Government of Western Australia
Department of Water and Environmental Regulation

Licence

Licence number	L6989/1997/14
Licence holder	Shire of Augusta Margaret River
Registered business address	41 Wallcliffe Road MARGARET RIVER WA 6285
DWER file number	2013/003284-1
Duration	19/12/2022 to 18/12/2042
Date of issue	16/12/2022
Date of amendment	9/04/2025
Premises details	Davis Road Putrescible Landfill Davis Road FOREST GROVE WA 6286 Legal description - Lot 5011 on Plan 192309 As shown in Schedule 1

Prescribed premises category description (Schedule 1, ***Environmental Protection Regulations 1987***)	**Assessed design capacity**
Category 64 – Class II putrescible landfill site: premises (other than clean fill premises) on which waste of a type permitted for disposal for this category of prescribed premises, in accordance with the *Landfill Waste Classification and Waste Definitions 1996*, is accepted for burial.	20,000 tonnes per annual period

This licence is granted to the licence holder, subject to the attached conditions, on 9 April 2025, by:

Abbie Crawford

Digitally signed by Abbie Crawford
Date: 2025.04.09 11:49:35 +08'00'

Abbie Crawford
MANAGER, WASTE INDUSTRIES
an officer delegated under section 20 of the *Environmental Protection Act 1986* (WA)

Licence history

Date	Reference number	Summary of changes
23/10/2019	L6989/1997/13	Licence amendment for construction and operation of Cell 3 and new leachate pond – refer to Decision Report dated 23 October 2019.
23/12/2019	L6989/1997/13	Administrative amendment to correct typographical errors in conditions 2.1.5 and 2.1.7.
16/12/2022	L6989/1997/14	Licence renewal.
09/04/2025	L6989/1997/14	Licence amendment for Phase 1 landfill capping works and submission of the Closure and Post-Closure Management Plan

Interpretation

In this licence:

(a) the words 'including', 'includes' and 'include' in conditions mean "including but not limited to", and similar, as appropriate;

(b) where any word or phrase is given a defined meaning, any other part of speech or other grammatical form of that word or phrase has a corresponding meaning;

(c) where tables are used in a condition, each row in a table constitutes a separate condition;

(d) any reference to an Australian or other standard, guideline, or code of practice in this licence:

  (i) if dated, refers to that particular version; and

  (ii) if not dated, refers to the latest version and therefore may be subject to change over time;

(e) unless specified otherwise, any reference to a section of an Act refers to that section of the EP Act; and

(f) unless specified otherwise, all definitions are in accordance with the EP Act.

NOTE: This licence requires specific conditions to be met but does not provide any implied authorisation for other emissions, discharges, or activities not specified in this licence.

This licence does not provide any implied authorisation for the clearing of native vegetation in order to meet the conditions or activities specified in this licence, beyond that approved under licence conditions 22 and 23 herein. Any further clearing of native vegetation requires a separate Native Vegetation Clearing Permit issued under the EP Act.

Licence conditions

The licence holder must ensure that the following conditions are complied with:

Construction phase

Infrastructure and equipment

1. The licence holder must construct the infrastructure listed in Table 1 in accordance with the requirements of Table 1.

Table 1: Infrastructure design and construction requirements

Infrastructure	Design and construction requirements	Location
Phase 1 stormwater pond 1	(a) To be constructed to contain runoff produced as a result of a '1 in 100' year, 24 hour rainfall event; (b) To be constructed from earth; and (c) To be constructed to a length of 75 m, a width of 40 m, and a depth of 3 m.	Schedule 1, Figure 4
Phase 1 stormwater swales 1 to 5	(a) To be constructed to contain runoff produced as a result of a '1 in 100' year, 24 hour rainfall event; (b) Swales are to be trapezoidal, open channels constructed from earth; (c) Swale 1 to be constructed to an approximate length of 560 m, bottom width of 0.3 m, top width of 4.5 m and height of 0.7 m; (d) Swale 2 to be constructed to an approximate length of 228 m, bottom width of 0.3 m, top width of 4.5 m and height of 0.7 m; (e) Swale 3 to be constructed to an approximate length of 115.4 m, bottom width of 0.3 m, top width of 3.66 m and height of 0.56 m; (f) Swale 4 to be constructed to an approximate length of 147 m, bottom width of 0.0 m, top width of 0.98 m and height of 0.14 m and (g) Swale 5 to be constructed to an approximate length of 161 m, bottom width of 0.3 m, top width of 2.1 m and height of 0.8 m.	Schedule 1, Figure 4
Phase 1 culverts 1 to 3	(a) To be constructed to contain runoff produced as a result of a '1 in 100' year, 24 hour rainfall event; (b) Culverts are to be constructed from Class 4 reinforced concrete; (c) Culvert 1 to be constructed to an approximate length of 12 m, with a pipe with an internal diameter of 674mm; (d) Culvert 2 to be constructed to an approximate length of 20.7 m, with a pipe with an internal diameter of 445 mm; and (e) Culvert 3 to be constructed to an approximate length of 29.6 m, with an internal diameter of 445 mm.	Schedule 1, Figure 4
Phase 1 landfill gas venting wells GV-1, GV-2, GV-3, GV-4, GV-5, GV-6, GV-7, GV-9 and GV-10	Gas venting wells are to be constructed in accordance with Schedule 1, Figure 5 with the following characteristics: (a) Gravel for use in the pack aggregate to be: (i) washed; (ii) rounded to sub-rounded and non-calcareous (< 5% carbonate); (iii) sized sufficiently larger than the pipework slots/perforations to prevent blocking; and (iv) shall have 100% passing through a 50 mm sieve and < 5% passing through a 19 mm sieve;	Schedule 1, Figure 5

Infrastructure	Design and construction requirements	Location
	(b) Well head assembly to: (i) be installed as per the manufacturer's specifications; (ii) have a minimum 150 mm diameter stainless steel aspiromatic cowl with minimum flow of capacity of 150 m^3/year; (iii) have a protective bird cage with a minimum clearance to the aspiromatic cowl of 75 mm and mild steel mesh of maximum squares 25mm, with galvanised or painted epoxy finish; (iv) have fasteners to allow the cowl to be hinged back for inspection and cleaning; (v) have a minimum 3 mm steel plate adaptor flange bolted to steel vent stack with galvanised or painted finish; (vi) have a sampling port; (vii) have a hinged or bolted transition flange; and (viii) be installed so that the measurement tube assembly is concentric with the well casing. (c) Pipework to: (i) be manufactured in accordance with AS/NZS 4131, including joints and junctions; (ii) be constructed from 160 mm high density polyethylene (HDPE) SDR17, including joints and junctions, with the exception of venting well GW5 which will be 50 mm HDPE SDR17; (iii) be joined to form a flush union by either screw-fit connections or butt-fusion full-face welds; (iv) have a HDPE end cap fitted to the pipe at the base of the well; (v) have a neoprene seal installed around the solid section of pipe to clamp the Linear Low-Density Polyethylene geomembrane layer pipe boot; (vi) be installed using a drill barrel auger of ≥ 450 mm in diameter; (vii) consist of perforated pipe extending from the base of the well to 1 m below the surface level of the final capping layer, and solid non-perforated pipe extending from 1 m below the surface level of the final capping layer to 2.5 m above the final capping layer to accommodate the 1.3 m thick capping system; and (viii) venting well GW5 shall also consist of a horizontal perforated pipe leading to the western side of the landfill, be wrapped in a filter sock, installed within a 600 mm wide by 300 mm deep trench and surrounded by non-calcareous aggregate. (d) If a venting well cannot be advanced to the target depth, it shall be relocated within 5 m from its original position. If the second attempt is unsuccessful, the well will be relocated to the opposite side of the original location. If any well cannot be advanced to the target depth, the licence holder is to advise the CEO of the outcome; and (e) If construction of a venting well is to be left incomplete overnight or longer, a temporary gas-tight cap is to be installed on the top of the casing until construction can recommence.	

Infrastructure	Design and construction requirements	Location
Phase 1 landfill gas perimeter wells G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G12, G13	Gas perimeter wells are to be constructed in accordance with Schedule 1, Figure 5 with the following characteristics: (a) Gravel for use in the pack aggregate to be: (i) washed; (ii) rounded to sub-rounded and non-calcareous (< 5% carbonate); (iii) sized sufficiently larger than the pipework slots/perforations to prevent blocking; and (iv) shall have 100% passing through a 50 mm sieve and < 5% passing through a 19 mm sieve. (b) Well head assembly to: (i) be installed as per the manufacturer's specifications; (ii) have a lockable steel headworks set at a minimum of 500 mm above ground level; and (iii) have a valve port for gas sampling. (c) Pipework to: (iv) be constructed from 50 mm PVC casing; (v) be joined to form a flush union by either screw-fit connections or butt-fusion full-face welds; (vi) have a PVC end cap fitted to the pipe at the base of the well; (vii) be installed using a drill barrel auger of ≥ 150 mm in diameter; (viii) consist of perforated pipe extending from the base of the well to 1.6 m below ground level which is to be fitted with a filter sock and surrounded by gravel pack aggregate; (ix) consist of solid non-perforated pipe extending from 1.6 m below ground level to 0.5 m above ground level; (x) the solid non-perforated pipe from 1.6 m below ground level to 1.3 m below ground level is to be surrounded by gravel pack aggregate; (xi) the solid non-perforated pipe from 1.3 m below ground level to 0.3 m below ground level is to be surrounded by a bentonite seal; and (xii) the solid non-perforated pipe from 0.3 m below ground level to ground level is to be surrounded by concrete. (d) If a perimeter well cannot be advanced to the target depth, it shall be relocated within 5 m from its original position. If the second attempt is unsuccessful, the well will be relocated to the opposite side of the original location. If any well cannot be advanced to the target depth, the licence holder is to advise the CEO of the outcome.	Schedule 1, Figure 5

Environmental compliance report

2. The licence holder must within 30 calendar days of an item of infrastructure required by condition 1 being constructed:

(a) undertake an audit of their compliance with the requirements of condition 1; and

(b) prepare and submit to the CEO an Environmental Compliance Report on that compliance.

3. The Environmental Compliance Report required by condition 2, must include as a minimum the following:

(a) certification by a suitably qualified civil engineer (see Table 15) that the items of infrastructure or components thereof as specified in condition 1, have been constructed in accordance with the relevant requirements specified in condition 1;

(b) as constructed plans and a detailed site plan for each item of infrastructure or component of infrastructure specified in condition 1; and

(c) be signed by a person authorised to represent the licence holder and contains the printed name and position of that person.

Landfill capping

4. All laboratory tests must be performed in a NATA accredited geosynthetics laboratory.

5. The licence holder must ensure that the capping works of the landfill cells specified in Table 2 meet or exceed the corresponding specifications in that table.

Table 2: Landfill capping works specifications

Landfill capping phase	Specifications	Date of completion
Phase 1: Cell 1, northern and western portion of the unlined historic landfill (see Schedule1, Figure 3)	The landfill cell cap is to be constructed in accordance with Schedule 1, Figure 7 with the following characteristics: (a) regulating layer atop waste, with the following characteristics: (i) 200 mm in thickness; (ii) Free from organic matter, perishable material, or other deleterious material; (iii) maximum particle size of < 50 mm; and (iv) clay to consist of ≤ 80% liquid limit and/or plasticity index of ≤ 55%. (b) Linear Low-Density Polyethylene geomembrane layer to be at least 1.5 mm thick, double textured. (c) high permeability geosynthetic subsoil drainage layer. (d) 1,000 mm of soil cover atop drainage layer; (e) 100 mm of topsoil / growing medium; and (f) side batters with slope no steeper than 1 (vertical) in 4 (horizontal) and no less than 1 (vertical) in 20 (horizontal).	No later than 12 months following the completion of waste disposal in Phase 1.

6. The licence holder must undertake construction quality assurance testing for the Linear Low-Density Polyethylene (LLDPE) geomembrane layer installed during Phase 1 capping works, in accordance with Table 3.

Table 3: LLDPE geomembrane construction quality assurance testing

Item	Property	Standards	Frequency
Visual inspection	Colour, thickness, needle punching, presence of needles or broken needles, and sewing density or other faults in the material	N/A	Every roll
Conformance testing upon shipment to site	Asperity height	ASTM D7466	Every second roll
	Thickness	ASTM D5199	One sample per 5,000 m², or every five rolls delivered to site, whichever is the greatest number of tests
	Density	ASTM D1505 ASTM D792	
	Tensile properties – break strength	ASTM D6693	
	Tensile properties – break elongation	Type IV	
	Tear resistance	ASTM D1004	
	Puncture resistance	ASTM D4833	
	Carbon black content	ASTM D1603(4)	
	Carbon black dispersion	ASTM D5596	
	Axi – Symmetric break resistance strain	ASTM D5617	Per formulation
	2% Modulus	ASTM D5323	Per formulation
	Oxidative induction time (OIT) – standard	ASTM D3895	One sample every 10,000 m², or resin type or manufacturing run whichever is the greatest number of tests
	Oxidative induction time (OIT) – high pressure	ASTM D5885	
	Oven aging at 85°C	ASTM D5721	Per formulation
	Oven aging at 85°C – standard OIT	ASTM D3895	
	Oven aging at 85°C – high pressure OIT	ASTM D5885	
	UV resistance – standard OIT	ASTM D3895	Per formulation
	UV resistance – high pressure OIT	ASTM D5885	Per formulation

Item	Property	Standards	Frequency
Start-up test weld	Welding equipment	-	Start of works daily and whenever the welding equipment is shut off for more than one hour. Also after significant changes in weather conditions.
	Weld conditions	-	Test weld strips will be required whenever personnel or equipment are changed and/or wide temperature fluctuations are experienced. Minimum 1.5 m continuous seam.
Destructive weld testing	Onsite, hand tensiometer in peel and shear	ASTM D6392	Every weld
Non-destructive weld testing	Air pressure test	ASTM D5820	All seams over full length
	Vacuum box test	ASTM D5641	

Construction quality assurance report

7. The licence holder must within 30 calendar days of an item of infrastructure required by condition 5 being constructed:

(a) undertake an audit of their compliance with the requirements of condition 5; and

(b) prepare and submit to the CEO a Construction Quality Assurance Report on that compliance.

8. The Construction Quality Assurance Report required by condition 7 must include as a minimum the following:

(a) certification by a suitably qualified geotechnical engineer (see Table 15) that the items of infrastructure or components thereof as specified in condition 5, have been constructed in accordance with the relevant requirements specified in condition 5;

(b) as constructed plans and a detailed site plan for each item of infrastructure or component of infrastructure specified in condition 5;

(c) document the quality of the completed capping works for Phase 1;

(d) demonstrate that all requirements of the capping works specifications and the quality assurance provisions specified in condition 6 have been complied with;

(e) assess test results against tolerance standards;

(f) document all repairs resulting from non-destructive weld testing;

(g) be signed by a person authorised to represent the licence holder and contains the printed name and position of that person.

Premises operation

9. The licence holder must only accept waste on to the premises if:

(a) it is of a type listed in Table 4;

(b) the quantity accepted is below any quantity limit listed in Table 4;

(c) it meets any specification listed in Table 4; and

(d) in the case of solid contaminated waste, is supported by documentation that demonstrates compliance with the acceptance criteria for Class II landfills.

Table 4: Waste acceptance

Waste type	Quantity limit tonnes / year	Specification[1]
Inert Waste Type 1	Combined total of 20,000 tonnes per annual period.	None specified
Special Waste Type 1		
Putrescible Waste		
Contaminated Solid Waste		Must meet the acceptance criteria for Class I and Class II landfills.
Hazardous waste		Waste oil, vehicle batteries, paint and metal and plastic chemical containers only.

Note 1: Additional requirements for the acceptance of controlled waste (including asbestos and tyres) are set out in the *Environmental Protection (Controlled Waste) Regulations 2004*.

10. The licence holder must ensure that where waste does not meet the waste acceptance criteria set out in Table 4 it is removed from the premises by the delivery vehicle or, where that is not possible, stored in a quarantined storage area or container and removed to an appropriately authorised facility as soon as practicable.

11. The licence holder must ensure that wastes accepted on to the premises are only subjected to the processes set out in Table 5 and in accordance with any process limits described in that Table.

Table 5: Waste processing

Waste type	Process	Process limits[1]
All	Disposal of waste by landfilling	(a) Disposal of waste by landfilling must only take place within Landfill Cell 3 area shown on the Premises layout map in Figure 2.
Inert Waste Type 1	Receipt, handling and disposal of waste by landfilling, or storage prior to removal offsite	(a) None specified.
Contaminated Solid Waste		
Special Waste Type 1		(a) Only to be disposed of into a designated asbestos disposal area within the landfill; (b) Not to be deposited within 2m of the final tipping surface of the landfill; and (c) No works shall be carried out on the landfill that could lead to a release of asbestos fibers.
Hazardous waste	Receipt, handling and storage prior to removal offsite	(a) Drum Muster products must be triple rinsed prior to acceptance on the premises; (b) Waste oil, paint, vehicle batteries must be stored in a fully enclosed bunded area/container.
Putrescible Waste	Receipt, handling and storage prior to disposal by landfilling	<u>Greenwaste</u> (a) No more than 10,000 cubic metres of green waste shall be stored at any one time; (b) Green waste must not be stored in a dried state; (c) No more than 6,000 cubic metres of mulched green waste can be stored at any one time; (d) All mulched green waste must be stored in windrows; and (e) A 5 m fire break must be maintained around all areas used to store green waste.

Note 1: Additional requirements for the acceptance and landfilling of controlled waste (including asbestos and tyres) are set out in the *Environmental Protection (Controlled Waste) Regulations 2004*.

12. The licence holder must ensure that the premises infrastructure and equipment is maintained and operated in accordance with the requirements set out in Table 6.

Table 6: Infrastructure requirements

Infrastructure	Infrastructure requirements
Leachate pond (see Schedule 1, Figure 2)	(a) Liner to be maintained to achieve a permeability of ≤1x10^{-9} m/s or equivalent. (b) To be maintained to contain an operational volume of 23,165 m^3; (c) a top of embankment freeboard of 500 mm is maintained within the leachate pond. (d) The head of leachate within the leachate sump of Landfill Cell 3 is maintained at a level equal to or less than 1m. (e) the leachate transfer pipeline must be inspected on at least a weekly basis and ensure that any detected leaks are repaired as soon as practicable. (f) Any equipment used for the purpose of evaporation or aeration of leachate must not generate spray drift beyond the perimeter of the leachate pond (namely the lined pond footprint).
Landfill cap (see Schedule 1, Figure 3)	(a) To be maintained as free of leaks and defects. (b) Vehicles and machinery not to traverse the surface of the cap.
Phase 1 Stormwater Pond 1 (see Schedule 1, Figure 4)	(a) To be maintained to contain an operational volume of 4,116 m^3. (b) To be maintained with a freeboard of 300 mm.
Phase 1 stormwater swales 1 to 5 (see Schedule 1, Figure 4)	(a) To be maintained with a freeboard of 300 mm. (b) To be maintained to be free of blockages.
Phase 1 culverts 1 to 3 (see Schedule 1, Figure 4)	(a) To be maintained to be free of leaks, defects and blockages.
Phase 1 landfill gas venting wells GV-1, GV-2, GV-3, GV-4, GV-5, GV-6, GV-7, GV-9 and GV-10 (see Schedule 1, Figure 5)	(a) To be operated and maintained in accordance with the manufacturer's specifications.
Phase 1 landfill gas perimeter wells G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G12, G13 (see Schedule 1, Figure 5)	(a) To be operated and maintained in accordance with the manufacturer's specifications.
Groundwater monitoring bores M1, P1, P2, MW1, MW2, MW3, MW4, MW5, MW6, MW7, MW8 and MW9 (see Schedule 1, Figure 8)	(a) To be maintained in accordance with the manufacturer's specifications.

13. The licence holder must manage the landfilling activities to ensure:

(a) the size of the tipping face is kept to a minimum and not larger than 2 metres in vertical height and 30 metres in length;

(b) where waste received in Cell 3 is to be placed against existing internal waste batter of former active landfill cells, benches 2 metres in vertical height and 2 metres in horizontal depth are cut into the existing waste;

(c) waste is levelled and compacted to ensure all faces are stable and capable of retaining rehabilitation material;

(d) daily cover and intermediate cover is applied in accordance with Condition 14;

(e) waste exposed by the process of cutting benches into the existing landfill waste body is covered as soon as possible after being exposed and not later than by the end of the working day; and

(f) rehabilitation of a cell or phase takes place within 6 months after disposal in that cell or phase has been completed.

14. The licence holder must ensure that cover is applied to waste in accordance with Table 7 and that at all times sufficient stockpiles of cover are maintained on site.

Table 7: Cover requirements [1]

Waste Type	Material	Depth	Timescales
Special Waste Type 1	Inert Waste Type 1 or clean fill	300 mm	As soon as practicable after deposit and prior to compaction.
		1,000 mm	By the end of the working day in which the asbestos waste was deposited.
Putrescible waste (non-green waste)		150 mm	By the end of the working day in which the waste was deposited.
Contaminated solid waste			
Putrescible waste (non-green waste)		300 mm	As soon as practicable where the deposited waste surface will not receive active waste for more than 90 consecutive calendar days.
Contaminated solid waste			

Note 1: Additional requirements for the covering of tyres are set out in Part 6 of the EP Regulations.

15. The licence holder must:

(a) erect and maintain suitable fencing to prevent unauthorised access to the premises;

(b) ensure that any entrance gates to the premises are securely locked when the premises are unattended; and

(c) undertake regular inspections of all security measures and repair damage as soon as practicable.

16. The licence holder must ensure that wind-blown waste is contained within the boundary of the premises and that wind-blown waste is returned to the tipping area on at least a weekly basis.

17. The licence holder must install and maintain a sign at the entrance to the premises which clearly displays the following information:

(a) hours of operation;

(b) contact telephone number;

(c) a warning indicating penalties for people lighting fires; and

(d) list of materials accepted for recycling and the location of where they can be deposited on the premises.

18. The licence holder must ensure that vermin, birds, flies and other insects do not give rise to nuisance at the premises or in the immediate area of the premises. Any method used by the licence holder must not cause environmental pollution.

19. The licence holder must ensure stormwater does not pond on the surface of the active cell.

20. The licence holder must ensure that no visible dust generated from the primary activities crosses the boundary of the premises.

Emissions

21. The licence holder must ensure that emissions are discharged in accordance with Table 8.

Table 8: Authorised discharge points from Phase 1 of landfill capping

Emission	Emission reference	Emission point
Landfill gas	Phase 1 landfill gas venting wells: GV-1, GV-2, GV-3, GV-4, GV-5, GV-6, GV-7, GV-9 and GV-10. (as depicted in Schedule 1, Figure 5)	Aspiromatic cowls

Clearing

22. The licence holder is permitted to clear native vegetation from 24 October 2019 to 24 October 2029 inclusive, within the area cross-hatched yellow on the Clearing Plan depicted in Figure 9 in Schedule 1, subject to conditions 23 to 27 of this licence.

23. The licence holder must not clear more than 1.64 hectares of native vegetation within the area cross-hatched yellow on the Clearing Plan depicted in Figure 9 in Schedule 1.

24. In determining the amount of native vegetation to be cleared authorised under this licence, the licence holder must have regard to the following principles, set out in order of preference:

(a) avoid the clearing of native vegetation;

(b) minimise the amount of native vegetation to be cleared; and

(c) reduce the impact of clearing on any environmental value.

25. When undertaking any clearing or other activity authorised under this Licence, the licence holder must take the following steps to minimise the risk of the introduction and spread of weeds and dieback:

(a) clean earth-moving machinery of soil and vegetation prior to entering and leaving the area to be cleared;

(b) ensure that no known dieback or weed-affected soil, mulch, fill or other material is brought into the area to be cleared; and

(c) restrict the movement of machines and other vehicles to the limits of the areas to be cleared.

Fauna management

26. The licence holder must conduct clearing in a slow progressive manner towards surrounding remnant vegetation to allow fauna to escape the clearing activity.

27. Prior to undertaking any clearing or other activity authorised under conditions 22 to 26 of this licence, the licence holder must install two artificial black cockatoo nesting hollows within the area hatched red on the Clearing Plan depicted in Figure 9 in Schedule 1. The artificial black cockatoo nest hollows of this licence must:

(a) be designed and placed in accordance with the guidelines provided in Schedule 2 to this licence; and

(b) be monitored and maintained in accordance with the guidelines provided in Schedule 3 to this licence, for a period of at least 10 years.

Records must be kept

28. The licence holder must maintain the following records for activities done in pursuant to this licence:

(a) in relation to the clearing of native vegetation authorised under this Licence:

(i) the location where the clearing occurred, recorded using a Global Positioning System (GPS) unit set to Geocentric Datum Australia 1994 (GDA94), expressing the geographical coordinates in Eastings and Northings;

(ii) the date that the area was cleared;

(iii) the size of the area cleared (in hectares);

(iv) actions taken to avoid, minimise and reduce the impacts and extent of clearing in accordance with condition 24 of the licence;

(v) actions taken to minimise the risk of the introduction and spread of weeds and dieback in accordance with condition 25 of the licence; and

(vi) actions taken in accordance with condition 26 of this licence.

(b) in relation to fauna management pursuant to condition 27 of this licence:

(i) the date each artificial black cockatoo nest hollow was installed;

(ii) the location of each artificial black cockatoo nest hollow installed, recorded using a GPS unit set to GDA94, expressing the geographical coordinates in Eastings and Northings or decimal degrees;

(iii) a photo of each artificial black cockatoo nest hollow installed;

(iv) the dates each artificial black cockatoo nest hollow installed was monitored;

(v) a description of the monitoring methodology employed for each artificial black cockatoo nest hollow installed;

(vi) a description of the monitoring observations for each artificial black cockatoo nest hollow installed;

(vii) the date(s) each artificial black cockatoo nest hollow installed was maintained; and

(viii) a description of the maintenance activities undertaken for each artificial black cockatoo nest hollow installed.

Reporting – Clearing

29. The licence holder must provide to the CEO on or before 30 June of each year, a written report:

(a) of records required under condition 28 of this licence; and

(b) concerning activities done by the licence holder under this licence between 1 January to 31 December of the preceding calendar year.

30. If no clearing authorised under this licence was undertaken between 1 January to 31 December of the preceding calendar, a written report confirming that no clearing under this licence has been carried out, must be provided to the CEO on or before 30 June of each year.

31. Prior to 25 June 2029, the licence holder must provide to the CEO a written report of records required under condition 28 of this licence where these records have not already been provided under condition 29 of this licence.

Monitoring

32. The licence holder must ensure that:

(a) all water samples are collected and preserved in accordance with AS/NZS 5667.1;

(b) all groundwater sampling is conducted in accordance with AS/NZS 5667.11; and

(c) all laboratory samples analysis must be undertaken submitted to and tested by laboratories a laboratory with current NATA accreditation for the parameters specified, unless indicated otherwise in the relevant table specified Table 10 in Schedule 2.

33. The licence holder must ensure that:

(a) monthly monitoring is undertaken at least 15 days apart;

(b) quarterly monitoring is undertaken at least 45 days apart;

(c) six monthly monitoring is undertaken at least 5 months apart;

(d) annual monitoring is undertaken at least 9 months apart;

(e) two yearly monitoring is undertaken at least 18 months apart; and

(f) five yearly monitoring is undertaken at least 54 months apart.

34. The licence holder must ensure that all monitoring equipment used on the premises to comply with conditions 36, 37, 38 and 39 of this licence is calibrated in accordance with the manufacturer's specifications.

35. The licence holder must, where the requirements for calibration cannot be practicably met, or a discrepancy exists in the interpretation of the requirements, bring these issues to the attention of the CEO accompanied with a report comprising details of any modifications to the methods.

36. The licence holder must undertake the monitoring in Table 9 according to the specifications in that table.

Table 9: Monitoring of inputs and outputs

Input/Output	Parameter	Units	Averaging period	Frequency
Waste Inputs	Inert Waste Type 1, Special Waste Type 1, Putrescible Waste, Contaminated Solid Waste and Hazardous waste.	m^3	Annual	Each load arriving at the premises
Waste Outputs	Waste type as defined in the *Landfill Waste Classification and Waste Definitions 1996* (as amended from time to time)			Each load leaving or rejected from the premises

37. The licence holder must undertake ambient groundwater monitoring in accordance with the requirements specified in Table 10.

Table 10: Monitoring of ambient groundwater

Location	Parameter	Units	Frequency
Groundwater monitoring bores: M1, P1, P2, MW1, MW2, MW3, MW4, MW5, MW6, MW7, MW8 and MW9 (as depicted in Schedule 1, Figure 8)	NH_3-N	mg/L	Six monthly
	Chemical Oxygen Demand		
	NO_3-N		
	NO_2-N		
	Total Phosphorus		
	Total Nitrogen		
	Total Dissolved Solids		
	Total Organic Carbon		
	Calcium		
	Magnesium		
	Potassium		
	Sodium		
	Chloride		
	Bicarbonate		
	Aluminium		
	Arsenic		
	Cadmium		
	Chromium		
	Copper		
	Total Iron		
	Lead		
	Manganese		
	Mercury		
	Nickel		
	Selenium		
	Zinc		
	pH [1]	pH units	
	Electrical conductivity [1]	µS/cm	
	Standing Water Level [1]	m AHD	
	Eh (redox potential) [1]	mV	
	Dissolved Oxygen [1]	mg/L	
	Benzene, toluene, ethylbenzene and xylenes (BTEX)	mg/L	Annually
	Total Recoverable Hydrocarbons (TRH)		
	Organochlorines		
	Phenols		
	Polycyclic Aromatic Hydrocarbons (PAH)		
	Polychlorinated Biphenyls (PCB)		

Note 1: In-field non-NATA accredited analysis permitted.

38. The licence holder must undertake the landfill gas monitoring in Table 11 according to the specifications in that table.

Table 11: Monitoring of landfill gas

Location	Parameter	Units	Averaging period	Frequency	Method
Phase 1 landfill gas venting wells: GV-1, GV-2, GV-3, GV-4, GV-5, GV-6, GV-7, GV-9 and GV-10 Phase 1 landfill gas perimeter wells: G1, G2, G3, G4, G5, G6, G7, G8, G9, G10, G11, G12 and G13. (as depicted in Schedule 1, Figure 5)	Volumetric flow rate	m^3/hr	Spot sample	Quarterly	*Guideline: Assessment and management of contaminated sites*
	Carbon dioxide (CO_2) Oxygen (O_2) Methane (CH_4)	volume %			
	Carbon monoxide (CO)	PPM			
	Hydrogen sulphide (H_2S)				
	Temperature	^oC			
	Pressure	mbar			

39. The licence holder must undertake monitoring of the landfill cap infrastructure in Table 12 according to the specifications in that table.

Table 12: Landfill cap monitoring

Attribute	Monitoring method	Frequency	Duration
Landfill cap integrity	Visual inspection	(a) Annually; and (b) Within 10 days following any 1 in 100-year, 72-hour duration storm event.	First five years following completion of capping works.
		(a) Every two years; and (b) Within 10 days following any 1 in 100-year, 72-hour duration storm event.	Ongoing after the first five years following completion of the capping works, for an additional 10 years.
		(a) Every five years; and (b) Within 10 days following any 1 in 100-year, 72-hour duration storm event.	Ongoing after the first 15 years following completion of the capping works, until stabilised.
Landfill cap vegetation	Visual inspection	Quarterly	Ongoing for the first five years following completion of the capping works.

Records and reporting

Records

40. The licence holder must maintain a register of Special Waste Type 1 (Asbestos waste) disposed of at the premises which must include a plan showing the position of Special Waste Type 1 disposed of at the premises.

41. The licence holder must record the following information in relation to complaints received by the licence holder (whether received directly from a complainant or forwarded to them by the Department or another party) about any alleged emissions from the premises:

(a) the name and contact details of the complainant, (if provided);

(b) the time and date of the complaint;

(c) the complete details of the complaint and any other concerns or other issues raised; and

(d) the complete details and dates of any action taken by the licence holder to investigate or respond to any complaint.

42. The licence holder must maintain accurate and auditable books including the following records, information, reports, and data required by this licence:

(a) the calculation of fees payable in respect of this licence;

(b) the works conducted in accordance with conditions 1, 5 and 6;

(c) any maintenance of infrastructure that is performed in the course of complying with condition 12 of this licence;

(d) monitoring programmes undertaken in accordance with conditions 36, 37, 39 and 38 of this licence; and

(e) complaints received under condition 40 of this licence.

43. The books specified under condition 40 must:

(a) be legible;

(b) if amended, be amended in such a way that the original version(s) and any subsequent amendments remain legible and are capable of retrieval;

(c) be retained by the licence holder for the duration of the licence; and

(d) be available to be produced to an inspector or the CEO as required.

Reporting

44. The licence holder must, 6 to 12 months prior to the completion of waste disposal in Cell 3, submit to the CEO a Technical Specification and CQA Plan for Phase 2 of the landfill capping project, which must include:

(a) detailed design;

(b) associated stability and technical assessments;

(c) material specifications;

(d) landfill gas infrastructure details, gas trigger levels and emergency actions;

(e) current and finished survey levels; and

(f) construction quality assurance reporting requirements.

45. The licence holder must:

(a) undertake an audit of their compliance with the conditions of this licence during the preceding annual period; and

(b) prepare and submit to the CEO by no later than 60 days after the end of that annual period an Annual Audit Compliance Report in the approved form.

46. The licence holder must:

(a) prepare an Environmental Report that provides information in accordance with Table 13 for the preceding annual period, and

(b) submit that Environmental Report to the CEO by 01 March each year.

Table 13: Environmental Report

Condition	Parameter
-	Summary of any failure or malfunction of any pollution control equipment and any environmental incidents that have occurred during the annual period and any action taken.
Condition 36	Monitoring of inputs and outputs: (a) volumes in m^3 presented in tabulated form.
Condition 37	A summary of all groundwater monitoring data for all parameters including: (a) a clear statement of the scope of work carried out; (b) a description of the field methodologies employed; (c) a summary of the field and laboratory QA/QC program; (d) copies of the field monitoring records and field QA/QC documentation; (e) an assessment of reliability of field procedures and laboratory results; (f) a tabulated summary of results as well as all raw data provided in an excel document which are clearly referenced to laboratory certificates of analysis; (g) a diagram with aerial image overlay showing all monitoring locations and depicting groundwater level contours, flow direction and hydraulic gradient. Relevant site features including discharge points and other potential sources of contamination must also be shown; (h) an interpretive summary and assessment of the results against relevant assessment levels for water, as published in the *Guideline Assessment and management of contaminated sites*; (i) an interpretive summary and assessment of results against previous monitoring results; and (j) trend graphs to provide a graphical representation of historical results and to support the interpretive summary. Note 1: General guidance on report presentation can be found in the *Guideline Assessment and management of contaminated sites*.
Condition 39	Landfill cap infrastructure monitoring
Condition 38	Landfill gas monitoring reports for venting wells and perimeter wells: (a) data in tabulated and graphical form including the sample date; (b) an assessment and interpretation of the data; (i) a comparison to historical trends over the previous three annual periods; and (c) copies of laboratory sample analysis reports.
Condition 40	Complaints summary
Condition 45	Compliance

Notification

47. The licence holder must ensure that the parameters listed in Table 14 are notified to the CEO in accordance with the notification requirements of that Table.

Table 14: Notification requirements

Conditions	Parameter	Notification requirement[1]
Condition 9 Condition 22	Breach of any limit specified in the Licence	As soon as practicable.
Condition 34	Calibration report	

Note 1: Notification requirements in the licence must not negate the requirement to comply with s72 of the EP Act

Definitions

In this licence, the terms in Table 15 have the meanings defined.

Table 15: Definitions

Term	Definition
acceptance criteria	has the meaning defined in *Landfill Waste Classification and Waste Definitions 1996* (as amended from time to time), published by the CEO and as amended from time to time.
annual period	a 12 month period commencing from 1 January until 31 December of the immediately following year.
approved form	means the Annual Audit Compliance Report (AACR) form template approved by the CEO for use and available via DWER's external website
AS/NZS 4131	means the Australian/New Zealand Standard AS/NZS 4131 *Polyethylene (PE) compounds for pressure pipes and fittings*, as amended from time to time.
AS/NZS 5667.1:1998	means the Australian/New Zealand Standard *Water quality – sampling Part 1: Guidance on the design of sampling programs, sampling techniques and the preservation and handling of samples,* as amended from time to time
CEO	means Chief Executive Officer of the Department. "submit to / notify the CEO" (or similar), means either: Director General Department administering the *Environmental Protection Act 1986* Locked Bag 10 Joondalup DC WA 6919 or: info@dwer.wa.gov.au
clean fill	has the meaning defined in *Landfill Waste Classification and Waste Definitions 1996* (as amended from time to time), published by the CEO and as amended from time to time.
condition	a condition to which the licence is subject under section 62 of the *Environmental Protection Act 1986*.
contaminated solid waste	has the meaning defined in *Landfill Waste Classification and Waste Definitions 1996* (as amended from time to time), published by the CEO and as amended from time to time.
controlled waste	has the definition in *Environmental Protection (Controlled Waste) Regulations 2004*.
cover	means clean fill or subsoil used for covering waste.
department, DWER	means the department established under section 35 of the *Public Sector Management Act 1994* (WA) and designated as responsible for the administration of the EP Act, which includes Part V Division 3.
dieback	means the effect of Phytophthora species on native vegetation.

Term	Definition
EP Act	*Environmental Protection Act 1986* (WA)
EP Regulations	*Environmental Protection Regulations 1987* (WA)
fill	means material used to increase the ground level, or fill a hollow
freeboard	means the distance between the maximum water surface elevation and the top of the retaining banks or structures at their lowest point;
Guideline: Assessment and management of contaminated sites	means the document titled *Assessment and management of contaminated sites, Contaminated sites guidelines,* December 2014 (Department of Environment Regulation), as amended from time to time.
hazardous waste	has the meaning defined in *Landfill Waste Classification and Waste Definitions 1996* (as amended from time to time), published by the CEO and as amended from time to time.
Inert Waste Type 1	has the meaning defined in *Landfill Waste Classification and Waste Definitions 1996* (as amended from time to time) published by the CEO and as amended from time to time.
licence	refers to this document, which evidences the grant of a licence by the CEO under section 57 of the EP Act, subject to the specified conditions contained within.
licence holder	refers to the occupier of the premises, being the person specified on the front of the licence as the person to whom this licence has been granted.
mulch	means any organic product (excluding polymers that do not degrade, such as plastics, rubber and coatings) that is suitable for placing on soil surfaces.
NATA	means the National Association of Testing Authorities, Australia
NATA accredited	means in relation to the analysis of a sample that the laboratory is NATA accredited for the specified analysis at the time of the analysis.
Phase 1 landfill capping	refers to the portion of putrescible landfill consisting of cell 1 and the northern and western portions of the unlined historic landfill area and the infrastructure intended to be installed during that time period (Figure 3).
Phase 2 landfill capping	refers to the portion of putrescible landfill consisting of cells 2 and 3 and the southern and eastern portions of the unlined historic landfill area and the infrastructure intended to be installed during that time period (Figure 3).
Phase 3 inert landfill capping	refers to the inert landfill cell (Figure 3).
premises	refers to the premises to which this licence applies, as specified at the front of this licence and as shown on the premises map Figure 1 in Schedule 1 to this licence.
putrescible waste	means the component of the waste stream likely to become putrid;
rehabilitation	means the completion of the engineering of a landfill cell and includes capping and/or final cover

Term	Definition
Special Waste Type 1	has the meaning defined in *Landfill Waste Classification and Waste Definitions 1996* (as amended from time to time) published by the CEO and as amended from time to time.
suitably qualified civil engineer	means a person who: (a) holds a Bachelor of Engineering degree recognised by Engineers Australia; and (b) has a minimum of five years of experience working in a supervisory role in civil or structural engineering; and (c) is employed by an independent third party external to the licence holder's business.
suitably qualified geotechnical engineer	means a person who: (a) holds a Bachelor of Engineering degree recognised by Engineers Australia; and (b) has a minimum of five years of experience working in a supervisory role of geotechnical engineering; and (c) is employed by an independent third party external to the licence holder's business.
weed/s	means any plant – (a) that is a declared pest under section 22 of the *Biosecurity and Agriculture Management Act 2007*; (b) published in a Department of Biodiversity, Conservation and Attractions Regional Weed Rankings Summary, regardless of ranking, or not indigenous to the area concerned.

END OF CONDITIONS

Schedule 1: Maps

Premises maps

The boundary of the prescribed premises is shown in the map below (Figure 1).

Figure 1: Map of the boundary of the prescribed premises

The premises layout and infrastructure are shown in the map below (Figure 2).

Figure 2: Premises layout

Phased capping areas and associated putrescible landfill cells are shown in the plan below (Figure 3)

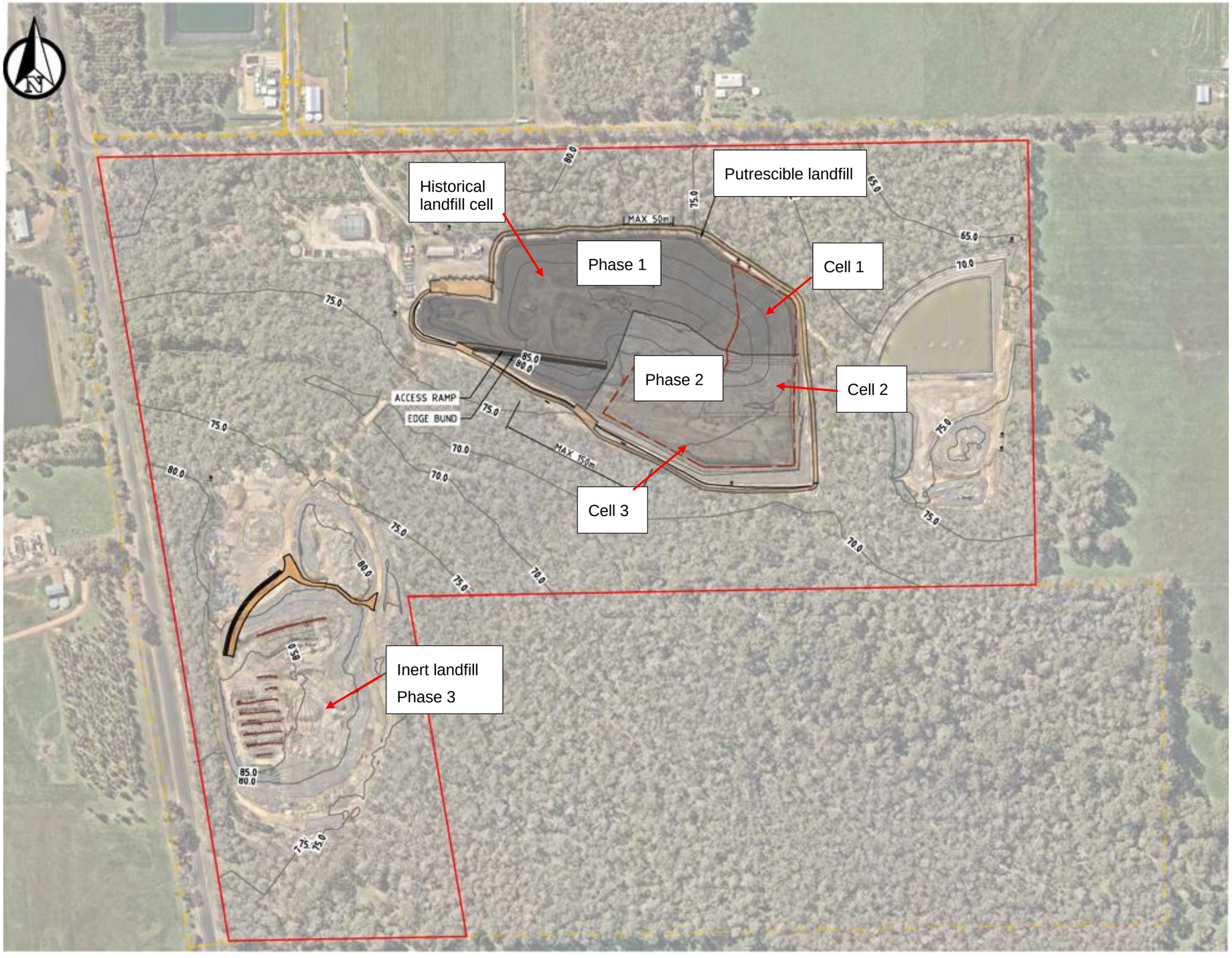
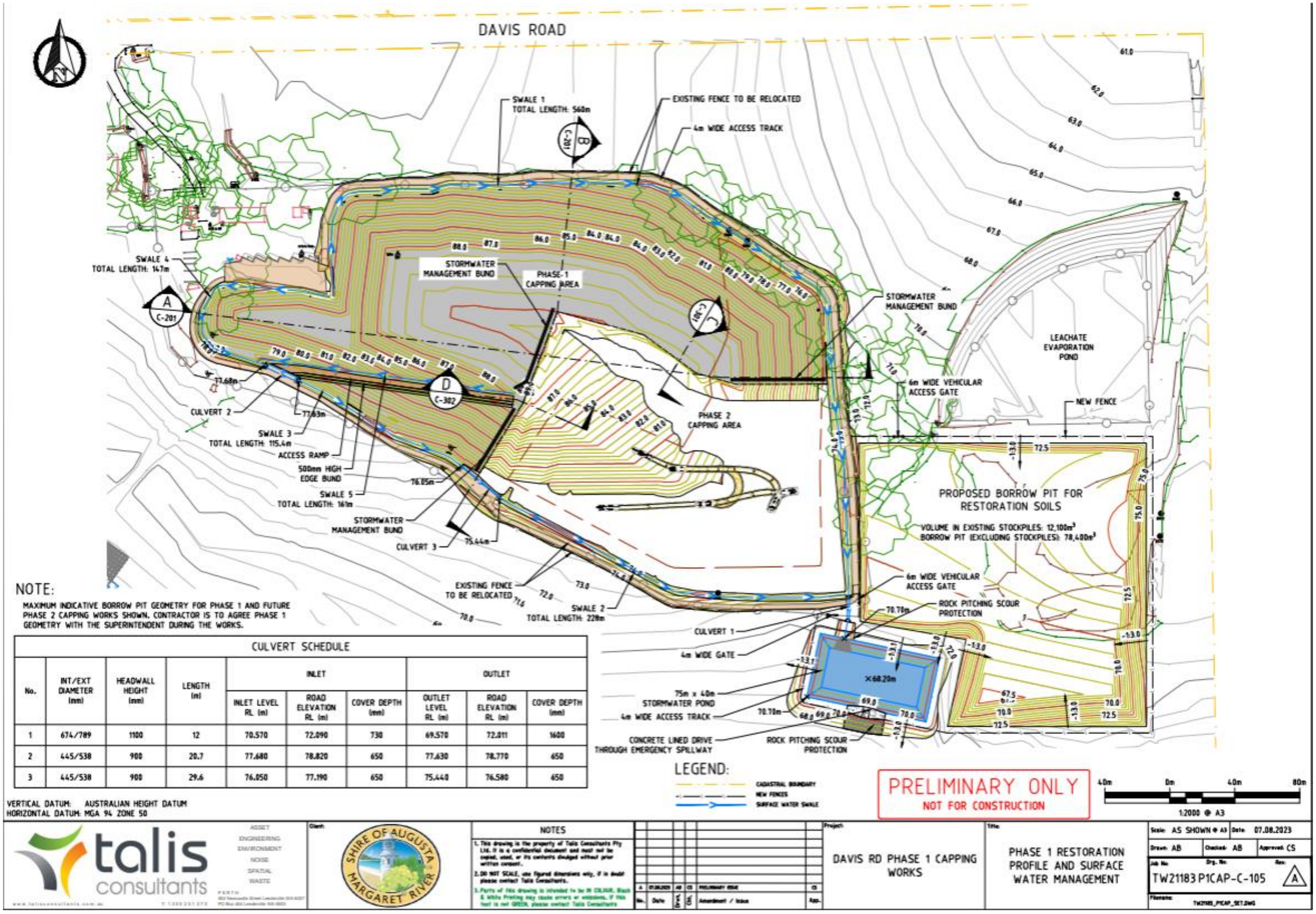


Figure 3: Phased capping areas and associated putrescible landfill cells

The location of Pond 1 and the stormwater swales and culverts for Phase 1 are shown in the plan below (Figure 4)



CULVERT SCHEDULE

No.	INT/EXT DIAMETER (mm)	HEADWALL HEIGHT (mm)	LENGTH (m)	INLET			OUTLET		
				INLET LEVEL RL (m)	ROAD ELEVATION RL (m)	COVER DEPTH (mm)	OUTLET LEVEL RL (m)	ROAD ELEVATION RL (m)	COVER DEPTH (mm)
1	674/789	1100	12	70.570	72.090	730	69.570	72.011	1600
2	445/538	900	20.7	77.680	78.820	650	77.630	78.770	650
3	445/538	900	29.6	76.050	77.190	650	75.440	76.580	650

Figure 4: Pond 1, stormwater swales and culverts for Phase 1

The landfill gas venting well locations for Phase 1 (green) and Phase 2 (blue) and the perimeter wells (red) are shown in the plan below (Figure 5).

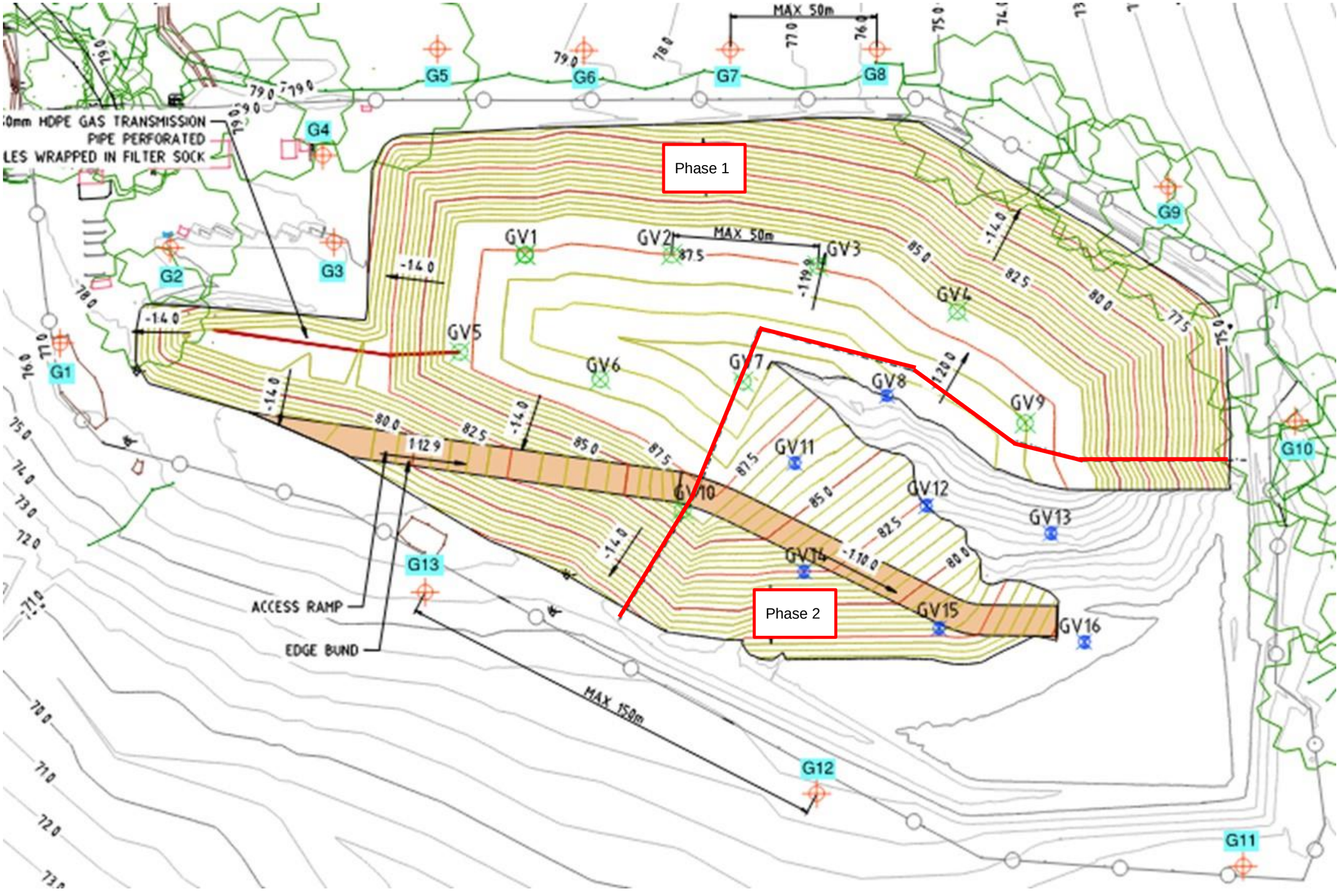


Figure 5: Landfill gas venting wells and perimeter wells

The landfill gas extraction and perimeter wells for Phase 1 and Phase 2 are shown in the construction plan below (Figure 6).

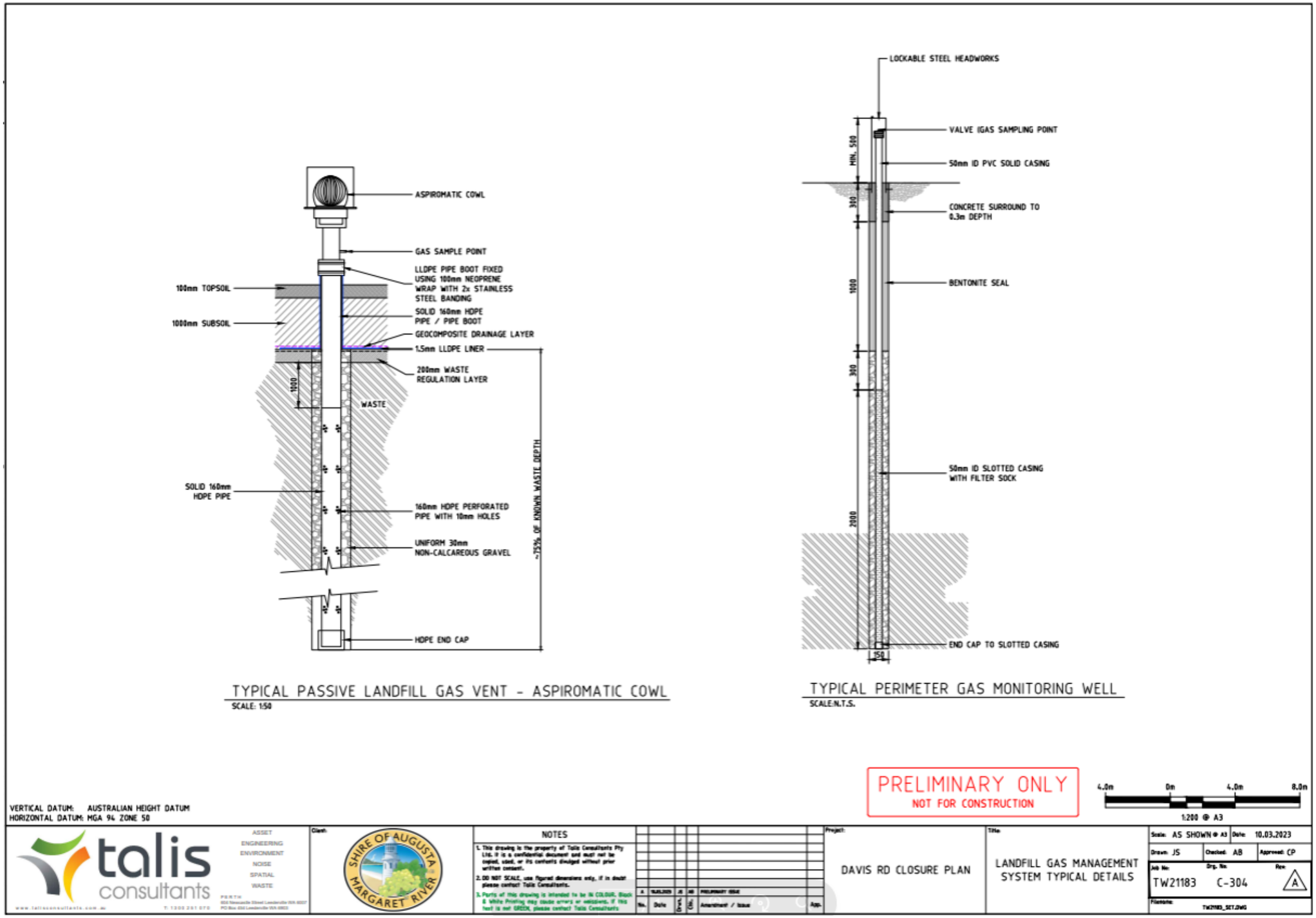


Figure 6: Landfill gas extraction and perimeter wells construction plans for Phase 1 and Phase 2

The landfill capping configurations for Phases 1, 2 and 3 are shown in the plan below (Figure 7)

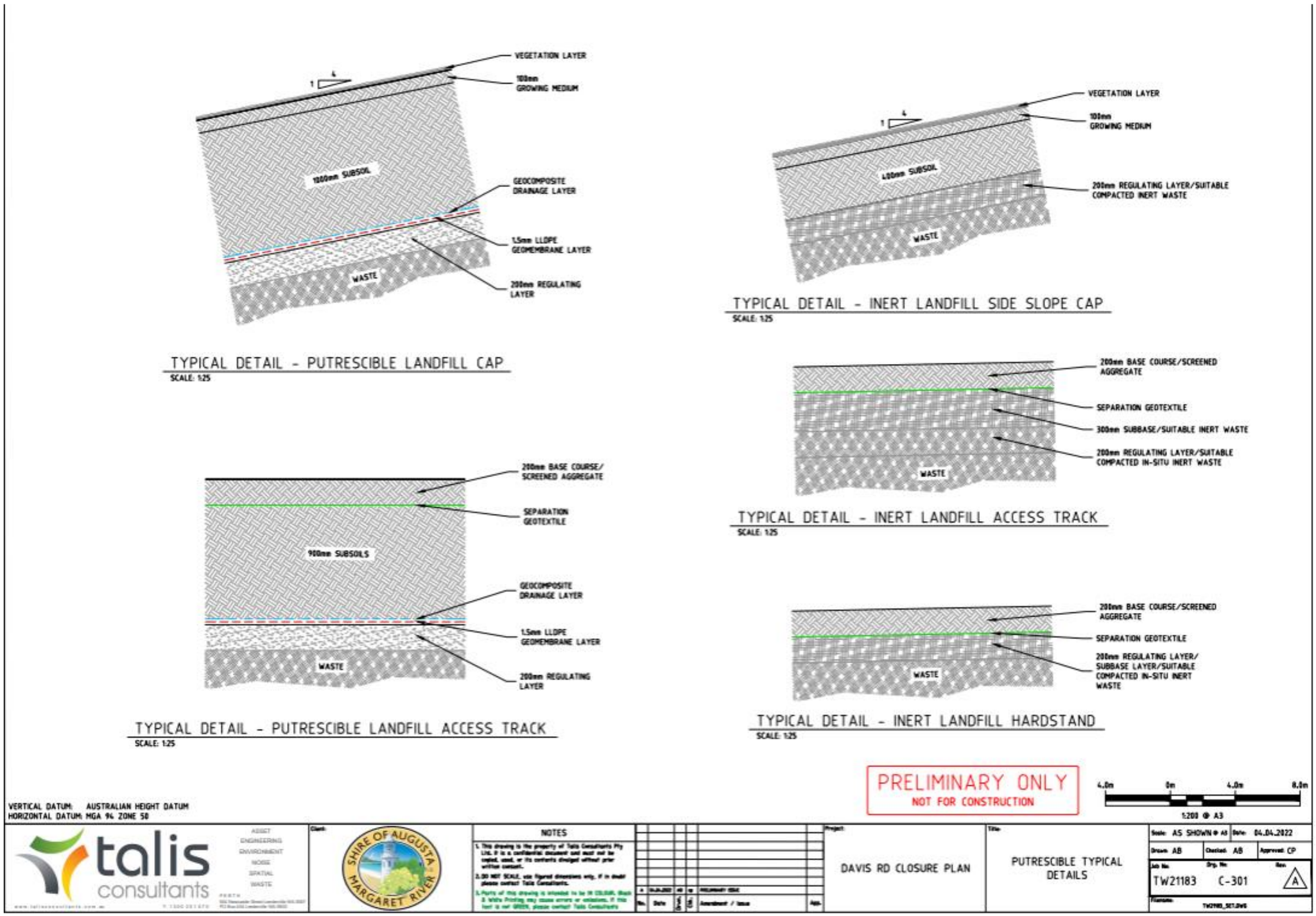


Figure 7: Landfill capping configurations for Phases 1, 2 and 3

The groundwater monitoring bores (blue) are shown in the map below (Figure 8).

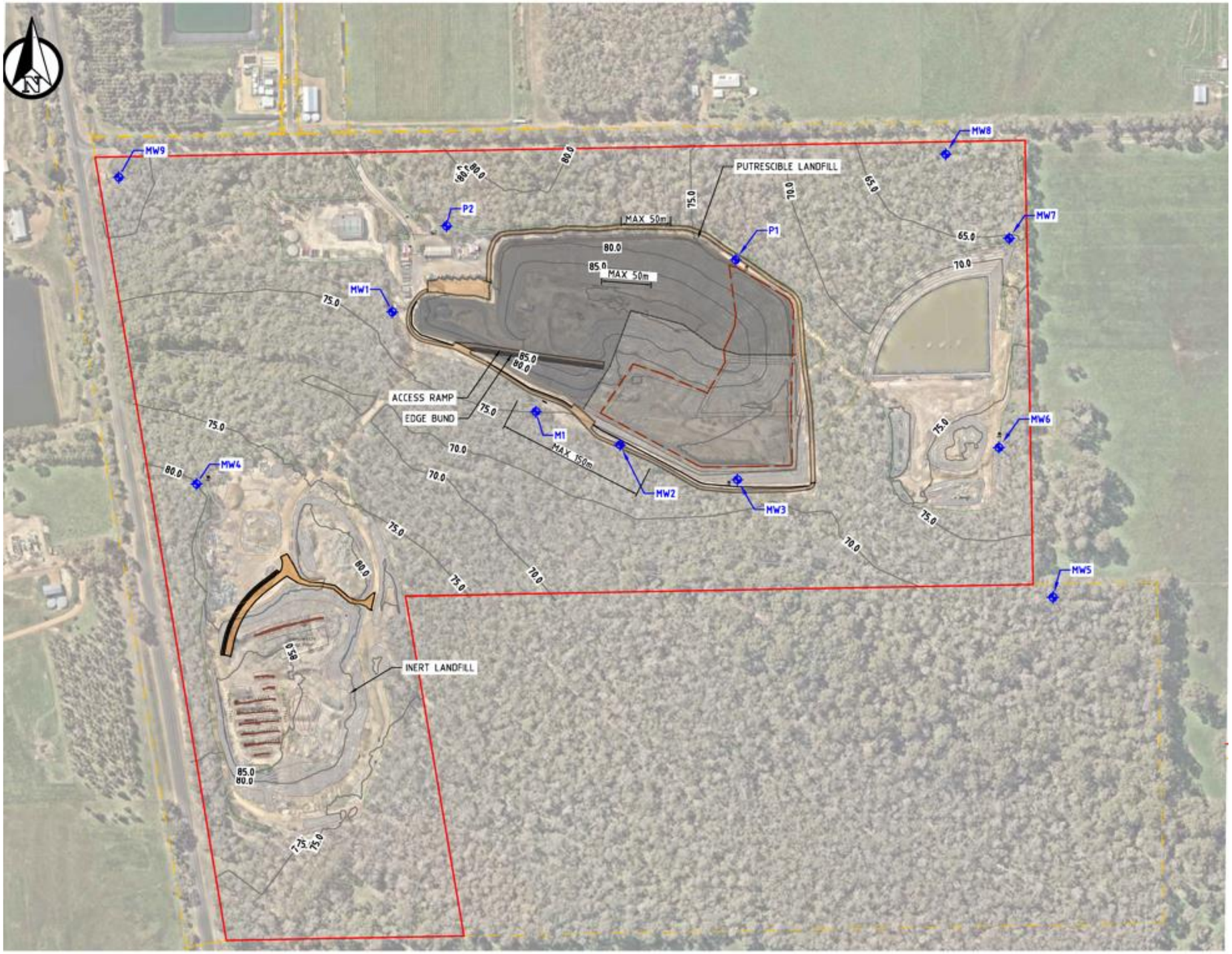


Figure 8: Groundwater monitoring bore locations

The clearing authorised under Clearing Permit CPS 8228/1 is shown in the map below (Figure 9).

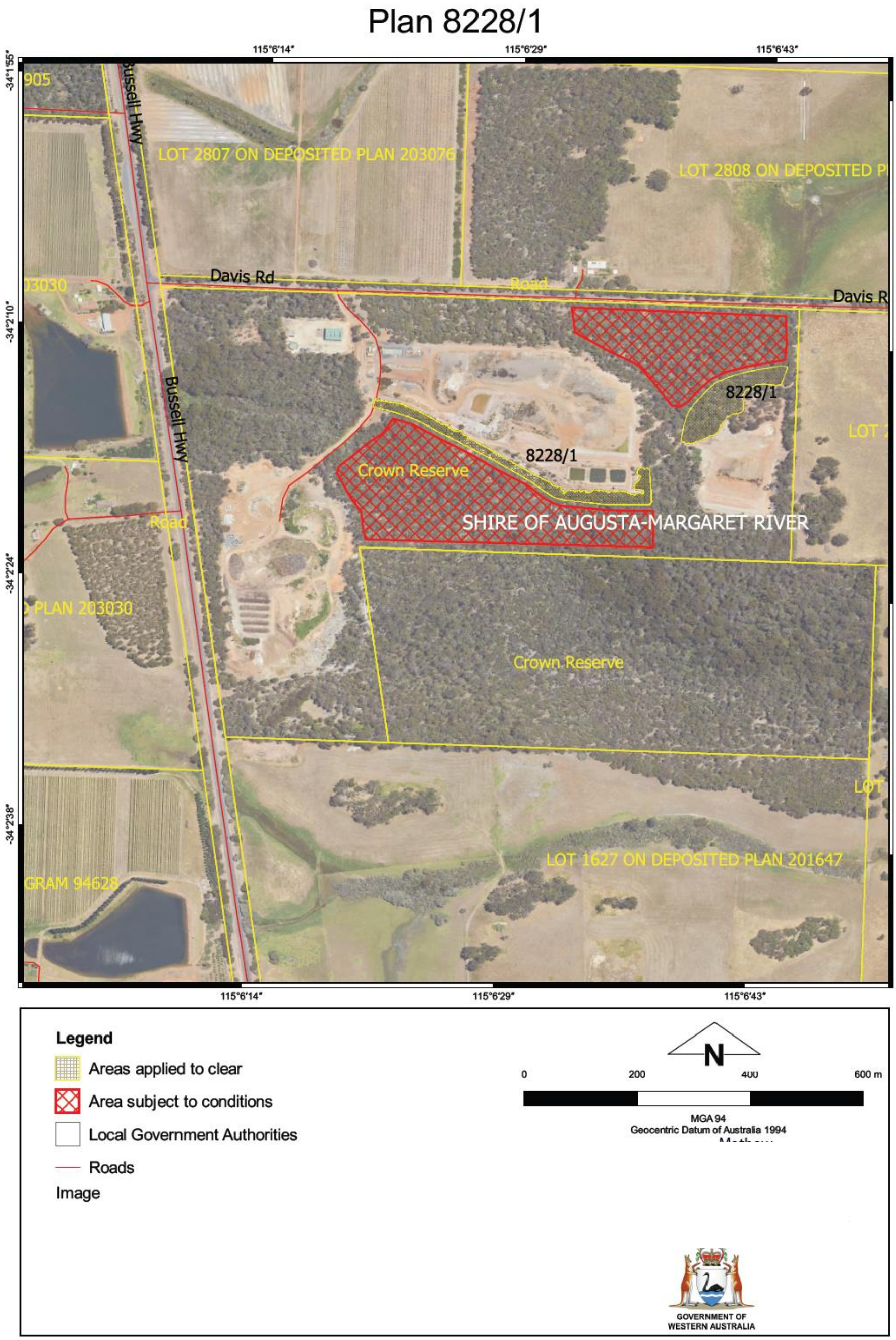


Figure 9: Clearing plan map

Schedule 2: How to design and place artificial hollows for Carnaby's cockatoo

Department of Parks and Wildlife

Fauna notes

Artificial hollows for Carnaby's cockatoo

birdlife AUSTRALIA

WATER CORPORATION

museum

How to design and place artificial hollows for Carnaby's cockatoo

Artificial hollows can be used to help conserve the threatened Carnaby's cockatoo by enabling the cockatoos to breed in areas where natural hollows are limited.

A wide variety of artificial hollow designs have been used with mixed success. Evidence suggests that, while the hollow must meet some basic requirements, other factors such as proximity to existing breeding areas may be more important in determining the success of artificial hollows. Before using this information sheet to construct or install an artificial hollow, you should refer to the criteria listed in the separate information sheet; *When to use artificial hollows for Carnaby's cockatoo.*

This information sheet contains broad guidelines for the design and placement of artificial hollows for Carnaby's cockatoo.

Below are three examples of successful artificial hollows used by Carnaby's cockatoo for nesting. Artificial hollows made from a natural log with cut side entrance (left), white industrial pipe with top entrance (centre) and natural log with natural side entrance (right).

Photos by Christine Groom (left and right) and Rick Dawson (centre)

Page 1 of 5

Walls

The walls of the artificial hollow need to be constructed from a material that is;

- Durable enough to withstand exposure to elements for an extended period of time (i.e. 20+ years).
- Able to simulate the thermal properties of a natural tree hollow.
- Not less than 380 mm in internal diameter.
- Preferably 1.2 m deep overall and 1m deep to top of substrate/nesting material.

Successful artificial hollows have been constructed from sections of salvaged natural hollow, black and white industrial pipe. When using non-natural materials care must be taken to ensure there are no toxic residues and that the materials are safe to ingest.

Base

The base of the artificial hollow must be;

- Able to support the adult and nestling(s).
- Durable enough to last the life of the nest.
- Free draining.
- At least 380 mm in diameter.
- Covered with 200 mm of sterile, dry, free draining material such as charcoal, hardwood woodchips or wood debris.

Do not use:

- Saw dust or fibre products that will retain moisture.

Example materials that could be used for artificial hollow bases include heavy duty stainless steel, galvanised or treated metal (e.g. Zincalume ®), thick hardwood timber slab or marine ply (not chipboard or MDF). The base material must be cut to size to fit internally with sharp or rough edges ground away or curled inwards and fixed securely to the walls.

Carnaby's cockatoo eggs in an artificial hollow.
Photo by Rick Dawson

Entrance

The entrance of the artificial hollow must;

- Have a diameter of at least 270 mm).
- Preferably be top entry which will minimise use by non-target species.

Top entry hollows are unattractive to nest competitors such as feral bees, galahs and corellas. Side entry hollows have been successful in areas where feral bees are not a problem and where galahs and corellas are deterred.

Ladder

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide a ladder to enable the birds to climb in and out of the hollow easily.

The ladder must be;

- Securely mounted to the inside of the hollow.
- Made from an open heavy wire mesh such as WeldMesh™ with mesh size of 30 - 50 mm, or heavy chain.

Do not use:

- A material that the birds can chew.
- Galvanized because the birds may grip or chew the ladder and ingest harmful compounds.

If using mesh for the ladder, the width will depend on the curvature of the nest walls. A minimum width of about 60 - 100 mm is recommended.

Sacrificial chewing posts

For artificial hollows made of non-natural materials, or of processed boards, it is necessary to provide sacrificial chewing posts. The birds chew material to prepare a dry base on which to lay their egg(s).

The sacrificial chewing posts must:

- Be made of untreated hardwood such as jarrah, marri or wandoo
- Be thick enough to satisfy the birds' needs between maintenance visits.
- Extend beyond the top of the hollow as an aid to see whether the nest is being used.
- Be placed on the inside of the hollow.
- Be attached in such a way that they are easy to replace e.g. hook over the top of hollow or can slide in/out of a pair of U bolts fitted to the side of the hollow.

It is recommended that at least two posts are provided. Posts 70 x 50 mm have been used, but require replacing at least every second breeding season when the nest is active. Birds do vary in their chewing habits and therefore the frequency at which the chewing posts require replacement will also vary.

Bottom of an artificial hollow showing ladder that is fixed to the wall and a chewed sacrificial post which is 200 mm from the floor.

Photo by Rick Dawson

Mountings

The artificial hollows must be mounted such that:

- The fixings used will last the duration of the nest e.g. galvanized bracket or chain fixed with galvanized coach screws.
- It is secured by more than one anchor for security and stability.
- It is positioned vertically or near vertically.

Placement

Sites should be chosen within current breeding areas and where they can be monitored, but preferably not conspicuous to the general public. It is important that artificial hollows are placed where they will be accessible for future monitoring and maintenance. For more detail refer to the separate information sheet; *When to use artificial hollows for Carnaby's cockatoo*.

The height at which artificial hollows should be placed is variable. The average height of natural hollows in dominant tree species in the area is a good guide. Natural hollows used by Carnaby's cockatoos have been recorded as low as 2 m above the ground. If located on private property the hollows can be placed lower to the ground so they are accessible by ladder or a rope and pulley system can be used. Where public access is possible artificial hollows should be placed at least 7 m high (i.e. higher than most ladders) and on the side of the tree away from public view to reduce the chance of interference or poaching.

Carnaby's cockatoo show no preference for aspect of natural hollows, however, it may still be beneficial to place artificial hollows facing away from prevailing weather and where they receive the most shade and protection.

Artificial hollows to be placed in trees require:

- Accessibility of the tree for a vehicle, elevated work platform or cherry picker.
- A section of trunk 2-3 m long suitable for attaching the hollow

If necessary, artificial hollows may be placed on poles, but this may result in excessive exposure to sun during very hot weather. When erected on poles there should be"

- A hinge at the bottom of the pole that can be secured when the pole is in the upright position.
- Access for a vehicle to assist raising the pole.

Safety

Care needs to be taken when placing artificial hollows to ensure safety is considered at all times. Artificial hollows are heavy and require lifting and manoeuvring into position up to 7 m above the ground.

Maintenance and monitoring

Once artificial hollows have been placed they require monitoring and maintenance to ensure they continue to be useful for nesting by Carnaby's cockatoo. It is important to monitor artificial hollows to determine use by Carnaby's cockatoo, other native species as well as pest species. By undertaking monitoring the success of the design and placement of artificial hollows can be determined and areas for improvement identified for future placement of artificial hollows.

Monitoring can also assess whether any maintenance is required. Without regular maintenance artificial hollows are unlikely to achieve their objective (that is, they will fail to provide nesting opportunities for threatened cockatoos). Therefore it is important to continue a regime of regular maintenance while the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available.

For further advice on monitoring and maintenance of artificial hollows please refer to the separate information sheet; *How to monitor and maintain artificial hollows for Carnaby's cockatoo*.

Carnaby's cockatoo female prospecting an artificial hollow.
Photo by Rick Dawson

Example fixing for artificial hollow
Photo by Christine Groom

Acknowledgements

This information sheet is a joint initiative of Birdlife Australia, the Western Australian Museum and the Department of Parks and Wildlife. Many individuals have contributed to its preparation. Special acknowledgement is made for the contributions of Ron Johnstone from the WA Museum, Alan Elliott from the Serpentine-Jarrahdale Land care Centre and Denis Saunders. This updated version was compiled by Rick Dawson Department of Parks and Wildlife).

Other information sheets in the series: Artificial hollows for Carnaby's cockatoo

- *How to design and place artificial hollows for Carnaby's cockatoo*
- *How to monitor and maintain artificial hollows for Carnaby's cockatoo*

Information sheets available on the *Saving Carnaby's cockatoo* webpage:
http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/208-saving-carnaby-s-cockatoo

Further Information **Last updated 28/04/2015**

Contact fauna@dpaw.wa.gov.au or your local office of the Department of Parks and Wildlife

See the department's website for the latest information: www.dpaw.wa.gov.au

Schedule 3: How to monitor and maintain artificial hollows for Carnaby's cockatoo

Department of Parks and Wildlife

Fauna notes

Artificial hollows for Carnaby's cockatoo

birdlife AUSTRALIA

WATER CORPORATION

museum

How to monitor and maintain artificial hollows for Carnaby's cockatoo

It is important to monitor and maintain artificial hollows after they have been erected. Monitoring ensures that the effectiveness of the artificial hollow can be determined. It also means that problems with pest species or any maintenance requirements can be identified and resolved.

Without regular maintenance, artificial hollows are likely to fail to achieve their objective (that is, they will fail to provide nesting opportunities for threatened cockatoos). Therefore it is important to continue a regime of regular maintenance while the artificial hollow is required. It may be several (to many) decades until a natural replacement hollow is available.

Monitoring should be undertaken in order to detect:

- Use by Carnaby's cockatoo
- Maintenance requirements
- Use by other native species
- Use by pest species (e.g. feral bees, galahs, corellas etc.)

Carnaby's cockatoo female prospecting an artificial hollow.
Photo by Rick Dawson

How do I monitor artificial hollows?

Before undertaking monitoring of artificial hollows for Carnaby's cockatoo it is recommended that you seek advice from BirdLife Australia, the WA Museum or the Department of Parks and Wildlife. It is also important to contact Parks and Wildlife, Wildlife Licensing Section, to determine if a scientific licence is required (wildlifelicensing@dpaw.wa.gov.au).

Monitoring artificial hollows requires keen observation and naturalist skills. It is often not possible to observe evidence of breeding directly (i.e. nestlings or eggs) and inferences must be made based on observation. There are many techniques available to monitor artificial hollows. A combination of several is likely to achieve the best results.

Page 1 of 4

Looking for signs of use

Cobwebs covering the entrance to the hollow will indicate that the hollow has not been used recently. This would also apply to other light debris that may have fallen to cover the opening partially. Signs of recent use or interest in the hollow include evidence of chewing.

Observing parent behaviour around the hollow

The behaviour of parent birds around a hollow will indicate an approximate age of young in the nest.

Parent behaviour	Approximate age/stage of young
Prospecting for hollow	Unborn
Male only seen out of hollow	Egg or very young nestling (< 3 - 4 weeks)
Both parents seen entering/exiting the hollow	Nestling(s) have hatched (> 3 - 4 weeks)

Observing feeding flocks

Flocks of all male birds indicate that the females are incubating eggs. When flocks are mixed it suggests the birds have either not laid yet or that the nestlings have hatched and no longer require brooding (approximately 3 - 4 weeks old).

Tapping

When females are sitting on eggs they will usually respond to tapping at the base of their tree (or pole) by appearing at the entrance or flying from the hollow opening. This is not a guarantee of breeding activity, but an indication that it is possibly occurring in the hollow.

Observing insect activity around nest

The faecal matter produced by nestlings in a nest attracts insects, especially flies and ants. The type and number of these insects will help indicate how old any nestlings present may be. Factors such as temperature and humidity will also affect insect activity and so observations of insect activity should only be used as supporting evidence for other indications of age/use. Blowflies around a nest usually indicate that a death has occurred.

Listening for nestlings

With experience it is possible to determine if one or two nestlings are present and a broad estimate of age based on the type and loudness of noises they make.

Looking inside the nest

This can be achieved either with the aid of a telescopic pole and camera or mirror, or with the use of a ladder or other climbing equipment. This method can obtain the most detailed monitoring information for artificial hollows. However it is also the most time consuming and difficult to organise. Special equipment is likely to be needed depending on the height and positioning of artificial hollows. There are also safety issues associated with ladder or rope climbing options to reach nests to undertake observations.

How often should I monitor artificial hollows?

The minimum frequency of monitoring and the techniques used will be determined by the aims of the monitoring and the resources available. It is important to limit disturbance to breeding birds and this should be considered when determining the techniques used and frequency.

How do I maintain artificial hollows?

Artificial hollows require maintenance to ensure they continue to have the greatest chance of them being used by Carnaby's cockatoos. Periodic maintenance checks should be undertaken at least every two years, preferably annually. These checks should be undertaken prior to the breeding season which is between July and January with breeding occurring later in this period in southern areas. It is important to maintain a regime of regular maintenance as long as the artificial hollow is required. It may take several (to many) decades until a natural replacement hollow is available.

Maintenance checks should assess the following as a minimum:

- Condition of chewing posts (if present)
- Condition of attachment points
- Condition of hollow bases
- Stability of tree or pole used to mount the artificial hollow

Artificial hollow base needing repair.
Photo by Christine Groom

Repairing hollows

Any problems identified during maintenance checks should be addressed, and any repairs required done, as soon as possible. If breeding is currently occurring, maintenance may need to be delayed if it is likely to disturb the parents or nestling. Likely maintenance needs include replacement of chewing posts (frequently) or nest bases (occasionally) and repairing of any cracks (infrequently). Maintenance concerns regarding the security of attachment points or the stability of the tree or pole should be addressed as a priority for safety reasons.

For artificial hollows known to be used, spare chewing posts should be taken into the field when undertaking maintenance checks.

Monitoring of artificial hollows:

Monitoring aim	Frequency of visits	Monitoring techniques
To determine possible use by Carnaby's cockatoo	At least once during peak breeding season (i.e. between September and December)	• Observing behaviour of adults around hollow • Tapping to see if female will flush from hollow (best undertaken between 10am and 3pm when females most likely to be sitting) • Listening for nestlings • Looking for evidence of chewing • Looking inside nest
To confirm use by Carnaby's cockatoo	At least two visits during peak breeding season (i.e. between September and December)	To observe at least two of the following: • Breeding behaviour of adults around hollow or evidence of chewing • Female flushed from hollow • Noises from nestlings in hollow Or to observe: • Nestlings or eggs in nest
To determine nesting success by Carnaby's cockatoo	The more visits, the better. Preferably fortnightly visits between July and December. As a minimum, at least 3 visits spread throughout breeding season.	• Looking inside nest to observe eggs or nestlings.
To determine use by any species	As often as possible.	• Inspection from ground as a minimum. • Looking inside nest for detailed observations.
To determine maintenance requirements	At least every two years and preferably annually if hollow fitted with sacrificial chewing posts, can be longer if without.	• A basic maintenance check can be undertaken from the ground. A ladder or elevated work platform will be required for a comprehensive check and to replace sacrificial chewing posts

Acknowledgements

This information sheet is a joint initiative of Birdlife Australia, the Western Australian Museum and the Department of Parks and Wildlife. Many individuals have contributed to its preparation. The updated version was compiled by Rick Dawson (Department of Parks and Wildlife) with assistance from Denis Saunders.

Other information sheets in the series: Artificial hollows for Carnaby's cockatoo

- *How to design and place artificial hollows for Carnaby's cockatoo*
- *How to monitor and maintain artificial hollows for Carnaby's cockatoo*

Information sheets available on the *Saving Carnaby's cockatoo* webpage:
http://www.dpaw.wa.gov.au/plants-and-animals/threatened-species-and-communities/threatened-animals/208-saving-carnaby-s-cockatoo

Further information **Last updated 28/04/2015**

Contact fauna@dpaw.wa.gov.au or your local office of the Department of Parks and Wildlife

See the department's website for the latest information: www.dpaw.wa.gov.au