Local Planning Policy 4.12: Horticulture

Responsible Directorate	Development Services
Responsible Business Unit/s	Statutory Planning
Responsible Officer	Manager Statutory Planning and Compliance
Affected Business Units	Strategic Planning

Objectives:

- Ensure new horticultural enterprises pose a low risk to catchment water quality and are able to meet or improve catchment standards for water quality.
- Encourage new types of horticultural enterprises which are compatible with Catchment Water Quality Improvement Standards.
- Encourage high standards in horticultural management practices.
- Ensure strategic and statutory proposals do not compromise existing well-managed horticultural developments or compromise potential future horticultural development, of relatively high capability areas.

Definitions

Bushland – land on which there is vegetation which is either a remainder of the natural vegetation on the land, or, if altered, is still representative of the structure and floristics of the natural vegetation and provides the necessary habitat for native fauna (EPA, 2008b).

Catchment – is the area around the wetland or waterway that contributes surface run-off or groundwater to the wetland or waterway.

Catchment Water Quality – The quality of water in ground and surface waters of the Peel – Harvey Coastal Catchment including drains, creeks, wetlands, rivers, and estuarine areas. Water quality parameters include levels of phosphorus, nitrogen, organics, salinity, acidity, and total suspended solids.

Catchment Water Quality Improvement Standards – The threshold levels of nutrients applied to land, or exported from land as described in Appendix C.

Closed System (as in closed system hydroponics) – hydroponics system in which the nutrient solution is recirculated, and the nutrient concentrations are monitored and adjusted accordingly. There is zero or minimal discharge of the solution or water to the environment.

Hydroponics – the process of growing plants using mineral nutrient solutions, with growing media, alternatives to in-situ soil.

In-ground Horticulture – horticulture where the crop is grown directly into in-situ soils and landforms, whether the soils have been amended or not.

Locally Significant Natural Areas – As identified in the Shire of Serpentine Jarrahdale Local Biodiversity Strategy

Site Management Plan - The plan prepared by the proponent to document how the production area and site will be managed over the lifespan of the operation to reduce nutrient export and manage all aspects of the operation in relation to the natural environment, pollution risk, visual landscape, and maintenance of the amenity to neighbouring properties. A checklist to guide preparation of a Site Management Plan is included in Appendix A.

Watercourse – a river, stream creek or manmade drainage features in which water flows in a channel, whether permanently or intermittently (EPA, 2008b)

Wetland – areas of seasonally, intermittently, or permanently waterlogged soils or inundated land, whether natural or artificial, fresh, or saline (EPA, 2008b).

Policy provisions:

- All applications for horticultural pursuits / intensive agriculture proposed within the Peel-Harvey Catchment area, must be referred to the Department of Water and Environment Regulation (DWER) and the Department of Primary Industries and Regional Development (DPIRD) for comment and any other agency the Shire deems relevant.

- Planning applications within *high-risk areas* (as defined by Appendix E) are not to be supported by the Shire unless comments received from the DWER and DPIRD are in support of the application.

- All proposals for horticultural development must be accompanied by a Site management plan. (Appendix A requirements)

- Proposals for horticultural operations must pose a low risk to catchment water quality and land resources and aim to achieve the Catchment Water Quality Improvement Standards as contained within Appendix C.

- All proposals for annual and perennial horticulture and viticulture which are located on soil-landscape mapping units which are not potentially suitable for the proposed type of horticulture (Appendix E) should be accompanied by a Site Management Plan which reduces nutrient export risks to achieve Catchment Water Quality Improvement Standards, and must include, but not limited to:
  i. Site-specific soil testing
  ii. Site-specific land capability assessment
  iii. Nutrient Export Risk Assessment.

iv. All other details listed in Appendix A, including measures to reduce risk of nutrient export.

- All proposals for nurseries (potted plants) and closed systems (e.g., closed system hydroponics) are to be accompanied by a Site Management Plan with sufficient detail to demonstrate how the proposal will pose a low risk to catchment water quality and can be appropriately managed (refer to Appendices A, B & D for the preparation of a Site Management Plan).

- Where on-site soil-landscape conditions vary from the mapped land units, shown in Appendix E, the conditions must be demonstrated by the proponent through site-specific soil testing and site-specific land capability assessment for the proposed type of horticultural land use and included as part of the Site Management Plan.

Relevant Policies/Council Documents

- Planning and Development Act 2015
- Planning and Development (Local Planning Schemes) Regulations 2015
- Serpentine Jarrahdale Local Planning Scheme No. 3

Office Use Only				
Relevant Delegations				
Council Adoption	**Date**	23 July 2018	**Resolution #**	*OCM063/07/18*
Reviewed/Modified	**Date**	15 July 2024	**Resolution #**	*OCM182/07/24*
Reviewed/Modified	**Date**		**Resolution #**	

Appendix A - Checklist for Site Management Plans

The following provides a checklist of the types of information that should be included within a Site Management Plan. Not all information may be required for all proposals. The checklist is not intended to be used as the format/structure of the Site Management Plan. It is intended to list the types of information that are used by government to assess development applications.

Information should be provided in map form where appropriate.

Site conditions	• Soil types and mapping of soil types • Nutrient retaining capacity of soils • Other soil capability issues • Site-specific land capability assessment • Location of vegetation, watercourses, and wetlands • Depth to groundwater • Existing structures and fences
Crop and cultivation details	• Location and size of production area • Future stages of development • Types of crops • Cultivation system • Physical barriers to soil (plastics)
Nutrient inputs and management	• Fertiliser regimes – rate and frequency • Total nutrient input calculation • Nutrient content of fertiliser • Application method • Nutrient monitoring – soil and water • Crop nutrient monitoring
Irrigation management	• Type of irrigation • Water source • Irrigation control and monitoring
Nutrient Export Risk Assessment	• The Nutrient Export Risk Assessment is to provide evidence to the local government (and experts advising the local government) that given the specific site conditions, production system and management practices, the proposal will likely pose a low risk to catchment water quality and other environmental values. • The level of detail to be provided in the risk assessment should be commensurate with the inherent risk posed by the type of production system and predominant landscape-soil units on the site. Where proposals are likely to pose a high risk to catchment water quality or other environmental value, quantitative nutrient budgets for phosphorus and nitrogen may be required in the Assessment.

	• Where appropriate, the Nutrient Export Risk Assessment may be provided in the format of a Nutrient and Irrigation Management Plan (NIMP), such as in cases where a NIMP is required by other agencies such as the Department of Water and Environment Regulation.
Nutrient reduction strategies	• Production area design and establishment • Soil amendment • Soil ameliorants • Type of fertiliser – controlled release fertilisers • Crop monitoring and testing • Soil condition monitoring • Fertiliser application methods • Type of irrigation methods • Cultivation methods • Physical barriers • Vegetative barriers
Details of any other nutrient reduction strategies	e.g., Where not addressed above: • Offset plantings
Information to address other considerations listed in Appendix B relevant to the site and proposal	See below

Appendix B - Other Considerations

Planning matter	Consideration
Protection of groundwater and surface waters	• Potential impacts of dam or drain construction (note: Approvals are generally required for dams and drain construction) • Storage of hydrocarbons, pesticides and other chemical • Levels of total suspended solids and organics in discharge waters (e.g., hydroponics) or drains/watercourses on the site • Levels of salinity and acidity of discharge waters (e.g., hydroponics).
Stormwater management	• Management of runoff from hard surfaces • Management of runoff from production area and site
Wetlands	Proposals should comply with State Government policy regarding: • protection and management of Conservation Category Wetlands • protection and management of Resource Enhancement Wetlands, and \ • management of Multiple Use Wetlands (Water and Rivers Commission, 2001) (EPA, 2008b)
Wetland Buffers	• Wetland buffers should be determined in accordance with the Draft Guideline for the Determination of Wetland Buffer Requirements (WAPC, 2005
Watercourse protection	• Identification of suitable buffers to watercourses • Physical delineation and protection of the buffer area • Restoration of vegetated buffers
Native vegetation and bushland protection	• Protection of: • Regionally and Locally Significant Natural Areas, • Bush Forever Sites • Known location of Declared Rare and listed species of flora and fauna • Threatened Ecological Communities • Priority Ecological Communities • Other significant vegetation and flora • Other habitat for wildlife • Protection of buffers to native vegetation and bushland.
Weeds, pests, and diseases	• Compliance with control and management of species listed under the Biosecurity and Agricultural Management Act and Regulations • Other weed management • Other feral animal management
Odours	• Storage and use of manures

Visual amenity	• Existing vegetation • Proposed revegetation and landscaping
Noise	• Operating hours • Types and standards of machinery or motors
Management of effluent	• Workers' ablution facilities • Effluent treatment systems
Other matters	• Dam construction approval • Drain construction approval • Groundwater abstraction licence • Building approvals • Buffers to sensitive premises • Setbacks

Appendix C - Catchment Water Quality Improvement Standards and Guidance

A1. Phosphorus - For proposals within the Peel-Harvey Coastal Plain Catchment Area.

Phosphorus application rates

To meet targets for phosphorus reduction established in the Peel-Harvey EPP (EPA, 1992) and supported in SPP2.1, proposals for new horticulture should not apply phosphorus at rates exceeding 6.5 kg P/ha/yr (Kelsey *et al,* 2011).

Phosphorus export rates

The following export rates of phosphorus from the Coastal Catchment Area have been determined by State Government (Kelsey *et al*, 2011) to ensure that catchment targets for phosphorus reduction are met:

- 0.29 kg P/ha/yr for sites in the Serpentine River Subcatchments
- 0.28 kg P/ha/yr for sites in the Murray River Subcatchments
- 0.47 kg P/ha/yr for sits in the Harvey Basin

These export rates of phosphorus from the Coastal Catchment Area are end of sub-catchment targets (measured at the end of the sub-catchment). Phosphorus export rates measured at each Site would be higher due to dilution and in-stream losses. However, the actual loss rate that is acceptable will vary depending upon the location of the site taking into account distance to the receiving water body, shape of sub-catchment, slope of the land amongst other factors.

A2. Phosphorus – For all proposals in the Shire of Serpentine Jarrahdale

All other proposals in the Shire of Serpentine Jarrahdale should demonstrate, through a Site Management Plan including a Nutrient Export Risk Assessment, how the proposal will minimise the application and export of phosphorus from the production area and site.

A3. Nitrogen – For proposals within the Peel-Harvey Coastal Plain Catchment Area

To meet targets for nitrogen reduction, proposals for new horticulture should not apply nitrogen (in all forms) at rates exceeding 45 kg N/ha/yr or on average does not discharge nitrogen at rates above 1.2 mg/L (Total Nitrogen) (Kelsey *et al*, 2011).

A4. Nitrogen – for all proposals in the Shire of Serpentine Jarrahdale

All other proposals in the Shire of Serpentine Jarrahdale should demonstrate, through a Site Management Plan including a Nutrient Export Risk Assessment, how the proposal will minimise the application and export of nitrogen from the production area and site.

Appendix D: Guidance on site specific soil testing and land capability assessment for horticulture on the Peel-Harvey coastal plain catchment

The following guidelines have been developed by the Department of Primary Industries and Regional Development (DPIRD) specifically for on-site assessment of annual or perennial horticulture on the Peel-Harvey Coastal Plain. If you have queries regarding this guidance, please contact DPIRD.

Soil sampling, survey and land capability assessment undertaken as a requirement of this policy need to adhere to the following published guidelines:

Soil survey and characterisation

McKenzie NJ, Grundy, MJ, Webster, R and Ringrose-Voase AJ 2008 Guidelines for Surveying Soil and Land Resources Second Edition Australian Soil and Land Survey Handbooks Series 2 CSIRO Publishing

National Committee on Soil and Terrain 2009 Australian Soil and Land Survey Field Handbook Third Edition Australian Soil and Land Survey Handbooks Series 1 CSIRO Publishing; specifically, Soil profile (RC McDonald and RF Isbell)

Soil analysis

Rayment, GE and Lyons DJ 2010 Soil Chemical Methods - Australasia Australian Soil and Land Survey Handbooks Series CSIRO Publishing

Allen, DG and Jeffery, RC 1990 Methods for analysis of phosphorus in Western Australian soils. Report of investigation No:37. Chemistry Centre of Western Australia.

Soil type description and land capability

Isbell, R 2002 The Australian Soil Classification Revised Edition Australian Soil and Land Survey Handbooks Series 4

Schoknecht N and Pathan S 2013 Soil Groups of Western Australia A simple guide to the main soils of Western Australia Fourth Edition Resource Management Technical Report 380 Department of Agriculture and Food. Western Australia

Van Gool, D, Tille P and G Moore 2005 Land evaluation standards for land resource mapping Third edition Resource Management Technical Report 298 Department of Agriculture and Food

Minimum requirements

- Grid survey, free or transverse survey at scale of 1:10 000
- Observations in the range of 1 per ha to a minimum of 0.25 per ha
- On deep sands profiles, observations to extend to at least 100 cm (or to impeding layers if less than 100cm)
- Detailed profile descriptions and sampling of each main soil type at a minimum one site per 10 ha
- GPS coordinates of soil profiles and soil sampling sites or sites located on aerial photo base image
- Detailed soil profiles described to at least 100 cm (or to impeding layers if less than 100cm)

- Description of impeding layer if present
- Horizons depths recorded and for each horizon:
    - Soil colour (Munsell colour chart) main colours and mottles
    - Soil texture
    - Soil structure (if described from soil pit)
- Information on soil samples collected for analysis: sampling depths and type of analysis
- Main soil types identified and classified to WA soil group (plus Australian Soil Classification is preferred)
- The above should be included in a report (e.g., Site Management Plan) and descriptions included in Appendix
- Map of main soil types, preferably marked on aerial photo background, scale, and north needs to accompany report; map should also identify area that is to be developed for horticulture. This map should show location of nearest surface drains creeks and waterways
- The depth to groundwater in winter needs to be assessed. This is difficult if studies are undertaken in summer and may require subsequent information to be provided by proponent if not available. The levels and dates of measurement need to be included in the Site Management Report.

Soil testing

Analysis for soil pH 1:5 Calcium chloride, salinity (EC 1:5), total phosphorus and soil PRI should be undertaken by an accredited laboratory.

The most important aspect for soil phosphorus (P) retention is the Phosphorus Retention Index (PRI) as described by Allen and Jeffery (1990)

Allen, DG and Jeffery, RC 1990 Methods for analysis of phosphorus in Western Australian soils. Report of investigation No:37. Chemistry Centre of Western Australia.

It is also important to interpretation of results of soil PRI against relevant experimental data for horticultural crops on the Swan coastal plain.

Dellar GA, Eales M, McPharlin IR, Delroy ND, and Jeffery RC (1990) Phosphorus retention of sandy horticultural soils on the Swan Coastal Plain Journal of Agriculture Western Australia 4 ser. V31(1) 28-

Dellar et al (1990) has evaluated existing horticultural sites on sandy soils and assessed the P leaching with respect to the PRI. All of the P was retained in the top metre of soil from 25 years of horticultural operations in a soil with a PRI of 7. Based on this a target PRI of 10 for a metre of soil would retain P for at least this period of time.

This could be achieved by a shallower depth of higher PRI, but the minimum depth of the high PRI soil should be greater than the usual operational tillage depth or 30cm. Note that this pertains to predominantly sandy soils and relies on their permeability to make contact with the subsoil and the water table must be greater than 1 metre.

Qualifications of consultant

The report should outline the experience and background of the consultant in soil survey and land capability assessment. A Certified Professional Soil Scientist or Fertcare Accredited Advisor is preferred.

Appendix E: Suitability of soil-landscape mapping units in Shire of Serpentine Jarrahdale for annual horticulture, perennial horticulture, and viticulture

Table 1 provides advice from the Department of Primary Industries and Regional Development (DPIRD) on the potential suitability of mapped soil-landscape units in the (Insert local government name) for in-ground horticulture (Column 5). Mapping of soil-landscape units is available from (insert appropriate source for mapping).

The advice is based on two major assessments:

- The phosphorus export hazard associated with the soil-landscape unit (Column 3); and
- The land capability class rating of the soil-landscape unit for annual horticulture (A), perennial horticulture (P) and vines (V) (Column 4).

DPIRD defines land capability as the ability of the land to sustain a specific land use without undesirable onsite or off-site effects. The essence of land capability assessment is a comparison of the biophysical requirements for a particular land use with the biophysical attributes (or qualities) of the land (Wells and King 1989).

Land capability refers to the ability of land unit to support a type of land use without causing damage (Austin and Cocks, 1978).

The assessments follow the methodology described in van Gool, D, Tille, P J, and Moore, G A. (2005), Land evaluation standards for land resource mapping: assessing land qualities and determining land capability in south-western Australia. Department of Primary Industries and Regional Development, Western Australia, Perth. Report 298. Weblink https://library.dpird.wa.gov.au/rmtr/280/

Proportional land capability categories (Column 4) are denoted in Table 1 using the following symbols: A1 A2, B1, B2, C1 OR C2. These symbols represent the following:

A1 More than 70% of the unit has high capability land (class 1 and 2)

A2 50-69% of the unit has high capability land (class 1 and 2).

B1 More than 70% of the unit has moderate or high capability land (class 1, 2 or 3)

B2 50-69% of the unit has moderate or high capability land (class 1, 2 or 3)

C1 50-69% of the unit has low capability land (class 4 and 5)

C2 More than 70% of the unit has low capability land (class 4 and 5).

Note: Land capability ratings are designed for broad-scale map units in which the availability of water resources for irrigation and the proximity to waterways has not been considered. Any on-site assessment should consider this.

Table 1: Nutrient export risk and suitability for in-ground horticulture in different land units of the Peel-Harvey Coastal Catchment

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
The **Forrestfield System (213Fo**) consists of undulating foot slopes of the Darling Scarp on colluvium over granitic and sedimentary rocks in the eastern margin of the Swan Coastal Plain. Soils include duplex sandy gravels, pale deep sands, and grey deep sandy duplexes. Native vegetation is jarrah-marri forest and woodland.							
213Fo__F1a	Forrestfield F1a phase	1-15% lower slopes with well drained shallow to moderately deep, very gravelly acidic yellow duplex soils and common laterite.	Yes	B2	B2	B2	Yes, APV
213Fo__F1b	Forrestfield F1b phase	1-15% lower slopes with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	Yes	B1	B1	B1	Yes, APV
213Fo__F1c	Forrestfield F1c phase	1-15% lower slopes with well drained deep uniform yellowish brown sands which are generally free of laterite or gravel.	Yes	B1	A2	A2	Yes, APV
213Fo__F2a	Forrestfield F2a phase	Low slopes and foot slopes up to 5-10% with well drained shallow to moderately deep, very gravelly acidic yellow duplex soils and common laterite.	Yes	B1	B2	B2	Yes, APV
213Fo__F2b	Forrestfield F2b phase	Low slopes and foot slopes up to 5-10% with well drained moderately deep to deep, gravelly acidic yellow duplex soils and rare laterite.	Yes	B1	A2	A2	Yes, APV

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
213Fo__F2c	Forrestfield F2c phase	Low slopes and foot slopes up to 5-10% slopes with well drained deep uniform yellowish brown sands which are generally free of laterite or gravel.	Yes	B1	B1	B1	Yes, APV
213Fo__F3	Forrestfield F3 phase	1-3% foot slopes with deep, imperfectly drained yellow and, less commonly, acidic gley duplex soils.	Yes	B1	B2	B1	Yes, APV
213Fo__F4	Forrestfield F4 phase	Incised stream channels within gentle slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	No	C1	C2	C2	No
213Fo__F5	Forrestfield F5 phase	Poorly defined stream channels on lowest slopes with deep acidic yellow duplex soils and sandy alluvial gradational brown earths.	No	C2	C2	C2	No
213Fo__Ff1	Forrestfield (D Range) F1 phase	Foot and low slopes < 10% with deep rapidly drained siliceous yellow brown sands, and pale or bleached sands with yellow-brown subsoil. Shrubland of unidentified species.	Yes	B1	A2	A1	Yes, APV

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
The **Pinjarra System (213Pj)** consists of poorly drained coastal plains on alluvium over sedimentary rocks. Soils include semi-wet soils, grey deep sandy duplexes, brown loamy earths, pale sands, and clays. Native vegetation is mainly jarrah-marri-wandoo-paperbark forest and woodland.							
213Pj__B1	Pinjarra, B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale-yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No	B1	B1	B1	No
213Pj__B1a	Pinjarra, B1a phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.	Yes	B1	A2	A2	Yes, APV
213Pj__B2	Pinjarra, B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan 1-2 metres.	No	B1	B1	B1	No

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
213Pj__B2a	Pinjarra, B2a phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	Yes	B1	A1	A1	Yes, APV
213Pj__B3	Pinjarra, B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	No	C2	C2	C2	No
213Pj__B4	Pinjarra, B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	No	C2	C2	C2	No
213Pj__B6	Pinjarra, B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	No	C2	C2	C2	No

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
213Pj__P1a	Pinjarra P1a phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay; imperfect to poorly drained and generally not susceptible to salinity.	Yes	B2	C2	C1	Yes A
213Pj__P1b	Pinjarra P1b phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Moderately deep pale sand to loamy sand over clay: imperfectly drained and moderately susceptible to salinity in limited areas.	Yes	B2	C2	B2	Yes A V
213Pj__P1c	Pinjarra P1c phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Deep pale brown to yellowish sand to sandy loam over clay; imperfectly drained and moderately susceptible to salinity in limited areas.	Yes	B1	C2	B1	Yes A V
213Pj__P1d	Pinjarra P1d phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over clay;	Yes	C2	C2	C2	No Unless land capability constraints can be managed

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
		imperfect to poorly drained and moderately susceptible to salinity.					
213Pj__P1e	Pinjarra P1e phase	Flat to very gently undulating plain with deep acidic mottled yellow duplex (or effective duplex) soils. Shallow pale sand to sandy loam over very gravelly clay; moderately well drained.	Yes	B1	B2	B1	Yes APV
213Pj__P2	Pinjarra P2 phase	Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam over clay.	Yes	C2	C2	C2	No Unless land capability constraints can be managed
213Pj__P2a	Pinjarra P2a phase	Flat to very gently undulating plain with deep alkaline mottled yellow duplex soils which generally consist of shallow pale sand to sandy loam with a silcrete hardpan at 50-100 cm depth generally on top of an olive-grey clay.	No	C2	C2	C2	No

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
213Pj__P3	Pinjarra P3 phase	Flat to very gently undulating plain with deep, imperfect to poorly drained acidic gradational yellow or grey-brown earths and mottled yellow duplex soils, with loam to clay loam surface horizons.	Yes	C2	C2	C2	No Unless land capability constraints can be managed
213Pj__P4	Pinjarra P4 phase	Poorly drained flats, sometimes with gilgai microrelief and with moderately deep to deep black, olive grey and some yellowish-brown cracking clays and less commonly non-cracking friable clays with generally acidic subsoils.	Yes	C2	C2	C2	No Unless land capability constraints can be managed
213Pj__P4a	Pinjarra P4a phase	Poorly drained flats. Cracking clays similar to P4 with a thin veneer of grey sand.	Yes	C2	C2	C2	No Unless land capability constraints can be managed
213Pj__P5	Pinjarra P5 phase	Poorly drained flats, commonly with gilgai microrelief and with deep black grey to olive-brown cracking clays with subsoils becoming alkaline.	Yes	C2	C2	C2	No Unless land capability constraints can be managed

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
213Pj__P5a	Pinjarra P5a phase	Poorly drained flats. Cracking clays similar to P5 with a thin veneer of grey sand.	Yes	C2	C2	C2	No Unless land capability constraints can be managed
213PjSWP6a	Pinjarra P6a phase	Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well drained soils associated with major current river systems and larger streams. Acidic red and yellow duplex soils, less common.	Yes	A1	B1	A1	Yes APV
213PjSWP6b	Pinjarra P6b phase	Very gently undulating alluvial terraces and low rises contiguous with the plain, with deep moderately well to well drained soils associated with prior stream deposits. Soils are uniform brownish sands.	Yes	B1	A2	A1	Yes APV
213PjSWP6c	Pinjarra P6c phase	Very gently undulating alluvial terraces and fans. Moderate to moderately well drained uniform friable brown loams, or well-structured gradational brown earths.	Yes	A1	B1	A1	Yes APV

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
213Pj__P7	Pinjarra P7 phase	Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and gley sandy duplex and effective duplex soils.	No	C2	C2	C2	No
213Pj__P7a	Pinjarra P7a phase	Seasonally inundated swamps and depressions with very poorly drained variable acidic mottled yellow and gley duplex soils becoming alkaline with depth.	No	C2	C2	C2	No
213Pj__P7b	Pinjarra P7b phase	Seasonally inundated swamps and depressions or seepage areas near the base of the foothills with very poorly drained deep bleached siliceous sands.	No	C2	C2	C2	No
213Pj__P8	Pinjarra P8 phase	Broad poorly drained flats and poorly defined stream channels with moderately deep to deep sands over mottled clays; acidic or less commonly alkaline gley and yellow duplex soils to uniform bleached or pale brown sands over clay.	Yes	C2	C2	C2	No Unless land capability constraints can be managed

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
213Pj__P9	Pinjarra P9 phase	Shallowly incised stream channels of minor creeks and rivers with deep acidic mottled yellow duplex soils.	No	C2	C2	C2	No
213Pj__P9a	Pinjarra P9a phase	Generally shallow incised stream channels of minor creeks and rivers with poorly drained deep mottled yellow duplex soils, becoming alkaline with depth.	No	C2	C2	C2	No
213PjSWP10	Pinjarra P10 phase	Gently undulating to flat terraces adjacent to major rivers, but below the general level of the plain, with deep well drained uniform brownish sands or loams subject to periodic flooding.	Yes	B2	A2	A2	Yes APV
213PjSWP10a	Pinjarra P10a phase	Flat terraces adjacent to major rivers with deep black cracking clays with alkaline subsoils; soils similar to P5.	No	C2	C2	C2	No
213Pj__P11	Pinjarra P11 phase	Shallow brown loamy soils or less commonly, very shallow sands over ironstone pavement which is a clear barrier to drainage.	Yes	C2	C2	C2	No Unless land capability constraints can be managed

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Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
The **Bassendean System (212Bs)** consists of sand dunes and sand plains with flats and swamps on sandy alluvium over sedimentary rocks. Soils include pale deep sand, semi-wet soil, and wet soil. These soils have low fertility and are susceptible to leaching. In the Peel, these soils may become waterlogged because of high groundwater levels and may become flooded in some areas. Native vegetation is mainly banksia-paperbark woodlands and mixed heaths.							
212Bs__B1	Bassendean B1 phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands sometimes with a pale-yellow B horizon or a weak iron-organic hardpan at depths generally greater than 2 m; banksia dominant.	No	B1	B1	B1	No
212Bs__B1a	Bassendean B1a phase	Extremely low to very low relief dunes, undulating sandplain and discrete sand rises with deep bleached grey sands with an intensely coloured yellow B horizon occurring within 1 m of the surface; marri and jarrah dominant.	Yes	B1	B1	B1	Yes, APV
212Bs__B2	Bassendean B2 phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with a pale-yellow B horizon or a weak iron-organic hardpan 1-2 metres.	No	B1	B1	B1	No

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
212Bs__B2a	Bassendean B2a phase	Flat to very gently undulating sandplain with well to moderately well drained deep bleached grey sands with an intensely coloured yellow B horizon usually well within 1 m of the surface.	No	B1	A1	A1	No
212Bs__B3	Bassendean B3 phase	Closed depressions and poorly defined stream channels with moderately deep, poorly to very poorly drained bleached sands with an iron-organic pan, or clay subsoil. Surfaces are dark grey sand or sandy loam.	No	C2	C2	C2	No
212Bs__B4	Bassendean B4 phase	Broad poorly drained sandplain with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	No	C2	C2	C2	No
212Bs__B5	Bassendean B5 phase	Shallowly incised stream channels of minor creeks and rivers with deep grey siliceous sands or bleached sands, underlain at depths generally greater than 1.5 m by clay or less frequently a strong iron-organic hardpan.	No	C2	C2	C2	No

Soil-landscape mapping unit			Less than 50% of the map unit classed as High, Very High or Extreme Phosphorus Export Hazard?	Proportional Land Capability Category for In-ground Horticulture			Is the map unit potentially suitable for in-ground horticulture? A=Annual P = Perennial V= Vines
Map Unit Symbol	**Map Unit Name**	**Map unit description**		Annual (A)	Perennial (P)	Vines (V)	
212Bs__B6	Bassendean B6 phase	Sandplain and broad extremely low rises with imperfectly drained deep or very deep grey siliceous sands.	No	C2	C2	C1	No