of design details for the proposed solar PV installation at Christies Beach WWTP site. Ordinarily a dedicated chainmesh security fence would be required around all perimeters, however in this case an agreement has been reached between SA Water's Asset Security team and three of the neighbouring residents along the northern development perimeter so that the existing back fences (which are very low in height) can be replaced with higher fencing that allows a consistent height across the whole northern resident interface fence line. This outcome avoids the need for a separate, more visually intrusive chainmesh security fence.

For each of the above two examples of ZCEF sites within much closer proximity to residences, the potential interface concerns have been addressed through adaptive design measures and SA Water has taken a proactive approach to Stakeholder Engagement through having direct discussions with residents early on in the process. While these two installations are smaller in scale to the Happy Valley Reservoir, our intention is not to seek a direct comparison, particularly as the ZCEF project is very much defined by the diversity found within individual site considerations. Notwithstanding this, the example provided remains valuable as far as demonstrating that adaptive design measures which seek to mitigate against interface concerns, paired with proactive stakeholder engagement, can ensure that project objectives are well balanced against the ability for a development to be of an appropriate scale, form and design. We consider that the same has been achieved by the proposed installation at Happy Valley Reservoir.

Increase to ambient air temperatures

One representor has raised concern for the potential increase to ambient air temperatures resulting from the installation of the solar PV arrays at Happy Valley Reservoir. We acknowledge that this concern has been raised previously within various stakeholder forums. We also note that a copy of the 'SA Water Photovoltaic Heat Island (PVHI) Report' has been included within a list of documents provided for public viewing via SA Water's website, on the *Water Talks* page dedicated to the Happy Valley Reservoir ZCEF site, located here: https://watertalks.sawater.com.au/zcef-happy-valley/documents .

This report had been prepared by SA Water, in partnership with Aurecon, as part of broader ZCEF-wide correspondence with the DPTI – Crown and Major Developments planning team regarding the determination of appropriate setback distances which should be achieved by the solar PV arrays from outer property perimeters. We understand that this representor considers that the report is based solely upon "*tests conducted at a totally different site*". Accordingly, we wish to clarify that the multi-method approach which was employed for the PVHI Report comprised; a theoretical model, physical sampling and statistical analysis, as further explained below:

1. **Theoretical model** – utilising Computational Fluid Dynamics (CFD) simulation to model the nature of what is termed 'Photovoltaic Heat Island' effects (or PVHI) at solar PV installations of varied sizes, through having regard to multiple site condition factors (i.e. air temperatures and wind speed).
2. **Statistical Analysis** – to further contextualise the results of the CFD modelling, a mesoscale analysis was undertaken utilising Aurecon's Weather Forecasting and Research (WFR) model which accounts for the frequency of occurrence of particular weather conditions in a specific location.
3. **Physical sampling** – primary data obtained from the previously constructed Hope Valley Reservoir solar PV installation. temperature measurements were recorded periodically, at multiple distances from the site, during multiple days.

A copy of the PVHI report is attached for reference.

To summarise the key findings, it was shown that the maximum consequence on a neighbouring allotment, at the worst-case panel temperature (infinite irradiation), worst-case wind speed (strong enough to carry the heat, but not so strong as to dilute it), the highest ambient temperature and no thermal effect from anything but the PV array; the absolute maximum increase in air temperature beyond the subject land is expected to be 1°C.

Realistically however, it would be expected that wind cools the surface temperature of the panels, the irradiation is not infinite and the land surrounding the PV array has similar irradiation to the PV panels. Note also, this study is not implying that the air temperature within the array is not more than 1 degree above ambient. In fact, within 10cm or less from the PV panel surface, the air temperature rises by up to 3°C.

The report concludes, based upon the undertaken analysis, an insignificant temperature variance extends from the immediate vicinity of the solar PV array. Furthermore, the frequency or regularity of this worst-case impact is limited to times of certain wind and temperature conditions which occur during few times of the year. In order to produce conservative, worst-case results the CFD modelling did not take into account the effect of existing vegetation, which would likely further reduce the extent of measurable temperature variance beyond the subject land.

Ongoing care for landscaped buffers

We note that one representor has sought confirmation from SA Water regarding the ongoing care and maintenance for the proposed native vegetation buffers which are to be established along the northern and western perimeters of the solar PV array.

SA Water wishes to assure this representor that the design and specification of the proposed native vegetation buffers has incorporated considerable effort to ensure the species selected for each buffer are of local provenance, and moreover;

- The species have been selected for their particular ability to thrive in the specific soil conditions of the subject land (soil type matched);
- The seeds/ seedlings to be planted will be sourced locally so that the genetics of planted specimens have developed and adapted in response to local conditions;
- Direct seed sowing and the planting of tube stock will take place at suitable times of the year to further increase success rates.

The Specialist Native Vegetation team in SA Water has a wealth of experience with revegetation projects successfully undertaken elsewhere in the region and through the careful selection of species, these do not generally require that any irrigation or additional watering be implemented. However, it is general practice for revegetation projects to include targets around survival rates, as well as specifying requirements for replacement plantings.

In the event that the proposed development receives approval, SA Water would be very supportive of the inclusion of a condition which seeks that the native vegetation buffers are appropriately maintained to ensure they fulfil the screening function and are kept in reasonable condition post establishment.

Stormwater runoff and flooding

Regarding the concern raised for the potential impact of the solar PV arrays upon "absorption of rainwater" within the project footprint, we can advise that the development does not propose the introduction of impervious ground surface treatments. Ground preparations of the solar array footprint area will involve the removal of 300-400mm of top soil and backfilling of conditioned fill which is compacted to an MDD of 95%. The ground surface throughout the solar PV array footprint will allow for the ongoing absorption of rainfall, with stormwater to be further managed through the incorporation of swales which will direct water run-off to existing watercourses within the subject land. A higher level of detail for the proposed stormwater management at the Happy Valley Reservoir solar PV installation can be provided at the time of Detailed Designs.

We further acknowledge the representors concern that the proposed development *"will escalate the risk of flooding in the area"* and more specifically *"within the Flagstaff Pines Estate"*. By design, the Happy Valley Reservoir landholding is situated within undulating terrain, allowing for the effective capture and storage of water. Ground elevations are highest towards the outer extent of the reservoir landholding and the terrain then falls away from the outer perimeters (particularly the northern perimeter) to form a central depression which contains the reservoir waters. The proposed development does not involve significant grading and levelling of the project footprint, and the existing site hydrology (where surface run-off is maintained within the landholding and flows towards the central reservoir waterbody) will be largely maintained.

Noise emissions

The representor has raised a broad concern for noise emissions resulting from "*a development of this magnitude*", and while specific sources of noise emissions are not referenced, we consider the key source of noise emissions to be limited to the construction period.

The selection of a unique, low-profile solar design type (5B) allows for a significantly less conspicuous visual profile than typical solar design types used elsewhere for the ZCEF project, and additionally, the 5B solar type achieves a far less impactful construction methodology.

5B are an Australian owned company, founded in 2013 and offering a 'cutting-edge technology' through their flagship 'MAVERICK™' portable and prefabricated solar array. The deployment of the prefabricated 5B arrays does not require percussion piling and the system instead utilises a robust ballasted configuration. As the construction will not require extensive drilling/ piling activities, the overall disturbance to the surrounding locality is significantly reduced. Examples of 5B deployment at previously completed developments across Australia can be found on their website, here: https://5b.com.au/

Furthermore, the ongoing operation of the solar PV development will not result in significant noise generation, which would be limited to that resulting from associated Inverter equipment, installed within appropriate weather-proofed shelters which also serve to reduce resultant noise emission. The inverters will seek a relatively central position within the development footprint and will therefore be well separated from the northern perimeter of the subject land, which is the nearest point to adjoining sensitive land uses.

SA Water further acknowledges that the existing dense plantation of pines within the subject land influences the way in which noise travels within, across and beyond the landholding. Accordingly, baseline noise level measurements are intended to be obtained at the project location once the pine trees have been removed by ForestrySA (with the exception of the 40m wide retained buffer) so that a firm reference point exists in the event that noise concerns are raised during construction or the ongoing operation.

Security fencing and lighting

We acknowledge the representors concern that "*unsightly high security fencing and bright security lights at night*" may form part of the proposal. However, we wish to assure this representor that the proposed development is to utilise the existing security fence line which surrounds the outer perimeter of the Happy Valley Reservoir land holding. The proposal also makes no inclusion for the provision of security lighting as part of the development as the existing security arrangements of this land holding are considered to be sufficient.

Conclusion

We hope that the above information sufficiently addresses the concerns which have been raised within the two submissions received with regards to the proposed solar PV installation at Happy Valley Reservoir. SA Water has worked closely with nearest surrounding residences (including the two representors) and other relevant stakeholders in order to arrive at a proposed design which meets the objectives of the ZCEF program, whilst mitigating potential impacts as far as practical. Should further information be required in support of this Development Application, please do not hesitate to contact me at lauren.nicholson@aurecongroup.com , or via mobile on 0478550440.

Kind Regards,

Lauren Nicholson (Aurecon – on behalf of SA Water)
Senior Consultant, Environment and Planning

Enclosed:

Appendix A – copy of '*Photovoltaic Heat Island (PVHI) Report*'

Appendix A *- Photovoltaic Heat Island (PVHI) Report'*

Capital Delivery/Zero Cost Energy Future

Photovoltaic Heat Island (PVHI) Report

Version: 1
Date: 23/05/2019
Status: Final

Government of South Australia

Document Controls

Version History

Version	Date	Author	Comments
1	23/05/2019	Doug Shadwell	Final Issue

Template: Report Version 4.0 31/07/17

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1 Introduction

SA Water are proposing the installation of solar Photovoltaic (PV) arrays and associated infrastructure at a number of key operating sites across South Australia as part of the Zero Cost Energy Future (ZCEF) project. The overarching aim of this project is to reduce the operating costs of, and improve reliability of energy supplies to SA Water's critical infrastructure.

The vast majority of those sites where solar PV installations are proposed will require Development Approval, in accordance with Section 49 of the *Development Act 1993*. The Minister for Planning is deemed to be the relevant authority for Crown Development, taking advice from the State Commission Assessment Panel (SCAP) and staff working under delegated authority.

A suite of draft approval conditions has been outlined by the assessment staff for Crown and Major Developments within the Planning and Land Use Services team at DPTI (Dept. Planning Transport and Infrastructure), so that greater consistency can be reached across the remaining Development Approvals for ZCEF installations. One of the draft conditions appearing in this suite requires that a minimum 25 metre setback be maintained from the site boundary to any installed equipment. We understand the basis of this condition is due to recent concerns on other solar PV projects where the potential for photovoltaic heat island (PVHI) effect was considered to have possible effects of the surroundings. The setback requirement is informed by recent large-scale installations and by the outcome of one recent interstate case determined by the Victorian Civil and Administrative Tribunal (VCAT); *ESCO Pacific Pty Ltd v Wangaratta RCC [2019] VCAT 219 (14 February 2019),* where a 30m setback was established.

In the case of most large-scale solar farms, a setback distance of 30 metres from site boundaries is manageable and largely inconsequential. However, the Zero Cost Energy Future project comprises a large proportion of sites ranging from small, by industry standard, to very small (100kW installed PV equivalent to 3000m^2), making such a setback either unfeasible or completely impossible.

1.1 Purpose

Based on currently available research and scientific literature[1], SA Water believe the existing PVHI knowledge is based on large, industrial sized installations and does not accurately represent installations of a smaller magnitude as incorporated in the ZCEF project.

The purpose of this report is to summarise the investigations which SA Water have commissioned externally, as well as separate analysis carried out internally, to establish the nature and extent of the PVHI effect based on the scale of solar PV installations proposed as part of the ZCEF project. The findings of this undertaking will endeavour to demonstrate that a 25 metre setback is not required for sites which exhibit the size ranges as being developed in the Zero Cost Energy Future project.

[1] At present, there is a limited number of studies and reports which have sought to understand the potential PVHI effect resulting from solar installations, with isolated examples offered in the below works;

- Barron-Gafford, G. A. et al., 2016, 'The Photovoltaic Heat Island Effect: Larger solar power plants increase local temperatures.', *Scientific Reports, vol.* 6, Issue 35070, https://www.nature.com/articles/srep35070
- Yang, L et al., 2017, 'Study on the local climatic effects of large photovoltaic solar farms in desert areas', *Solar Energy,* vol. 144, pp. 244–253
- Fthenakis, V, Yu, Y, 2017, 'Analysis of the Potential for a Heat Island Effect in Large Solar Farms', *IEEE 39th Photovoltaic Specialists Conference (PVSC)*, 16-21 June 2013, Tampa, FL, USA, viewed 12 April 2019, https://ieeexplore.ieee.org/abstract/document/6745171

the applicability of the above is further limited by their focus upon large scale solar farms.

1.2 Glossary

The following glossary items are used in this document:

Term	Description
CFD	Computational Fluid Dynamics – a method to mathematically calculate the movement of fluids and their properties, such as temperature, in a theoretical simulation.
CFS	Country Fire Service
DA	Development Approval
DPTI	Dept. Planning Transport and Infrastructure
PV	Photovoltaics
PVHI	Photovoltaic Heat Island – an effect by which a large number of co-located PV panels purportedly increase the temperature of that area
SA Water	South Australian Water Corporation
SCAP	State Commission Assessment Panel
WWTP	Waste Water Treatment Plant
ZCEF	Zero Cost Energy Future – the name of SA Waters project through which the PV arrays are being constructed

2 Multi-method Approach

SA Water have selected to investigate the potential impact of the PVHI effect utilising a multi-method approach, which comprised; a theoretical model, physical sampling and statistical analysis, further explained below:

1. Theoretical model – utilising CFD simulation, or Computational Fluid Dynamics, to model the nature of PVHI effects at solar PV installations of varied sizes, through having regard to multiple site condition factors (i.e. air temperatures and wind speed).

2. Physical sampling – primary data was obtained at one previously constructed SA Water solar PV installation in the Hope Valley Reservoir land. Temperature measurements were recorded periodically, at multiple distances from the site, during multiple days.

3. Statistical Analysis – to further contextualise the results of the CFD modelling, a mesoscale analysis was undertaken utilising Aurecon's Weather Forecasting and Research (WFR) model which accounts for the frequency of occurrence of particular weather conditions in a specific location.

The three approaches briefly outlined above are discussed in greater detail in the following sections of this report. With regards to the CFD modelling and the primary data sampling, individual reports are attached as appendices A and B, respectively.

2.1 Computational Fluid Dynamics

As detailed in Appendix A, a CFD simulation for solar PV installations of three varying size-ranges was modelled. The size ranges selected were for a 200kW, 2MW and 10MW PV installation, corresponding to sites such as the Millicent PS, Aldinga WWTP and Bolivar WWTP, respectively. The three installation sizes selected are representative of the size-range for Zero Cost Future Energy proposals, as illustrated within the below Site Supply Curve graph.

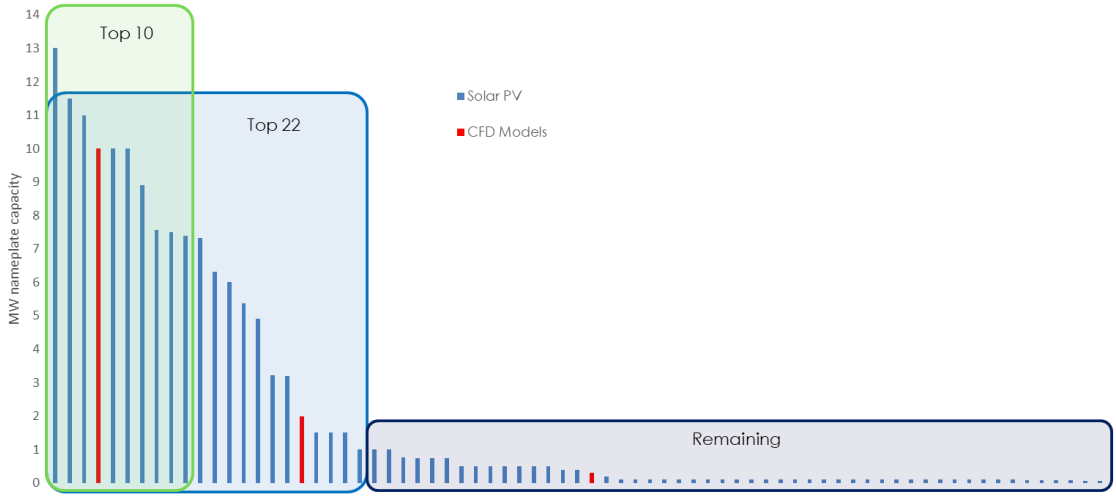

Figure 1 - Range of site sizes and corresponding CFD analyses marked in red.

The 3D model was developed as a simplified model with all fine detail, not relevant to the flow, removed. The surface area of the PV panels was modelled at 25 °C above the ambient, while the ground was modelled at ambient temperature. Atmospheric boundary layer wind speed profiles were applied. The model was solved until a steady state condition established. Subsequently the isothermal surfaces and temperature sections were analysed and exported.

2.1.1 Results

As observed within the modelling results, the temperature difference between the surface of the PV panels and the ambient air temperature (indicated as the red arrow "$\Delta T_{Amb\text{-}Surf}$" in Figure 2 below) dictates the change in air temperature (indicated as the purple arrow "$\Delta T_{Amb\text{-}Conv}$" in Figure 2 below) which will result from the presence of the solar array. This principle[2] states that the absolute temperatures of the two interfaces (being the PV panel surface and ambient air) do not impact the exchange of energy. Rather, the temperature difference between the two interfaces dictates the temperature change. This is further illustrated within the graph included on the following page;

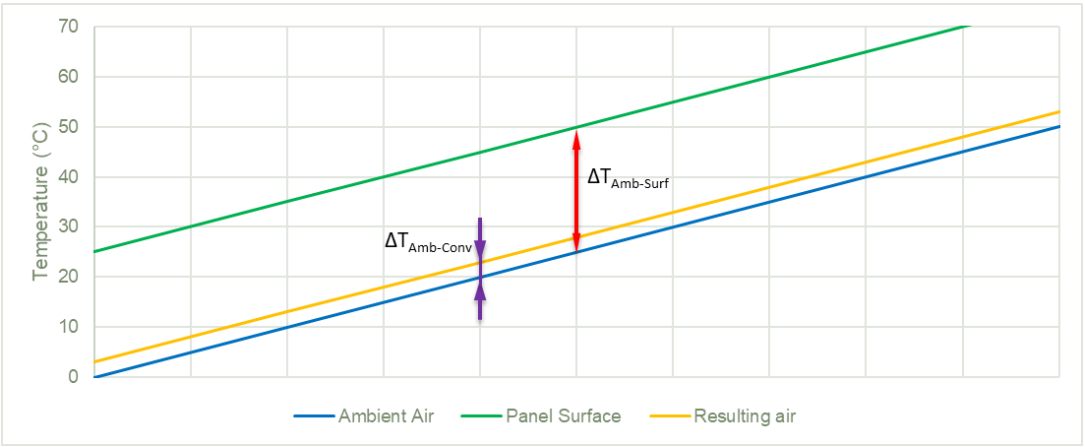

Figure 2 - Graphical representation of the relationship between panel surface temperature, ambient air and resultant change in air temperature

Accordingly, the absolute figures for ambient air temperature and PV panel surface temperature used in the modelling are irrelevant if the temperature difference is constant. To

[2] Newton's law of cooling

ensure that the modelling would reflect worst-case scenarios, a very conservative fixed temperature difference of 25 degrees Celsius was applied for the surface of the solar PV panels.

It was found that during low wind speeds the heat does not drift into the neighbouring allotment, instead it wafts upwards with buoyancy, as can be seen in Figure 3, below.

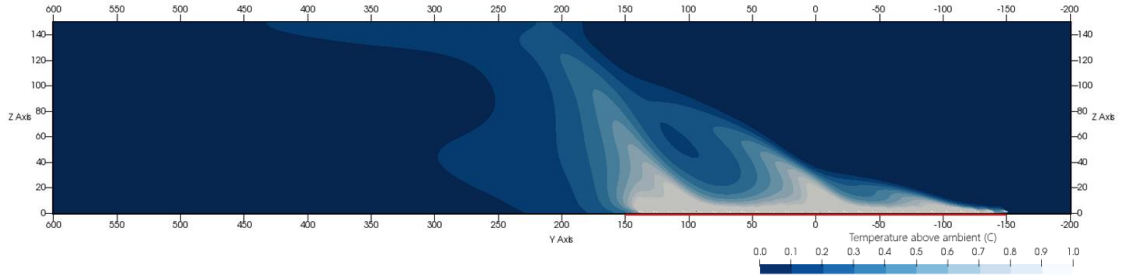

Figure 3 - Temperature profile of a 2MW array with low (0.5m/s) windspeed.
Note the PV array is located from -150 to 150m on the Y-axis (indicated in red). For the detailed results see Page 18 of the report in Appendix A.

However, the CFD modelling shows that if all variables are considered worst-case, then at a wind speed of 5 m/s, a maximum of 1°C temperature change can be expected at ground level next to the PV array. This as shown in Figure 4, where the wind is blowing right to left.

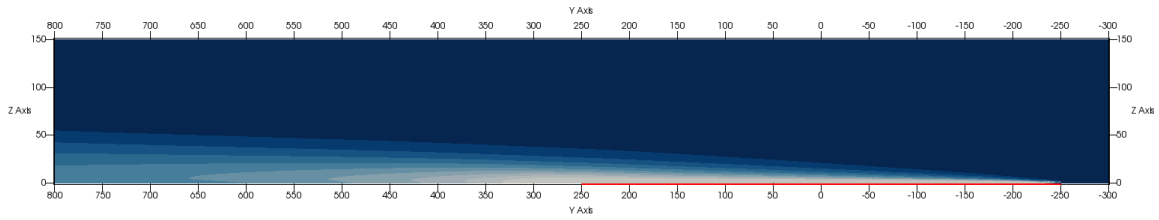

Figure 4 - Showing the dispersion of heated air from a 10MW PV installation
Note the PV array is located from -250 to 250m on the Y-axis (indicated in red). For the detailed results see Page 22 of the report in Appendix A.

The above two excerpts from the report "*CFD simulation of the Photovoltaic Heat Island Effect*" (included as Appendix A) are included as examples, while a complete presentation and discussion of the modelling results can be found within the report itself.

Within this model, by having the PV array isolated from all other thermal effects, it was shown that the maximum consequence on neighbouring allotment, at the worst-case panel temperature (infinite irradiation), worst-case wind speed (strong enough to carry the heat, but not so strong as to dilute it), the highest ambient temperature and no thermal effect from anything but the PV array; the absolute maximum increase in air temperature in the neighbouring property is expected to be 1°C.

Realistically however, it would be expected that wind cools the surface temperature of the panels, the irradiation is not infinite and the land surrounding the PV array has similar solar irradiation to the PV panels. This being a more realistic model, but still with worst-case assumptions, the temperature effect on neighbouring properties is a fraction of that 1 degree.

Note, this study is not implying that the air temperature within the array is not more than 1 degree above ambient. In fact, in the immediate vicinity (10cm or less) to the surface of the PV panels, the air temperature rises by up to 3°C. See Figure 5, below.

However, by the time the air moves away from the immediate vicinity (>20 cm), the turbulent mixing of the air has cooled it to be within a fraction of a degree Celsius.

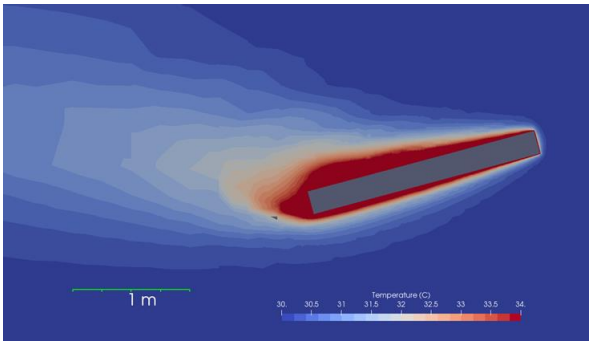

Figure 5 – Near-field air temperature around a single PV panel at a wind speed of 0.5 m/s

It can therefore be determined from this analysis that the temperature rise in practice at 25m, 10m or even 5m will be less than a degree.

2.2 Site temperature measurements

SA Water currently operate a 1.242 MW solar PV array at their Hope Valley water reservoir site. The installation of solar PV arrays and associated infrastructure at this site was granted Development Approval by a delegate of the Minister for Planning on 30th April 2018, under assessment number 070/V001/18. As part of the PVHI investigations, SA Water recorded temperatures at, and at increasing distance from, the PV array presently in-situ at the Hope Valley Reservoir land.

Figure 6 - Site aerial view showing the array, locations of temperature measurements (red and blue lines) and the temperature control location (star).

During the six days of recording, no clear correlation at any distance from the array, could be measured and it was found that the natural fluctuations in surrounding air temperature overshadowed any change in temperature which may have been present and could be directly attributed to the solar PV array.

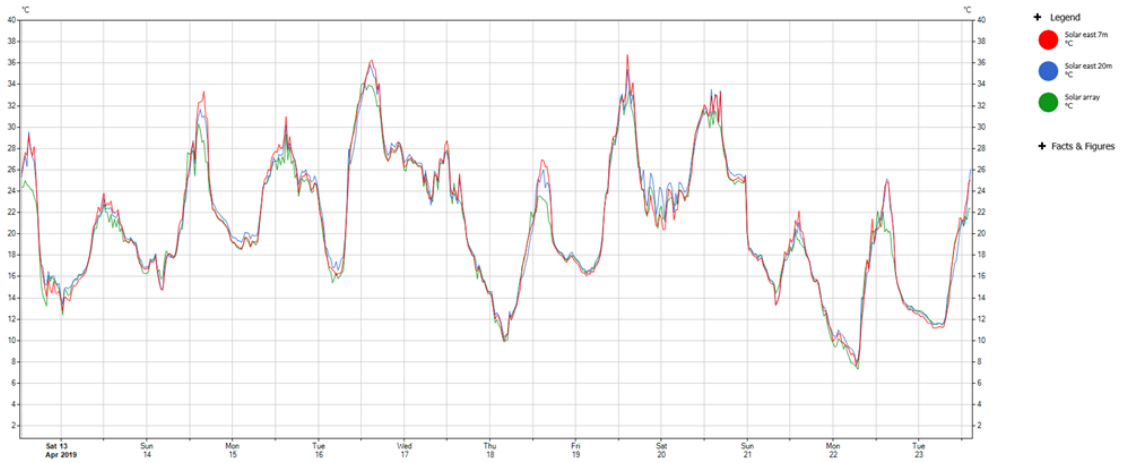

Figure 7 – Measured temperatures during the recording interval

For the detailed report which includes a description of the methodology and detailed findings of this study, please see Appendix B.

Site temperature measurements showed that the PV array had no measurable effect on the surrounding air temperature.

2.3 Mesoscale statistical analysis

The CFD modelling demonstrated that the scale or extent of PVHI impact upon a neighbouring allotment is of limited significance in terms of temperature variance (even where worst-case scenarios for all tested factors were applied). Notwithstanding this, it is necessary to contextualise the frequency, occurrence and proportion of the worst-case climate conditions which contributed to the overall worst-case PVHI impact to neighbouring allotments.

The CFD modelling showed the influence on neighbouring properties as most pronounced at higher wind speeds (i.e. above 2 m/s) and it would also not be unreasonable to assume that an increase in temperature would be of greatest consequence when the ambient temperature is high (i.e. above 30°C), rather than at times when ambient temperature is low.

Hence Aurecon used their mesoscale modelling (weather simulation capability) to determine the proportion of time the temperature was high, at the same time as the wind speed is above a certain threshold. Weather data was obtained for Murray Bridge to Hahndorf Pipeline pump station 2 (near 35.093S, 139.209E). This site was chosen as it is relatively central both in latitude and longitude of all sites within the ZCEF project.

2.3.1 Mesoscale modelling explained

Mesoscale modelling involves the downscaling of global reanalysis data to simulate the weather at high resolution over specific target areas. This 'reanalysis' is a method of weather modelling combining large amounts of historical observational data and highly detailed numerical models. The state of the art mesoscale simulation model that is used to downscale the global reanalysis data is called the Weather Forecasting and Research (WFR) model. https://www.mmm.ucar.edu/weather-research-and-forecasting-model. Aurecon's weather simulation evolved from renewable energy applications to determine wind, solar and hydro resource, and for the feasibility of renewable energy developments around the world. Aurecon have utilised mesoscale modelling extensively over Australia for such applications. The degree of accuracy and confidence in this model is such that a number of wind farm projects have been financed based upon Aurecon's weather simulation capability.

2.3.2 Proportions analysis

The following Table 1 shows the proportions of the hourly expected local climate at the Murray Bridge to Hahndorf Pump Station No.2 site, broken down in to wind speed and temperature steps.

Table 1 - Temperature and wind speed proportion matrix

		Wind Speed (m/s)				
		< 0.5	0.5 - 2	2 - 5	> 5	Sum
Temperature (°C)	< 25	0.6%	10.7%	44.1%	35.7%	91.1%
	25 - 30	-	0.5%	2.0%	3.3%	5.8%
	30 - 35	-	0.1%	0.9%	1.3%	2.3%
	35 - 40	-	-	0.1%	0.7%	0.8%
	40 - 50	-	-	-	-	0.0%
	Sum	0.6%	11.3%	47.1%	41%	100%

As an example to reading the table above, during 10.7% of the year being equivalent to 39 days cumulatively (10.7/100x365=39) the temperature will be less than 25°C and the wind speed between 0.5 – 2 m/s. Or alternatively, 2.0% of the year, being equivalent to 10.6 days cumulatively (2.0/100x365=10.6), the temperature will be between 25°C - 30°C and the wind speed between 2 – 5 m/s.

Hence, as can be concluded from the table, 3.0% (0.9+1.3+0.1+0.7) of the time the temperature is over 30°C and the wind speed over 2 m/s. This would imply that only 11 days cumulatively (3.0/100*365) of the year exhibit the weather conditions coinciding with the notable CFD results.

2.3.3 Results

The mesoscale modelling shows that for approximately 97% of the time, the climate conditions do not align with those required to produce any PVHI effect on any neighbouring allotment. During the remaining 3% of the year, the climate conditions are such, that the PV array may create an effect which can extend to neighbouring allotments.

3 Conclusion

As can be concluded from the studies and investigations undertaken within our multi-method approach, which have sought to model and understand the potential for a Photovoltaic Heat Island (PVHI) effect, an insignificant temperature variance extends from the immediate vicinity of the solar PV array. Furthermore, the frequency or regularity of this worst-case impact is limited to times of certain wind and temperature conditions which occur during very few times of the year.

Due to the insignificance of the PVHI effect, we do not consider that a particular setback requirement should be enforced on the basis of this effect alone.

Nevertheless, we acknowledge that a minimum setback of 10 metres has previously been upheld for all perimeters of the proposed solar PV arrays. This setback had been deemed appropriate through previous engagement with Crown Development Assessment staff at DPTI, and further consulted upon with Local Councils where the proposed sites are located and with the South Australian Country Fire Service (CFS). This minimum setback distance is considered appropriate as it allows for the provision of ongoing access around the perimeter of sites, as well as allowing for visual impact to be addressed and the potential provision of vegetation screening.

Appendix A Computational Fluid Dynamics Report

Zero Cost Energy Future

CFD simulation of the Photovoltaic Heat Island Effect

SA Water

Reference: 503097

Revision: 2

2019-05-21

aurecon

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Document control record

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Document control						aurecon
Report title		CFD simulation of the Photovoltaic Heat Island Effect				
Document code			**Project number**		503097	
File path		\\Aurecon.info\shares\AUADL\Admin\Data\General Staff\Disciplines\Noise and Vibration\Projects\PVHI - PV heat Island\report\190517 - Report - CFD simulation of the Photovoltaic Heat Island Effect.docx				
Client		SA Water				
Client contact		Doug Shadwell	**Client reference**		Zero Cost Energy Future	
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
0	2019-05-08	Issued as Draft	B Malin	P Mischler		
1	2019-05-17	Final	B Malin	P Mischler		
2	2019-05-21	Final with client comments	B Malin	P Mischler		M Green
Current revision		**2**				

Approval			
Author signature		Approver signature	
Name	Ben Malin	Name	Michael Green
Title	Applied Sciences Engineer	Title	Engineering Meteorologist

Contents

Appendices

Figures

Tables

1 Introduction

Aurecon have been engaged by SA Water to undertake a computational fluid dynamics (CFD) study to understand the potential thermal impact of solar farms on their surroundings. Incident solar radiation causes the surface temperature of photovoltaic (PV) arrays to increase above the ambient air temperature. There is a concern that the solar arrays could heat the surrounding air, and thus cause an elevation in temperature at the site boundaries. This analysis is intended to inform the specification of required setback distances between photovoltaic cells and the development boundary, based on the expected impact on adjacent properties.

2 Methodology

2.1 Overview

The following outlines the steps taken in the analysis of this study:

- A simplified 3D model was developed of three possible array configurations, with fine details not relevant to the flow removed.
- A CFD model was developed in OpenFOAM representing the various PV array configurations
- PV surface temperature of 25°C above ambient and three different wind speed profiles were applied to the model
- The model was run until a steady-state condition established
- Isothermal surfaces and temperature sections were analysed and exported

2.2 Modelling Inputs and Assumptions

Three different array configurations have been modelled, each at three different wind speeds for a total of 9 simulations. As the aspect ratio of a PV array is not fixed and rarely ideally square (1:1), the aspect ratio was assumed to be in the order of 3:1 or less to give a rectangular layout.

Of the technologies currently considered for installation, the fixed tilt racking system has a higher area coverage compared to that of the single axis tracking systems and with more panels assumed to be generating more heat it was decided to model the array as fixed tilt with typical tilt of 15° from horizontal and an approximate coverage of 35% of the total site area.

The wind was modelled assuming a neutral atmospheric boundary layer, with a reference velocity applied at a reference height of 10m. Array configurations and modelled wind speeds are shown in Table 1.

Table 1 - Array configurations

Array Configurations	Land Area
200 kW	approx. 30m by 100m
2 MW	approx. 100m by 300m
10 MW	approx. 300m by 500m

Table 2 - Wind speeds

Wind Speeds (m/s)
0.5
2
5

The surface area of the PV array has been modelled at 25 °C above the ambient temperature (assumed to be 30°C). This is a typical conservative assumption based on industry practice. The ground has been modelled at ambient temperature as a worst-case assumption. In practice, the temperature of the ground is

likely to also be warmer than the ambient air. Consequently, the relative temperature difference between the array and the ground will be lower than that modelled, so temperature impacts at ground level will be lesser than that modelled.

The arrays have been modelled with incoming wind aligned with the long axis of the array. This orientation is expected to represent a worst-case scenario, where air must travel over the panels for the greatest distance before reaching the array boundary. A simulation was carried out on the 200kW array with wind travelling along the short axis to confirm this assumption. To reduce required simulation time, a symmetry condition was used along the centre-line of the array.

2.3 Model Creation

Modelling has been carried out in the open-source CFD software OpenFOAM.

A 3D model of the ground, PV array, the surrounding area and airspace above was developed.

2.3.1 Mesh

CFD divides (meshes) the volume surrounding all modelled geometry into discrete 3D elements (cells), over which the governing equations of fluid motion are solved. Smaller cell sizing is required in regions of expected flow field variation and where there are areas of complex geometry. To keep calculation time to a manageable level cell count must be judiciously managed. Therefore, geometry was simplified, and fine details removed where appropriate. In this instance, the structure supporting the PV array was removed, as it is expected to have a negligible impact on the flow of wind across the array. The computational domain dimensions were chosen as a compromise between establishment of adequate free-field atmospheric boundary layer flow and a manageable cell count.

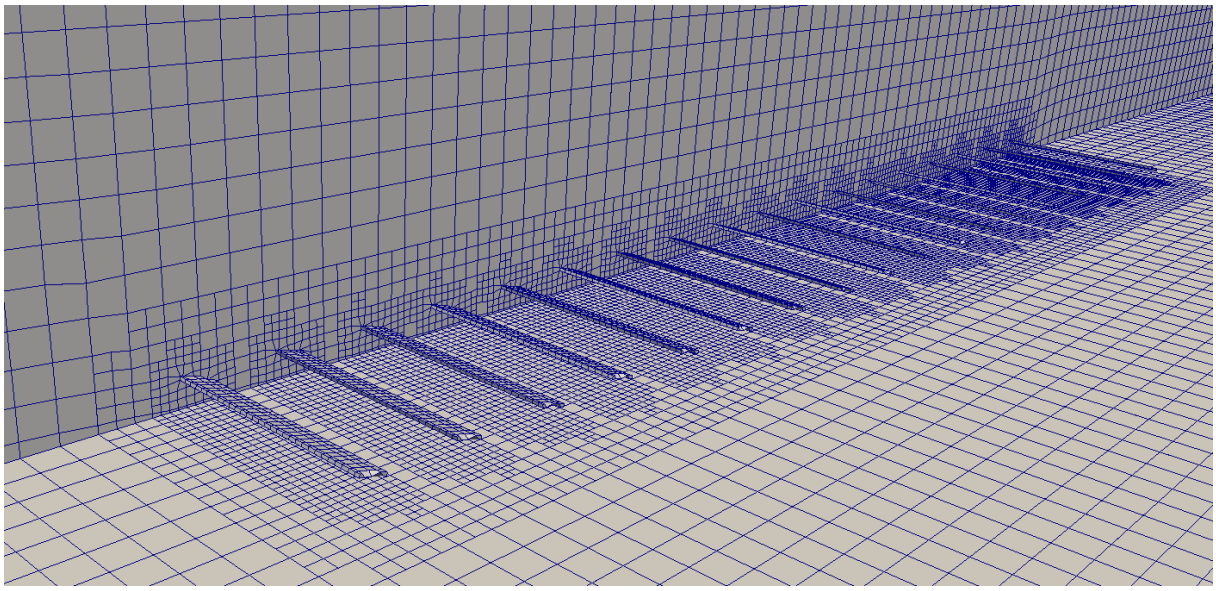

Figure 1 - Mesh refinement in the near field of the 200kW configuration

2.3.2 Boundary Conditions and Wind Modelling

A suitable model of the atmospheric boundary layer is incorporated in the Australian Wind Actions Standard, AS 1170.2 (Standards Australia, 1989 and 2011). This model uses a logarithmic law to describe the mean wind speed profile as a function of the aerodynamic roughness length which, in turn, is related to the surrounding terrain category (TC). Terrain categories and associated roughness lengths are defined in Table 3.

Simulation of the Atmospheric Boundary Layer (ABL) requires the basic characteristics of the natural wind to be modelled. Aurecon have implemented the Deaves and Harris (1978) ABL model in OpenFOAM, closely

following all recommendations of Richards and Hoxey (1993) including upper boundary shear stress. The upper boundary turbulent gradients are also defined following the equations outlined in Sumner and Masson (2012). These equations were implemented for the k-epsilon class of turbulence models, with the realizable k-epsilon model (Shih et. al. 1994) used for the wind simulation. A full description of the computational method used by Aurecon is documented in Jones et. al. (2017). Surroundings have been assumed to be TC3, corresponding to an aerodynamic roughness length of 0.2m. This terrain category represents typical suburban housing or forest areas.

Table 3 - Terrain categories used to simulate approach flows (Standards Australia, 2011)

Terrain Category	Definition	Aerodynamic Roughness Length [m]
1	Very exposed open terrain such as treeless flat plains, rivers, canals and lakes	0.002
2	Open grassland with no more than two well scattered obstructions per hectare of height generally 1.5 to 5m. Includes farmland and clear land with isolated trees.	0.02
3	Numerous closely spaced obstructions with heights generally 3 to 10m, such as suburban housing or forest.	0.2
4	Numerous large, high (10-30m) closely spaced obstructions. Includes large city centres and well-developed industrial complexes.	2

Steady, buoyant Reynolds averaged simulations were conducted for all cases. Velocity and Temperature boundary conditions are shown in Table 4.

Table 4 - Velocity and Temperature Boundary Conditions

Boundary	Velocity	Temperature
Inlet	ABLInletU (Custom Aurecon boundary condition)	Fixed 30ºC
Outlet	Zero Gradient	Zero Gradient
Ground	noSlip (0 velocity)	Fixed 30ºC
Sky	ABLUpperU (Custom Aurecon boundary condition)	Zero Gradient
panels	noSlip (0 velocity)	Fixed 55ºC
Centre Plane	Symmetry Plane	Symmetry Plane
Side	Zero Gradient	Zero Gradient

3 Results

3.1 Near-Field Behaviour

A simulation was conducted for a single PV panel with highly refined mesh to study the near-field temperature distribution. This simulation was carried out at a reference wind velocity of 0.5 m/s and 2 m/s, for which temperature contours are shown in Figure 2 through Figure 6.

It can be seen that the oncoming wind rapidly transports heat away from the surface of the panel, with air temperatures dropping to approximately 3°C above ambient 10cm away from the panel for the 2 m/s case. Temperatures in the vicinity of the panel are higher for the 0.5m/s wind speed case, and the warmed air in the wake can be seen to rise due to buoyancy effects. It is therefore expected that temperatures will be highest during low wind speeds, but buoyancy effects will likely serve to reduce impacts on neighbouring areas

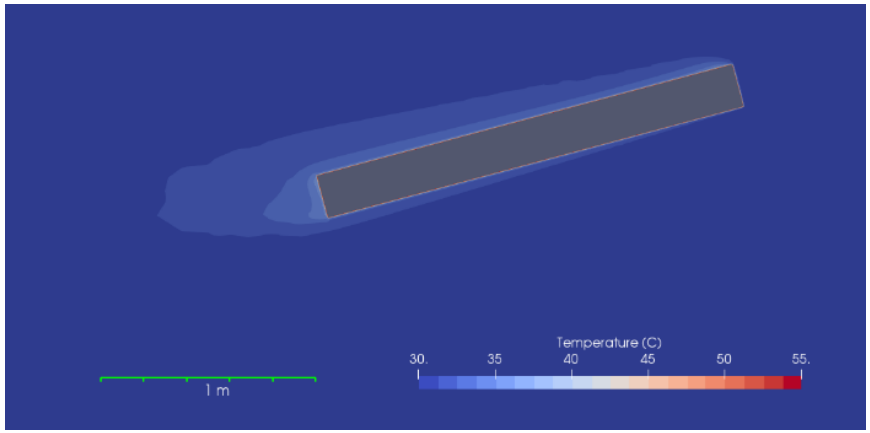

Figure 2 - Single panel detail at 2 m/s

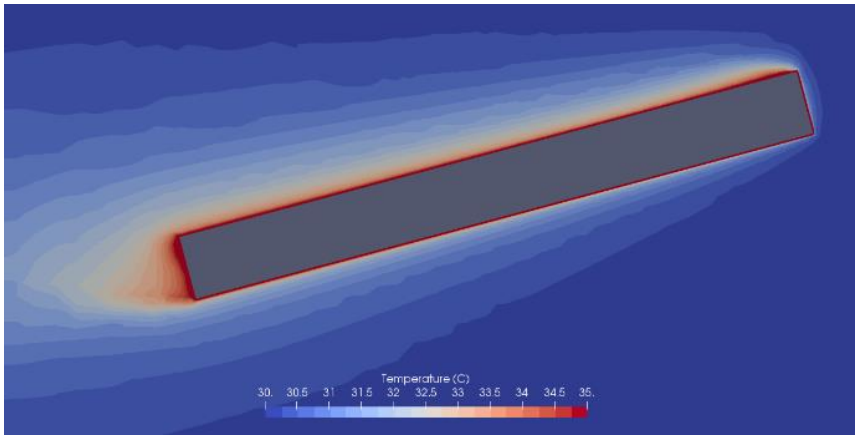

Figure 3 - Single panel detail with a finer scale at 2 m/s

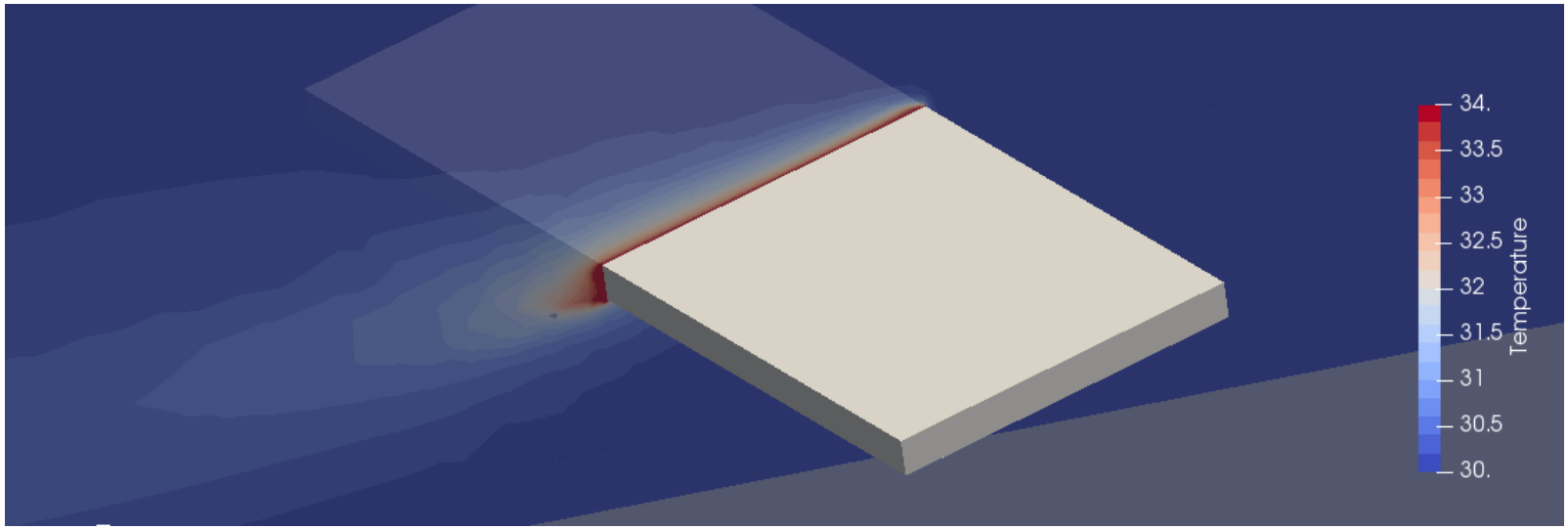

Figure 4 - Three-dimensional view of the array at 2 m/s

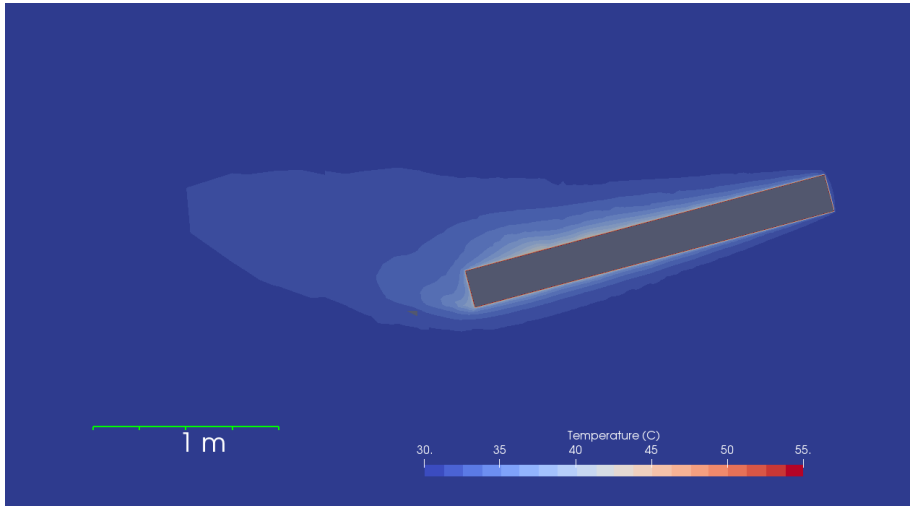

Figure 5 - Single panel detail at 0.5 m/s

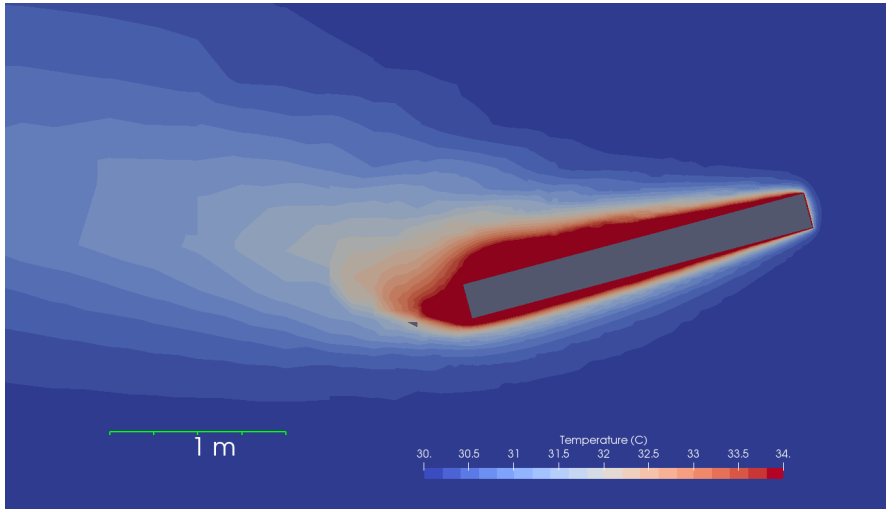

Figure 6 - Single panel detail with a finer scale at 0.5 m/s

3.2 Far-Field Behaviour

Comprehensive results of the simulations are attached as appendices to this document. Contours have been generated showing the temperature profile in plan and side view (sample at 1.5m height for plan view). Also provided are iso-surfaces showing the movement of air generated by the array. The temperature scale has been chosen to show the greatest detail in the flow-field, but it is important to keep in mind that the difference in temperature between the dark-blue and white areas is only approximately 1°C. As stated in section 2.2.

At lower speeds, buoyancy forces dominate the dispersion of warm air resulting in a plume which rapidly rises. As a result, there is minimal impact at ground level. This can be seen clearly in Figure 7.

At wind speeds of 2m/s and above, temperatures extending beyond the array boundaries for all three configurations are in the order of a 1ºC rise, which then decays further from the boundary as the warm air mixes with the cooler ambient air. The distance this temperature rise travels beyond the boundary is dependent on the size of the array: approximately 80m for the 10MW array, 40m for the 2MW array, and 20m for the 200kW array (for 5 m/s).

It should be noted that this simulation does not take into consideration any thermal influence from adjoining areas and that high wind speed is expected to cool the array through convection, and it is likely that the panels would not reach 25ºC above ambient temperature. These effects add further to the conservatism of the modelling.

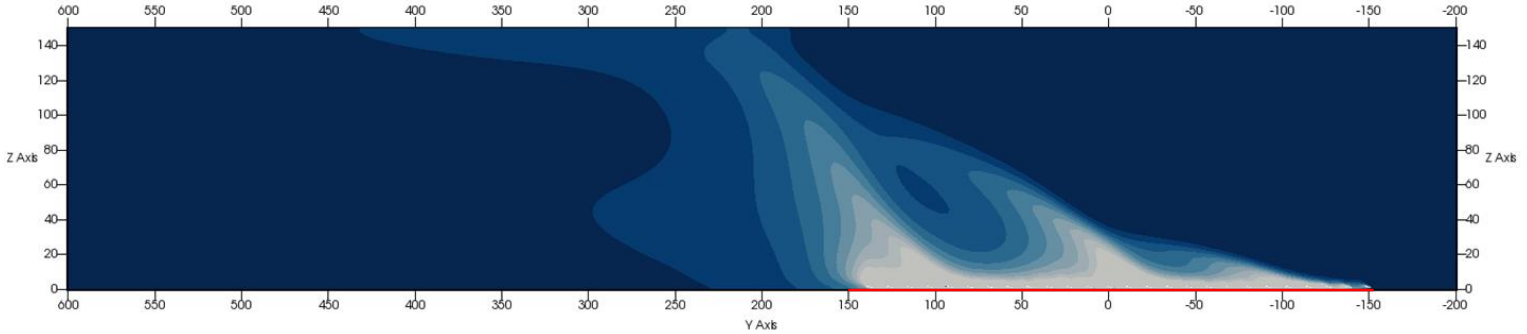

Figure 7 - Typical heat dispersion of a 2MW array at 0.5m/s

Note the PV array is located from -150 to 150m on the Y-axis.

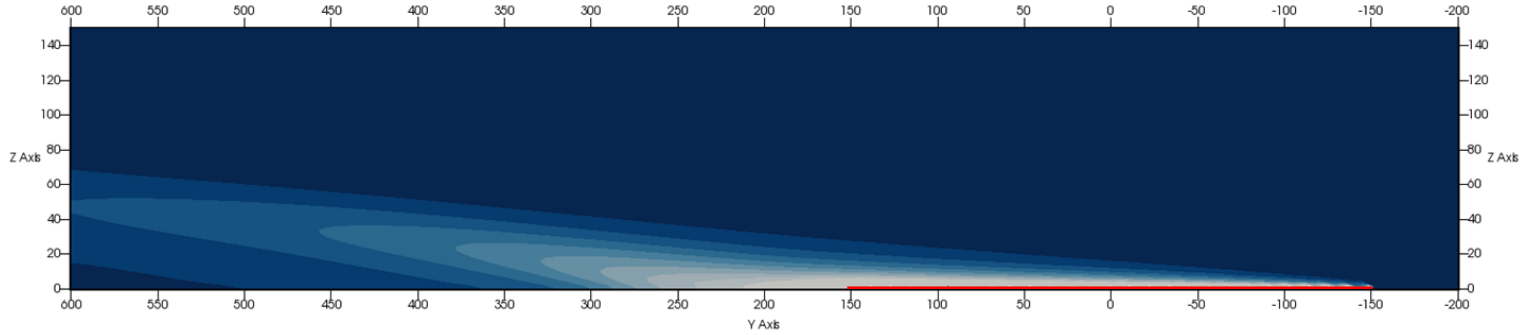

Figure 8 - Typical heat dispersion of a 2MW array at 2m/s

Note the PV array is located from -150 to 150m on the Y-axis.

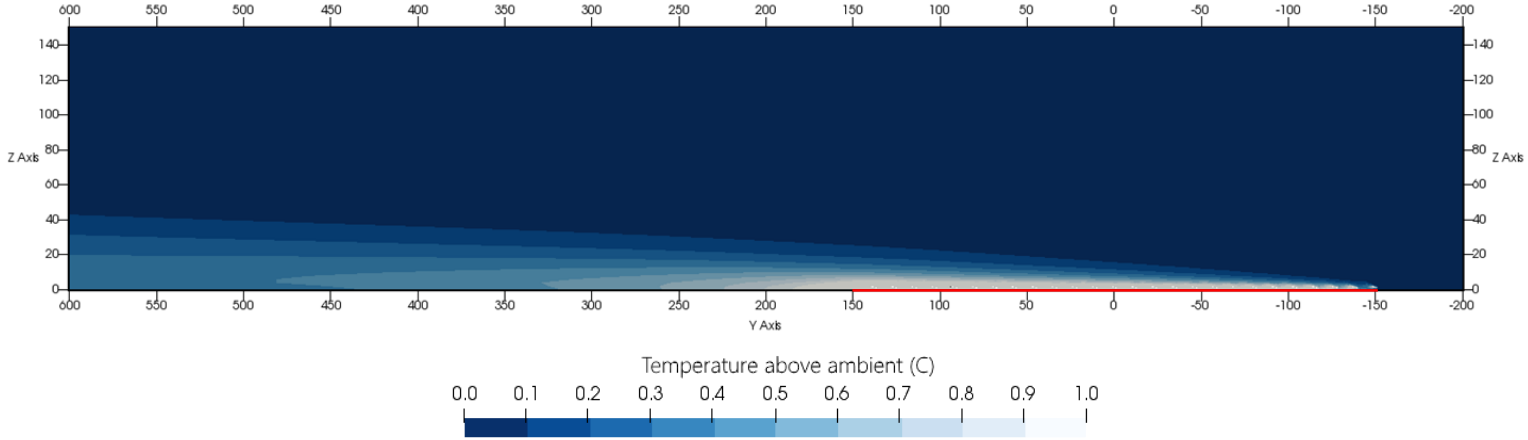

Figure 9 - Typical heat dispersion of a 2MW array at 5m/s

Note the PV array is located from -150 to 150m on the Y-axis.

4 Conclusion

A computational wind assessment was undertaken to determine the thermal impact of a solar array on adjacent areas. A model was developed in the CFD package OpenFOAM, with simplified panel geometry and a series of conservative assumptions. Three array configurations were analysed, each at three different wind speeds.

During periods of low wind speed, air which is warmed by the panels quickly rises due to buoyancy effects. Resultantly, there is minimal thermal impact adjacent to the arrays, even in the case of a 10MW array. Temperatures were found to be highest during 5 m/s winds, as the wind's momentum overrode the buoyancy of the air. However, even during these wind speeds the temperature rise in the wake of the array is only in the order of approximately 1ºC. In the case of the 10MW array, this 1ºC temperature rise extends approximately 35m in the wake of the panels for 5m/s winds.

A notable assumption of this model was that the ground is at the same temperature as the ambient air. This is considered conservative, as in reality the ground is likely to be warmer than the ambient air (potentially by as much as 15ºC). With a warmer ground, the relative temperature difference between the panels and the ground is reduced. Consequently, the thermal impact of the panels is expected to be lower in reality than that what has been modelled.

Overall, the temperature in the wake of the array is conservatively expected to be in the order of 1ºC under the following conditions/assumptions:

- PV panel surface temperature is at 25ºC above ambient temperature
- Wind speeds at 2 m/s or greater (noting that higher wind speeds are expected to cool the panels through convection, reducing the surface temperature)
- Wind travels along the long axis of the array configuration
- The ground is at ambient temperature

Depending on the local meteorology and orientation of the array, the frequency at which these conditions are expected to occur will vary.

Even given a number of conservative assumptions and a set of meteorological conditions which are expected to occur infrequently, temperatures rise to be only 1ºC above ambient. However, the actual temperature rise is likely to be significantly lower.

5 References

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6 Disclaimer

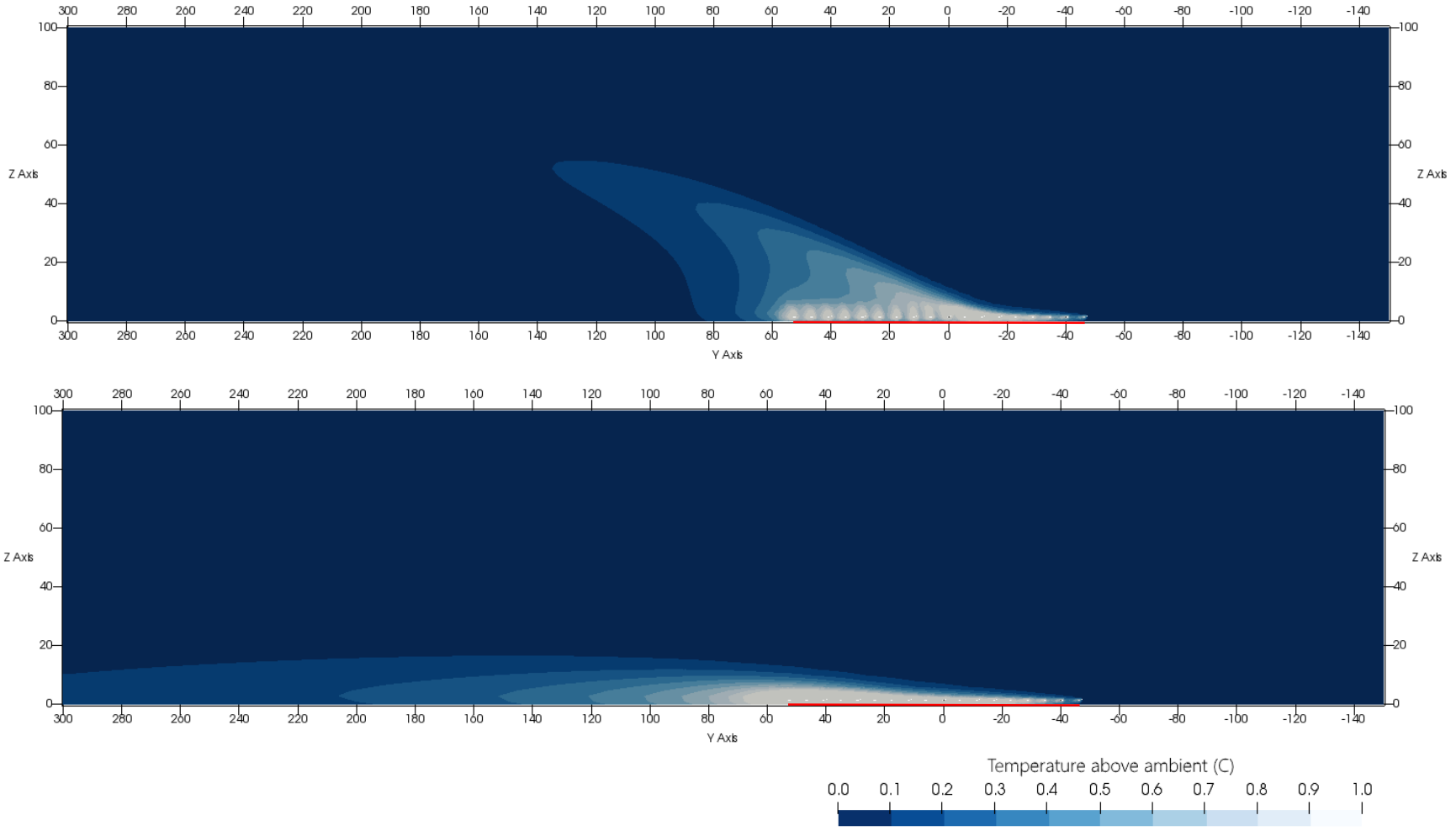
Computer simulation provides a representation or estimation of a physical system based on mathematical models. Implementing these models require necessary simplification and idealisation of the system and will not and cannot fully represent all the potential variables observed in real life. These simplifications may be inherent to the underlying theoretical basis of the model or may relate to computational limitations.

As a result, simulation results only represent an interpretation of the potential performance, providing qualitative information on possible behaviour and interactions.

Appendix A

Complete results of the 200kW model

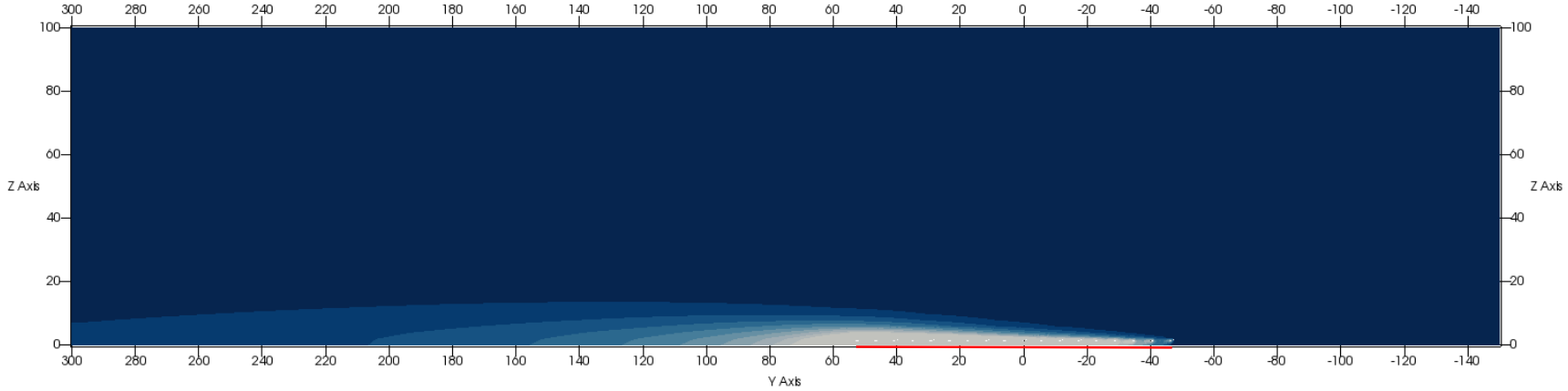
Wind speed



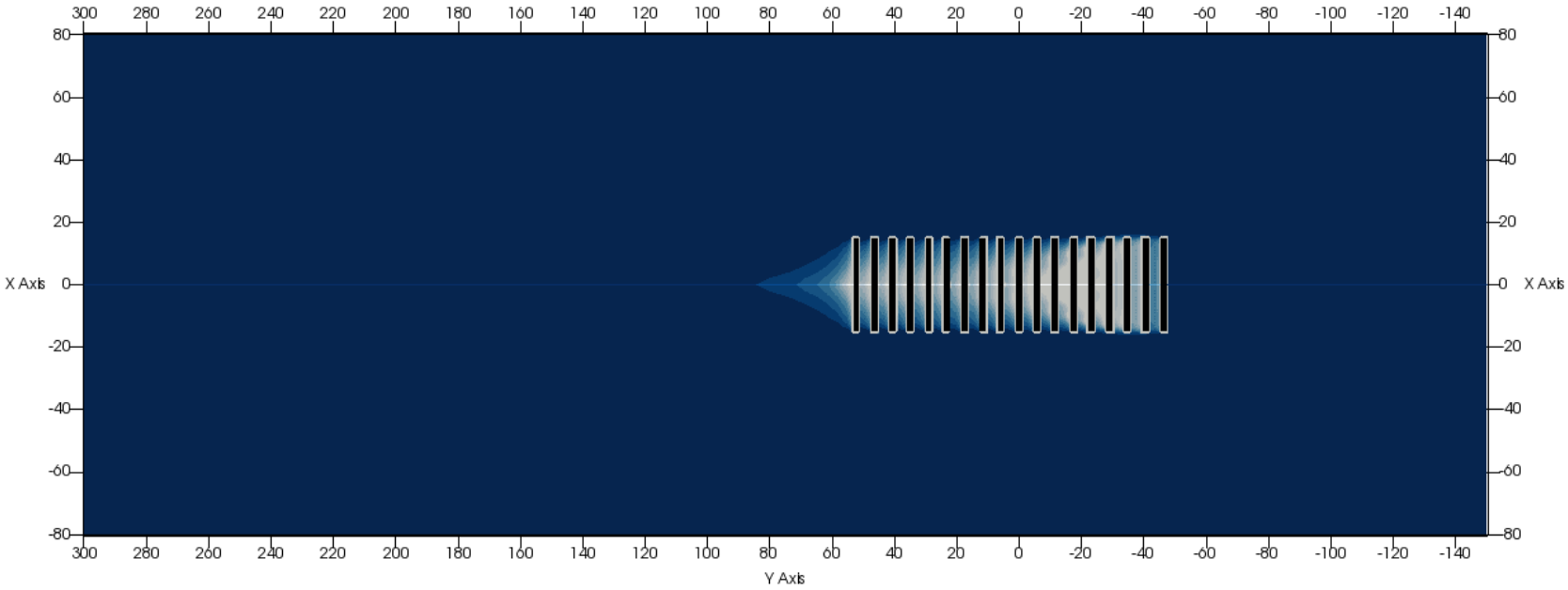
0.5 m/s

2 m/s

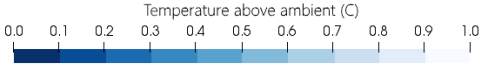
Wind speed



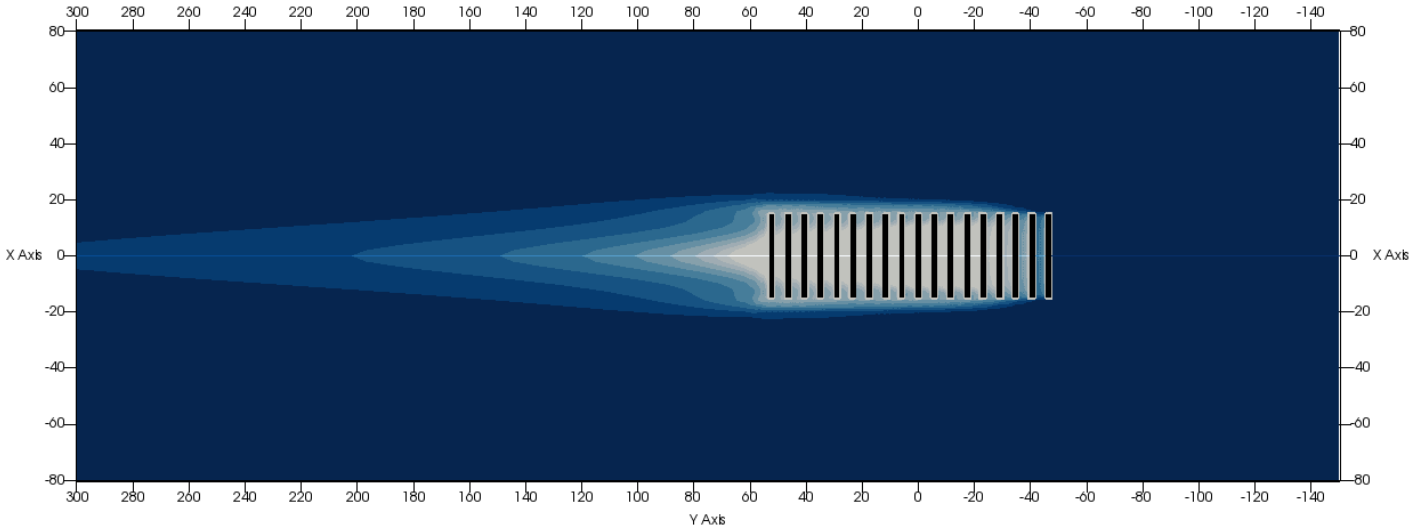
5 m/s



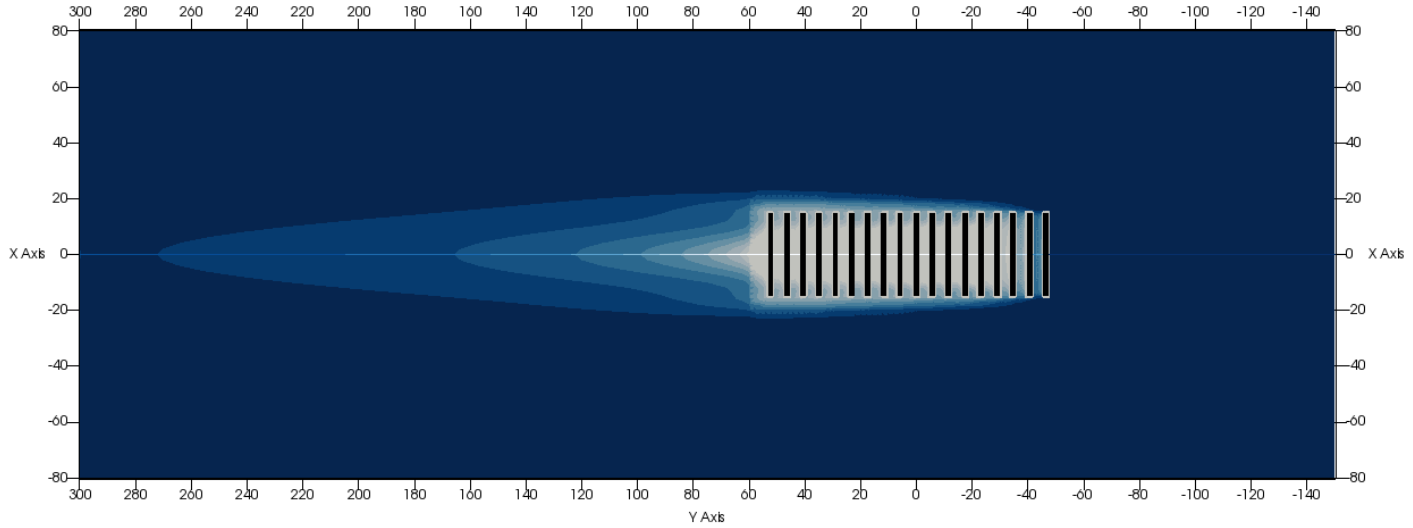
0.5 m/s



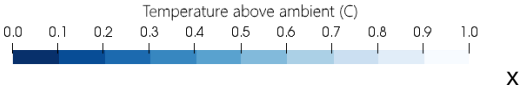
Wind speed



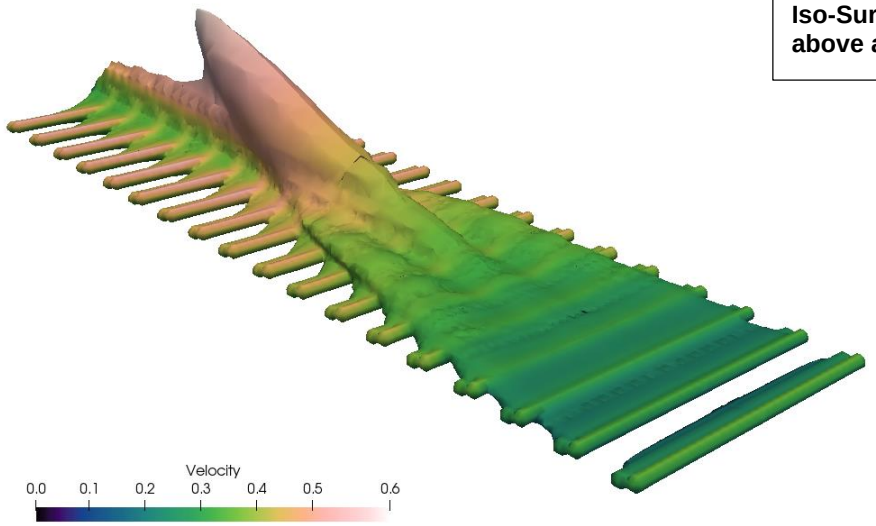
2 m/s



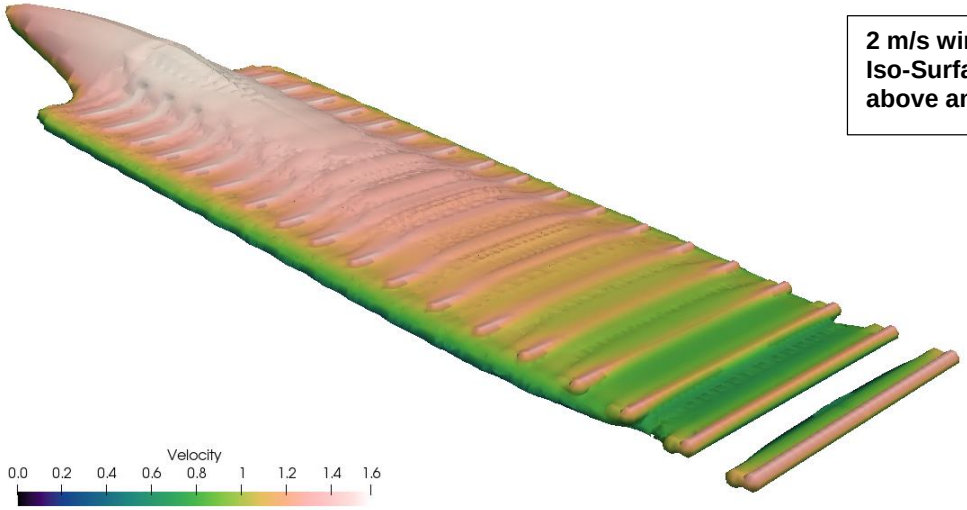
5 m/s



0.5 m/s wind speed Iso-Surface at 0.5C above ambient



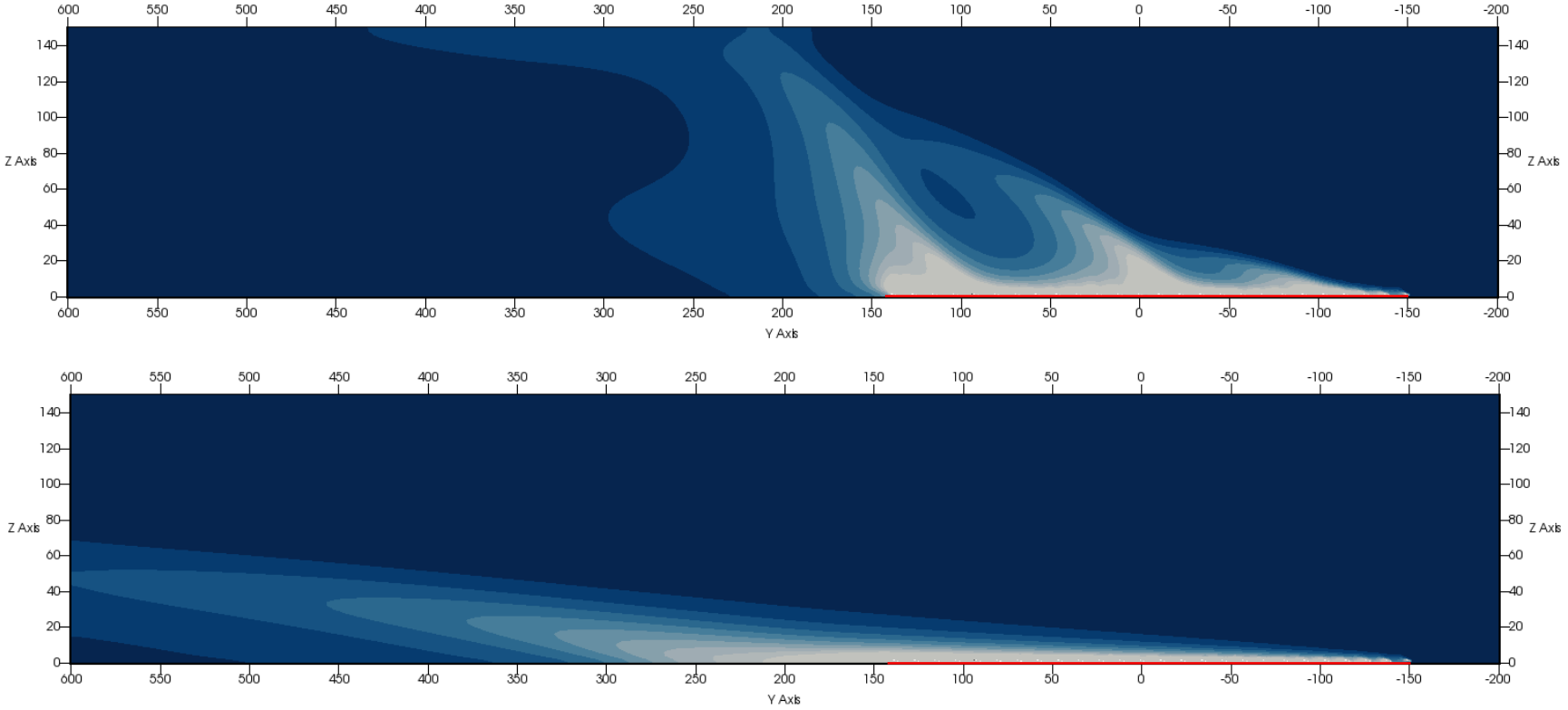
2 m/s wind speed Iso-Surface at 0.5C above ambient



Appendix B

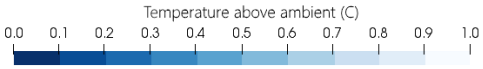
Complete results of the 2MW model

Wind speed

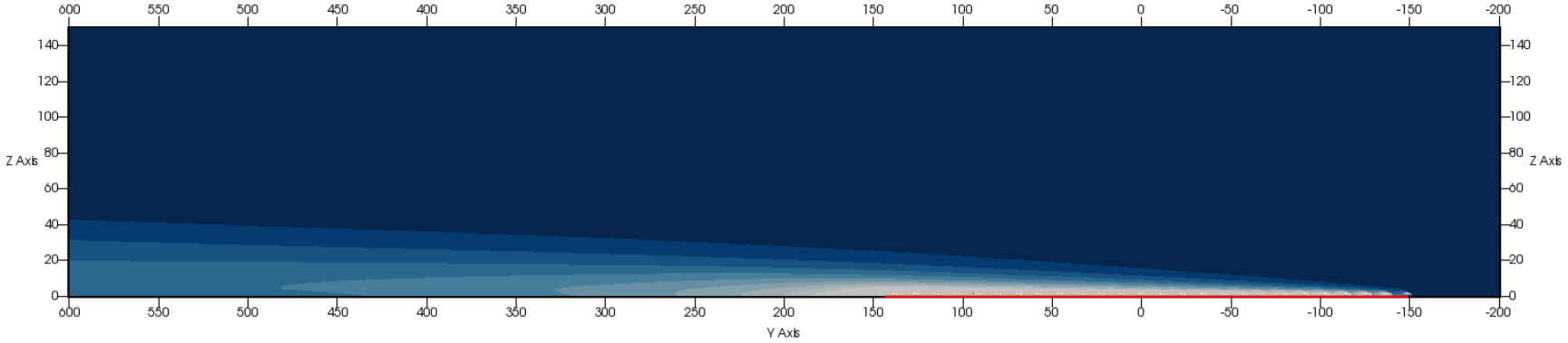


0.5 m/s

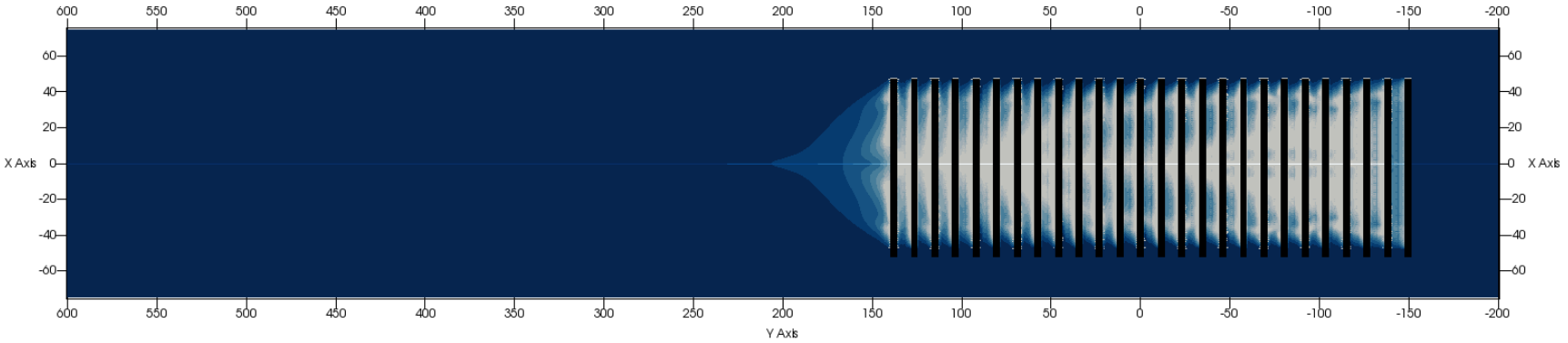
2 m/s



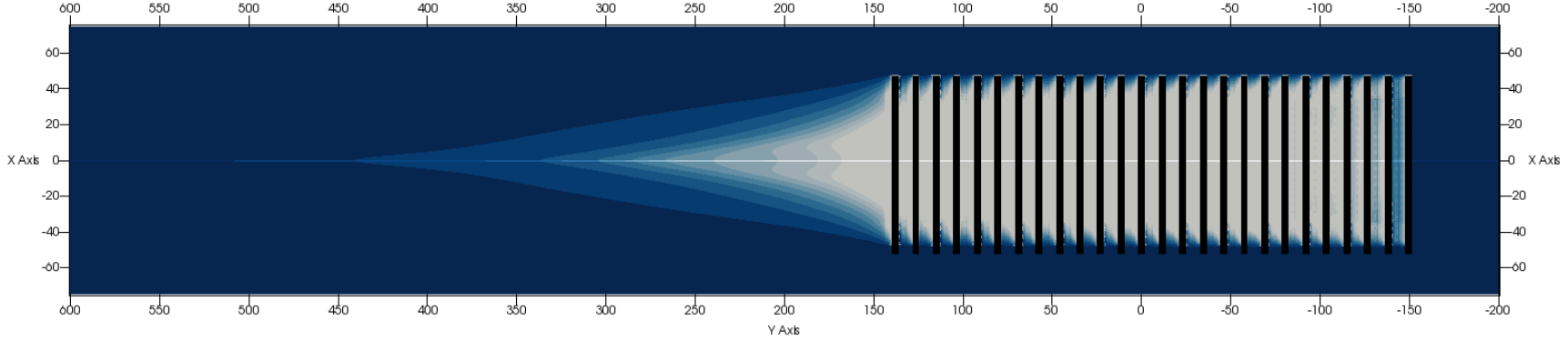
Wind speed



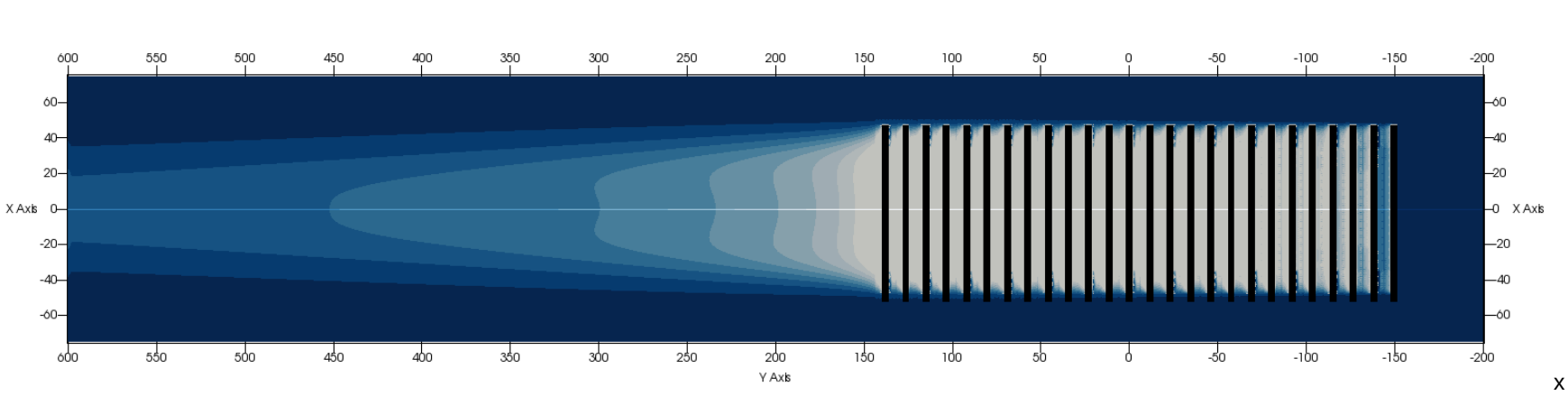
5 m/s



0.5 m/s



2 m/s


Wind speed
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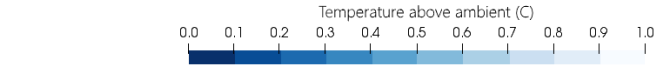
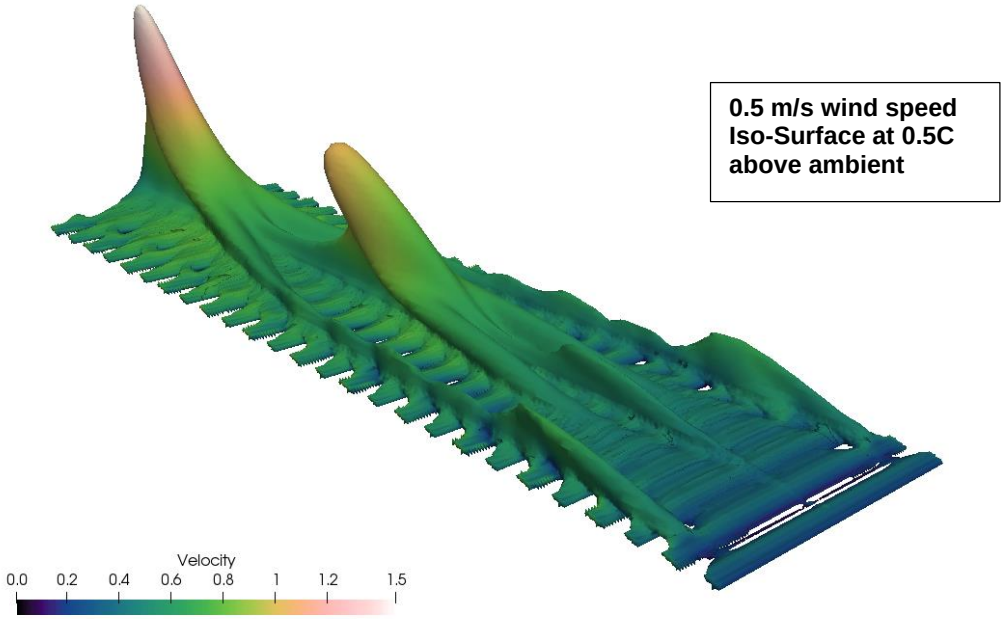
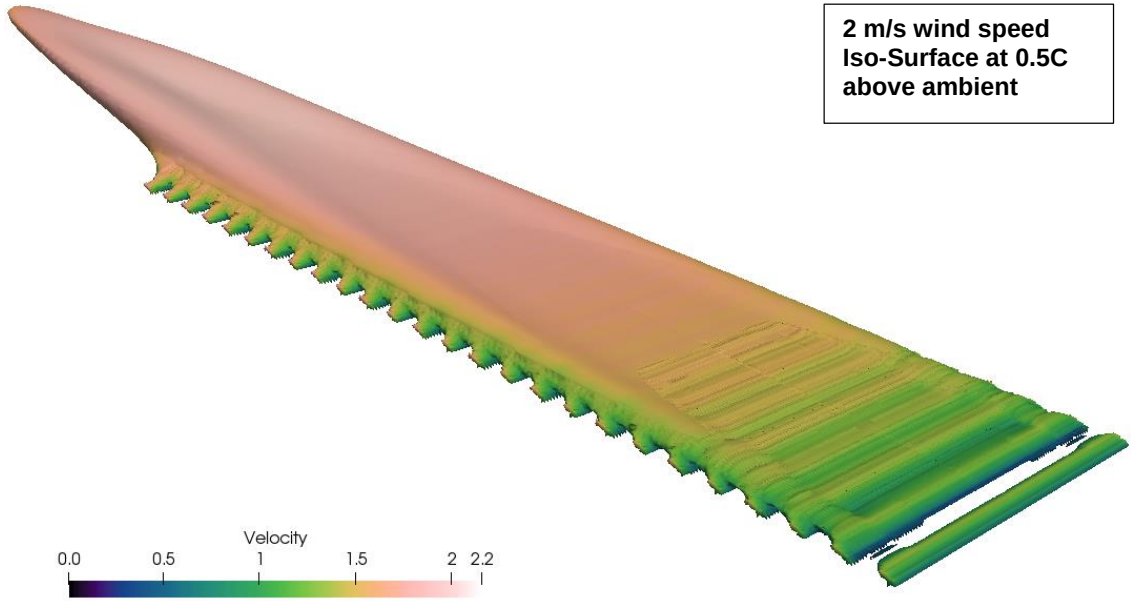
60 40 20 0 -20 -40 -60
X Axis
Y Axis
5 m/s
X

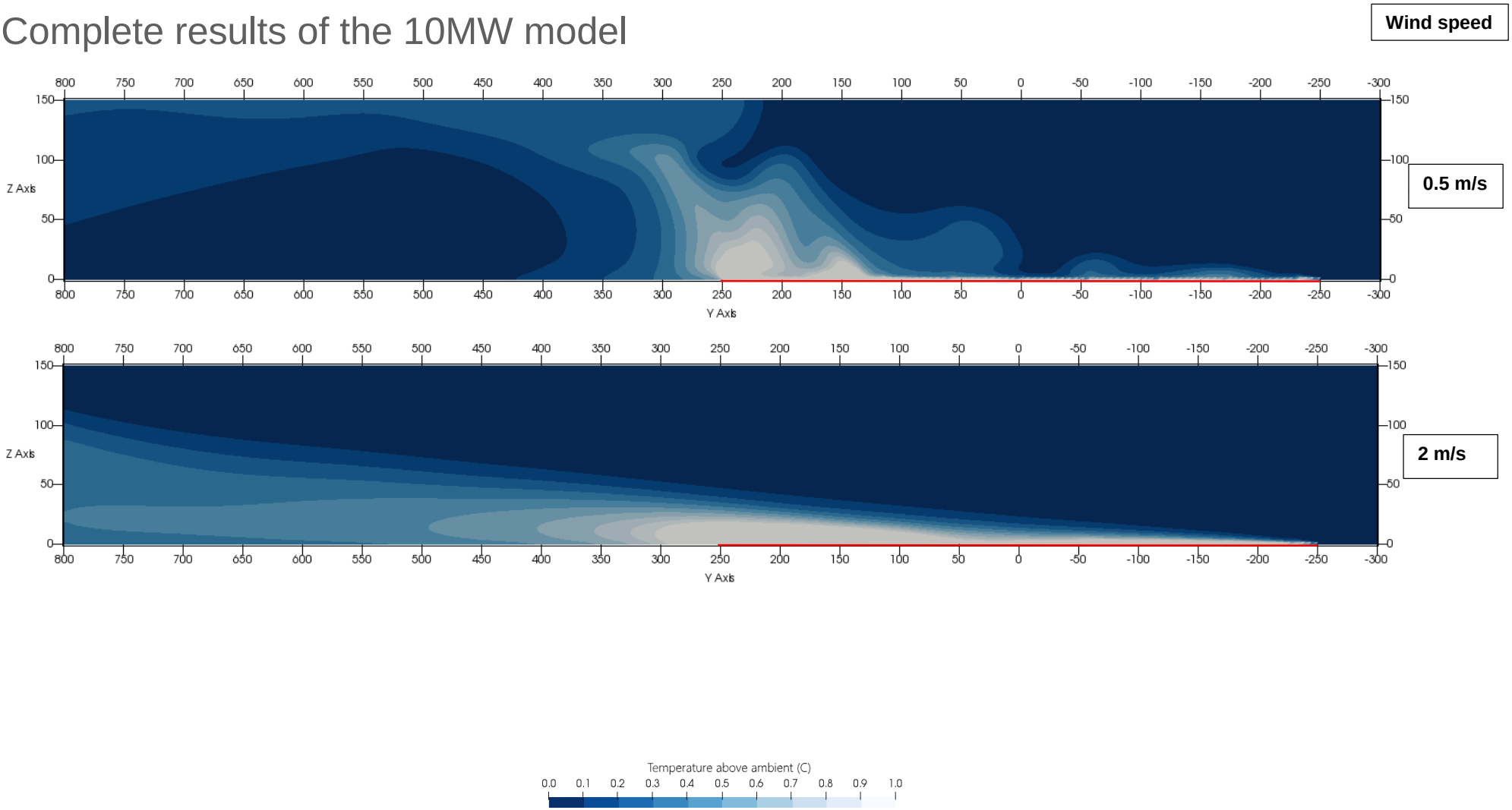

Temperature above ambient (C)
0.0 0.1 0.2 0.3 0.4 0.5 0.6 0.7 0.8 0.9 1.0


0.5 m/s wind speed
Iso-Surface at 0.5C
above ambient
Velocity
0.0 0.2 0.4 0.6 0.8 1 1.2 1.5

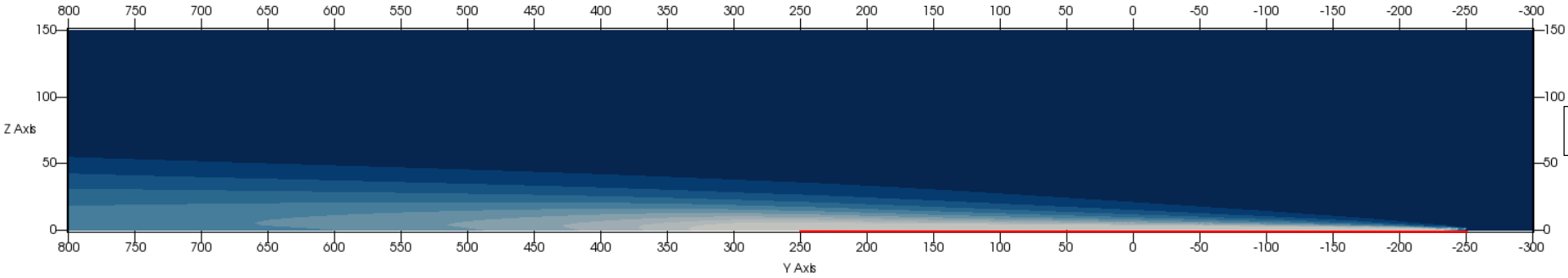

2 m/s wind speed
Iso-Surface at 0.5C
above ambient
Velocity
0.0
0.5
1
1.5
2
2.2

Appendix C

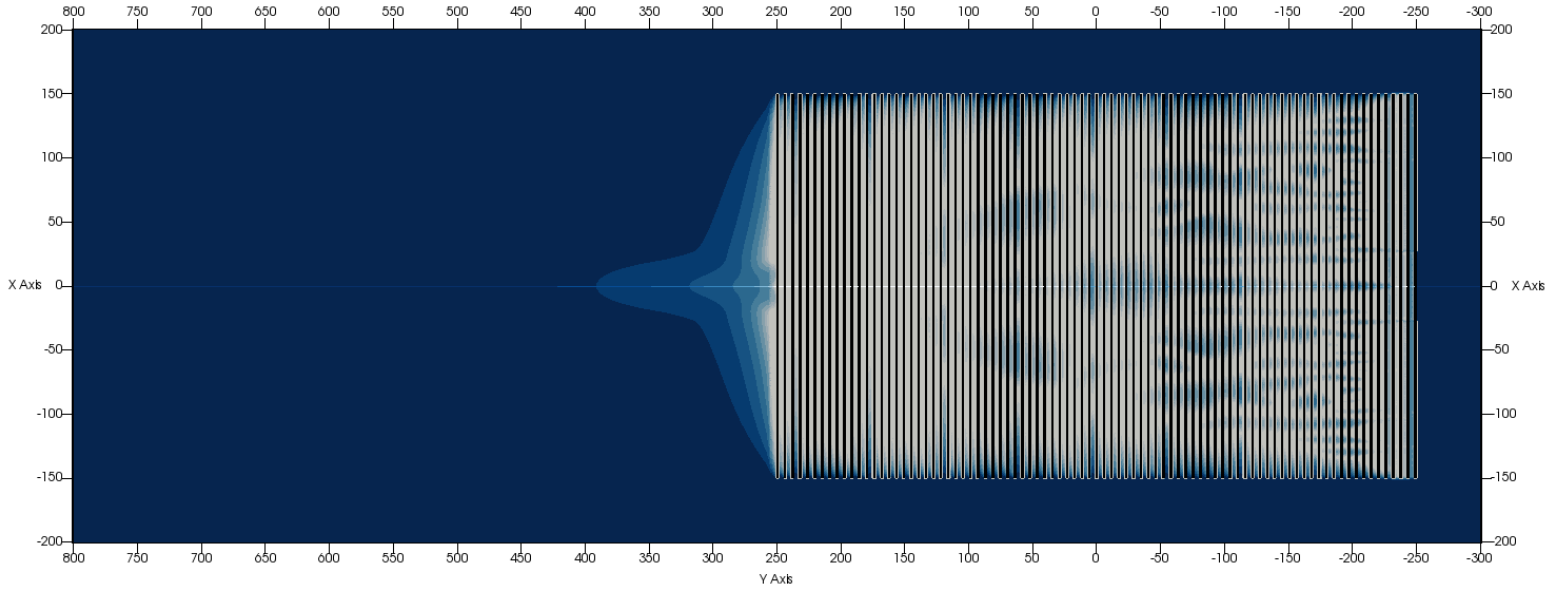
Complete results of the 10MW model



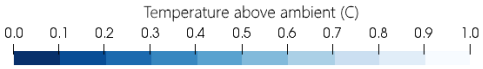
Wind speed

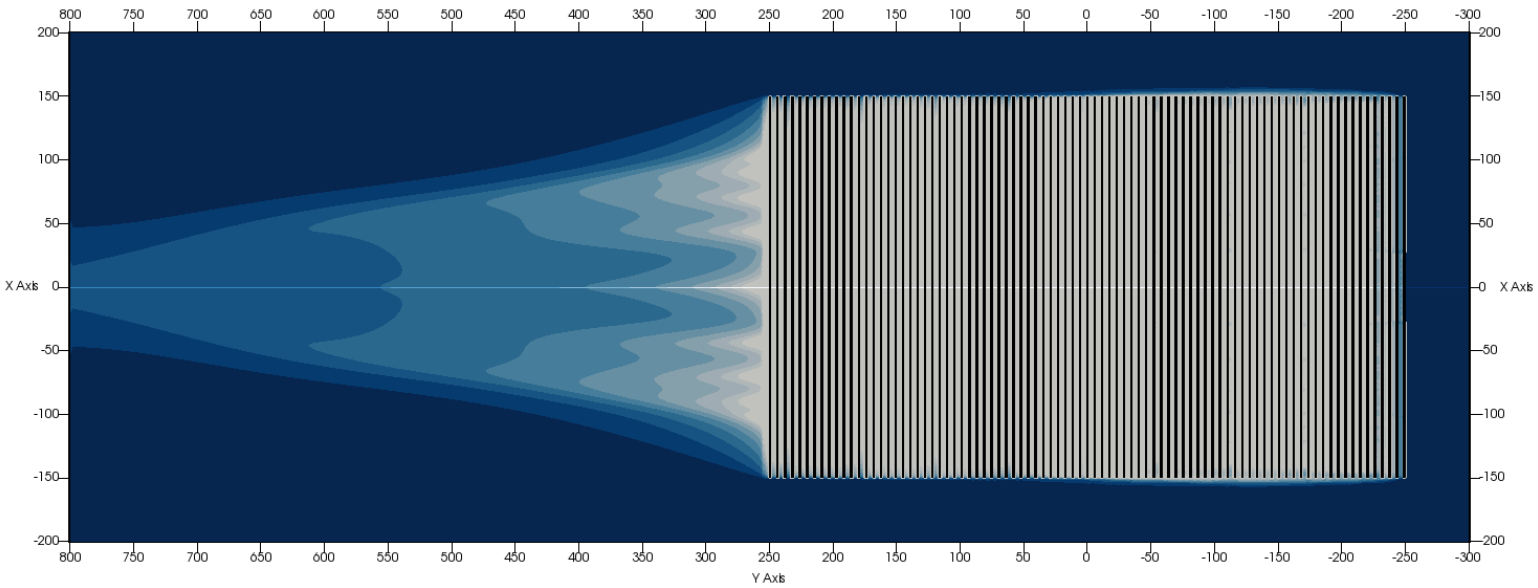


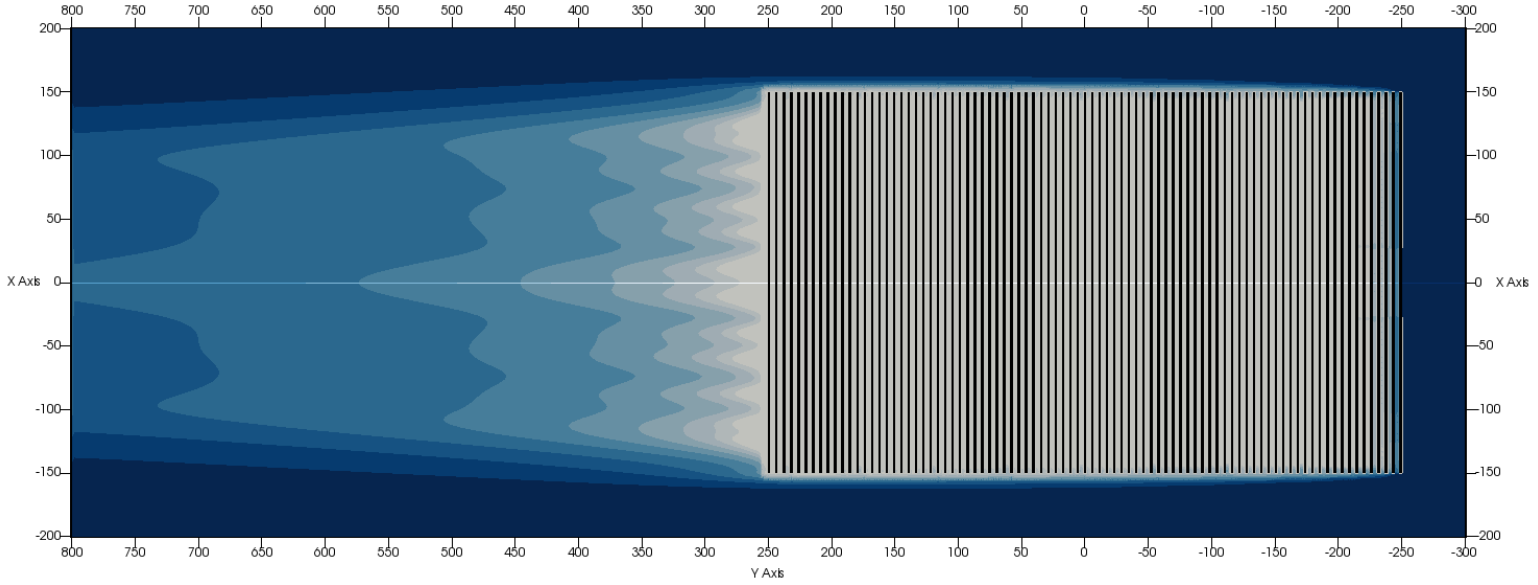
5 m/s

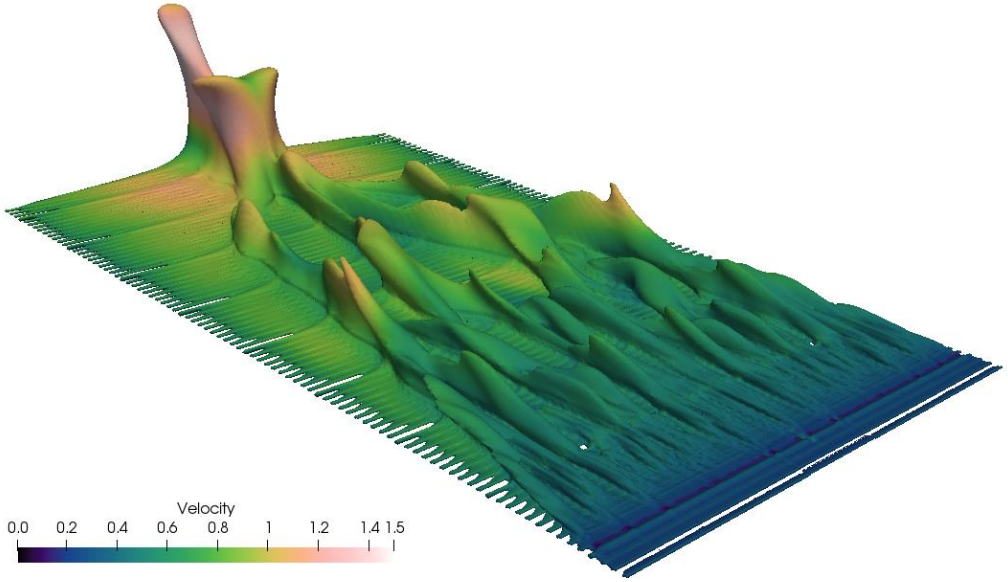


0.5 m/s

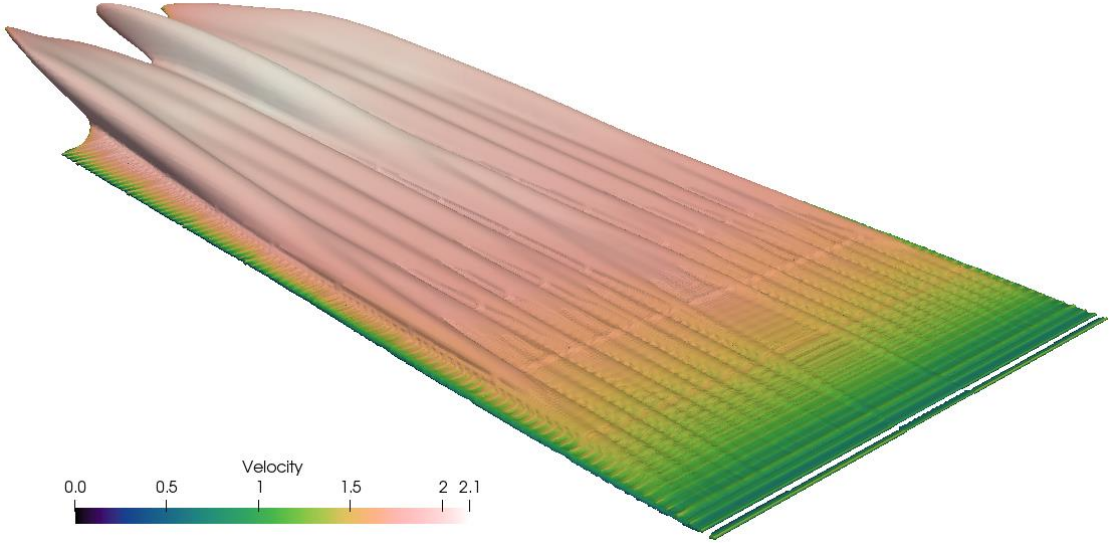



Wind speed
2 m/s
X Axis
Y Axis


5 m/s
X Axis
Y Axis



0.5 m/s wind speed Iso-Surface at 0.5C above ambient



2 m/s wind speed Iso-Surface at 0.5C above ambient

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United Arab Emirates, Vietnam, Zambia,

Appendix B Site temperature measurements Report

Solar panel influence on external air temperature

1 Purpose

This document was produced to convey the information captured during a short investigation into the impacts of solar panel installations on the external air temperature surrounding the panels. The reason for the investigation was to address a concern from the Department for Planning, Transport and Infrastructure (DPTI) raised during the Development Application process for the 70+ sites for solar panel installations across the state on SA Water land. DPTI raised concerns that the solar panel arrays may influence the air temperature of neighbouring properties and were proposing a 25 metre setback from the SA Water property boundary for the panel installations.

2 Location

The Hope Valley solar panel installation has several arrays which are located on the eastern side of the water treatment plant. The northern array was used due to the ability to access and install two transects of air temperature sensors with minimal influence from existing structures and ground cover, and the presence of open ground without undue shading from a tree canopy.

Figure 1. *Map of the Hope Valley solar panel installations. The temperature sensor transects (Red line for the western transect and blue line for the eastern transect) and the Control sensor (yellow star) are located on the map.*

The aerial image in Figure 1 shows the location of the two air temperature sensor transects, named the Western and Eastern transects. The northern array has also been used to trial the ability to cool the panels down using misting systems, which were installed over 20 metres from the western transect and 80 metres from the eastern transect.

2.1 Methodology

The West and East transects contain 5 and 4 air temperature sensor units respectively. The sensor units are WILD-E-2T3 series distributed by Outpost Central. The unit includes two air temperature sensors, a data logger and communication unit to enable data to be uploaded to the Cloud and viewed via the Outpost Central portal.

On the western transect the units are located at 3, 8, 13, 18 and 23 metres from the panels. On the eastern transect they are located 2, 7, 12 and 20 metres from the panels. The units have been used by SA Water in several locations to determine management methods to counter the impacts of urban heat.

Figure 2. *Showing the western transect (left) and the eastern transect (right)*

Each unit was placed on a 70cm wooden stake, with the actual sensor being located at a height of around 60cm above ground level. A small piece of cardboard was placed on the northern side of the unit to reduce direct sunlight on the sensor, with the sensor being positioned in a southern direction.

An additional "Control" unit was placed on the opposite side of the water treatment plant, adjacent to the works depot and car park. It is acknowledged that the carpark would influence the Control unit, however there is a lack of open space not impacted by either tree cover or buildings, bitumen etc at the site. This unit was used as a control as it was located in an area that was not impacted by the solar panels and was arguably in an area that was typical in an urban setting, with numerous buildings and the carparks potentially influence temperature at the Control site.

Figure 3. *The Control unit is in the foreground of the image*

There were several units located within the solar panel array, attached to the underside of the panels to determine the air temperature within the array. These were positioned at 60cm above ground level, as per the units on the external transects.

The units where installed on the 4th April 2019 following concerns raised by DPTI regarding heat island effects from solar panels. The sensor units were activated once installed on the wooden post and data was collected from this time. Fortunately, the temperature on the day of installation and the following day was around 30 degrees, which correlates well to an average summer day. As the sensors were installed in autumn it will not be possible to gain insight into the heat generation from the panels on a hot or extreme day until later in the year.

3 Results and discussion

The following graphs were extracted from the Outpost Central database. There are a series of comparisons displayed below, each designed to show the relative influence of heat from the solar panels at various distances from the panels. It should be noted that the images may be difficult to read on a portrait orientation. All images, with their figure number reference are also located in the Appendix in landscape format.

3.1 Western transect

As shown in Figure 2 (left side image) the Western transect was not influenced by shading from trees, or heat being generated from buildings or hard surfaces, with the exception of the bare earth that was present for the first 15 metres of the transect which had a slight influence on the sensors at the 3 metre and 8 metre locations along the transect. Data from these units is not displayed. Likewise, the data from the Control location was influenced by the bitumen surface and as such was always considerably higher than the air temperature from within and adjacent to the array and is not shown in the graphs below.

The first graph shows the three main units of interest, being those located within the solar panel array, and at the 13 metre and 23 metre locations for the warmest period, being between April 12 and April 22.

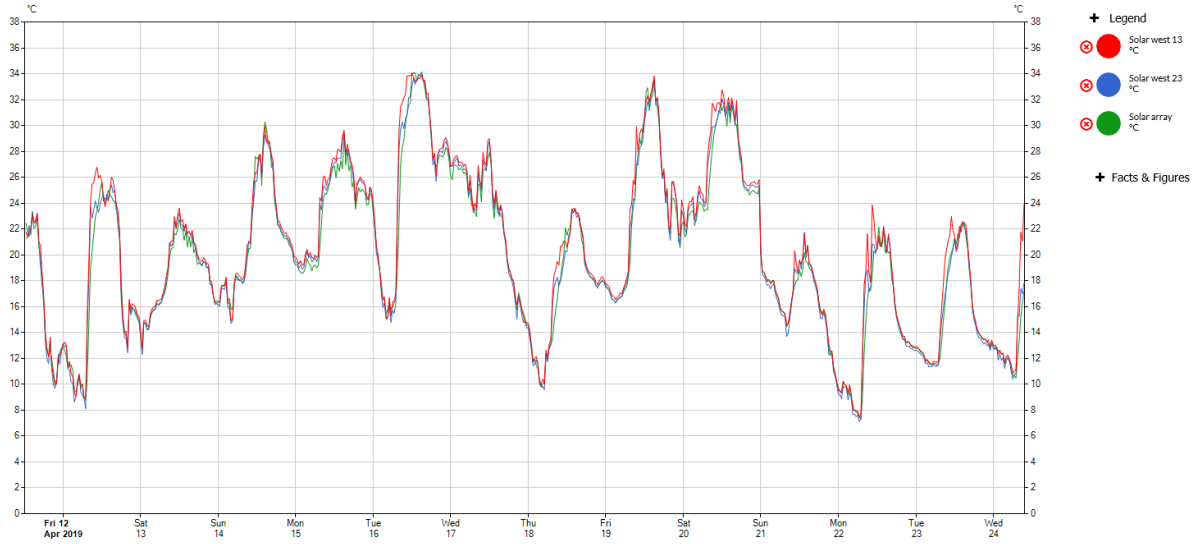

Figure 4. *Showing data from the sensors of interest on the western transect*

From Figure 4 it is clear that there is minimal difference in air temperature between that within the solar panel array, and at the 13 metre and 23 metre distances from the array.

The reason for the air not being hot within the array area is assumed to be due to the shading that the panels provide. The solar radiation from the sun is either reflected back from the panels or absorbed by the panels to produce electricity. The solar panels are dark on their surface however they are less than 5mm thick, therefore the amount of heat that can be stored in them is minimal. The amount of heat generated from them is also limited and tends to not move far from the source.

This is demonstrated in the following graph. The data in Figure 5 is from a single warm day, being the 20th of April. The graph shows the temperature at 3 different times of the day, being 12pm, 4.30pm and 10pm. The data also contains temperature from inside the solar array (which is indicated by the first data point called "Panels"). The reason for the selection of these times is that the 12pm data will show what has happened during the morning and represents the high point of the morning. The 4.30pm temperature was the peak temperature for the day, and the 10pm temperature shows the radiation of heat accumulated during the day in the soil.

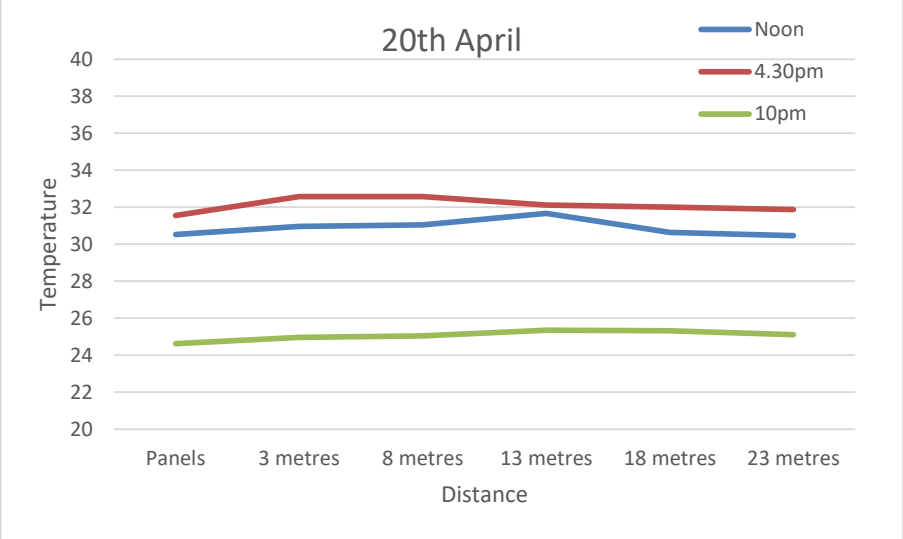

Figure 5. *Showing the temperature over the distance from the panels on a warm day*

The data in Figure 6 suggests that the change in temperature between the solar panel and each of the sensors along the transect is minimal, particularly during the hottest part of the day. The most interesting aspect of this graph is that it shows the temperature within the solar panel array is lower than that of the sensors outside of the array for the two daytime periods of 12 noon and 4.30pm.

3.2 Eastern transect

The results from the eastern transect are not as clear as those from the western transect. This is due to the position of the transect, which is intercepted by a small bitumen road and is also influenced by a stand of trees, with the 20 metre sensor being in shade up to 2pm on each day. The results for the 7 metre, 20 metre and solar array (sensor within the solar panel array) is displayed in Figure 6.

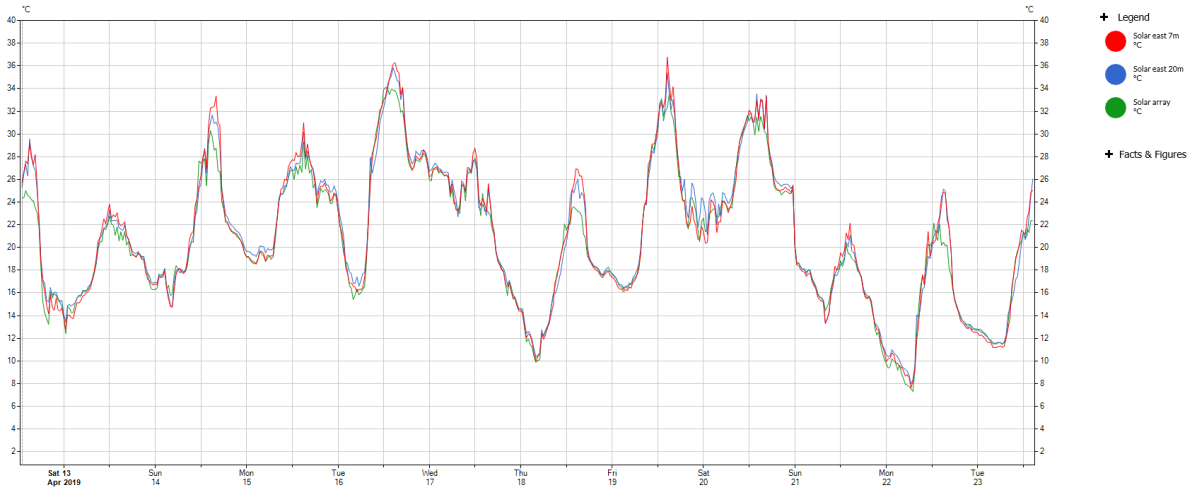

Figure 6. *Showing the sensor data for the eastern transect.*

From this data it is again evident that there is minimal difference in air temperature from within the solar array and at the 7 metre and 20 metre locations.

There may be a suggestion that the reason for the air temperatures being similar within and at the most distant sensors on the two transects is due to the panels having an influence

which extends further than the 23 metre and 20 metre sensors from the western and eastern transects, respectively.

This has been addressed through the comparison shown in Figure 7, which contains the air temperature data from within the solar panel arrays, and that from a distant sensor (same units that were used at Hope valley) located in an unirrigated park in Fulham Gardens in the western suburbs. Whilst this comparison is not perfect, due to the distance between Hope Valley and Fulham Gardens, the maximum air temperatures across Adelaide were very similar over this time period. The difference in maximum air temperature was around 1 degree or less between the Bureau of meteorology weather stations within the Adelaide CBD (representing a built up urban area) and at the Adelaide airport (representing a coastal urban open space).

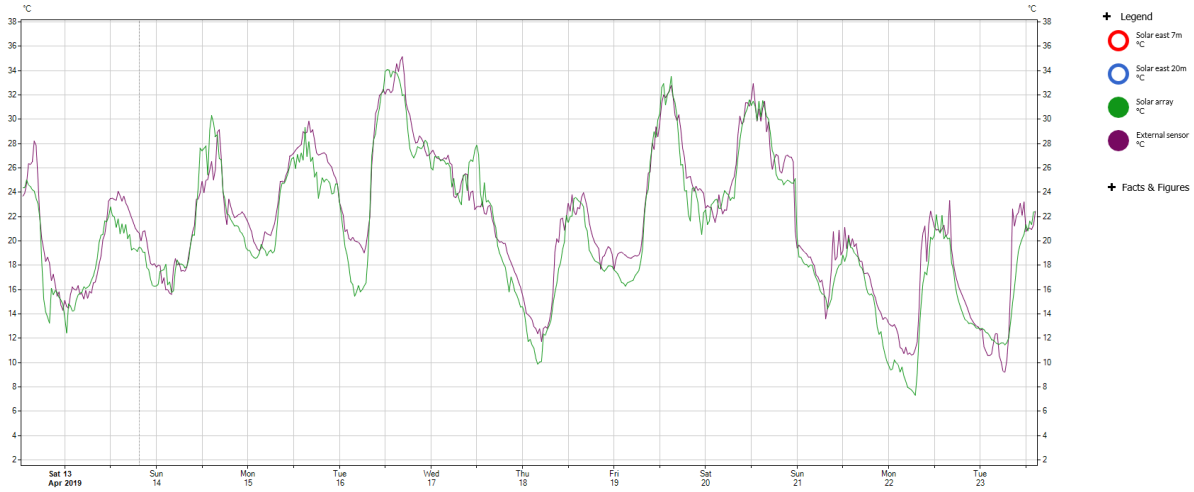

Figure 7. *showing the air temperature within the solar array compared to that in a park at Fulham gardens.*

The daytime temperatures are very similar between the solar array and the park at Fulham Gardens. This should provide confidence in the previous statement that the solar panels are not causing an increase in air temperature that is being seen at the 23 metre sensor and beyond.

4 Conclusion

It is acknowledged that the investigation period was relatively short. However, it is assumed that the patterns identified over this period would be similar for hotter days due to the consistency of the data, and also the physical properties of the solar panels when compared to other land surfaces. However, from the information presented above it is clear that there is very little difference between the air temperature within the solar panels and that of the sensors along the transects. This would be due to the shading function of the panels and the reflection of the solar radiation away from the ground.

This demonstrates that there would be minimal impact on a neighbouring property from a fixed tilt array of this size and configuration if the panels were adjacent to the boundary. Further, it suggests that there may be a cooling benefit that could come from arrays located in areas that have minimal or no vegetated ground cover over summer, due to the ability for the panels to reflect the solar radiation away from the bare earth and hence a reduction in the bare earth becoming a heat source due to solar radiation absorption.

Version History

Version	Date	Author / Reviewer	Comments
1	12/4/2019	Greg Ingleton	First draft
2	2/5/2019	Greg Ingleton and Jackie Griggs	Second draft
3	8/5/2019	Greg Ingleton and Jackie Griggs	Third draft
4	17/05/2019	Greg Ingleton and Jackie Griggs	Final Copy

Appendix A – Larger versions of graphs contained within the report

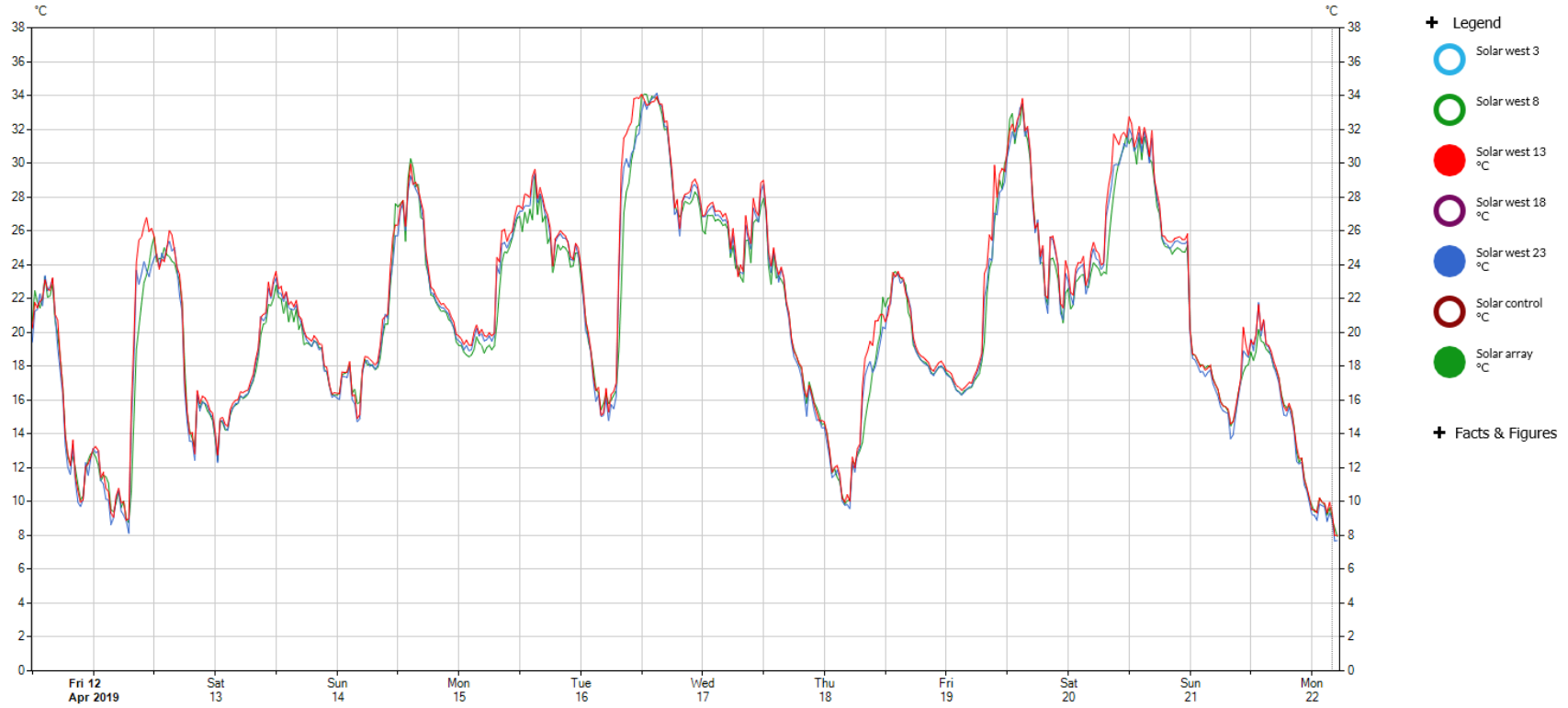

Figure 4. *Showing data from the sensors of interest on the western transect*

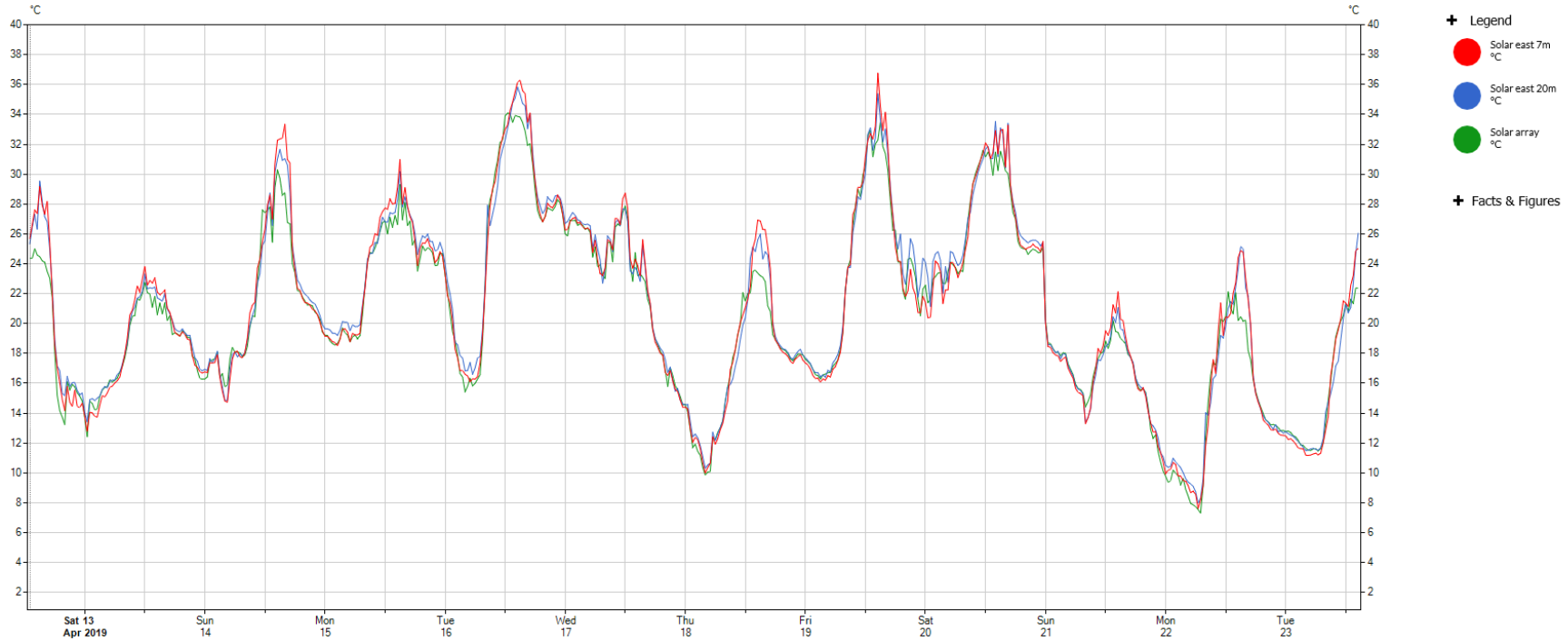

Figure 6. *Showing the sensor data for the eastern transect.*

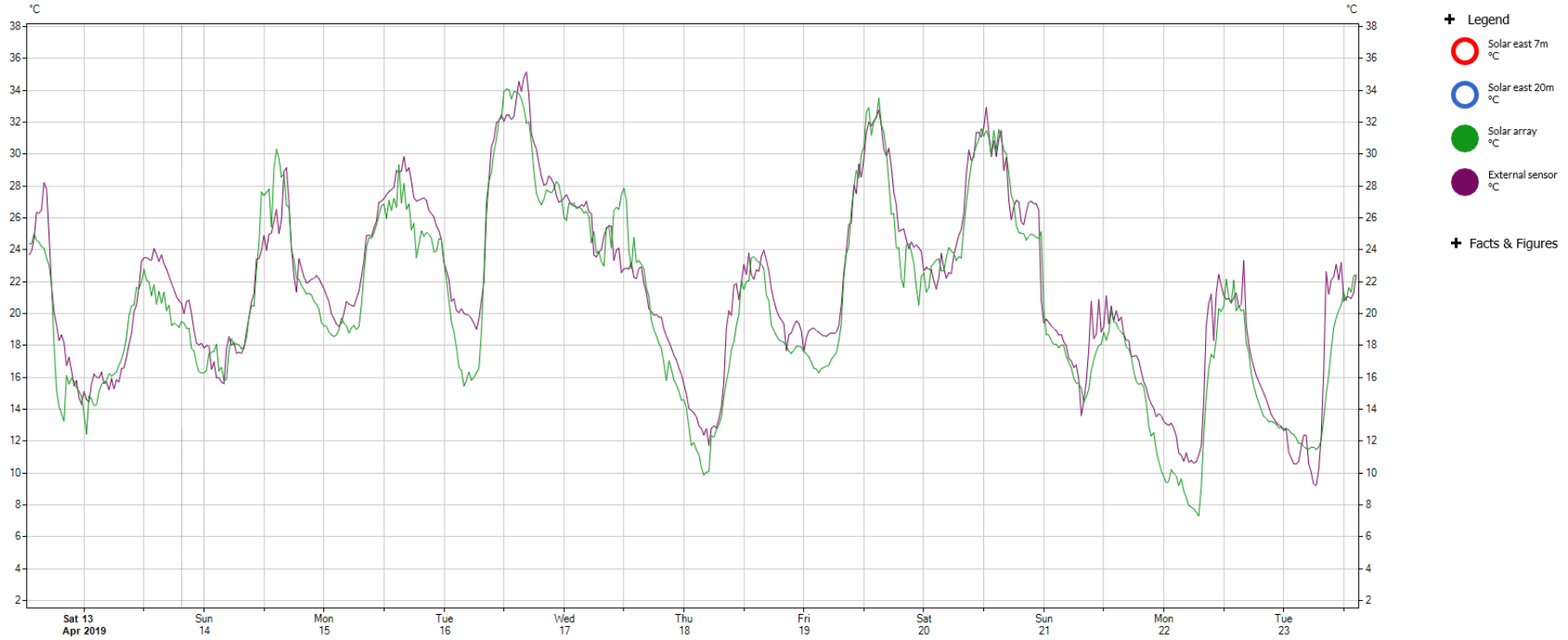

Figure 7. *showing the air temperature within the solar array compared to that in a park at Fulham gardens*

Fyffe, Brianna (DPTI)

From: Lauren Nicholson <Lauren.Nicholson@aurecongroup.com>
Sent: Thursday, 21 November 2019 2:30 PM
To: Fyffe, Brianna (DPTI)
Subject: RE: Happy Valley energy generation (MW)
Attachments: FW: ZCEF Waste & Recycling Initiatives

Hi Brianna,

Apologies, we must have misunderstood that the second part of item 14 does not relate to health concerns (not included with an assessment against the Development Plan). SA Water have previously outlined the below in response to similar concerns raised during the stakeholder engagement work;

"Solar panel recycling is a growth industry worldwide, emerging to meet the demand for end of life recycling of used or damaged panels. South Australia is home to Australia's first solar panel recycling facility, which reclaims useful cells from damaged panels for re-use.
SA Water will dispose of used panels in the most sustainable way practicable, maximising recycling opportunities. Solar modules are largely recyclable – component materials such as glass, aluminium and semi-conductors can all be recovered and reused. SA Water intends to have all components, including panels, mounting structures, cables, batteries and inverters de-assembled and transported off site to appropriate recycling facilities."

In addition, I have attached an email from Jackie Griggs (Heritage and Environment Officer, SA Water) recently sent to Simon Neldner and Janine Philbey which provides some information around the management of waste streams during the installation/ construction phase at ZCEF solar PV sites. This makes reference to Adelaide based solar PV recycling company, ReclaimPV, who will be utilised for the recycling of any damaged panels.

As the operating lifespan of the proposed development at Happy Valley Reservoir (and for all SA Water ZCEF sites) is 25 years it is difficult to know exactly what recycling opportunities will be available, particularly because this is an area experiencing strong Research and Development attention. It is absolutely SA Waters intention however that all components of the proposed development are recycled wherever possible.

Regarding the 'remediation' works required at the site post decommissioning, this also depends upon how SA Water intends to utilise the land once there is no longer a need for the solar PV arrays and associated equipment to remain. The Happy Valley Reservoir ZCEF development proposes to utilise a 5B solar PV system which is prefabricated off-site and then deployed at site by 'folding out' the array strings – there is no requirement for piling works and therefore soil disturbance is minimal. The disturbance to the site at the time of decommissioning would be similarly low impact, where the arrays would be 'folded up' and taken away from site and ground disturbance limited to the removal of underground cables.

Please let me know if anything further is required to help address this point.

Kind Regards,

Lauren Nicholson
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aurecongroup.com

ATTACHMENT 8: DEVELOPMENT PLAN PROVISIONS

ONKAPARINGA COUNCIL DEVELOPMENT PLAN CONSOLIDATED 20 DECEMBER 2018

OPEN SPACE ZONE

OB 1 A zone:
(a) in which the open space character is preserved to provide a visual contrast to the surrounding urban area
(b) comprising open space that accommodates a range of public and private activities in an open and natural setting, including:
    (i) passive and active recreation land uses
    (ii) habitat conservation and restoration.

OB 2 Private land within the Metropolitan Open Space System (MOSS) contributing to regional open space networks and providing an open, natural and rural character accommodating low-scale uses such as non-intensive agriculture, especially where topographically related to flood prone land within the zone.

OB 6 Protection of areas of scientific, geological, archaeological, cultural or heritage significance.

OB 8 Development that contributes to the desired character of the zone.

Desired Character

The zone recognises and manages extensive areas of open space, in both natural and landscaped settings. These spaces make a valuable contribution to the maintenance of ecosystems, which are important to both Council and the wider community. In the natural order, they play a significant role in areas such as biodiversity, water filtration, aquifer recharge and wildlife protection. For humans, these areas provide aesthetic landscapes (often as a visual break between large urban areas), they assist in urban stormwater control and other development processes and provide a link to our natural heritage and are a source of recreation. While the focus is on their natural state, carefully managed departures from this will occasionally be necessary for the benefit of the community.

The zone also includes the site of the Happy Valley Reservoir which is comprised of land in government ownership.

It will provide for the establishment and maintenance of a linear open space and biological corridor based on the existing watercourse channel, associated floodplains and vegetation.

Landscaping should ensure that any remnant native vegetation is incorporated into the landscape design and that locally indigenous vegetation is utilised wherever possible.

PDC 1 The following forms of development are envisaged in the zone:
- conservation work
- farming
- outbuilding associated with open space maintenance
- playground
- recreation area
- sporting club facility
- structure associated with a public facility such as car parking, picnic/barbeque area, shelter and toilet
- toilet block and barbeque facility.

PDC 3 Publicly owned land within the MOSS should be used for any of the following:
(a) to provide natural or landscaped open space using locally indigenous plant species
(b) to accommodate a range of public recreation, sporting and institutional facilities and uses
(c) to accommodate stormwater retention and management
(d) to conserve and restore areas of remnant native vegetation and wildlife habitats and corridors
(e) to conserve sites of scientific, cultural or heritage interest

(f) for revegetation purposes using locally indigenous plant species
(g) to provide a buffer to adjoining areas of conservation significance.

PDC 7 Development should not be undertaken unless it is consistent with the desired character for the zone.

PDC 8 Development should not result in damage to sites of geological, scientific, cultural or heritage significance

PDC 9 Development, including facilities, roads, tracks and trails, should not be undertaken if the establishment, operation or management of such development is likely to result in the introduction of or an increase in the number of pest plants or vermin.

PDC 12 Buildings should be:
(a) restricted in size and number
(b) sited unobtrusively so as not to detract from the open, natural character of the zone
(c) constructed of materials which blend with the natural, heritage or character of the landscape.

PDC 15 Landscaping should be used to screen and soften the appearance of buildings and car parking areas.

PDC 16 Landscaping should comprise locally indigenous species and incorporate existing remnant vegetation.

PDC 17 Planting of indigenous vegetation within the zone should avoid creating an obstruction to water flow, particularly during periodic flood events.

PDC 22 Buildings and structures should not be located in a conservation area unless for reserve or park management purposes.

PDC 25 Materials used in fencing should be sympathetic to the natural character of the landscape and provide as little visual intrusion as possible.

PDC 29 Development should not compromise the integrity of the Happy Valley Reservoir as a water storage and supply facility.

PDC 30 Public access to the Happy Valley Reservoir should be restricted where there is potential to compromise the integrity of the reservoir's management.

GENERAL SECTION

Design and Appearance

PDC 1 Buildings should reflect the desired character of the locality while incorporating contemporary designs that have regard to the following:
(a) building height, mass and proportion
(b) external materials, patterns, colours and decorative elements
(c) roof form and pitch
(d) façade articulation and detailing
(e) verandas, eaves, parapets and window screens.

PDC 5 The external walls and roofs of buildings should not incorporate highly reflective materials which will result in glare to neighbouring properties, drivers or cyclists.

PDC 10 Development on land adjacent to a State or local heritage place, as listed in Table Onka/10 - State Heritage Places or in Table Onka/9 - Local Heritage Places, should be sited and designed to reinforce the historic character of the place and maintain its visual prominence.

PDC 22 Except in areas where a new character is desired, the setback of buildings from public roads should:
(a) be similar to, or compatible with, setbacks of buildings on adjoining land and other buildings in the locality

(b) contribute positively to the function, appearance and/or desired character of the locality
(c) not result in or contribute to a detrimental impact upon the function, appearance or character of the locality.

PDC 23 Except where otherwise specified in a particular zone, policy area or precinct, buildings and structures should be set back from road boundaries having regard to the requirements set out in Table Onka/2 - Building Setbacks from Road Boundaries.

Energy Efficiency

OB 1 Development designed and sited to conserve energy.

OB 2 Development that provides for on-site power generation including photovoltaic cells and wind power.

PDC 4 Public infrastructure and lighting, should be designed to generate and use renewable energy.

Hazards

OB 2 Development located away from areas that are vulnerable to, and cannot be adequately and effectively protected from the risk of natural hazards.

OB 5 Development located to minimise the threat and impact of bushfires on life and property.

PDC 1 Development should be excluded from areas that are vulnerable to, and cannot be adequately and effectively protected from, the risk of hazards.

PDC 8 The following bushfire protection principles of development control apply to development of land identified as General, Medium and High bushfire risk areas as shown on the Bushfire Protection Area BPA Maps - Bushfire Risk.

PDC 9 Development in a Bushfire Protection Area should be in accordance with those provisions of the Minister's Code: Undertaking development in Bushfire Protection Areas that are designated as mandatory for Development Plan Consent purposes.

PDC 10 Buildings and structures should be located away from areas that pose an unacceptable bushfire risk as a result of one or more of the following:
(a) vegetation cover comprising trees and/or shrubs
(b) poor access
(c) rugged terrain
(d) inability to provide an adequate building protection zone
(e) inability to provide an adequate supply of water for fire fighting purposes.

PDC 13 Buildings and structures should be designed and configured to reduce the impact of bushfire through using simple designs that reduce the potential for trapping burning debris against the building or structure, or between the ground and building floor level in the case of transportable buildings.

Heritage Places

OB 1 The conservation of State and local heritage places.

OB 3 Conservation of the setting of State and local heritage places.

PDC 1 A heritage place spatially located on Overlay Maps - Heritage and Character Preservation District and more specifically identified in Table Onka/10 - State Heritage Places or in Table Onka/9 - Local Heritage Places should not be demolished, destroyed or removed, in total or in part, unless either of the following apply:
(a) that portion of the place to be demolished, destroyed or removed is excluded from the extent of the places identified in the Table(s)
(b) the structural condition of the place represents an unacceptable risk to public or private safety.

PDC 3 Development of a State or local heritage place should retain those elements contributing to its heritage value, which may include (but not be limited to):
(a) principal elevations
(b) important vistas and views to and from the place
(c) setting and setbacks
(d) building materials
(e) outbuildings and walls
(f) trees and other landscaping elements
(g) access conditions (driveway form/width/material)
(h) architectural treatments
(i) the use of the place.

PDC 4 Development of a State or local heritage place should be compatible with the heritage value of the place.

Infrastructure

OB 1 Infrastructure provided in an economical and environmentally sensitive manner.

OB 2 The visual impact of infrastructure facilities managed.

PDC 1 Development should only occur where it has access to adequate utilities and services, including:
(a) electricity supply
(b) water supply
(c) drainage and stormwater systems
(d) effluent disposal systems
(e) formed all-weather public roads
(f) telecommunications services
(g) gas services.

Interface between Land Uses

OB 1 Development located and designed to minimise adverse impact and conflict between land uses.

OB 2 Protect community health and amenity from adverse impacts of development.

OB 3 Protect desired land uses from the encroachment of incompatible development.

PDC 1 Development should not detrimentally affect the amenity of the locality or cause unreasonable interference through any of the following:
(a) the emission of effluent, odour, smoke, fumes, dust or other airborne pollutants
(b) noise
(c) vibration
(d) electrical interference
(e) light spill
(f) glare
(g) hours of operation
(h) traffic impacts.

PDC 2 Development should be sited and designed to minimise negative impacts on existing and potential future land uses desired in the locality.

PDC 6 Non-residential development on land abutting a residential zone should be designed to minimise noise impacts to achieve adequate levels of compatibility between existing and proposed uses.

PDC 7 Development that emits noise (other than music noise) should include noise attenuation measures that achieve the relevant Environment Protection (Noise) Policy criteria when assessed at the nearest existing noise sensitive premises.

Landscaping, Fences and Walls

OB 1 The amenity of land and development enhanced with appropriate planting and other landscaping works, using locally indigenous plant species where possible.

PDC 2 Landscaping should:
(a) include the planting of locally indigenous species where appropriate
(b) be of a sufficient mature height and oriented towards the street frontage where it should screen buildings (except for entry doors and foyer areas) and enhance the appearance of development
(c) result in the appropriate clearance from powerlines and other infrastructure being maintained
(d) provide summer shade to reduce urban heat loading and where appropriate allow winter sun penetration and improve micro-climate conditions.

PDC 4 Landscaping should not:
(a) unreasonably restrict solar access to adjoining development
(b) cause damage to buildings, paths and other landscaping from root invasion, soil disturbance or plant overcrowding
(c) introduce pest plants
(d) increase the risk of bushfire
(e) remove opportunities for passive surveillance
(f) increase leaf fall in watercourses
(g) increase the risk of weed invasion
(h) obscure driver sight lines
(i) create a hazard for train or tram drivers by obscuring sight lines at crossovers.

PDC 5 Fences and walls, including retaining walls, should:
(a) not result in damage to neighbouring trees
(b) be compatible with the associated development and with existing predominant, attractive fences and walls in the locality
(c) enable some visibility of buildings from and to the street to enhance safety and allow casual surveillance
(d) incorporate articulation or other detailing where there is a large expanse of wall facing the street
(e) assist in highlighting building entrances
(f) be sited and limited in height, to ensure adequate sight lines for motorists and pedestrians especially on corner sites
(g) in the case of side and rear boundaries, be of sufficient height to maintain privacy and/or security without adversely affecting the visual amenity or access to sunlight of adjoining land
(h) be constructed of non-flammable materials.

Natural Resources

OB 1 Retention, protection and restoration of the natural resources and environment.

OB 2 Protection of the quality and quantity of South Australia's surface waters, including inland, marine and estuarine and underground waters.

OB 4 Natural hydrological systems and environmental flows reinstated, and maintained and enhanced.

OB 5 Development consistent with the principles of water sensitive design.

OB 6 Development sited and designed to:
(a) protect natural ecological systems
(b) achieve the sustainable use of water
(c) protect water quality, including receiving waters
(d) reduce runoff and peak flows and prevent the risk of downstream flooding
(e) minimise demand on reticulated water supplies
(f) maximise the harvest and use of stormwater
(g) protect stormwater from pollution sources.

OB 7 Storage and use of stormwater which avoids adverse impact on public health and safety.

OB 8 Native flora, fauna and ecosystems protected, retained, conserved and restored.

OB 10 Minimal disturbance and modification of the natural landform.

OB 11 Protection of the physical, chemical and biological quality of soil resources.

OB 12 Protection of areas prone to erosion or other land degradation processes from inappropriate development.

OB 13 Protection of the scenic qualities of natural and rural landscapes.

PDC 1 Development should be undertaken with minimum impact on the natural environment, including air and water quality, land, soil, biodiversity, and scenically attractive areas.

PDC 2 Development should ensure that South Australia's natural assets, such as biodiversity, water and soil, are protected and enhanced.

PDC 4 Development should be appropriate to land capability and the protection and conservation of water resources and biodiversity.

PDC 7 Development should be sited and designed to:
(a) capture and re-use stormwater, where practical
(b) minimise surface water runoff
(c) prevent soil erosion and water pollution
(d) protect and enhance natural water flows
(e) protect water quality by providing adequate separation distances from watercourses and other water bodies
(f) not contribute to an increase in salinity levels
(g) avoid the water logging of soil or the release of toxic elements
(h) maintain natural hydrological systems and not adversely affect:
(i) the quantity and quality of groundwater
(i) the depth and directional flow of groundwater
(ii) the quality and function of natural springs.

PDC 8 Water discharged from a development site should:
(a) be of a physical, chemical and biological condition equivalent to or better than its pre-developed state
(b) not exceed the rate of discharge from the site as it existed in pre-development conditions.

PDC 12 Development should include stormwater management systems to minimise the discharge of sediment, suspended solids, organic matter, nutrients, bacteria, litter and other contaminants to the stormwater system.

PDC 13 Stormwater management systems should preserve natural drainage systems, including the associated environmental flows.

PDC 14 Stormwater management systems should:
(a) maximise the potential for stormwater harvesting and re-use, either on-site or as close as practicable to the source
(b) utilise, but not be limited to, one or more of the following harvesting methods:
(i) the collection of roof water in tanks
(ii) the discharge to open space, landscaping or garden areas, including strips adjacent to car parks
(iii) the incorporation of detention and retention facilities
(iv) aquifer recharge.

PDC 18 Development should ensure watercourses and their beds, banks, wetlands and floodplains are not damaged or modified and are retained in their natural state, except where modification is required for essential access or maintenance purposes.

PDC 26 Development should comply with the current Environment Protection (Water Quality) Policy.

PDC 27 Development should retain existing areas of native vegetation and where possible contribute to revegetation using locally indigenous plant species.

PDC 28 Development should be designed and sited to minimise the loss and disturbance of native flora and fauna, including marine animals and plants, and their breeding grounds and habitats.

PDC 29 Native vegetation should be conserved and its conservation value and function not compromised by development if the native vegetation does any of the following:
(a) provides an important habitat for wildlife or shade and shelter for livestock
(b) has a high plant species diversity or includes rare, vulnerable or endangered plant species or plant associations and communities
(c) provides an important seed bank for locally indigenous vegetation
(d) has high amenity value and/or significantly contributes to the landscape quality of an area, including the screening of buildings and unsightly views
(e) has high value as a remnant of vegetation associations characteristic of a district or region prior to extensive clearance for agriculture
(f) is growing in, or is characteristically associated with a wetland environment.

PDC 33 Development should be located and occur in a manner which:
(a) does not increase the potential for, or result in, the spread of pest plants, or the spread of any non-indigenous plants into areas of native vegetation or a conservation zone
(b) avoids the degradation of remnant native vegetation by any other means including as a result of spray drift, compaction of soil, modification of surface water flows, pollution to groundwater or surface water or change to groundwater levels
(c) incorporates a separation distance and/or buffer area to protect wildlife habitats and other features of nature conservation significance.

PDC 37 Development should not have an adverse impact on the natural, physical, chemical or biological quality and characteristics of soil resources.

PDC 38 Development should be designed and sited to prevent erosion.

PDC 39 Development should take place in a manner that will minimise alteration to the existing landform.

PDC 40 Development should minimise the loss of soil from a site through soil erosion or siltation during the construction phase of any development and following the commencement of an activity.

Orderly and Sustainable Development

OB 1 Orderly and economical development that creates a safe, convenient and pleasant environment in which to live.

OB 2 Development occurring in an orderly sequence and in a compact form to enable the efficient provision of public services and facilities.

OB 3 Development that does not jeopardise the continuance of adjoining authorised land uses.

OB 4 Development that does not prejudice the achievement of the provisions of the Development Plan.

OB 5 Development abutting adjoining Council areas having regard to the policies of that Council's Development Plan.

PDC 1 Development should not prejudice the development of a zone for its intended purpose.

Renewable Energy Facilities

OB 1 Development of renewable energy facilities that benefit the environment, the community and the state.

OB 2 The development of renewable energy facilities, such as wind farms and ancillary development, in areas that provide opportunity to harvest natural resources for the efficient generation of electricity.

OB 3 Location, siting, design and operation of renewable energy facilities to avoid or minimise adverse impacts on the natural environment and other land uses.

PDC 1 Renewable energy facilities, including wind farms and ancillary development, should be:
(a) located in areas that maximize efficient generation and supply of electricity; and
(b) designed and sited so as not to impact on the safety of water or air transport and the operation of ports, airfields and designated landing strips.

Siting and Visibility

OB 1 Protection of scenically attractive areas, particularly natural, rural and coastal landscapes.

PDC 1 Development should be sited and designed to minimise its visual impact on:
(a) the natural, rural or heritage character of the area
(b) areas of high visual or scenic value, particularly rural and coastal areas
(c) views from the coast, near-shore waters, public reserves, tourist routes and walking trails
(d) the amenity of public beaches

PDC 2 Buildings should be sited in unobtrusive locations and, in particular, should:
(a) be grouped together
(b) where possible be located in such a way as to be screened by existing vegetation when viewed from public roads and especially from the Mount Lofty Ranges Scenic Road as shown on Overlay Maps - Transport.

PDC 3 Buildings outside of urban areas and in undulating landscapes should be sited in unobtrusive locations and in particular should be:
(a) sited below the ridgeline
(b) sited within valleys or behind spurs
(c) sited in such a way as to not be visible against the skyline when viewed from public roads, and especially from the Mount Lofty Ranges Scenic Road as shown on *Overlay Maps - Transport*
(d) set well back from public roads, particularly when the allotment is on the high side of the road, or especially from to the Mount Lofty Ranges Scenic Road as shown on *Overlay Maps - Transport.*

PDC 4 Buildings and structures should be designed to minimise their visual impact in the landscape, in particular:
(a) the profile of buildings should be low and the roof lines should complement the natural form of the land
(b) the mass of buildings should be minimised by variations in wall and roof lines and by floor plans which complement the contours of the land
(c) large eaves, verandas and pergolas should be incorporated into designs so as to create shadowed areas that reduce the bulky appearance of buildings.

PDC 5 The nature of external surface materials of buildings should not detract from the visual character and amenity of the landscape.

PDC 6 The number of buildings and structures on land outside of urban areas should be limited to that necessary for the efficient management of the land or the harvesting of wind resources for the generation of renewable energy.

PDC 8 Driveways and access tracks should be designed and surfaced to blend sympathetically with the landscape and to minimise interference with natural vegetation and landforms.

PDC 9 Development should be screened through the establishment of landscaping using locally indigenous plant species:
(a) around buildings and earthworks to provide a visual screen as well as shade in summer, and protection from prevailing winds

(b) along allotment boundaries to provide permanent screening of buildings and structures when viewed from adjoining properties and public roads
(c) along the verges of new roads and access tracks to provide screening and minimise erosion.

Transportation and Access

OB 2 Development that:
(a) provides safe and efficient movement for all transport modes
(b) ensures access for vehicles including emergency services, public infrastructure maintenance and commercial vehicles
(c) provides off-street parking
(d) is appropriately located so that it supports and makes best use of existing transport facilities and networks
(e) provides convenient and safe access to public transport stops.

PDC 2 Development should be integrated with existing transport networks, particularly major rail, road and public transport corridors as shown on *Location Maps* and *Overlay Maps - Transport*, and designed to minimise its potential impact on the functional performance of the transport network.

PDC 8 Development should provide safe and convenient access for all anticipated modes of transport.

PDC 14 Development should provide for the on-site loading, unloading and turning of all traffic likely to be generated.

PDC 22 Development should have direct access from an all-weather public road.

PDC 23 Development should be provided with safe and convenient access which:
(a) avoids unreasonable interference with the flow of traffic on adjoining roads
(b) provides appropriate separation distances from existing roads or level crossings
(c) accommodates the type and volume of traffic likely to be generated by the development or land use and minimises induced traffic through over-provision
(d) is sited and designed to minimise any adverse impacts on the occupants of and visitors to neighbouring properties.

PDC 25 The number of vehicle access points onto arterial roads shown on *Overlay Maps - Transport* should be minimised and, where possible, access points should be:
(a) limited to local roads (including rear lane access)
(b) shared between developments.

PDC 27 Development with access from arterial roads or roads as shown on *Overlay Maps - Transport* should be sited to avoid the need for vehicles to reverse onto or from the road.

PDC 29 Driveways, access tracks and parking areas should be designed and constructed to:
(a) follow the natural contours of the land
(b) minimise excavation and/or fill
(c) minimise the potential for erosion from surface runoff
(d) avoid the removal of existing vegetation
(e) be consistent with *Australian Standard AS: 2890 - Parking facilities*.

PDC 37 Vehicle parking areas should be sealed or paved to minimise dust and mud nuisance.

Waste

OB 1 Development that, in order of priority, avoids the production of waste, minimises the production of waste, re-uses waste, recycles waste for re-use, treats waste and disposes of waste in an environmentally sound manner.

PDC 1 Development should be sited and designed to prevent or minimise the generation of waste (including wastewater) by applying the following waste management hierarchy in the order of priority as shown below:
(a) avoiding the production of waste
(b) minimising waste production
(c) reusing waste

(d) recycling waste
(e) recovering part of the waste for re-use
(f) treating waste to reduce the potentially degrading impacts
(g) disposing of waste in an environmentally sound manner.

PDC 2 The storage, treatment and disposal of waste materials from any development should be achieved without risk to health or impairment of the environment.

PDC 3 Development should avoid as far as practical, the discharge or deposit of waste (including wastewater) onto land or into any waters (including processes such as seepage, infiltration or carriage by wind, rain, sea spray, stormwater or by the rising of the water table).