Sapphire Solar Farm

EPBC Referral – Additional Information Document (s1.2)

December 2017

Delivering Energy, Powering Communities.

1 Description of Solar Farm Key Components

Solar array

The solar array refers to the solar farm and would comprise of approximately 660,000 individual solar panels with a combined generation capacity of approximately 180 MW_{AC}. The solar panels would be fitted to either or a combination of (depending on technology selection):

- Fix tilt frames which would be orientated so the panels face upwards at approximately 300 through 25 degrees in a north, north west or north easterly direction; or
- A single-axis tracking system which would track the sun from east to west as it moves throughout the day.

The solar array will be supported by approximately 90,000 piles which would be mechanically driven, screwed into, drilled and concreted or ballasted to the ground.

The solar array would be wired in 'blocks' that would be connected to Power Conversion Units (PCUs) (likely to be approximately 2.5 MW to 6MW each) located throughout the Proposed Development. Blocks would not necessarily appear as discrete entities but would appear as a series of continuous rows. In the case of a fixed tilt mounting system the rows would typically run west to east, while the single-axis tracking system would be installed in rows that are oriented typically north to south. The solar array would connect to the Substation through a series of 33 kV lines that would be above or below ground depending on local ground conditions. Waterloo and Western Feeder roads will be impacted by this aspect of the Proposed Development.

Power Conversion Units (PCUs)

PV panels produce Direct Current (DC) electricity which would be converted to Alternating Current (AC) at the many central PCUs. The PCUs will be approximately 2.5 MW to 10 MW each, though subject to procurement processes. PCUs are typically housed in containers, or located on platforms, either singularly the size of a 20 ft container, measuring approximately 6.1 m (l) x 2.9 m (h) x 2.5 m (w), or doubly, the size of a 40 ft container measuring approximately 12.2 m (l) x 2.9 m (h) x 2.5 m (w). Each PCU would also have:

- A 33 kV Medium Voltage (MV) transformer;
- Circuit breakers; and
- Communication equipment.

PCUs will be transported to site readymade and require little in the way of foundations, either attached to steel or concrete pilings approximately 1.6 m deep depending on ground conditions. Figures 1-1 and 1-2 below illustrate double and single PCUs respectively.

Figure 1-1: Double PCU container (image courtesy of SMA)

Figure 1-2: Single PCU container (image courtesy of SMA)

Battery-based Storage

The Proposed Development is likely to include an energy storage system which would consist of batteries that are generally housed in enclosures approximately the size of a shipping container. Battery storage can add significant benefits to solar generation because it allows for the dispatch of energy in accordance with market demand and overcomes potential issues associated with intermittency of output.

The battery assemblies would be mounted on pad foundations and, depending on the selected technology, may include bunded containment. Underground or overhead cables would connect the battery assemblies to the Proposed Development and Substation equipment. The quantity and type of battery technology to be used will be subject to procurement processes, however a range of technologies have been assessed within the EIS, including lithium iron, lead acid, sodium sulphur, sodium or nickel hydride or electrochemical technology. Proposed stand-alone locations of battery storage facilities have been identified and assessed within this EIS. One or more of these locations may be utilised for optimal construction and operation of the Proposed Development.

Accepted industry practice will be observed for handling the respective battery components during installation, maintenance, replacement and recycling. Moreover, a 20 m asset protection zone (APZ) will be incorporated into the final design layout of the battery-based storage facility locations.

Collector Systems

A typical collector system will include DC reticulation cabling run along each solar array (mechanically protected as required to facilitate co-use of land for grazing purposes) and then below ground to the PCUs. Inverters will convert the DC to alternating current (AC) with Medium Voltage (MV) and/or High Voltage (HV) transformers increasing the voltage for export to the grid.

Collector cables will be of sufficient length to minimise wherever possible the use of cable joints between PCU's and the Substation. In-ground earth loop joint pits will be utilised to ensure recovery of joints for repairs if joints are required for underground cables. Where underground, single mode fibre and the radial earth conductor (where required) will be laid in parallel to other cables in a common trench.

All cables will be designed based on site conditions in accordance with relevant Australian and international standards. Subject to final design, cable trenches will contain:

- Below ground warning tapes;
- Below ground Polymeric cover strips;
- Electrical cables to export power;
- Electrical supply cables where necessary;
- Earthing cable;
- Communications and SCADA links; and
- Above ground warning signs.

Where possible, trenches will be located alongside/underneath internal access tracks (including those constructed for SWF) to minimise ground disturbance (Figure 1-3). MV/HV cables may be either laid underground or constructed overhead to connect sections of the Proposed Development to the Substation.

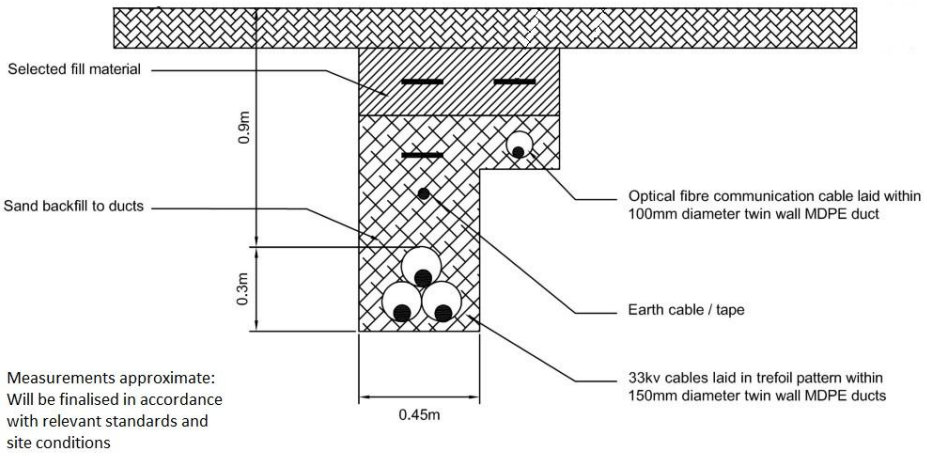

Figure 1-3: Indicative 33 kV cable trench design[1]

[1] Indicative design only. Cables may be direct buried rather than trenched. Cables will be buried to a depth >500 mm in land with a cropping history or land with a capability of cropping.

Operations and Maintenance Facility

A permanent Operations and Maintenance (O&M) facility will be provided to meet the ongoing operational needs of the Proposed Development. A typical arrangement is shown in Figure 1-4. Building fit-out will include power, lighting, air-conditioning, security, fire detection, and communication systems as required.

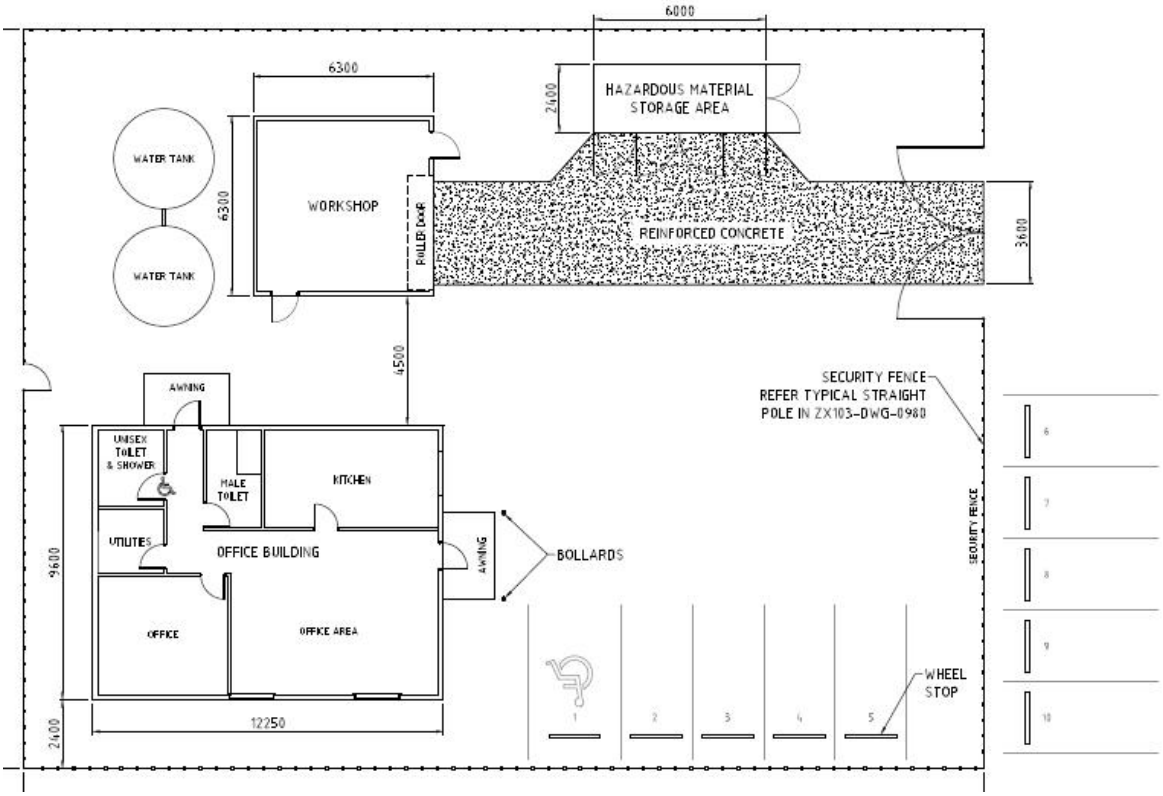

Figure 1-4: Typical O&M Facility

The Operations and Maintenance facility including associated parking would occupy an area of approximately 30 m by 40 m or 0.12 ha and may include the following:

- Office building, consisting of office, toilets, showers, staff room and kitchen;
- Maintenance building;
- Up to 3 storage buildings/sheds;
- Parking;
- Water storage;
- A septic tank; and
- A workshop.

Onsite support buildings will comply with all relevant Australian building standards and regulations. They will be designed to accommodate the maximum number of staff that will be required during the operational life of the Proposed Development. Water for the support buildings will be supplied to site by commercial contractors and stored in onsite water tanks. In addition, there will be a requirement for a 20,000-litre water tank solely for the purposes of fire protection.

Site Access and Onsite Access Tracks

The Site will be accessed directly off Waterloo and Western Feeder roads, both public roads. Waterloo Road joins the Gwydir Highway, a Roads and Maritime Services (RMS) Classified State Road southeast of the project boundary. The intersection between the Gwydir Highway and Waterloo Road has been upgraded to accommodate over-dimensional equipment for SWF, and it is not expected that further upgrades would be required for the Proposed Development.

Waterloo and Western Feeder roads are unsealed local roads that will require maintenance to support delivery vehicles during the construction phase. Maintenance and dust suppression activities will ensure the road is suitable for equipment delivery.

Internal tracks will be constructed of compacted gravel to an approximate depth of 150 mm depending on soil conditions (Figure 1-5). Internal access tracks would be approximately 4 m wide with intermittent wider stretches for passing, parking, and at corners. Small culverts over identified stream crossings would also be constructed. Culverts (where required) will be designed in line with the following guidance:

- *Policy and Guidelines for Fish Friendly Waterway Crossings* (NSW DPI, 2004); and
- *Why do Fish Need to Cross the Road? Fish Passage Requirements for Waterway Crossings* (Fairfull and Witheridge, 2003).

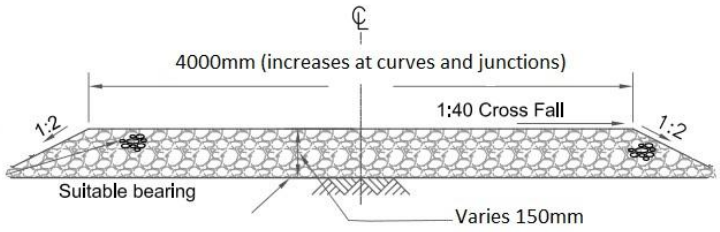

Figure 1-5: Typical track cross section

Fencing and Security System

To ensure safety and security at the site, a perimeter fence up to 2.5 m will be installed around the perimeter of the Proposed Development in accordance with the Proponent's requirements to ensure entry into the site is controlled. Once operational, all access points will be gated. The security system may include a CCTV security system.

Meteorological Station

A number of metrological stations will be located at locations determined as part of the final design, located in proximity to solar arrays and consisting of equipment to measure solar radiation (global and direct), temperature, pressure, rainfall, wind speed and direction. For wind speed a mast approximately 10 m high would be installed. Ancillary power and optic fibre will be provided to each unit.

Vegetation Screen

The Site has been selected to minimise impacts to surrounding residences through a combination of consultation, consideration of existing vegetation and proximity to the Proposed Development. If required,

additional vegetation screening post construction may be planted in other areas of the Site or adjoining land (subject to landowner consent).

Firebreak

Where required, firebreaks will be established or maintained around the solar array (and associated infrastructure where appropriate) inside the Development Footprint. The firebreak will be ploughed, mown or grazed, and maintained in accordance with the NSW Rural Fire Service (RFS) standards (RFS, 2006). The firebreak is to ensure, as far as possible, that a fire that originates within the Site does not escape into the wider landscape or conversely the firebreak should reduce the potential of a fire that originates offsite encroaching onto the Site. Firebreaks will be approximately 5 m wide.

Grid Connection

The Substation and control building constructed for SWF provides additional 33 kV space to accommodate the connection of all or part of the Proposed Development. Augmentation within the Substation may include but not limited to the inclusion of an additional control building, limited high voltage infrastructure works and necessary interface connections. The extent of additional external works required at the Substation will be determined through detailed design in consultation with TransGrid, however are expected to be contained within the perimeter of the recently constructed Substation and associated temporary disturbance areas. Augmentation works may include expanded civil works (earthwork, earthing, conduits, concrete foundations, driveway crossover and culverts) to allow for integration with the existing Substation.

For the avoidance of doubt, additional works associated with the Proposed Development within (the inclusion of a new switch room and associated connection arrangement) and external to the Substation are included within this EIS.