Martin Flint
Flint Legal
40 Henning Crescent
Manning WA 6152

Review of Proposed pine plantation – Lot 12667 (No. 7691) Muir Highway, Frankland River

Background

This letter is in response to a request for an independent and objective expert report addressing any 'local environmental benefits' including:

(i) any environmental benefits to the property, and any environmental benefits consequential thereon, that will be associated with the plantation, including, where applicable, but not limited to, those matters outlined in clause 10.3 of the *Shire of Cranbrook Local Planning Policy No 1 – Plantations* (**LPP1**); and,

(ii) any environmental disbenefits that may be associated with the plantation, including whether any change to the water table may have an adverse impact on the Cobertup Swamp and, consequential upon that adverse impact, also have an adverse impact on any other water bodies.

My instructions are with respect to salinity, watercourses and water changes when comparing a pine plantation to a well-managed agricultural property.

My Qualifications and Experience

I currently consult on water resource management. My areas of expertise are hydrology, water resource management and planning, irrigation development and management, and agricultural business planning. This role involves:
(a) water resource assessment;
(b) feasibility studies; and
(c) business planning.

I have undertaken studies for grower research development corporations, State Governments, local government, and grower groups both directly and as a sub-consultant.

Prior to this role, I was Acting Executive Director, Business Development in Department of Primary Industries and Regional Development and prior to that Executive Director, Irrigated Agriculture, Department of Agriculture, WA.
I hold a PhD in water resource management from Murdoch University.

With respect to the issue of changing land use and dryland salinity my publications include:

- Schofield, N.J., **Ruprecht, J.K.** and Loh, I.C. (1988) The impact of agricultural development on the salinity of surface water resources of south-west Western Australia. For the Steering Committee for Research on Land Use and Water Supply. Water Authority of Western Australia, Rep. No. WS27, 83pp.
- **Ruprecht, J.K**. and Rodgers, S. (1999). Impact of climate variability on the surface water resources of south-western Western Australia. 25t[h] Hydrology and Water Resources Symposium, 6-8 July 1999 Brisbane, Institution of Engineers, Australia.
- Mayer, X., **Ruprecht, J.K.** and Bari, M.A., (2005). *Stream salinity status and trends in south-west Western Australia*. Natural Resource Management and Salinity Division, Department of Environment.
- Halse, S.A., **Ruprecht, J.K**., and Pinder, A.M. (2003) Salinisation and prospects for biodiversity in rivers and wetlands of south-west Western Australia. Aust. J. of Botany, 51, 673-688.
- **Hatton, T.J., Ruprecht, J.K.** and George, R.J. (2003). Preclearing hydrology of the Western Australia wheatbelt: target for the future? *Plant and Soil* **257**:341-356.

I am a past Chair of the National Water Engineering Committee, Engineers Australia, past President WA Division, Engineers Australia, and past Chair of the Hydrology and Water Resources Panel, Engineers Australia. A copy of my Curriculum Vitae is provided at Attachment 1.

Context of Proposed Pine Plantation

Flint Legal acts for Luzny Custodian Pty Ltd, the owner of Lot 12667 (No. 7691) Muir Highway, Frankland River (**Property**), which is attempting to obtain planning approval for a pine plantation on the Property (**Figure 1**).

Historically the property has had significant land use change from clearing, then plantation then back to clearing.

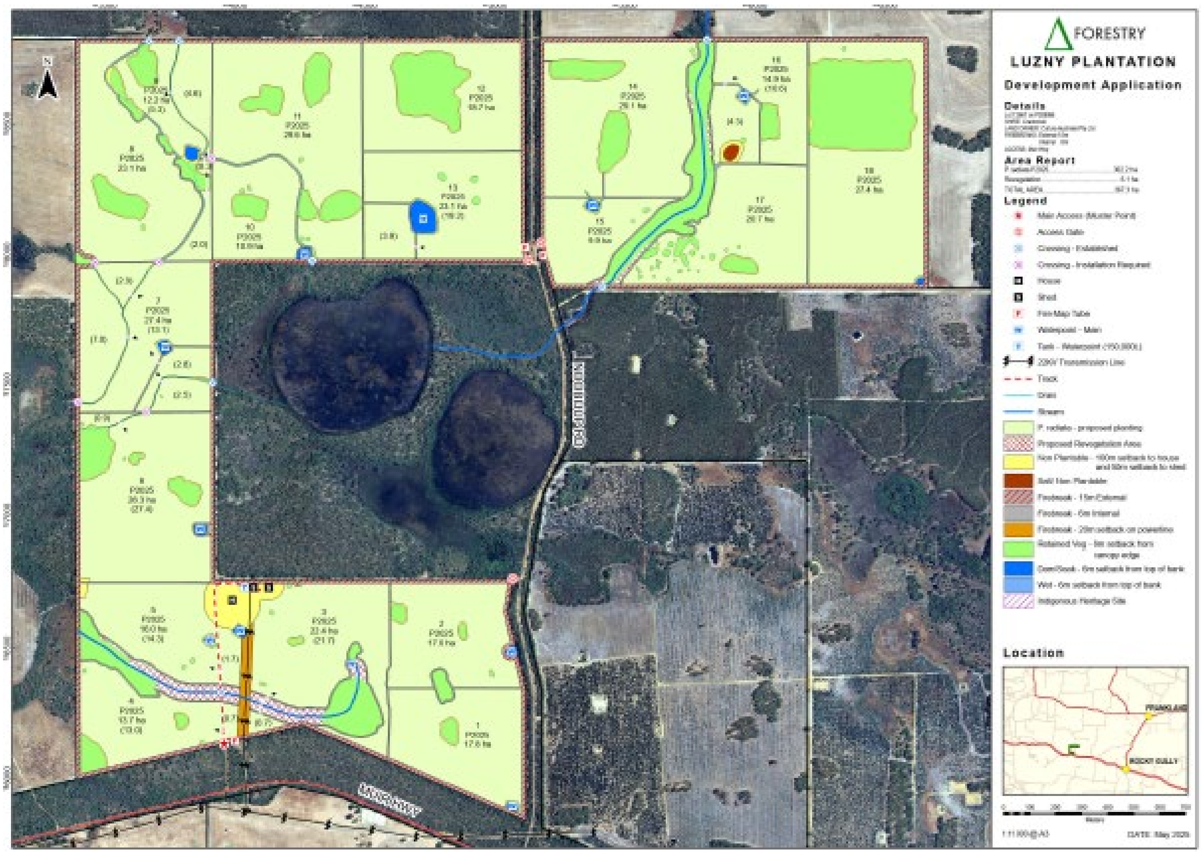

Figure 1 ***Proposed pine plantation and retained vegetation***

Context - Climate and Water

The mean annual rainfall since 1970 was approximately 700 mm for the site, with annual rainfall ranging from above 900 mm to approximately 450 mm (Figure 2) from My Climate View. My Climate View was developed by CSIRO and the Bureau of Meteorology as part of the Australian Government's Future Drought Fund (FDF) Climate Services for Agriculture program, which receives funding from the FDF.

The average annual maximum temperature has increased from 20.6 °C for 1965 to 1994 to 21.1 °C from 1995 to 2024 (**Figure 3**) based on the My Climate View.

The surface water around the Lot 12667 was sampled on 30th September 2025 using a HANNA HI98194 multiparameter probe, and the results are summarised in **Figure 4**. The salinity of the water discharging from the culvert into the Cobertup Nature Reserve was measured at 3400 µS/cm which is equivalent to 1938 mg/L TDS (based on DPIRD's saltlandgenie.com). The salinity of the water discharge from the property ranged from 1185 to 1820 µS/cm (675 mg/L TDS to 1037 mg/L TDS) (**Figure 4**).

The groundwater data for the area was sourced from the Department of Water and Environmental Regulation's Water Information Reporting website. The data was collected in either 1997 or 2003, with the highest salinities in the southern area of the property (**Figure 5**). A comparison of electrical conductivity (µS/cm) to salinity (mg/L TDS) is given in Table 1.

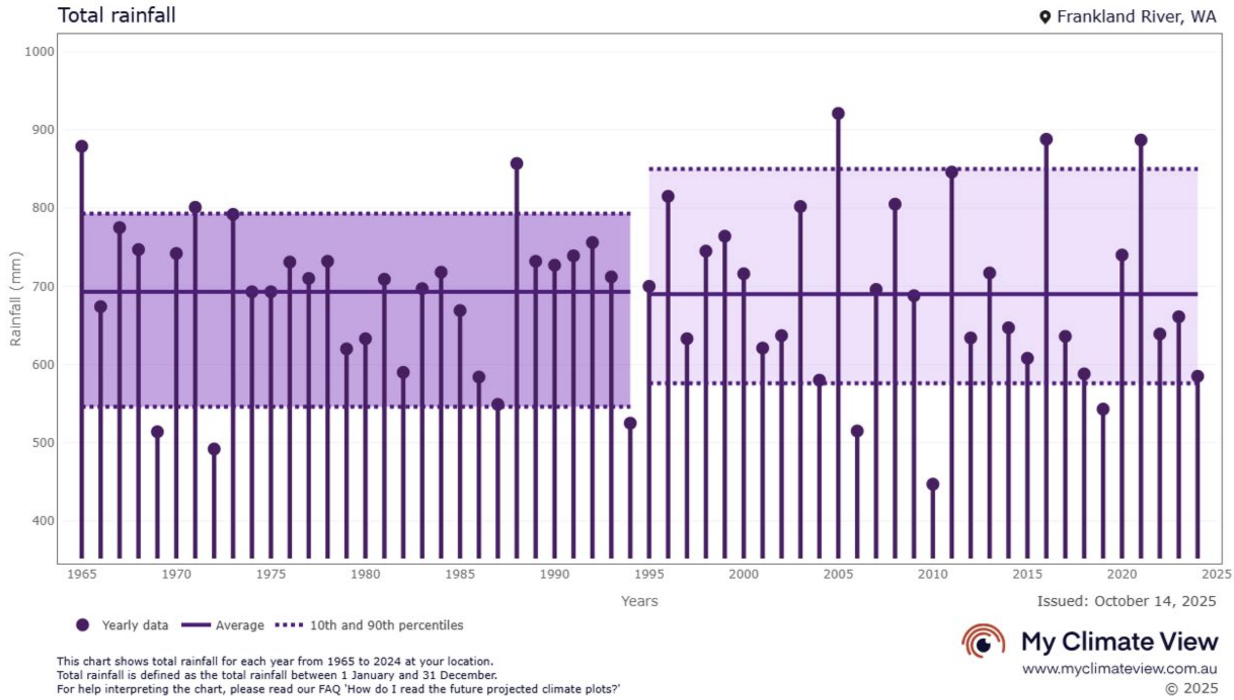

Figure 2 Annual rainfall for Frankland River

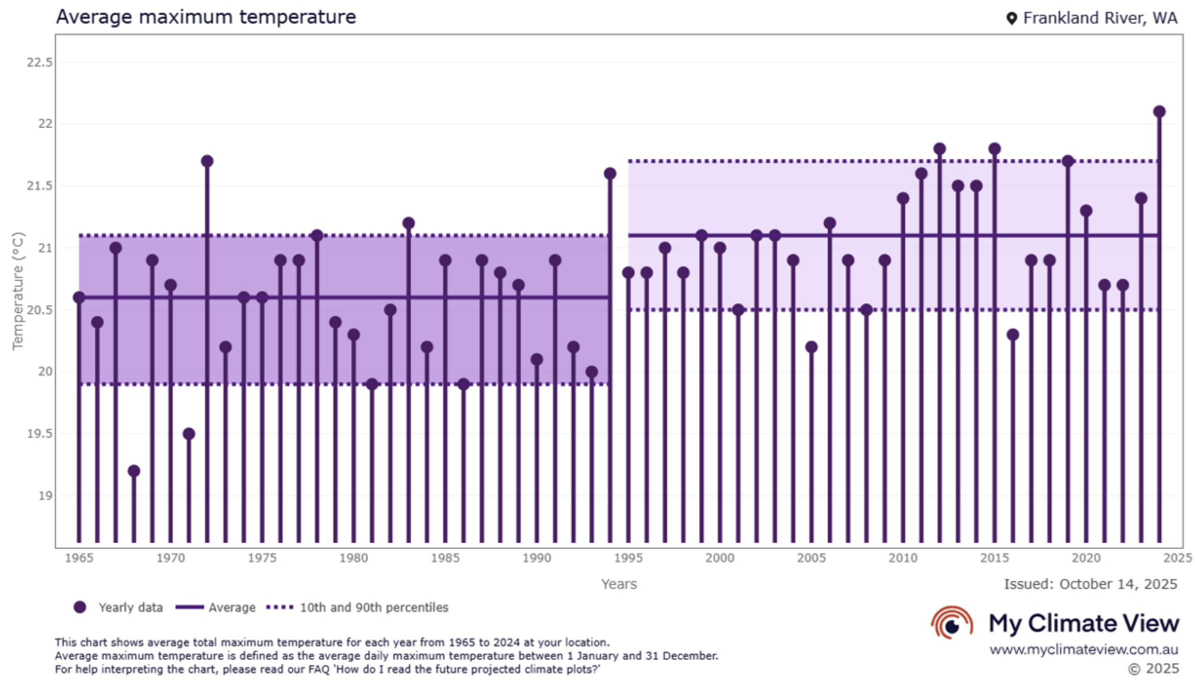

Figure 3 Annual average maximum temperature observed for Frankland River

Figure 4 Surface water sampling of electrical conductivity on 30th September 2025

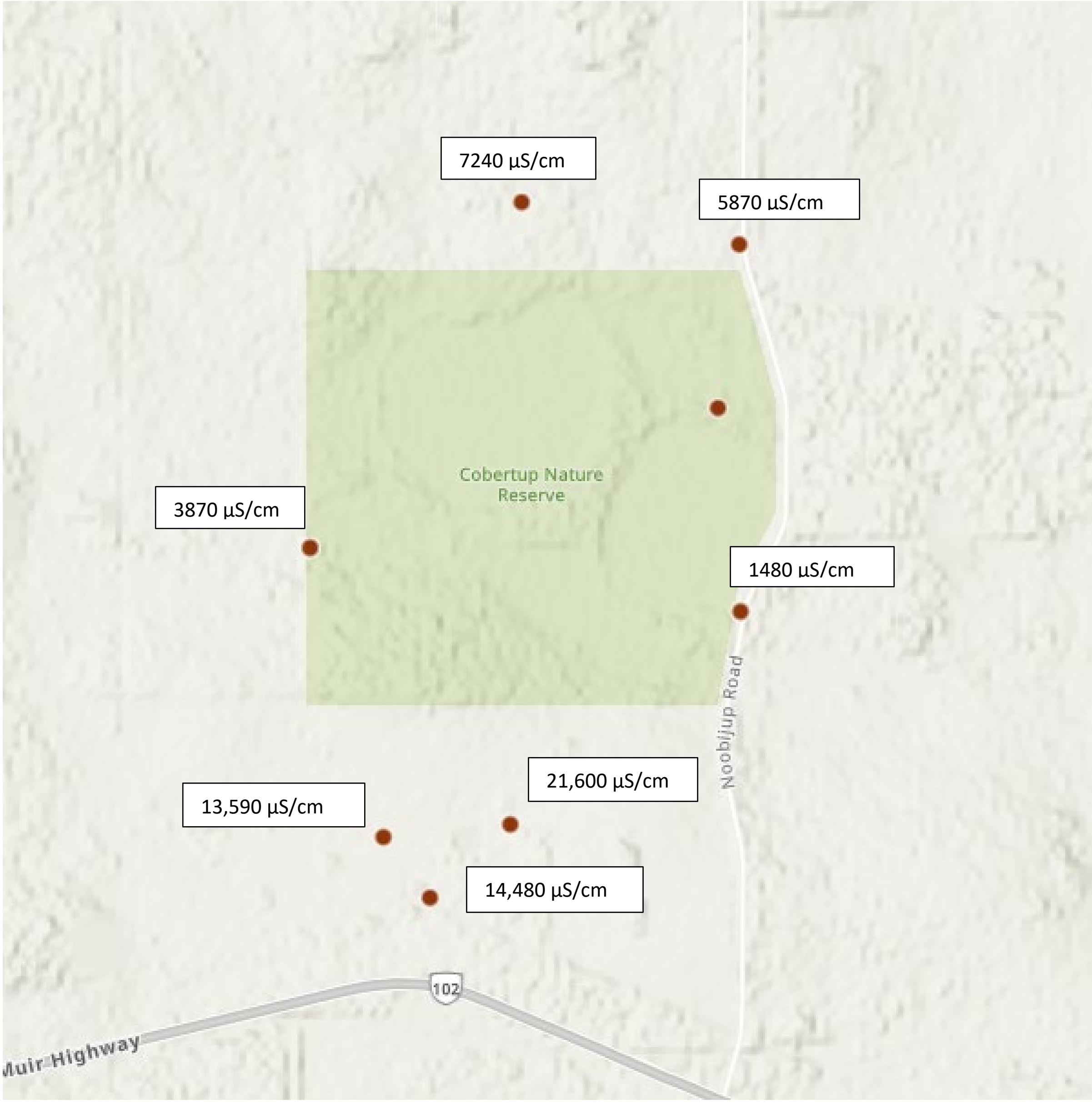

Figure 5 ***Groundwater electrical conductivity (data from DWER WIR website, samples from either 1997 or 2003)***

Table 1 ***Comparison of Electrical Conductivity to Salinity (based on saltlandgenie.com)***

Electrical conductivity (µS/cm)	Salinity (mg/L TDS)
1,000	570
5,000	2850
10,000	5,700
20,000	12,000

In addition, when a saline water table rises to within 1 to 2 metres of the soil surface, capillary action can transport salts into the root zone, which is harmful to non-salt tolerant plants.

Threats
With respect to risks to the Cobertup Nature Reserve the major disturbances or threats were considered to be runoff from the northern boundary providing extra nutrients on the clay flat with considerable weed invasion and the recent nature clearance on adjoining lands[1].

Assessment of Proposed Pine Plantation

The environmental benefits and disbenefits are assessed in the context of comparing the proposed pine plantation with a well-managed agricultural property. With respect to water use the deep-rooted summer active component of the native vegetation (or plantation) draws on sub-soil and sometimes groundwater reserves recharged over winter. By contrast, rainfall unused by annual shallow-rooted agricultural crops and pastures accumulates in the landscape and manifests as seasonal waterlogging and rising water tables[2]. The most dramatic consequence of the rising watertable is that salt stored in the soil profile can be drawn up into the active root zone by rising watertables.

In addition, the proposed pine plantation is assessed in the context of the overall catchment contributing water and nutrients to the Cobertup Nature Reserve.

Environmental Benefits

Reducing risk of dryland salinity – mitigating salinity affected areas

When compared to a well-managed agricultural property, the plantation is expected to significantly mitigate salinity affected areas and reduce the risk of increased salt affected areas across the property.

The clearing of native vegetation (mostly to establish agricultural crops and pastures) is the major cause of increasing land and water salinisation in the southwest of Western Australia. Removal of deep-rooted vegetation alters the water balance by reducing the evapotranspiration and interception components, leading to increased groundwater recharge and to rising water levels over most, if not all, of the catchment. Rising groundwater increases in salinity by dissolving salt within the unsaturated zone. Once groundwater is within about 2 m of the ground surface, it can be drawn up by capillary action and evaporated, leaving the salt in the soil. The increased soil salinity reduces agricultural production and in severe cases forms salt scalding at the surface, especially in combination with waterlogging. The land becomes unproductive and eventually pasture and vegetation die. Salt accumulated on the surface and within the (shallow) soil profile increases stream salinity when mobilised by runoff.

Rising water levels and groundwater discharge also lead to intermittent swamps or wetlands becoming more saline and permanently inundated/waterlogged. The broad flats that contain wetlands such as Lake Muir and Unicup Lake have the highest risk of land salinisation due to poor surface and groundwater drainage, combined with saline shallow groundwater.

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[1] Gibson, N. and Keighery, G.J. (1999) Assessment of the nature conservation values of the Byenup-Muir wetland system. Unpublished report for the Environment Australia prepared by Department of Conservation and Land Management.
[2] Lefroy, E. and Stirzaker, R. (1999). Agroforestry for water management in the cropping zone of southern Australia. Agroforestry Systems. 45. 277-302. 10.1023/A:1006241503888.

The consequence of increasing salinity in water bodies is the loss of aquatic biodiversity and reductions in the range of numerous flora and fauna, endemic to Western Australia[3].

The salinity extent and the salinity hazard for the property and surrounding areas is shown in **Figure *6***. Salinity hazard is defined as land that may develop a shallow water table within 2m of the soil surface and salt is also a hazard as it leads to salinity where it has the potential to be moved to where it can threaten assets such as agriculture, infrastructure, water resources and biodiversity. Salt stored in the ground may be mobilized by water and transported vertically and horizontally. To assess the hazard area, a map of current saline areas is overlain with surface contours and water table trend data.

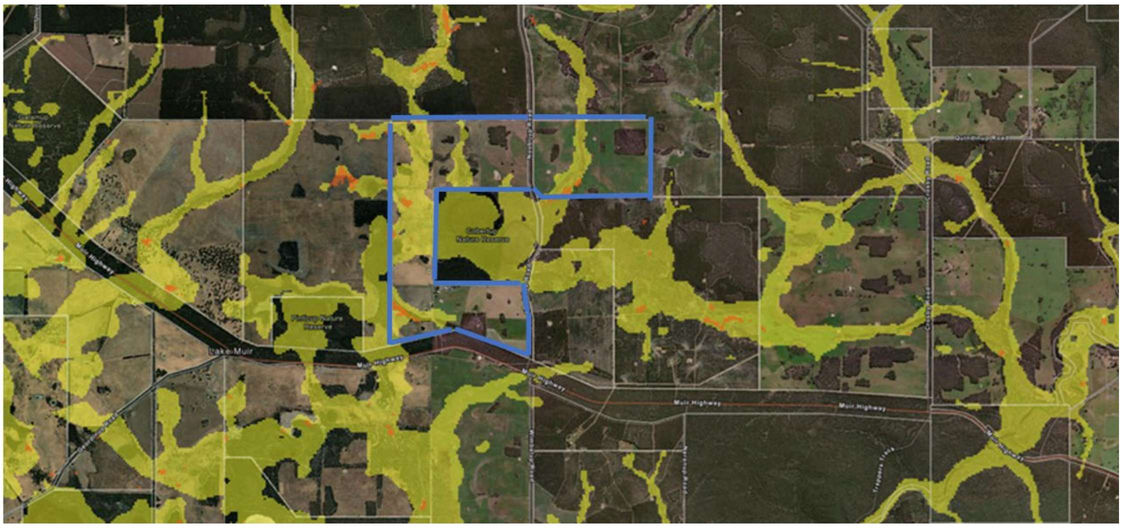

Figure 6 Salinity extent (orange) and area at risk of dryland salinity (green), property outline (blue)

The effects of reforestation techniques on groundwater level, streamflow and salt load have been reported previously[456.] Reforestation lowers groundwater level. Falls in groundwater level from 1 to 8 m (compared to the control areas) have been observed. The extent of watertable fall depends upon the proportion of the cleared area replanted and the stem density. If higher proportion of the cleared landscape is planted with higher stem density, a greater lowering in groundwater level is achieved. For example, at the Stenes Arboretum site (Collie River Catchment), where almost all the cleared area was planted with an initial tree density of 1200 stems/ha, a maximum fall of 8 m has been observed. Ten years after reforestation, the groundwater system seemed to achieve its new stability and no further lowering was observed.

[3] Department Biodiversity, Conservation and Attractions, 2023, Long-term salinity changes in the wetlands and lakes of southwest Australia., Department of Biodiversity, Conservation and Attractions, Perth, Australia.
[4] Schofield N.J., Loh I.C., Scott P.R., Bartle J.R., Ritson P., Bell R.W., Borg H., Anson B., Moore R., 1989a, Vegetation strategies to reduce stream salinities of water resource catchments in south-west Western Australia. Water Authority of Western Australia Report No, WS33, 98p.
[5] Bari M.A., Schofield N.J., 1992, Lowering of a shallow, saline water table by extensive eucalypt reforestation. *Journal of Hydrology* **133**, 273-291.
[6] Schofield, NJ & Bari, MA 1991, 'Valley reforestation to lower saline groundwater tables: results from Stene's Farm, Western Australia', Aust J Soil Research, vol. 29, pp. 635–650.

In comparing Eucalyptus and Pinus tree water use, the conclusion from White was that the water use by vegetation is very situation specific[7]. The comparison between depends on the age of the plantation, the length of the rotation, the seasonality of rainfall, and the depth of the soil. In the paper, a meta-analysis of published estimates of evapotranspiration by Pinus and Eucalyptus species in commercial plantations did not find a significant difference between the genera.

When compared to a well-managed agricultural property, the reforestation is expected to reduce the risk of land salinisation by transition to higher water use vegetation and deeper-rooted vegetation so being able to access water for more of the year. A pine plantation would be considered both a deeper rooted and higher water use vegetation than would be expected from a well-managed agricultural property.

Inhibit any further increase in stream salinity

When compared to a well-managed agricultural property, the plantation is likely to inhibit any further increase in stream salinity.

The plantation proposed on the property will significantly reduce any current and potential increase in stream salinity for the creek in the western edge of the property that then discharges across Muir Highway, for the proposed pine plantation compared to a well-managed agricultural. It has been clearly demonstrated above that reforestation either reduces stream salinity or inhibits any further increase.

The effects of partial reforestation on streamflow and salinity were monitored at the Maringee Farm (Collie River catchment), Batalling Creek (Collie River Catchment) and Padbury Road catchment (Blackwood River catchment). A fully distributed catchment model was set up and applied to Maringee Farm and Batalling Creek. Results show that 18% reforestation at Maringee Farm, predominantly along the stream zone, reduced streamflow by 10% and salt load by 15% [8]. Salinity increased due to the disproportionate reduction in streamflow. It appears that, 10 years after reforestation, the catchment achieves a new stability and no further reduction in streamflow or load is to be expected[9]. Modelling of the Batalling Creek catchment showed similar results[10]. The highest reduction in streamflow and salt load was observed at the Padbury Road catchment, where 75% of the cleared area was replanted between 1977–83 [11]. Annual streamflow and salt load fell to approximately 20% of the pre-planting values and stabilised in the 1990s, 10 years after planting. The average annual stream salinity increased from a pre-planting value of 1070 mg/L TDS to more

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[7] White, Don & Ren, Shiqi & Mendham, D.s & Balocchi-Contreras, Francisco & Silberstein, Richard & Meason, Dean & Iroumé, Andrés & Ramirez de Arellano, Pablo. (2022). Is the reputation of Eucalyptus plantations for using more water than Pinus plantations justified?. Hydrology and Earth System Sciences. 26. 5357-5371. 10.5194/hess-26-5357-2022.

[8] Bari M.A., Croton J.C., 2000, Predicting the impacts of land use changes on streamflow and salinity by a fully distributed catchment model. In 'Hydro 2000 Third International Hydrology and Water Resources Symposium'. (Institution of Engineers, Australia.

[9] Bari M.A., Croton J.C., 2000, Predicting the impacts of land use changes on streamflow and salinity by a fully distributed catchment model. In 'Hydro 2000 Third International Hydrology and Water Resources Symposium'. (Institution of Engineers, Australia.

[10] Bari M.A., Croton J.C., 2002, Assessing the effects of valley reforestation on streamflow and salinity using the WEC-C model. In 'Hydrology 2002 27th Hydrology and Water Resources Symposium' pp. 1024-1030. (The Institution of Engineers, Australia: Melbourne, Australia).

[11] Bari, MA 1998, 'Reforestation Reduces Groundwater Level and Stream Salt Load', in: National Conference on Productive Use and Rehabilitation of Saline lands, Tamworth, NSW.

than 2000 mg/L TDS in 1986–87. After that, there was a decreasing trend in stream salinity which stabilised at an average 1020 mg/L TDS in the mid-1990s.

The Denmark River is an example of the impact of forestry plantations. Annual salinity of the Denmark River peaked at 1520 mg/L TDS at the Mt Lindesay gauging station in 1987. However, since 1991 annual stream salinity has been decreasing by 8 mg/L/yr. This is partly because groundwater level rises following clearing have largely stopped, and, in part, due to the groundwater-lowering effects of plantations established after 1988. In 2009, annual mean salinity had dropped to around 540 mg/L following the establishment of additional commercial forestry plantations in the catchment from 2007 and is projected to fall to potable levels within the next decade[12].

Reduced nutrient input to Cobertup Nature Reserve

When compared to a well-managed agricultural property, the plantation is expected to reduce the nutrient discharge from the property to the Cobertup Nature Reserve.

A paired catchment study of pasture, pine and native vegetation found from measurements made of nitrogen (N) and phosphorus (P) concentrations in streams found that the pasture catchment stream showed highest concentrations of N and P, compared to the streams draining the pine and native catchments[13].

In a modelling study for the Peel-Harvey Catchment the input to the modelling used surplus nitrogen and phosphorus rates (Table 2) as part of the assessment of land use change in the catchment. This data whilst more relevant to the Swan Coastal Plain does indicate the reduced nutrients, particularly for nitrogen from a plantation land use.

Table 2 Surplus nutrients from Peel-Harvey Study[14]

Land use	Surplus N (kg/ha/yr)	Surplus P (kg/ha/yr)
Beef	78.8	11.3
Cropping	36.0	4.0
Plantation	9.5	6.2

Given the dominant nutrient flow into the Cobertup Nature Reserve is from the north eastern catchment outside of the property the change in nutrients is expected to be small, but a positive reduction in nutrients from the property to the reserve.

The consequence of reduce nutrient discharge into the Cobertup Nature Reserve is the reduced likelihood of algal blooms or eutrophication of the waterbodies in the nature reserve.

Environmental Disbenefits

Potential reduced inflow to Cobertup Nature Reserve

There is likely to be reduced inflow from the property with the proposed pine plantation, compared to a ‘well-managed agricultural property’.

[12] Ward, B, Sparks, T & Blake, G 2011, Denmark River water resource recovery plan, Salinity and land use impacts series, Report no. SLUI 40, Department of Water, Perth.
[13] Cooper, A. B., & Thomsen, C. E. (1988). Nitrogen and phosphorus in streamwaters from adjacent pasture, pine, and native forest catchments. *New Zealand Journal of Marine and Freshwater Research*, *22*(2)
[14] Hennig, K, Kelsey, P, Hall, J, Gunaratne, GG & Robb, M 2021 Hydrological and nutrient modelling of the Peel-Harvey catchment, Water Science Technical Series, report no. 84, Aquatic Science Branch, Department of Water and Environmental Regulation, Perth, Western Australia.

However, this reduced inflow is considered very minor due to the dominant inflow coming from the catchment to the north east (see **Figure 7**). This figure shows that the major inflows to the Cobertup Nature Reserve are from the large catchment to the north-east, with only a small contribution from the property.

Whether change to water table may have an impact on Cobertup Swamp

The impact of a changing climate, land use change history, and overall catchment provide a complex interaction and impact on the Cobertup Swamp water levels and water quality.

The study by Gibson and Keighery considered the major threats to Cobertup Swamp to be runoff from the northern boundary providing extra nutrients on the clay flat with considerable weed invasion and the recent nature clearance on adjoining lands.

The catchment for the eastern wetland part of Cobertup Swamp catchment is nearly all outside of the proposed pine plantation development so is independent of any land use change in the development (see **Figure 7**). The salinity of the water in the creek entering the Cobertup Swamp from Noobijup Road on 30th September was 1700 mg/L TDS.

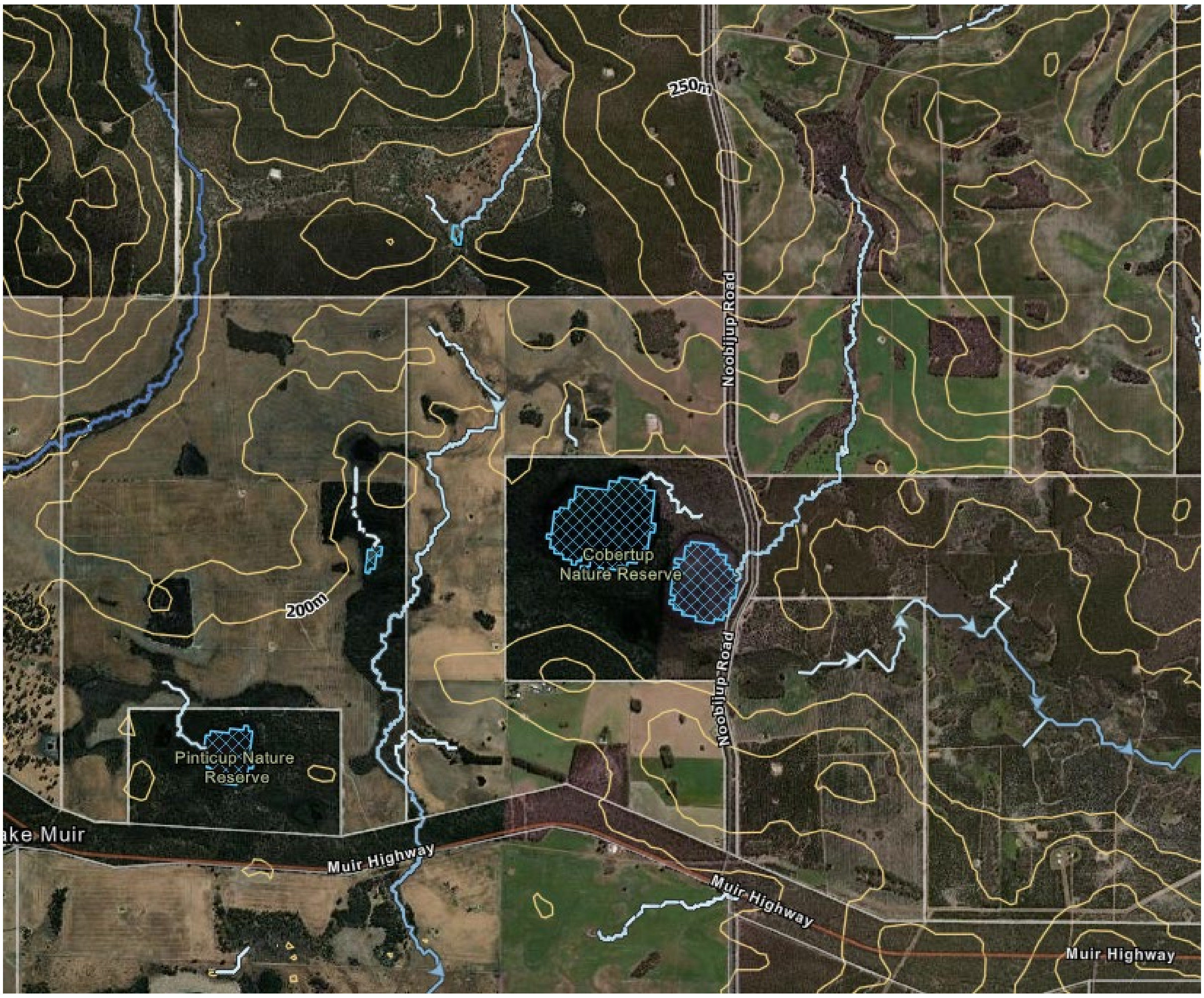

Figure 7 Contours and flow lines from DPIRD Hydro Guide (accessed 7/10/2025)

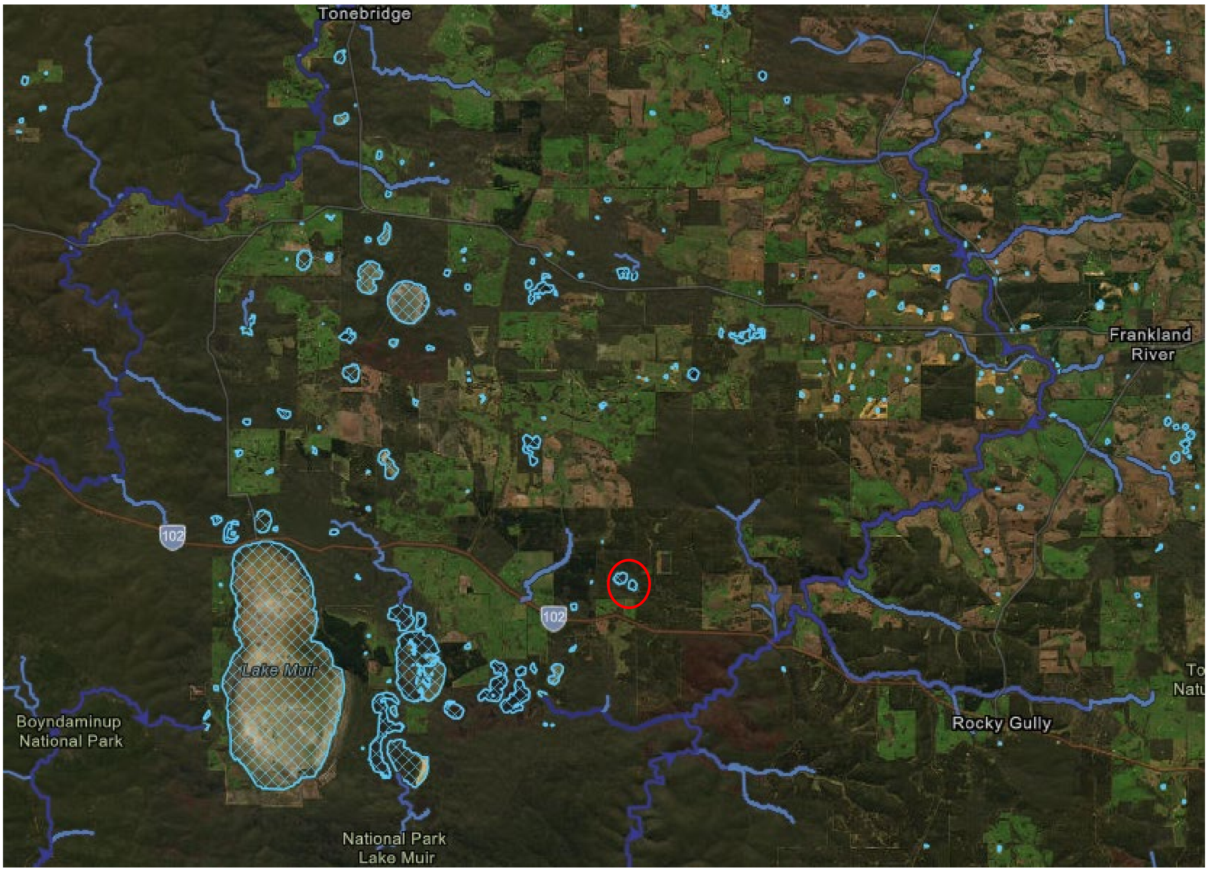

Figure 8 Flow line Frankland River with Cobertup Nature Reserve highlighted in red (Flowlines from DPIRD Hydro Guide - accessed 14/10/2025)

In addition, the surface water model also shows a significant part of the catchment area contributing to the western wetland in Cobertup Swamp is also from outside the proposed pine plantation development. This means that the change in the water table in the adjacent land as part of the pine plantation development is not considered to have a significant impact on the Cobertup Swamp.

The flow lines from DPIRD's Hydro Guide clearly show that the land use change for the land adjacent to the Cobertup Nature Reserve (the proposal) would have very little if any discernible impact of the water quality or water quantity into Lake Muir, Byenup Lagoon or the surrounding waterbodies (**Figure 8**). There is an extensive catchment and flow line from the Frankland River that contributes to the wetland suite adjacent to Lake Muir, so the change in contribution from the proposed development would be negligible and not discernible.

Yours sincerely

Dr John Ruprecht
Western Land & Water Consulting

14 October, 2025

Appendix 1 – CV John RUPRECHT

DIRECTOR & PRINCIPAL – WESTERN LAND & WATER CONSULTING

PROFILE

John has extensive experience in conceptualising, developing and leading major initiatives within the areas water, agricultural and regional development. John's areas of subject matter expertise include hydrology, water management, irrigation, land and water development, sustainable agriculture, urban water management, hydrologic research, and regional development.

Key projects as a consultant since 2018 include:

- De-risking agricultural development in WA and NT (CRC for Developing Northern Australia)
- Strategic review of salinity management in WA (DPIRD)
- Advice on water and irrigation management (ORD Irrigation Cooperative)
- Pilbara water options (BHP)
- Climate change impacts (Harvest Road)
- Urban water development assessment
- Review of water management in Warren-Donnelly (DPIRD)
- Small dam hydrology advice (GHD for DPIRD)
- Bauxite mining assessment (Water Corporation)
- Bauxite mining advice (Alcoa)
- Advice on water quality management of urban lakes (City of Bayswater)

CAREER OVERVIEW

Department / Business	Position	Period
Western Land & Water Consulting	• Director	2018 -
Murdoch University	• Research Fellow • Associate Professor	2018 2019
Primary Industries and Regional Development	• Executive Director, Business Development	2017 – 2018
Agriculture and Food	• Executive Director, Irrigated Agriculture • Executive Director, Agricultural Resource Risk Management	2014 – 2017 2010 – 2014
Water	• Director, Water Resource Management	2006 – 2010
Environment / Water and Rivers Commission	• Manager, Salinity and Land Use Impacts, • Manager, Surface Water Hydrology,	2000 – 2005 1996 – 1999
Water Authority of WA Surface Water Branch, Water Resources Directorate	• Supervising Engineer, Hydrology	1992 – 1996

WORK EXPERIENCE

Western Land and Water Consulting

Director **2018 -**

Undertaking specialist water resource and agricultural project management focusing on hydrology, water resource assessment, feasibility studies, and business planning.

Murdoch University

Associate Professor, Water-Energy-Waste Nexus **2019 -**

Developing research plan for a Water-Energy-Waste Nexus Research Centre as part of the Harry Butler Institute at Murdoch University.

Establishing Management Mine Closure course with South African universities.

Research Fellow, Water Resources **2018 - 2019**

Undertaking establishing linkages internationally in water and natural resource management (initial focus on Vietnam), and reviewing policy, management, and implementation for water resource recovery for economic and environmental benefit.

Department of Primary Industries and Regional Development

Executive Director, Business Development **2017 – 2018**

Established new directorate aimed at facilitating business development opportunities in agriculture and regional infrastructure.

Key Achievements

- Progressed sustainable irrigated agriculture developments (Ord, West Kimberley, Gascoyne, Myalup, Myalup-Wellington, and Southern Forests).
- Directed strategic initiatives in pastoral land reform, carbon farming, and protecting food production areas.
- Provided policy advice in strategic agricultural water management and development.
- Guided innovative regional infrastructure projects (digital connectivity, virtual solar plant, and green hydrogen).
- Instigated initiatives into aboriginal economic development and rangelands opportunities.

Department of Agriculture and Food

Executive Director, Irrigated Agriculture **2015 – 2017**

Key Achievements

- Managed regional operations for the North from Kalgoorlie to Kununurra).
- Led development of a report card for sustainable management of rangelands.
- Established the transformational Myalup Project to covert pine plantations into high value horticulture.
- Initiated the Perth Food Bowl study to protect and enhance food production precincts.
- Developed an Aboriginal Business Development program.
- Facilitated sustainable irrigation development, with focus on Gascoyne Food Bowl and Ord – Cockatoo Sands.
- Established structure and strategic intent for Irrigated Agriculture Directorate.
- Revitalised the Apple Breeding Program.

Executive Director, Agricultural Resource Risk Management **2010 – 2014**

Key Achievements

- Led development of a report card for sustainable agriculture for the South-West Land Division.
- Revitalised the Sustainable Resource Use Program.
- Enabled the *Biosecurity and Agriculture Management Act.*
- Guided the Invasive Species Strategic Plan.
- Developed structure and strategic intent for the Agricultural Resource Risk Management Directorate.
- Advocated best practice nutrient management in the Peel-Harvey Catchment.
- Managed border biosecurity (e.g. Kununurra and Eucla check points).
- Developed the State Natural Resource Management Plan and provided direction to associated funding program.

Department of Water

Director, Water Resource Management Division **2006 – 2010**

Key Achievements

- Led and managed a Division with 211 FTE staff and a $40m budget.
- Supervised and managed water resource assessment (groundwater and surface water), water science, salinity, drainage, urban water management, and water source protection programs.
- Developed a Water Resource Management Program for the Department.
- Coordinated Natural Resource Management engagement for the Department.
- Established the structure and direction for the Division.
- Developed new Urban Water Management and Coastal Drainage initiatives.
- Provided leadership to the Finance Sub-Committee of the Departmental Corporate Executive.
- Established direction for Water Science and Research for the Department.
- Coordinated approach to health and safety for the Division.

Acting Director General **3M in 2007 – 2008**

Key Achievements

- Led and managed a Department comprising 600 FTE staff and a $140m budget.
- Guided response to Economic Regulation Authority on a review of competitiveness in water and wastewater services.
- Supervised development of a business case for water reform implementation.
- Revitalised the Corporate Executive by increasing its strategic focus.
- Represented the State Government as Chair of the Council of Australian Governments (COAG) Water Sub-Group.

Water and Rivers Commission

Manager, Salinity and Land Use Impacts,

Resource Science Division **2000 – 2006**

Key Achievements

- Developed Engineering Evaluation Initiative Work Program (including studies into drainage, regional implications of drainage, and assessment of downstream impacts).
- Developed new programs for investigation into land use impacts (e.g. salinity, groundwater contamination and reservoir sedimentation).

- Supervised studies (e.g. Collie River Salinity Recovery, Toolibin Salinity Mitigation, Wheatbelt Clearing Hydrology, and Timber Industry Salinity Mitigation).
- Supervised extreme flood studies for water supply dams.
- Developed new approaches for extreme flood estimation at both State and National levels.
- Undertook review of sedimentation of Lake Argyle.
- Supervised water balance and yield studies for hydrology and salinity of Collie River.

Project Director, Study into Storage Dams in Oman 2000

Key Achievements

- Provided client liaison, project management and technical supervision for US$200,000 project in the Sultanate of Oman.
- Developed approaches and supervised hydrologic and water resource analysis for storage dams.
- Authored tender documents, inception report and final reports.

Manager, Surface Water Hydrology,

Resource Investigations Division 1996 – 1999

Key Achievements

- Planned and undertook studies into climate variability and its potential impact on the water resources of South West Western Australia.
- Co-established the Indian Ocean Climate Initiative with its Inaugural chair.
- Developed a framework for floodplain management, with a focus on Carnarvon.
- Developed position papers for the Minister for Water Resources on the State water supply the water supply for the Eastern Goldfields region.
- Supervised and planned policy on the measurement of surface water resources.
- Developed cabinet submissions to establish a Floodplain Management Taskforce and in response to the Moora Flood Study.

Water Authority of Western Australia

Supervising Engineer, Engineering Hydrology Section,

Surface Water Branch, Water Resources Directorate 1992 – 1996

Key Achievements

- Led and planned studies into reservoir yield, extreme flood hydrology, reservoir water quality, catchment water yield and quality, and land use impacts on water resources.
- Reviewed the surface water data networks for the State.
- Supervised, planned, controlled and provided leadership to the urban drainage planning, engineering hydrology and floodplain management programs.
- Planned, coordinated and carried out a review of rural drainage in South-West Western Australia for the Western Australian Water Resources Council.

BOARD / GOVERNANCE APPOINTMENTS

Appointment	Organisation	Period
Member	NRM Regions Australia	2021 - 2024
Chair	NRM Regions WA	2021 -2024
Member Deputy Chair	South Coast NRM Board	2018 -
Member	Executive Committee, Department of Agriculture and Food	2010 – 2017
Chair	NRM Senior Officers Group	2010 – 2017
Member	Executive Committee, Department of Water	2006 – 2010
Chair	Finance Sub-Committee, Department of Water	2006 – 2010
Deputy Chair, Member	Armadale Redevelopment Authority	2007 – 2009
Chair	6th International Water Sensitive Urban Design Conference	2009
Member	National Centre for Groundwater Research and Training	2006 – 2008
Chair	National Water Engineering Committee, Engineers Australia	2006 – 2007
President	WA Division, Engineers Australia	2005
Chair	Hydrology and Water Resources Panel, Engineers Australia	2002 – 2004
Chair	1st National Salinity Engineering Conference	2004
Chair	Organising Committee, 3rd International Hydrology and Water Resources Symposium	2000

PROFESSIONAL DEVELOPMENT

- Company Directors Course, Australian Institute of Company Directors (2010 & 2018)

QUALIFICATIONS

- Doctor of Philosophy, Murdoch University
  Thesis: *Impact of forest disturbance on jarrah (Eucalyptus marginata) forest hydrology*
- Master of Business Administration (Technology Management), Deakin University and Association of Professional Engineers, Managers and Scientists Australia (APESMA)
- Master of Engineering Studies, University of Western Australia
- Bachelor of Engineering (Hons), University of Western Australia

JOURNALS / PUBLICATIONS

- Reviewer, *Australian Journal of Water Resources and Hydrological Processes*
- Published Author in areas of hydrology, and water resources management and development (46 Journal Articles and Conference Papers)

A list of publications is available on request.