ARUP

Stockland

Road 1 Data Centre

SSD ESD Report

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Executive Summary

This Ecologically Sustainable Development Report has been prepared by Arup to support the application for SSD-80814238. The project is located at 1-5 Khartoum Road, Macquarie Park, within the City of Ryde local government area.

The report summarises the development's approach to addressing the greenhouse gas emissions as required by the Secretary's Environmental Assessment Requirements (SEARs) issued for 1-5 Khartoum Road, Road 1 Data Centre SSDA on the 14th March 2025. The project is subject to the industry specific SEARs for Data Storage Centres.

Documented in this report are how the design team has addressed the EP&A ESD Principles, and specific details regarding the project's design response to:

- Reduction of greenhouse gas emissions and approach to net zero emissions,
- Reduction of water use intensity,
- Resilience,
- Industry recognised sustainability performance and
- Measurement of embodied emissions.

Also addressed by the report are opportunities that the design team will investigate through design finalisation:

- Circular economy,
- Industry recognised rating, and
- Maximising the reduction in embodied emissions.

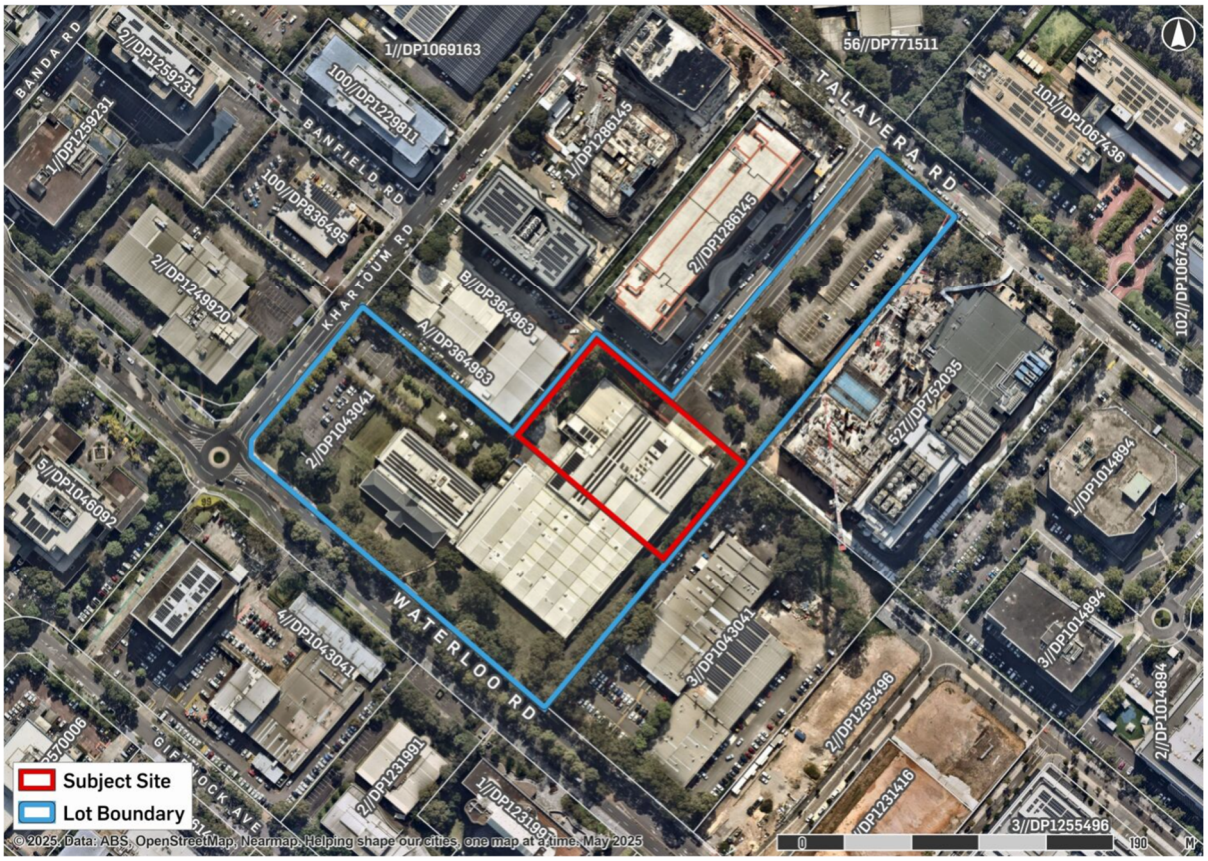
The report concludes that the development addresses the requirements of the SEARs and shows good opportunities for exceeding these with further opportunities to be explored through design finalisation.

1. Introduction

This Ecologically Sustainable Development Report has been prepared by Arup on behalf of Stockland to accompany a State Significant Development Application (**SSDA**) for a data centre development.

The site is located at 1-5 Khartoum Road, Macquarie Park, within the City of Ryde Local Government Area (**LGA**). The area subject of the data centre development is 8,096sqm. The site is legally described as part of Lot 2 in Deposited Plan 1043041 and is contained within the broader 'MPark' landholding as shown in **Figure 1.**

Figure 1 Aerial Photograph of Site



Source: Urbis GIS, 2024

The project comprises the construction of a data centre development including the following key components:

- Site preparation works including tree removal and earthworks.
- Construction and operation of a 10-storey data centre development, with a maximum height of 72.8 metres and a combined total gross floor area (GFA) of approximately 13,307sqm including:
  - Lobby and ancillary spaces: 5,857sqm
  - Offices: 878sqm
  - Four storeys of technical data floor space accommodating 8 data halls: 6,572sqm
- Vehicle access via Road 22 (Murrell Street) and Future Road 1 with 19 parking spaces to be located within the building footprint.
- Construction of part Road 1 and part of Road 23 as contained within the subject site.
- Landscaping and associated public domain works.

- Business identification signage zones.
- 19 diesel generators for back up power.
- Extension and augmentation of physical infrastructure and utilities including extension of water link main from Road 22 (Murrell Street) to Waterloo Road and secondary water connections.

1.1 The Site

The site is located at 1-5 Khartoum Road, Macquarie Park, within the City of Ryde Local Government Area (**LGA**), approximately 12km north-west of the Sydney CBD and proximate to the commercial centres of Chatswood and Norwest.

The area subject of the data centre development is 8,096sqm (legally described as Part Lot 2 DP 1043041) and is contained within the broader 'MPark' landholding – see **Figure 1**.

The site is within convenient walking distance (800m) of both Macquarie University and Macquarie Park Metro Stations, which provide high-frequency rail connections to Chatswood, Sydney CBD and the Norwest Business Park. It also benefits from access to high frequency bus services along Waterloo Road, Khartoum Road and Talavera Road and is well connected to the regional road network via the M2 Motorway.

The key features of the site which have the potential to impact or be impacted by the proposed development are summarised in the table below.

Table 1 Site Details

Feature	Description
Street Address	1-5 Khartoum Road, Macquarie Park
Legal Description	Part Lot 2 DP 1043041
Land Configuration	The site has an area of 8,096sqm and slopes towards Talavera Road.
Land Ownership	The land is owned by Stockland.
Existing Development	The site is currently occupied by an existing warehouse building and adjacent to an existing double storey concrete carparking structure.
Local Context	The site is surrounded by a range of office/warehouse building forms, which are predominantly low to medium rise with large areas of at-grade parking, consistent with Macquarie Park's traditional campus-style function and character.
Regional Context	The site is located within Macquarie Park, which with approximately 894,000 sqm of commercial floor space and approximately 140,000sqm of retail floor space, is the fourth largest employment centre in Greater Sydney by number of employees and the largest non-CBD office market in Australia. It is viewed as an innovative research, education, medical and technology employment centre. Macquarie Park is home to Macquarie University, Macquarie University Hospital, Macquarie University Incubator and more than 180 large international corporations (including Optus, Foxtel, Sonic Healthcare, Oracle, Schneider Electric and Astra Zeneca), together with over 200 small businesses. The area is well advanced in its transition from a campus-style industrial and business park into a denser, mixed-use urban centre with improved connectivity. This transition has been occurring for decades, led by events such as Macquarie University's expansion and the opening of the M2 motorway, together with more recent factors such as investment in rail/metro services and the NSW Government's 'Priority Precinct' program.
Site Access	Road 22 (Murrell Street) and Future Road 1 will provide access to the site, which was constructed as part of SSD-10467.

1.2 Project Description

Table 2 Project Description

Descriptor	Project Details
Project Area	The data centre development relates to the central part of Lot 2 DP 1043041 and comprises an area of approximately 8,096sqm.
Proposed Use	Data centre with ancillary office space.

Project Description	• Site preparation works including tree removal and earthworks.
	• Construction and operation of a 10-storey data centre development, with a maximum height of 72.8 metres and a combined total gross floor area (**GFA**) of approximately 13,307sqm including:
	  o Lobby and ancillary spaces: 5,857sqm
	  o Offices: 878sqm
	  o Four storeys of technical data floor space accommodating 8 data halls: 6,572sqm
	• Vehicle access via Road 22 (Murrell Street) and Future Road 1 with 19 parking spaces to be located within the building footprint.
	• Construction of part Road 1 and part of Road 23 as contained within the subject site.
	• Landscaping and associated public domain works.
	• Business identification signage zones.
	• 19 diesel generators for back up power.
	• Extension and augmentation of physical infrastructure and utilities including extension of water link main from Road 22 (Murrell Street) to Waterloo Road and secondary water connections.

Gross Floor Area	13,307sqm
Building Height	72.8 metres over 10 storeys
Floor Space Ratio	1.64:1
Data Halls	8 data halls
Deep Soil Area	11.48%
Car Parking	19 car spaces including 1 DDA spaces
Motorbike Spaces	3 spaces
Bicycle Spaces	8 spaces
Utilities	Provision of required utilities including: ▪ 19 x diesel generators, including18 x diesel generators (3MW/each) + 1 diesel generators (1MW) ▪ 6 x above-ground diesel storage tanks (75kL/each) ▪ 6 x above-ground water tanks for industrial water (450kL/each) ▪ 1 x above-ground water tank for fire water (400kL) ▪ Fully redundant 33kV switching station.
Power Consumption	34.3 MW
Operations and Management	The facility will be operated on a 24-hour, 7 day a week basis.
Existing Services and Infrastructure	The site is fully serviced; however, existing services and infrastructure will be extended, adapted and augmented to meet the demands of the project.
Job Numbers	Construction: 250 Operational: 50

1.3 SEARs Requirements

This report has been prepared in response to the requirements contained within the Secretary's Environmental Assessment Requirements (SEARs) dated 14 March 2025 issued for the SSDA (SSD-80814238). Specifically, this report has been prepared to respond to the SEARS requirement issued below.

Table 3 SEARs Requirements - Ecologically Sustainable Development

Issue and Assessment Requirements	Response
8. Ecologically Sustainable Development	
Identify how ESD principles (as defined in section 193 of the EP&A Regulation) are incorporated in the design and ongoing operation of the development.	Refer Section 2.3 Specific commentary provided for each of the principles of ESD with examples of initiatives to be included in the development.
Demonstrate how the development will meet or exceed the relevant industry recognised building sustainability and environmental performance standards.	Refer Section 3.2 Options for assessment of the development against relevant industry standards.
Demonstrate how the development minimises greenhouse gas emission (reflecting the Government's goal of net zero emissions by 2050) and consumption of energy, water (including water sensitive urban design) and material resources.	Refer Section 3.1 Initiatives provided in this section address the specific requirements noted here for energy efficiency, water efficiency, WSUD and material.
If Chapter 3 of SEPP (Sustainable Buildings) 2022 applies: Demonstrate how the development has been designed to enable the general sustainability provisions, as defined by Chapter 3.2(1)	Refer Section 3.1 In addition to the requirements addressed in the previous item above, this section also address renewable energy generation, metering and monitoring of energy use as required by the SEPP.
Provide a NABERS Embodied Emissions Material Form to disclose amount of embodied emissions attributable to the development in accordance with section 35B of the EP&A Regulation.	Refer NABERS Embodied Materials form submitted separate to this report.

1.4 Stakeholder Engagement Guidance

1.4.1 State Design Review Panel (SDRP)

SDRP Engagement was sought on the 4th of June 2025 and the 10th of July 2025, feedback from the engagement has been utilised to update:

- Comparative assessment of energy efficiency in Section 3.1.1.
- Energy efficiency strategies detailed in Section 3.1.1.
- Embodied carbon discussion in Section 3.1.3.

2. Ecologically Sustainable Development

2.1 Definition

Ecologically sustainable development (ESD) requirements to be addressed by this SSD report are derived from the definition documented in Section 193 of the Environmental Planning and Assessment Regulation 2021, under the Environmental Planning and Assessment Act 1979.

Namely, these are the principles of ecologically sustainable development:

1. The precautionary principle,
2. Inter-generational equality,
3. Conservation of biological diversity and ecological integrity, and
4. Improved valuation, pricing and incentive mechanisms.

2.2 Methodology

The principles of ecologically sustainable development have been used as an overarching guide to develop the ESD strategy for the project. The key elements of this development proposal in respect to Section 193 are resource consumption and carbon emissions. Specifically, the ESD strategy for the development addresses the following key areas:

- Greenhouse Gas Emissions
- Energy
- Water
- Material Resources
- Waste

Each of these areas identifies design initiatives that have been incorporated or are under consideration that have the potential to reduce the environmental impact of the proposed data centre. It should be noted the building is in the Development Application stage, therefore further consideration of sustainability initiatives will be applied throughout design development. The ESD principles specific to Section 193 are detailed in this Section, for further detail please refer to the design initiatives detailed in the body of the report.

2.3 Principles of ESD

2.3.1 The Precautionary Principle

The precautionary principle is defined as follows:

The precautionary principle is that if there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.

(3) In applying the precautionary principle, public and private decisions should be guided by -

(a) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and

(b) an assessment of the risk-weighted consequences of various options.

The proposed development has the potential to consume significant amounts of energy and water. A range of measures have been considered to reduce the environmental impact of the proposal.

Energy consumption will be minimised through optimisation of mechanical systems including: higher operating temperature set points, an energy management system and high efficiency equipment. In addition,

the proposed development will be implementing a commitment to rate, targeting a NABERS Energy Rating of 5 Stars for the data centre and an equivalent 5.5 stars for the base building office component. As described in Section 2.1.1of the SSD Greenhouse Gas Emissions Assessment report, the net lettable area of the office component is below the threshold to enable reporting, and therefore no NABERS Energy or Water rating is achievable.

Water consumption will be minimised through a range of measures including multi-layered metering strategies, rainwater harvesting, and deploying high-efficiency equipment to achieve a balance between energy consumption and water consumption. In addition, a specific water consumption target for the proposed development has been set to drive the water efficiency of the design.

2.3.2 Intergenerational Equity

The principle of intergenerational equity is defined as follows:

The principle of inter-generational equity is that the present generation should ensure the health, diversity and productivity of the environment are maintained or enhanced for the benefit of future generations.

Data centres are critical infrastructure, that not only provide employment-generating opportunities within the Information, Communication and Technology (ICT) sector, but also support the operation of business to business and business to consumer services. The storage of cloud and electronic data is a fundamental for both business and consumer transactions. By supporting productivity and helping to drive business activity that underpins current and future economic growth, the proposed development will positively impact future generations.

In addition, the proposed development will seek to minimise greenhouse gas emissions through operational energy efficiency measures and on-site renewables. Reducing the upfront embodied carbon footprint of the proposed development will also minimise the potential detrimental impact to future generations.

2.3.3 Conservation of biological diversity and ecological integrity

The principle of the conservation of biological diversity is defined as follows:

The principle of the conservation of biological diversity and ecological integrity is that the conservation of biological diversity and ecological integrity should be a fundamental consideration.

The resultant direct, indirect, and cumulative ecological impacts of the proposal are being carefully considered. Through the development of an Environment Impact Statement, recommendations and mitigation measures will be developed in order to address the principle of biological diversity and ecological integrity. These are addressed in a separate Environmental Impact Statement report.

2.3.4 Improved valuation, pricing and incentive mechanisms

The principle of improved valuation, pricing and incentive mechanisms is defined as follows:

The principle of improved valuation, pricing and incentive mechanisms is that environmental factors should be included in the valuation of assets and services, such as -

(a) polluter pays, that is, those who generate pollution and waste should bear the cost of containment, avoidance or abatement, and

(b) the users of goods and services should pay prices based on the full life cycle of the costs of providing the goods and services, including the use of natural resources and assets and the ultimate disposal of waste, and

c) established environmental goals should be pursued in the most cost effective way by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

Scope 2 emissions from tenant electricity consumption will be the main driver of carbon emissions for the facility. Electricity consumption from the tenant activities at the facility will be under the direct operational and financial control of the tenant. For tenant Scope 2 emissions, the proponent will actively pursue, the procurement of 100% renewal electricity by the tenant (combination of on-site and off-site renewable resources).

3. Assessment and Mitigation of Impacts

The following sections describe in detail the assessment of potential impacts and specific mitigation measures to respond to the SEARs objectives.

3.1 ESD Design Initiatives (Mitigation Measures)

To address the SEARs and Sustainable Buildings SEPP targets, the project will develop a comprehensive ESD strategy. The following areas are the focus of the design team:

- Energy and Greenhouse Gas Emissions – Incorporate energy efficient designs and technological strategies to reduce energy use and greenhouse gas emissions.
- Water – reduce consumption of potable water, by installing water efficient systems and water sensitive urban design features.
- Material Resources and Waste – Optimise the use of resources while minimising waste throughout the whole life cycle of the building. Reduce material embodied impacts through structurally optimal design and dematerialisation, low carbon building materials and recycled content.

This section outlines the ESD initiatives that are either being implemented into the design or are earmarked for further consideration.

3.1.1 Energy and Greenhouse Gas Emissions

This section describes the measures incorporated and being considered in the development's design to minimise the proposal's energy use and operational greenhouse gas emissions, in line with the Government's goal of net zero emissions by 2050 as noted in the SEARs.

The proponent seeks to design, build, and operate the data centre to achieve the NABERS Energy for data centres (Infrastructure) rating of 5 star. Once certified, the proponent facilities management team will perform annual re-certification. The target Power Use Efficiency (PUE) rating for Road 1 Data Centre is 1.35. This metric is used to determine the energy efficiency of data centres, lower numbers indicate better efficiency. Studies indicate that the global average PUE for data centres decreased from 2.5 when it was first introduced in 2007 to 1.59 in 2020.[1] This PUE is equivalent to a 5-star NABERS Energy rating for Data Centre and represents best practice in the Australian market. Data centre operators do not publicly share their achieved PUEs in operation as it can be commercially sensitive and these are very different from the design PUE ratings which are assessed for the design condition only. The combined compute and HVAC energy is the largest operational carbon impact, and small improvements in this results in large absolute savings.

Strategies to address energy and GHG emissions include:

- Envelope design using insulation, high performance selective glazing and external shading on appropriate elevations to achieve Section J envelope minimum compliance, balanced with allowing daylight into office spaces to reduce the reliance on artificial lighting.
- Efficient LED lighting with motion sensing throughout.
- Solar photovoltaic generation maximised for available rooftop areas and in excess of code requirements.
- Provision of EV charging stations.
- Metering and monitoring of energy consumption.
- Cooling towers, using heat exchangers on the water side that use cooling directly from cooling tower to reduce use of chillers and using economiser on the air-side

[1] Brocklehurst, Fiona. "International review of energy efficiency in Data Centres for IEA EBC Building Energy Codes Working Group" March 2022

Other potential initiatives being investigated include:

- High albedo materials to reduce Heat Island Effect, including high 'Solar Reflectance Index' 'cool roof' cladding materials and paving.
- A detailed study of back up generation technologies and their associated performance has been included in the Infrastructure Requirements and Utilities Report, Section 1.11, Table 6.

3.1.2 Water

This section describes the measures incorporated and being considered in the development's design to minimise the potable water consumption and water sensitive urban design as noted in the SEARs.

The target Water Use Efficiency (WUE) rating for the development is 1.5. This metric is used to determine the water efficiency of data centres, a lower number indicates improved efficiency. The global average WUE for data centres is 1.8.[2] The single largest water usage for the facility and small improvements in this results in large water savings.

Potential strategies currently under investigation include:

- Extensive use of native and indigenous planting with low water requirements.
- Rainwater collection, for cooling tower water top-up and irrigation.
- Recirculation and capture of fire testing water.
- Efficient fixtures and fittings with high WELS ratings.
- Prioritising permeable finishes and paving.
- Efficient air-side HVAC systems to reduce heat rejection requirements.
- Water treatment measures to improve the number of cycles, thereby reducing cooling tower discharge.

3.1.3 Material Resources and Waste

This section describes the measures incorporated or being considered in the development's design to optimise the use of resources while minimising waste.

Potential strategies currently under investigation include:

- A materials and waste recovery audit will be conducted on the existing building prior to demolition. This aims to identify opportunities to minimise waste to landfill and optimise circular reuse of materials back into the economy.
- Development of a construction and demolition waste management plan, detailing all major waste streams generated, including disposal and diversion rates.
- Consideration of low carbon, high Portland cement replacement concrete, arc furnace produced steel, high recycled content lower embodied carbon aluminium for glazing systems.
- Cradle-to-gate life cycle assessment of embodied carbon and other materials impacts.
- Provision of on-site separation of waste streams to maximise diversion from landfill.
- The structure of the building provides a robust framework for future adaptive reuse – with large floor to floor heights, high floor loading allowances and long design life, many different future uses would be achievable.

[2] https://www.sunbirddcim.com/glossary/water-usage-effectiveness-wue#:~:text=The%20average%20data%20center%20has,hour%20consumed%20by%20IT%20equipment.

3.2 Greenhouse Gas Emissions Estimate

A separate report detailing the Greenhouse Gas emissions has been developed to address this reporting requirement.

3.3 Industry Recognised Sustainability and Environmental Performance

Investigations have been made to confirm if applicable industry rating tools for the development which respond to the SEARs requirement meet or exceed the relevant industry recognised building sustainability and environmental performance standards.

The project is also subject to the Macquarie Park Design Guide. A consistency assessment has been undertaken to identify where the ESD principles and design initiatives outlined in this report (ESD-01) and the SSD Greenhouse Gas Emissions Assessment (ESD-02) align with the design guide.

In line with industry standard practice, it is proposed that any applicable rating tools are coordinated with the tenant.

The commercial component of the development, namely the Class 5 office space, is understood to be subject to the requirements of Section 3a and Schedule 3 of the SEPP. However, as the net lettable area of this component is below the threshold to enable reporting, no NABERS Energy or Water rating is achievable.

3.4 Climate Change Adaptation Planning

The development team is acutely aware of the current and increasing impacts of climate change and subsequent design impact. The development will utilise best practice climate change guidance to provide robust solutions. A screening checklist of major risks has been developed and will be used to ensure that significant impacts are addressed. The team has reviewed and addressed potential issues associated with increased rainfall and temperatures at this stage, and though design development, detailed assessment will be completed to ensure robust operations of the facility.

4. Conclusion

The ESD strategy is being developed to align with the SEARs requirements and Sustainable Building SEPP requirements for the Road Data 1 Centre development. These strategies will be realised through focused ESD initiatives involving building design that considers optimised energy generation, reduced greenhouse gas emissions and potable water use, optimised resource use and minimisation of waste throughout the whole lifecycle of the building.

The mitigation measures listed in Section 3 act to reduce the impacts of the proposal, particularly with regards to energy and water consumption. While savings of measures included in the design have been noted, other measures have been earmarked for further consideration where the savings will be further progressed through detailed design. As a result, it is not possible at this stage to give a definitive answer to the total savings achieved. Despite this, mitigations which have been included in the design have achieved significant savings across energy and water. Below provides a summary of the key savings.

- Energy use – Designing to a PUE of 1.35 compared to an industry average of 1.59 results in over to 15% savings in energy use. This amounts to a net reduction of 54,000 MWh/y and 39,000 tCO2e/y. In addition, the energy and greenhouse gas emissions targets are embedded within the NABERS Energy rating tool. The development is targeting a 5-star NABERS Energy rating for the data centre component, with the office component targeting an equivalent 5.5 star rating.
- Water use – Designing to a target WUE of 1.5 compared to the industry standard of 1.8 will result in a 17% saving in water use. This amounts to a net reduction of 151,000 kL/y. The water consumption estimates for the design are provided in Building H water use v1 issued on 21st May 2025.

The mitigation measures in Section 3 also act to impact or influence the ESD principles. The ESD principles that are particularly influenced by the above measures include:

- Intergenerational equity – By reducing environmental impacts and the consumption of resources due to the proposal, the measures help towards ensuring the health and productivity of the environment is maintained for the benefit of future generations.
- The precautionary principle – By reducing environmental impacts and resource consumption, the measures serve to avoid, wherever practicable, serious or irreversible damage to the environment.